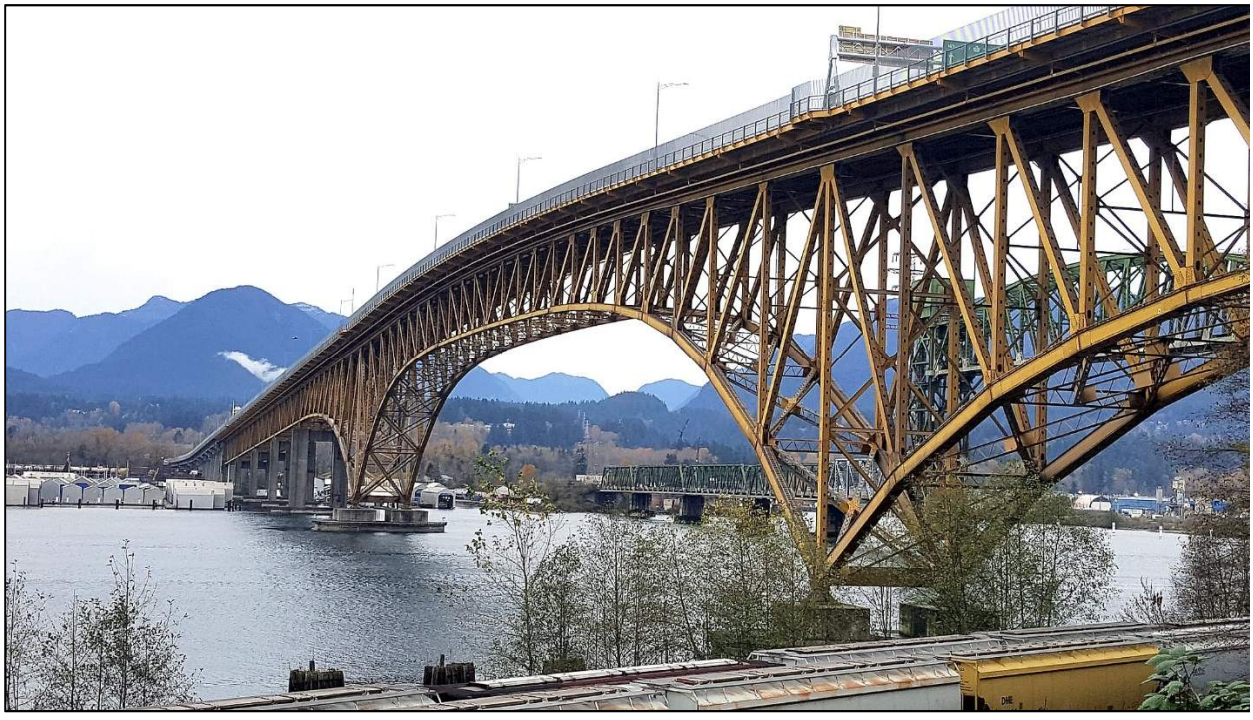
BC MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE

01459 IRONWORKERS MEMORIAL BRIDGE

VESSEL COLLISION RISK ASSESSMENT & MITIGATION

FINAL REPORT

March 16, 2018



MMM GROUP

01459 IRONWORKERS MEMORIAL BRIDGE

VESSEL COLLISION RISK ASSESSMENT & MITIGATION

BC MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE

FINAL REPORT

PROJECT NO.: 13M-00273-02
DATE: MARCH 2018

MMM GROUP LIMITED
SUITE 700
1045 HOWE STREET
VANCOUVER, BC, CANADA V6Z 2A9

T: +1 604 685-9381
F: +1 604 683-8655

MMM GROUP

March 16, 2018

FINAL REPORT

Willem Jellema, P.Eng., C.Eng.
Manger, Bridges & Structural Engineering
BC Ministry of Transportation and Infrastructure
Suite 310 - 1500 Woolridge Street
Coquitlam, BC V3K 0B8

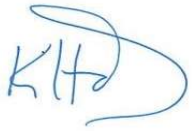
Dear Wim,

Subject: **01459 Ironworkers Memorial Bridge Vessel Collision Risk Assessment & Mitigation Report**

I am pleased to be sending our vessel collision risk assessment and mitigation final report for the 01459 Ironworkers Memorial Bridge. The report's contents document our comprehensive risk review and development of mitigation concepts in clear language, with supporting tables and graphics.

Many thanks to the Ministry team for the delivery and technical insight on this challenging project.

Yours sincerely,



Keith Holmes, P.Eng.
Manager, Bridges

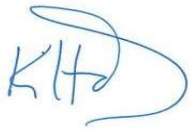
MMM ref.: 13M-00273-02

SUITE 700
1045 HOWE STREET
VANCOUVER, BC, CANADA V6Z 2A9

T: +1 604 685-9381
F +1 604 683-8655

SIGNATURES

PREPARED BY





Keith Holmes, P.Eng.
Manager, Bridges
MMM Group Limited

PREPARED BY





Michael Knott, P.E.
Project Technical Specialist
Moffatt & Nichol

REVIEWED BY



Stanley Cowdell, P.Eng.
Project Technical Specialist
Westmar Project Advisors

REVIEWED BY



Jianping Jiang, Ph.D., P.Eng.
Vice President, Bridges
MMM Group Limited

This report was prepared by MMM Group Limited for the account of BC MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE, in accordance with the professional services agreement. The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects MMM Group Limited's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. MMM Group Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

The original of the technology-based document sent herewith has been authenticated and will be retained by MMM for a minimum of ten years. Since the file transmitted is now out of MMM's control and its integrity can no longer be ensured, no guarantee may be given with regards to any modifications made to this document.

PROJECT TEAM

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE

Project Lead Manager, Bridges & Structural Engineering	Willem Jellema, P.Eng.
Director, Structural Engineering	Frank Dacho, P.Eng.
Senior Structural Engineer	Prerna Sohal, P.Eng.
Technical Specialist	Peter Brett, P.Eng. **KRM Consulting Ltd.**

MMM GROUP LIMITED

Project Manager	Keith Holmes, P.Eng.
Principal-in-Charge	Jianping, Jiang, Ph.D., P.Eng.
Senior Structural Engineer	Jan Kocaba, P.Eng.
Senior Geotechnical Engineer	Doug Wallis, P.Eng.
Environmental Reviewer	Tara Schmidt, B.Sc., MA, RPP
Geomatics Lead	Bert Hol, BCLS, CLS

SUB-CONSULTANTS

Vessel Collision Risk Analysis	Michael Knott, P.E. Michael Winters, P.E. Jeff Oskamp, P.E. **Moffatt & Nichol**
Marine Structures and Local Practices	Stan Cowdell, P.Eng. **Westmar Project Advisors**
Vessel Grounding Analysis	Norman Allyn, P.Eng.
Hydrotechnical Analysis	Edwin Wang, P.Eng., Des Goold, P.Eng. **Northwest Hydraulics Consultants**
Master Mariner	Chris Anderson, B.Sc.
Marine Construction / Cost Specialist	Wayne Saunders, P.Eng.

EXECUTIVE SUMMARY

The British Columbia Ministry of Transportation and Infrastructure (the Ministry) has completed an assessment of the risk for marine vessel contact with the 01481 Lions Gate Bridge (LGB) at First Narrows and the 01459 Ironworkers Memorial Bridge (IWMB) at Second Narrows in Vancouver's Burrard Inlet Harbour. This report provides a summary of a detailed probabilistic risk analysis and physical mitigation concepts for the IWMB.

Opened in 1960, the IWMB is a 1,292m long steel truss cantilever bridge spanning the Second Narrows of Burrard Inlet with a 335m main span **(1)**. The main span is supported by two main piers, each bearing on reinforced concrete pedestals and foundations. The bridge carries six lanes of vehicular traffic and two multi-use paths for pedestrians and cyclists between the City of Vancouver and the District of North Vancouver. The bridge was retrofitted in the mid-1990s for seismic deficiencies **(2) (3)** and further upgraded with a widened sidewalk and new safety fence in 2016 **(4)**.

The CN Rail Lift Bridge is located directly east of the IWMB. When open, the lift bridge has a vertical clearance of 46m (greater than the IWMB maximum air draft of 42.70m measured at Higher High Water – Large Tide) and a horizontal clearance of 137m (considerably narrower than the 315m clear width of the IWMB measured at waterline).

There have been no commercial vessel collisions with the IWMB since it was constructed. In 1979, the adjacent CN Rail Lift Bridge was struck by a cargo ship as it attempted to transit the harbour during heavy fog. As a result of that event, the Second Narrows was classified by the Vancouver Fraser Port Authority (VFPA) as a Traffic Control Zone (TCZ), subject to extensive vessel operating restrictions. There have been no commercial vessel collisions with the CN Rail Lift Bridge since the TCZ measures were enacted.

The vessel collision risk assessment completed for this study was conducted in accordance with the requirements and procedures for new bridges in the Canadian Highway Bridge Design Code (the Code) **(5)**, supplemented by the American Association of State Highway and Transportation Officials Standards **(6) (7)**. Based on the Code, highway bridges crossing navigable waterways are classified as one of the following:

- **Class I** bridges are of critical importance, including those that must remain open to all traffic after a vessel collision. The maximum annual frequency of collapse (AFC) for the whole bridge shall be 0.0001, which is a return period of 1 in 10,000 years.
- **Class II** bridges are of regular importance, including those that must remain open to emergency and security vehicles after a vessel collision. The maximum AFC for the whole bridge shall be 0.001, which is a return period of 1 in 1,000 years.

The vessel collision risk analysis for both pier and superstructure components of the bridge was conducted based on site specific data related to the Second Narrows waterway characteristics, vessel fleet characteristics, and existing bridge characteristics. Data for the analysis was obtained from publicly available sources as referenced in this report. The information in the public domain was also validated through discussions with the VFPA and the Pacific Pilotage Authority (PPA). A vessel collision risk analysis was not conducted for the adjacent CN Rail Lift Bridge as part of this study.

However, the rail bridge was included in the highway bridge risk analysis as an existing waterway structure to be considered in the risk assessment.

The risk analysis evaluated the present-day mandatory vessel operating requirements, the characteristics of the navigation channel and approaches to the channel, the vessel fleet and the structural configuration and capacity of the IWMB. This base case analysis assumes that the adjacent rail bridge provides a degree of protection from outbound aberrant vessels – the exception being those outbound aberrant ships passing through the rail bridge main span. The annual number of ship transits for the current vessel fleet passing under the IWMB was estimated to be 600 trips per year (excluding tugs, small barges, booms, small craft and recreational vessels). The risk analysis was then expanded to reflect the expected vessel traffic 25 years from today. For this 25-year projection, growth rates were based on known expansion projects or forecasted annual increases in the number of transits for each vessel class. The 25-year projection of the vessel fleet annual frequency was estimated to be 1,264 trips per year.

The base case analyses used the Code's base rate for vessel aberrancy (the rate at which vessels navigating through a channel are likely to go off course). The base rate was adjusted to reflect site-specific vessel operating practices in Second Narrows in accordance with existing Traffic Control Zone-2 (TCZ-2) requirements by the VFPA. Adjustments to the aberrancy base rate depended on the size, type and loading condition of the transiting vessels and considered the number of pilots, vessel maneuverability, tug escort, water currents, traffic density, daylight / visibility restrictions, electronic navigation tools and port state control. The magnitude of each adjustment was established based on Code recommendations, published research, and previous risk studies that have been accepted by federal agencies as appropriate for similar marine risk analyses.

The factors used in the study reflect the best estimate of the reality of the bridge site, waterway and fleet characteristics. Sensitivity runs were completed to gauge the significance of uncertainties for key input variables including (a) estimated growth rates for the vessel traffic; (b) probability of vessel aberrancy accident base rate; (c) tethered tug safety factor; (d) protection provided by the rail bridge (with and without protection); and (e) increasing the steel truss bottom chord (span) resistance strength. Water levels and depths at the bridge piers were adjusted in the risk analysis for predicted sea level rise and potential ride-up of vessels starting to run aground near the piers.

Results of the base case risk analyses are summarized as follows:

BASE CASE	**ANNUAL FREQUENCY OF COLLAPSE (AFC) FOR TOTAL BRIDGE** **Return Period (Years)**				
	Base Case Risk Analysis Results			**Code-Based Risk Threshold (5)**	
	Inbound Vessels	**Outbound Vessels**	**Total**	**Class I *Critical Importance***	**Class II *Regular Importance***
Present Day Vessel Traffic	1,409	14,142	**1,282**	10,000	1,000
Future Vessel Traffic (25 Years)	812	8,315	**740**	10,000	1,000

These results indicate that the AFC meets the criteria for a Class II (Regular Importance) highway bridge but does not meet the criteria for a Class I (Critical Importance) highway bridge. Key findings from the study were:

1. Primary vulnerabilities are potential impacts of ship mast, deckhouse and bow with the lower chord of the steel truss over the navigation channel between the two main piers of the bridge (Piers 15 & 16). The south portion of the main span truss has a higher collision risk than the north portion due to the effect of the bend in the waterway on the approaches to the bridge.
2. Over 90% of the collision risks are due to inbound ships (masts and deckhouses) potentially impacting the bottom chord of the bridge truss.
3. The potential vulnerabilities of the two main pier concrete substructure/foundations are low since the resistance strength of the piers to vessel impact are relatively high and the TCZ-2 operational restrictions reduce the probability of collision.
4. The potential vulnerabilities of the north anchor pier concrete substructure/foundation and north anchor span are low since the resistance strength of the anchor pier to vessel impact is relatively high and the TCZ-2 operational restrictions reduce the probability of collision farther away from the navigation channel.

For development of physical mitigation concepts, key site-specific issues were considered:

1. **Hydraulics:** The Burrard Inlet harbour has a relatively large daily tidal range that results in peak currents at the IWMB of 3.5 m/s (6.8 knots), generally uniform across the narrows in a direction roughly parallel to the vessel transit paths. Protection structures constructed adjacent to the main channel will result in minor increases in the currents through Second Narrows potentially reducing the allowable vessel transit windows as specified by the Port and thereby also reducing the number of vessels that can pass through the Second Narrows in a tide cycle. The tidal range and strong currents are a significant construction condition that influences the capital cost of the suggested protection measures.
2. **Port and Vessel Operations:** The main piers are located 100m from the edge of the navigation channel. The portion of the truss that is vulnerable to mast collision extends to within 35m of the edge of the navigation channel. In addition to transiting under the IWMB, commercial vessels are manoeuvering directly west of the bridge to berth at the adjacent terminals, both north and south of the channel. All protection measures must be cognizant of potential disruption of commercial marine traffic during both construction and in their permanent configuration.
3. **Environmental Impacts:** The Burrard Inlet is valued marine habitat and suitable mitigation for any habitat loss and / or construction activities will need to be developed.
4. **Public Context:** Recreational vessel marinas are located along the north shore on both sides of the IWMB. The design and construction of permanent protection structures will be required to include evaluating the risks to these users and developing suitable mitigation measures to ensure their safety. Construction during night-time hours will need to consider sound disturbance to nearby Capital Hill residents.
5. **Geotechnical and Bathymetry:** The seafloor conditions differ at the north and south main piers. A protection structure at the north pier will bear on marine deltaic deposits of layered sand and gravel. The south pier is bearing directly on sandstone. The sandstone is believed to

be dipping to the north such that a protection structure will bear partly on marine deltaic deposits and partly on sandstone.

Physical protection options were developed and the following two options were identified for further concept development.

Sheet pile cell **dolphins** are an effective and frequently used strategy for marine protection of lifeline structures exposed to large commercial vessel traffic. They are designed as sacrificial structures that absorb energy through large deformations. For IWMB, the proposed dolphins would be approximately 20m in diameter, with a crushed stone infill and a reinforced concrete cap. Three dolphin configurations were considered in the study, each with a different level of vessel collision protection.

A **truss fender** mounted to the bottom chord of the steel superstructure would intercept the initial contact of a vessel mast and redirect the impact forces to the truss nodes, eliminating the undesirable out-of-plane response of the bottom chord. The proposed system is a steel pipe that spans between the truss nodes and is vertically supported from hangers attached to the truss. However, the truss fender strategy alone will not reduce the risk from deck house or bow collisions. Furthermore, given the high degree of uncertainty in estimating collision forces, this light-weight system is generally not compatible with the level of robustness and redundancy typically used for vessel collision protection structures. As such, a truss fender is recommended as a "high-value" interim solution that, subject to further verification, can be easily implemented while the longer-term dolphin strategy is further developed.

To achieve the Class I criteria for vessel collision risks at the IWMB, the Ministry could consider the dolphin and fender enhancements with an estimated capital cost of **$58M**.

MMM GROUP

TABLE OF CONTENTS

1 INTRODUCTION 1

1.1 Project Background and Report Outline 1

1.2 IWMB, Previous Studies and Relevant Information 2

1.3 Overview of Risk Analysis Process 6

1.3.1 General Requirements 6

1.3.2 Project Approach and Risk Model Development 6

1.3.3 Bridge Importance Classification 7

1.4 Overview of Historical Vessel Accidents 8

2 WATERWAY CHARACTERISTICS 11

2.1 Bridge Location and Channel Alignment 12

2.2 Second Narrows Bathymetry 14

2.3 Tidal Levels and Currents 14

2.4 Practices and Restrictions for Vessels Operating In the Port 17

2.4.1 Operational, Pilot and Tug Requirements at Second Narrows 17

3 BRIDGE AND SITE CHARACTERISTICS 19

3.1 Structural Configuration 19

3.2 Geotechnical Conditions 19

3.3 Navigation Clearances 20

3.4 Superstructure (Span) Exposure to Ship Contact 21

3.5 Bridge Resistance to Ship Impact 22

3.5.1 Pier Collision 22

3.5.2 Superstructure Collision 22

3.6 Design Water Depths 24

3.7 CN Rail Lift Bridge 25

3.8 Environmental Context 27

3.9 Public Context 27

4 VESSEL FLEET CHARACTERISTICS 29
4.1 Vessel Types and Categories 29
4.2 Vessel Characteristics 31
4.3 Vessel Traffic (Annual Trip Frequencies) 33
4.3.1 Future Fleet Growth Factors 36
4.4 Vessel Transit Speeds 36
5 RISK ASSESSMENT METHODOLOGY 39
5.1 General 39
5.2 Vessel Frequency (N) 40
5.3 Probability of Aberrancy (PA) 40
5.3.1 Ship Accident Base Rate Adjustments (BR) 41
5.4 Geometric Probability 44
5.4.1 Adjustment for Tethered Tugs 46
5.5 Probability of Collapse (PC) 47
5.6 Vessel Collision Angles and Protection Factors (PF) 48
6 RISK ASSESSMENT RESULTS 52
6.1 Base Case Scenarios 52
6.2 Sensitivity Scenarios 52
6.2.1 Growth Rate Sensitivity 52
6.2.2 Probability of Aberrancy Sensitivity (PA) 53
6.2.3 Tethered Tug PG Sensitivity 53
6.2.4 Rail Bridge Protection Sensitivity 53
6.2.5 Span Resistance Strength Sensitivity 53
6.3 Key Risk Analysis Findings 54
6.4 Design Vessels 55
7 PHYSICAL MITIGATION: OPTIONS AND SITE CONSIDERATIONS 57
7.1 Typical Physical Mitigation Options 57

7.2 IWMB Vessel Collision Protection Considerations 59
7.2.1 Vessel Collision Protection Geometric Requirements 59
7.2.2 Key Site Constraints for Concept Development 60
7.3 Screening of Physical Mitigation Options 61
7.3.1 Truss Fender 61
7.3.2 Pile-Supported Structure 63
7.3.3 Sheet Pile Cell Dolphins 63
7.3.4 Rock Fill Island 64
8 PHYSICAL MITIGATION CONCEPTS 65
8.1 Concept Types and Configuration 65
8.1.1 Sheet Pile Cell Dolphin Option 65
8.1.2 Truss Fender Option 70
8.2 Vessel Collision Risk Implications 72
8.3 Hydraulic Implications 73
8.3.1 Hydrodynamic Analysis Summary 73
8.3.2 Analysis Findings: Peak Flows 75
8.3.3 Analysis Findings: Hydraulic Impact to Transit Windows 75
8.4 Impacts to Port and Vessel Operations 78
8.5 Environmental Considerations 78
8.6 Estimated Costs 79
9 SUMMARY OF KEY FINDINGS 80
10 ACKNOWLEDGEMENTS 83
11 REFERENCES 84

TABLES

TABLE 2.1: TIDAL ELEVATIONS AT VANCOUVER HARBOUR 15
TABLE 2.2: TCZ-2 REQUIREMENTS FOR TANKERS IN PRODUCT (LOADED) 18
TABLE 2.3: TCZ-2 REQUIREMENTS FOR ALL OTHER VESSELS AND TANKERS NOT IN PRODUCT (BALLASTED) 18
TABLE 4.1: ANNUAL VESSEL FREQUENCY 35
TABLE 4.2: VESSEL FLEET ANNUAL TRIP FREQUENCY SUMMARY 35
TABLE 4.3: SUMMARY OF GROWTH RATES AND GROWTH FACTORS 36
TABLE 4.4: VESSEL SPEEDS 38
TABLE 5.1: PA ADJUSTMENT FACTORS 43
TABLE 6.1: AFC SUMMARY 52
TABLE 6.2: SOUTH PORTION OF THE MAIN SPAN DESIGN VESSELS 56
TABLE 6.3: NORTH PORTION OF THE MAIN SPAN DESIGN VESSELS 56
TABLE 7.1: PHYSICAL PROTECTION OPTIONS SCREENING 62
TABLE 8.1: EXISTING DOLPHIN EXAMPLES FOR CONCEPT CALIBRATION 68
TABLE 8.2: SUMMARY OF TIME LOSS FOR THE 2 KNOT TRANSIT WINDOWS 77
TABLE 8.3: COST ESTIMATE SUMMARY 79
TABLE 9.1: SUMMARY OF VESSEL COLLISION PROTECTION CONCEPTS BASED ON KEY CRITERIA 82

FIGURES

FIGURE 1.1: LOCATION OF IRONWORKERS MEMORIAL BRIDGE AND CN RAIL LIFT BRIDGE 2
FIGURE 1.2: IRONWORKERS MEMORIAL BRIDGE (IWMB) PHOTOGRAPHS 3
FIGURE 1.3: POTENTIAL CONFIGURATION OF SHIP IMPACT PROTECTION BERMS, 1992 B&T STUDY (2) 4
FIGURE 1.4: LOOKING NORTH AT PIER 15 WITH RECENT UPGRADES SHOWN 5
FIGURE 1.5: RISK MODEL DEVELOPMENT 8
FIGURE 1.6: SECOND NARROWS RAIL BRIDGE COLLISIONS, VANCOUVER, B.C. 10
FIGURE 2.1: PORT OF VANCOUVER (POV) MAJOR MARINE TERMINAL LOCATION MAP 11
FIGURE 2.2: IWMB VICINITY MAP 12

FIGURE 2.3: IWMB GENERAL CONFIGURATION AND NAVIGATIONAL CHANNEL CLEARANCES 13
FIGURE 2.4: BATHYMETRY MAP 14
FIGURE 2.5: PEAK SURFACE VELOCITIES AT SECOND NARROWS – EXISTING CONDITIONS – EBB TIDE 16
FIGURE 2.6: PEAK SURFACE VELOCITIES AT SECOND NARROWS – EXISTING CONDITIONS – FLOOD TIDE 16
FIGURE 3.1: ELEVATION VIEW OF IWMB MAIN SPAN 19
FIGURE 3.2: VIEW OF IWMB AND RAIL LIFT BRIDGE FROM INBOUND SHIP 20
FIGURE 3.3: SUPERSTRUCTURE (SPAN) COLLISION GEOMETRY 21
FIGURE 3.4: BUILT-UP TRUSS COMPONENT SECTIONS 23
FIGURE 3.5: PLAN VIEW OF BOTTOM CHORD MODEL, SHOWING DEFLECTED SHAPE AND LIMITING MEMBER 24
FIGURE 3.6: MAIN SPAN TRUSS WITH BAYS VULNERABLE TO MAST COLLISION HIGHLIGHTED BY RED LINE 24
FIGURE 3.7: CN RAIL LIFT BRIDGE PLAN & ELEVATION 26
FIGURE 3.8: ROTATIONAL COLLAPSE OF THE CN RAIL BRIDGE PROXIMITY TO IWMB 26
FIGURE 3.9: LOOKING SOUTH-WEST AT TERMINALS AND PUBLIC USE ADJACENT TO IWMB 27
FIGURE 3.10: LOOKING EAST ALONG TRANS CANADA TRAIL UNDER THE SOUTH ANCHOR SPAN 28
FIGURE 3.11: TYPICAL TRAFFIC VOLUMES ON IWMB, BOTH DIRECTIONS (WEDNESDAY, MARCH 15, 2017) 28
FIGURE 4.1: AIS TANKER VESSEL TRACKS 30
FIGURE 4.2: AIS CONTAINER VESSEL TRACKS 30
FIGURE 4.3: AIS BULK CARRIER TRACKS 31
FIGURE 4.4: VESSEL TYPE PHOTOGRAPHS 32
FIGURE 4.5: BALLASTED VESSELS 34
FIGURE 4.6: VESSEL SPEED DISTRIBUTION 37
FIGURE 5.1: INBOUND & OUTBOUND CHANNEL LEGS 40
FIGURE 5.2: GEOMETRIC PROBABILITY PG (5) 45
FIGURE 5.3: PG NORMAL DISTRIBUTION PLAN 46
FIGURE 5.4: TUG ADJUSTMENT FACTOR 47
FIGURE 5.5: PROBABILITY OF COLLAPSE PC (5) 48
FIGURE 5.6: SHIP TURNING CIRCLES 49
FIGURE 5.7: INBOUND PIER 16 VESSEL COLLISION ANGLES 50
FIGURE 5.8: OUTBOUND PIER 15 VESSEL COLLISION ANGLES 50
FIGURE 5.9: SUMMARY OF PIER COLLISION ANGLES 51

FIGURE 7.1: STEEL FENDERING AT SEA ISLAND BRIDGE, RICHMOND BC 57
FIGURE 7.2: TIMBER PILE SUPPORTED PROTECTION AT MORAY BRIDGE, RICHMOND BC 58
FIGURE 7.3: DOLPHIN PROTECTION AT SUNSHINE SKYWAY 59
FIGURE 7.4: ROCK BERM PROTECTION AT LIONS GATE BRIDGE NORTH TOWER 59
FIGURE 8.1: DOLPHIN CONFIGURATIONS 66
FIGURE 8.2: COLLISION ENERGY ABSORBED BY DOLPHIN ROTATION AND SLIDING, AND BY CRUSHING OF VESSEL BOW **(6)** 67
FIGURE 8.3: MAIN PIER DOLPHIN (18.3M DIAMETER) AT THE SUNSHINE SKYWAY BRIDGE 67
FIGURE 8.4: DOLPHIN CONSTRUCTION AT THE SUNSHINE SKYWAY IN 1987 69
FIGURE 8.5: MAINTENANCE TRAVELER SEEN FROM THE SOUTH ABUTMENT, WEST SIDE 72
FIGURE 8.6: HYDRODYNAMIC MODEL EXTENTS 74
FIGURE 8.7: TRANSIT WINDOW ASSESSMENT LOCATIONS 75
FIGURE 8.8: CHANGE IN CURRENT VELOCITY DUE TO SIX DOLPHIN CONFIGURATION – PEAK EBB TIDE 76
FIGURE 8.9: CHANGE IN CURRENT VELOCITY DUE TO SIX DOLPHIN CONFIGURATION – PEAK FLOOD TIDE 76
FIGURE 8.10: CURRENT AND VELOCITY CHANGES IN THE UPPER TWO-THIRDS OF THE WATER COLUMN AT THE CN RAIL BRIDGE 77

APPENDICES

A BASE CASE (FUTURE VESSEL TRAFFIC; 25 YEAR HORIZON) VESSEL COLLSION RISK ANALYSIS

B CONCEPT DRAWINGS FOR PHYSICAL PROTECTION

C HYRAULIC IMPACT ASSESSMENT

D STRENGTH EVALUATION OF MAIN SPAN TRUSS FOR VESSEL MAST COLLISION LOADS

E RISK ANALYSIS FOR VESSEL COLLISION MITIGATION

F COST ESTIMATE TABULATION

1 INTRODUCTION

1.1 PROJECT BACKGROUND AND REPORT OUTLINE

The British Columbia Ministry of Transportation and Infrastructure (the Ministry) is undertaking a review and risk assessment of vessel impact issues for the 01481 Lions Gate Bridge (LGB) at First Narrows and the 01459 Iron Workers Memorial Bridge (IWMB) at Second Narrows in Vancouver's Burrard Inlet Harbour. This report provides a summary of a detailed probabilistic risk analysis and proposed physical mitigation concepts for the IWMB.

MMM Group Limited (MMM) was retained by the Ministry to perform the vessel collision studies for the bridge. MMM assembled a team of experts representing a diverse and in-depth level specialty experience assessing the risk and consequence of vessel impact on bridges. Acting as sub-consultants to MMM, the team included: Michael Knott, PE (Moffatt & Nichol) – risk assessment; Norman Allyn, P.Eng. – vessel grounding analysis; Stan Cowdell, P.Eng. (Westmar Project Advisors) – marine structures and local practices; Edwin Wang and Des Goold (Northwest Hydraulics Consultants) - hydrotechnical analysis; Chris Anderson - Master Mariner; and Wayne Saunders – marine construction and cost specialist. The MMM team has met with the Ministry, Vancouver Fraser Port Authority (VFPA) and Pacific Pilotage Authority (PPA) on several occasions as part of this work.

This report is organized as follows:

- **Section 1** introduces the project and provides background information on the bridge and the topic of vessel collision.
- **Sections 2, 3 and 4** provide detailed information relating to the waterway, bridge site and vessel fleet, respectively.
- **Section 5 and 6** provide a description of the risk evaluation and results, respectively.
- **Section 7** provides an overview of typical physical mitigation concepts and site constraints.
- **Section 8** provides a summary of physical mitigation concepts and review of various site factors.
- **Section 9** provides a summary of report findings.

The vessel collision risk assessment was conducted in accordance with the requirements and procedures of the 2014 Canadian Highway Bridge Design Code (the Code) **(5)**, supplemented by the American Association of State Highway and Transportation Officials Standards **(6) (7)**. The analysis used site specific data related to the Second Narrows waterway characteristics, vessel fleet characteristics, existing bridge characteristics and the mandatory vessel navigations practices specified by the VFPA. Data for the analysis was obtained from publicly available sources as referenced in this report. The information in the public domain was also validated through discussions with the VFPA and the PPA.

This report only considers physical protection risk mitigation measures. Under the jurisdiction of the VFPA, there is an extensive set of operating procedures currently in place at Second Narrows. The project's risk analysis has considered these operational procedures in quantifying the vessel collision risks.

1.2 IWMB, PREVIOUS STUDIES AND RELEVANT INFORMATION

Opened in 1960, the IWMB is a 1,292m long steel truss cantilever bridge spanning the Second Narrows of Burrard Inlet with a 335m steel main span **(1)**. The main span is supported by two main piers, each bearing on reinforced concrete pedestals and foundations. The bridge carries six lanes of vehicular traffic and two multi-use paths for pedestrians and cyclists between the City of Vancouver and the District of North Vancouver (**Figure 1.1**). Photographs of the bridge are shown in (**Figure 1.2**). The bridge is also known as the Second Narrows Bridge, but was renamed in 1994 in honour of the 19 workers who died in a collapse of the bridge during construction in 1958 and four others who also died during the construction process.

The CN Rail Second Narrows Rail Bridge is located directly east of the IWMB. When open, the lift bridge has a vertical clearance of 46m (greater than the IWMB maximum air draft of 42.70m measured at Higher High Water – Large Tide) and a horizontal clearance of 137m (considerably narrower than the 315m clear width of the IWMB measured at waterline).

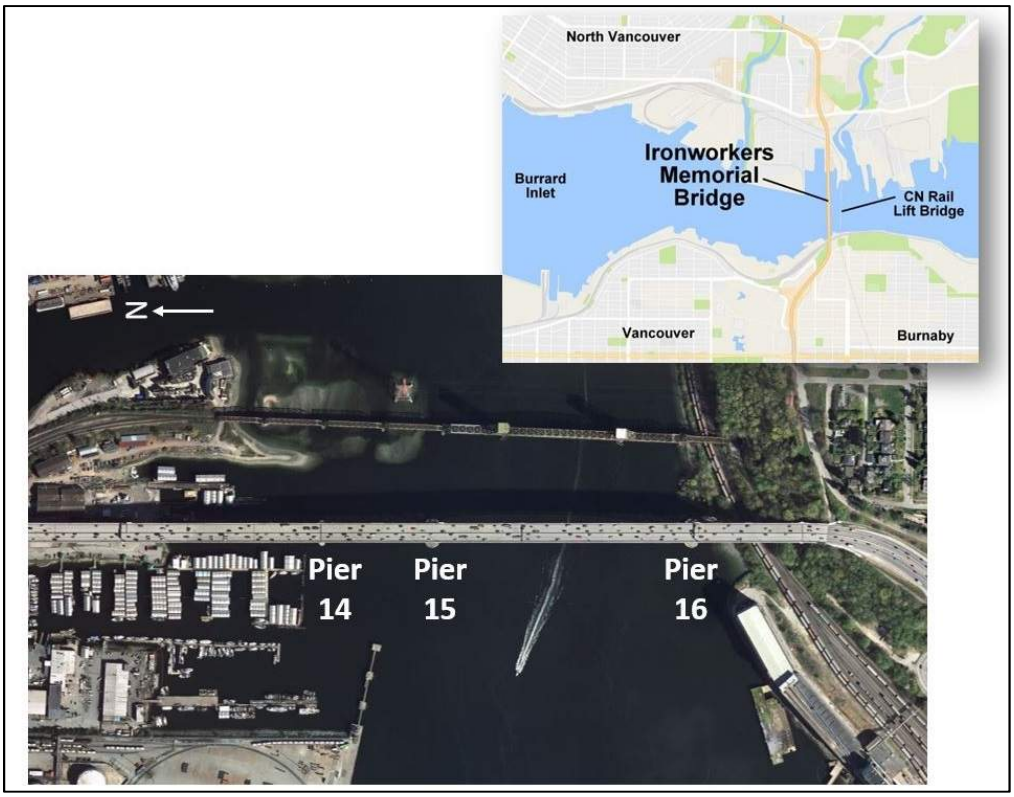


Figure 1.1: Location of Ironworkers Memorial Bridge and CN Rail Lift Bridge



A: View from South Shore looking Northeast



B: View from South Shore looking Northwest with
CN Rail Lift Bridge in Foreground

Figure 1.2: Ironworkers Memorial Bridge (IWMB) Photographs

A report by the Canadian Coast Guard in 1982 identified that the IWMB was at risk to ship collision due to the large volume of vessels transiting Second Narrows **(8)**. As part of a seismic safety retrofit project completed in 1994, a study was conducted by Buckland & Taylor Ltd. (B&T) in 1992 to evaluate the risk of ship collision with the bridge **(2)**.

The 1992 study found that the bridge was susceptible to ship collisions and in particular, the bridge had a significant risk from collision of a ship's upperworks (mast and deckhouse) with the lower chord of the main span steel truss. The result of such a superstructure (span) collision would potentially be collapse of the main span. The study found that the north and south main piers were also susceptible to collision but their structural resistance was such that catastrophic damage was unlikely.

The 1992 study recommended that, as part of a future widening of IWMB to eight lanes by building a parallel bridge structure, a ship impact protection system be installed. One potential strategy identified in the B&T study was to constrain the vessel traffic within the navigation clearance envelope by installing rock berms parallel to the channel at the vertical clearance lines as shown in **Figure 1.3**. The bridge was subsequently retrofitted in the mid-1990s for seismic deficiencies **(3)**; however, these works did not include vessel collision protection measures. In 2016, the IWMB was further upgraded with a widened sidewalk and new safety fence **(4)** (**Figure 1.4**).

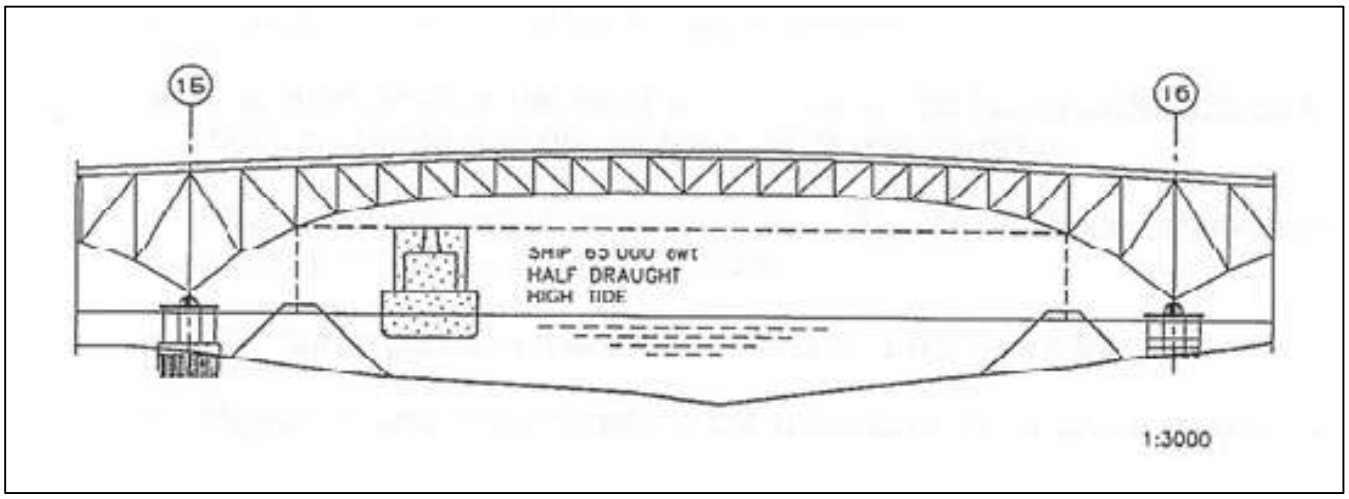


Figure 1.3: Potential Configuration of Ship Impact Protection Berms, 1992 B&T Study (2)



Figure 1.4: Looking North at Pier 15 with Recent Upgrades Shown

1.3 OVERVIEW OF RISK ANALYSIS PROCESS

1.3.1 GENERAL REQUIREMENTS

The vessel collision procedures and requirements in the Code (5-7) represent a simplification of a very complex problem involving ship design and operations, bridge design and response to extreme load events, the waterway and navigation channel layout, and a variety of environmental issues. Many of the Code provisions are based on lessons learned from historical accidents in which vessels impacted bridges as they were transiting the waterway in the vicinity of a bridge during normal merchant marine operations. The primary purpose of the Code's vessel collision provisions is to reduce the risk of bridge superstructure collapse to an acceptable level in the event of a vessel collision. Significant damage to secondary bridge structure components is permitted provided that alternative load paths and redundancy exists in the structure such that the superstructure does not collapse under the design impact event and the damage sustained is repairable.

The Code provides two alternative design methodologies (Methods I and II) in establishing criteria for vessel collision. **Method I** of the Code is a relatively simple, semi-deterministic procedure for selecting a design vessel and subsequently computing collision impact loads. The procedure is less accurate (and usually more conservative) than other methods and is, therefore, not recommended for final design of critical bridges. However, Method I procedures are useful in defining boundaries of the navigation zone used in a subsequent Method II risk analysis. Method I procedures are also useful in providing an initial assessment of the magnitudes of impact forces while input data for the significantly more complicated Method II risk analysis procedures are being collected and analyzed.

Method II is a probability-based risk analysis procedure that can be used both for directly assessing the risk of collapse from vessel impact and to develop vessel impact criteria for design. Using Method II procedures, a mathematical model is developed to estimate the annual frequency of bridge collapse based on the bridge pier/span geometry, ultimate pier strength, waterway characteristics, and the characteristics of the vessel fleet transiting the channel. The estimated risk of collapse can then be compared to predetermined acceptance criteria. Unless otherwise approved by the bridge owner for special situations, Method II is the recommended analysis procedure that should be used for all major bridges crossing navigable waterways.

The risk analysis presented in this report is based on the Method II procedures of the Code.

1.3.2 PROJECT APPROACH AND RISK MODEL DEVELOPMENT

The estimate of potential bridge collapse due to vessel collision in the Method II risk model includes consideration of four general risk components: (1) a vessel approaching the bridge becomes aberrant; (2) the aberrant vessel impacts a bridge element; (3) the bridge element that is hit fails; and (4) potential protection factors based on bridge location. The Code risk equation is shown in **Equation 1**, below:

$$AFC = (N)\ (PA)\ (PG)\ (PC)\ (PF)\ (GF) \quad \text{(Eq. 1)}$$

Where:

- AFC = Estimated annual frequency of bridge collapse due to vessel collision;
- N = Annual number of vessel trips classified by type, size, and loading condition (loaded or ballasted/empty), which can strike the bridge based on water depth and bridge clearances;
- PA = Probability of vessel aberrancy (*how often does the vessel go off-course?*);
- PG = Geometric probability of a collision between an aberrant vessel and the bridge pier or span (*if the vessel goes off-course, will it hit part of the bridge?*);
- PC = Probability of bridge collapse due to a collision with an aberrant vessel (*if it is hit, will the bridge collapse?*);
- PF = Protection factor considering the probability of collision between an aberrant vessel and bridge (*are there land masses or structures to protect the bridge from collision?*); and
- GF = Growth factor to account for future increase in annual number of vessel trips. This is typically projected to the mid-life of the bridge to compute an average lifetime risk.

Once the input information for the analysis has been collected and developed, the risk calculations can be completed by using programs such as Microsoft Excel and Mathcad to automate the repetitive/iterative analysis process. As illustrated in **Error! Reference source not found.**, the analysis is typically conducted in a matrix or table. In the first column, various types and sizes of ships/barges are arranged in order of decreasing size. Values for the various risk components are then computed for each specific vessel type and an AFC calculated for each row. This analysis is performed for each bridge pier and/or superstructure span as appropriate for the project as well as for vessels transiting both inbound and outbound (which can have differing speeds and water current conditions depending on transit direction). Once each bridge pier or span component has been computed, the annual frequency of collapse of the total bridge can then be obtained by summing the AFC's of each bridge component, vessel, and transit path in the analysis. The inverse of the annual frequency of collapse (1/AFC) represents the return period (in years) of the failure event. In general, the results of the risk analysis shown in this study are reported in terms of the estimated return period – which are easier to understand than the very small decimal fraction values associated with AFC.

Design vessels for collision evaluation and potential mitigation design are selected based on the bridge importance classification, waterway characteristics, vessel fleet characteristics, and crossing structure characteristics in accordance with the Code procedures.

1.3.3 BRIDGE IMPORTANCE CLASSIFICATION

All waterway crossings are not equally important to society. Crossings are usually classified based on social/survival and strategic highway network considerations. The social/survival evaluation for bridge crossings is primarily concerned with the need for civil defense, police, fire department, or public health agencies to respond to an emergency that might exist on opposite sides of a crossing. For highway bridges crossing navigable waterways, the Code requires that they be classified as either a Class I bridge (critical/essential) or a Class II bridge (regular) bridge as shown below:

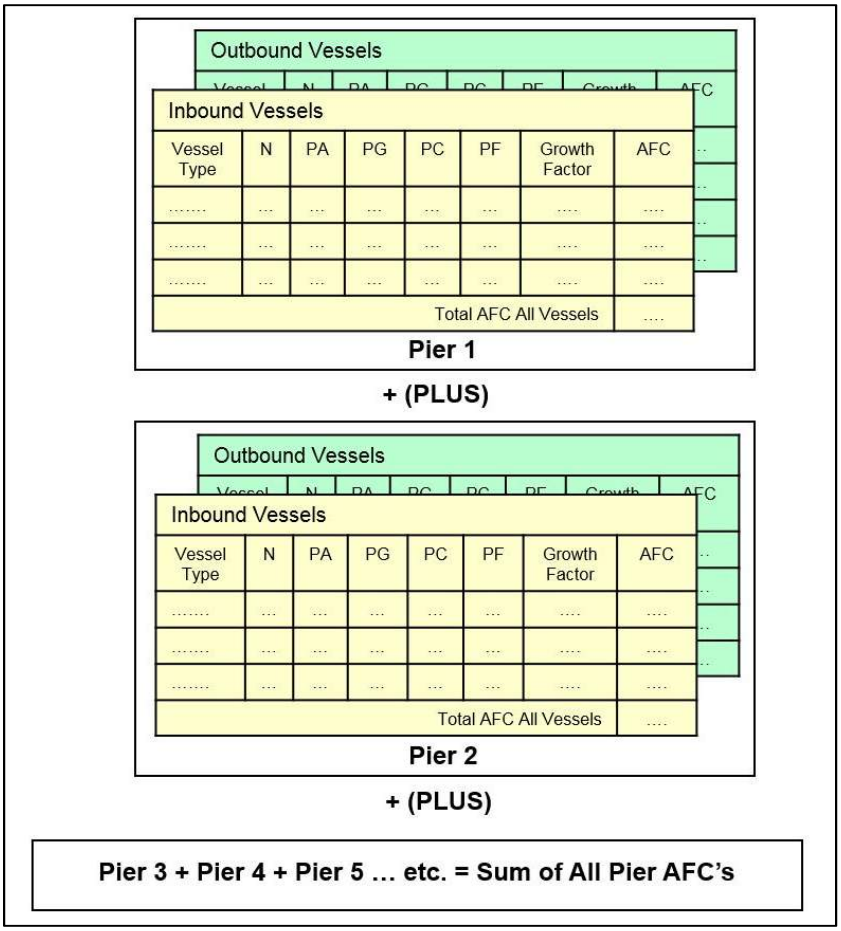


Figure 1.5: Risk Model Development

- **Class I** bridges are of critical importance, including those that must remain open to all traffic after a vessel collision. The maximum annual frequency of collapse for the whole bridge shall be 0.0001, which is a return period of 1 in 10,000 years.
- **Class II** bridges are of regular importance, including those that must remain open to emergency and security vehicles after a vessel collision. The maximum annual frequency of collapse for the whole bridge shall be 0.001, which is a return period of 1 in 1,000 years.

For purposes of this study the IWMB was classified as a Class I (Critical) bridge with a desired return period of 1 in 10,000 years for collapse due to potential vessel collision. It should be noted that the above-mentioned bridge collapse return period criteria does not imply that the bridge is expected to last 10,000 or 1,000 years, but rather that during the normal service life of the structure the risk of collapse due to a vessel collision will be very small.

1.4 OVERVIEW OF HISTORICAL VESSEL ACCIDENTS

Vulnerability of critical infrastructures to extreme events have made headlines worldwide in the past decades due to structural failures, loss of life and financial damage associated with earthquakes, hurricanes, storm surge and waves, tsunamis, flooding and scour, vessel collisions, and terrorist

attacks. For critical bridges, the risk and magnitude of such extreme events is often the controlling load case for the structure design.

The 1980 collapse of the Sunshine Skyway Bridge was a major turning point in awareness and increased concern for the safety of bridges crossing navigable waterways. Investigations and research subsequent to the Skyway and other major bridge accidents worldwide ultimately led to the development of the AASHTO Guide Specification and Commentary for Vessel Collision Design of Highway Bridges, 1st Edition, American Association of State Highway and Transportation Officials (AASHTO) in 1991. For the first time, this landmark publication provided the bridge design community the ability to evaluate the risk of vessel collision and estimate the magnitudes of impact forces associated with ship and barge collisions. A second edition of the Guide Specification was developed by AASHTO in 2009 **(6)** to update and incorporate lessons learned from the use of the original 1991 Guide Specification and incorporate results from barge and ship collision research conducted since the original vessel collision publication. The 1991 AASHTO Guide Specification was the primary basis for vessel collision requirements included within the Canadian Highway Bridge Design Code, Section 3.14 and Annex A3.3 **(5)**.

The Second Narrows CN Rail Lift Bridge across Burrard Inlet was struck by the cargo ship Japan Erica carrying logs in October of 1979 as it attempted to transit the harbour during heavy fog. The impact knocked an approach span adjacent to the main span section of the rail bridge into the water (**Figure 1.6**). The rail bridge remained closed until March 4, 1980. The existing rail bridge was constructed in 1968 and replaced the original bascule combined rail/highway bridge built in 1925, which had been hit by vessels several times and collapsed twice due to vessel collision. Subsequent to the 1979 accident, the VFPA in cooperation with the Coast Guard, PPA and other maritime stakeholders, imposed the Traffic Control Zone (TCZ-2), a set of rigorous vessel operating restrictions for vessels transiting the Second Narrows waterway.

A railroad swing bridge (Queensborough Railway Bridge) crossing the Fraser River in New Westminster, British Columbia was struck by a gravel barge under tug assistance on June 28, 2011. The Transportation Safety Board (TSB) of Canada determined that a fatigued tug master and an inexperienced mate were factors that led to the collision. The tug master apparently handed over the helm to the mate prior to a critical maneuver on the Fraser River with which the mate was unfamiliar. The tug master remained in the wheelhouse, but fell asleep. The bridge center swing span and protection pier sustained extensive damage. The bridge was inoperable for two months, causing major disruptions to railway and river traffic. Another barge impact in the area occurred on December 26, 1975 when the log barge Swiftsure Prince broke loose from its moorings at Pacific Coast Terminals and drifted upstream striking the New Westminster Railway Bridge. The collision sent the entire main fixed span into the river and caused major disruptions to both railway and river traffic.

Mast collisions are usually not catastrophic (bridge collapse) and typically result in damage to the fascia of the bridge and sometimes to the bridge deck which must be inspected and repaired during temporary closures of the bridge. On January 15, 2000, the boom of a mobile crane being transported on a barge struck the underside of the Knight Street Bridge crossing the Fraser River in Richmond, damaging the bridge and the fixtures secured underneath its deck. The impact caused the boom to bend and the crane to slide off the barge and sink. The bridge was closed to traffic for about 48 hours. A recent example of a mast-type vessel collision occurred with the Golden Ears Bridge over the Fraser River near Vancouver when the over-height mast of a crane mounted on a deck barge made contact with the exterior of the bridge deck causing relatively minor damage to the bridge railing.

It is important to note that there have been no vessel collision accidents with the Lions Gate or Ironworkers Memorial Bridges (both highway bridges). There have been no vessel collision incidents with the CN Rail Lift Bridge since the Traffic Control Zone-2 (TCZ-2) was implemented.

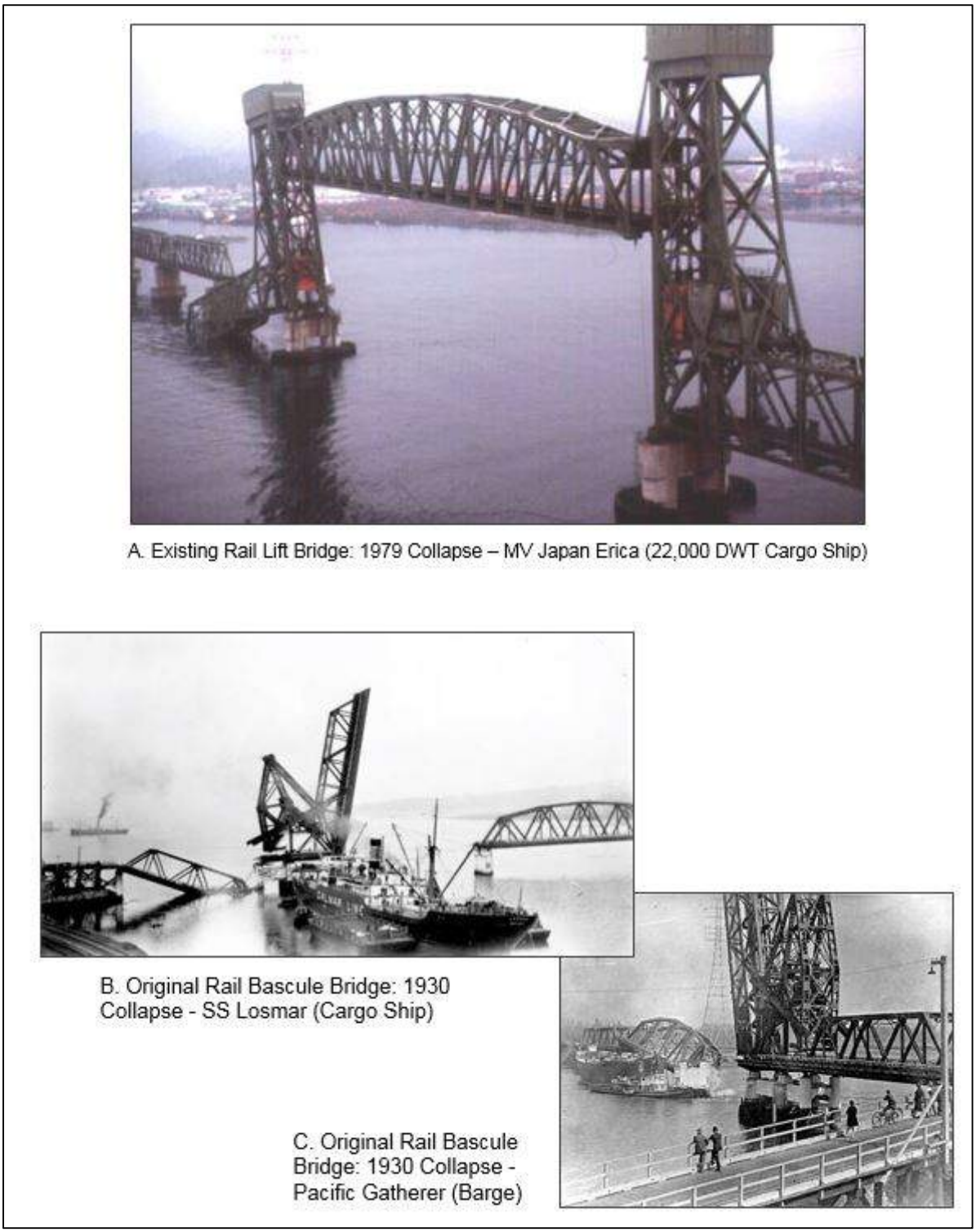


Figure 1.6: Second Narrows Rail Bridge Collisions, Vancouver, B.C.

2 WATERWAY CHARACTERISTICS

The Ironworkers Memorial Bridge crosses the Second Narrows portion of Burrard Inlet and Vancouver Harbour – which for marine navigation purposes is easily accessible and navigable by ocean going ships as far as Port Moody at the head **(9)**. The bridge is approximately 8km east of the Lions Gate Bridge, which crosses the First Narrows. The Second Narrows is longer and more constricted than the First Narrows and is spanned by two bridges; (1) IWMB, which is a fixed span highway bridge; and (2) the CN Rail Lift Bridge, which is a low level rail bridge with a main lift span just east of IWMB.

The fairway (navigation) channel through the Second Narrows varies in width, but the minimum navigable width is 137m at the CN Rail Lift Bridge. Vessels with drafts up to 13.5m can transit Second Narrows. Commercial vessels (ships and barges) passing under the IWMB are transiting to and from marine terminals located within the Port of Vancouver (PoV) at facilities east of the IWMB. The existing facilities east of Second Narrows are primarily bulk handling terminals for dry and liquid materials.

The PoV is Canada's largest port, supporting close to one in every five dollars of trade in goods that flow through the country and offers the broadest range of cargo-handling options of any port in North America. As established by the Government of Canada pursuant to the Canada Marine Act, the PoV is under the jurisdiction of the Vancouver Fraser Port Authority (VFPA) - which is responsible for the stewardship of federal port lands in and around Vancouver, British Columbia.

The VFPA operates across five business sectors: automobiles, breakbulk, bulk (dry and liquid), container and the passenger/cruise ship industry. The port facilitates trade with more than 170 world economies, and handled 138 million tonnes of cargo in 2015 valued at $200 billion. Almost 95 per cent of the port's total volume serves Canadian import and export markets. A map of the major marine terminal locations in Vancouver Harbour is shown in **Figure 2.1**. Detailed information about the VFPA and PoV facilities, including all requirements and restrictions for vessels operating within Vancouver Harbour, are contained in the VFPA's Port Information Guide **(10)**.

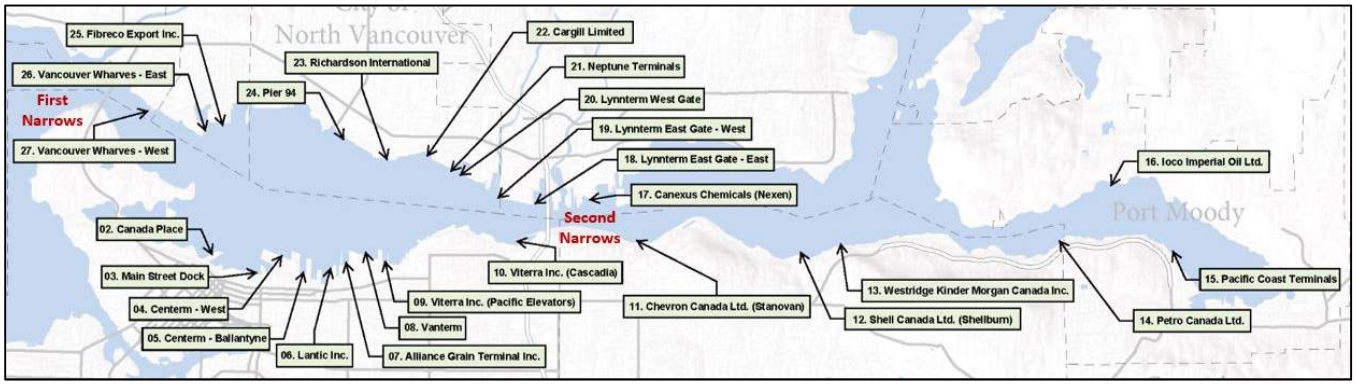


Figure 2.1: Port of Vancouver (PoV) Major Marine Terminal Location Map

2.1 BRIDGE LOCATION AND CHANNEL ALIGNMENT

A plan view of the IWMB superimposed on a section of the Vancouver Harbour nautical chart (Central Portion Chart # 3494) is shown in **Figure 2.2**. Added to the map are the typical vessel transit paths for inbound and outbound vessels, additional bathymetry near the bridge, and the location of the adjacent rail lift bridge. Inbound and outbound vessels make a relatively shallow turn on their approach to the IWMB.

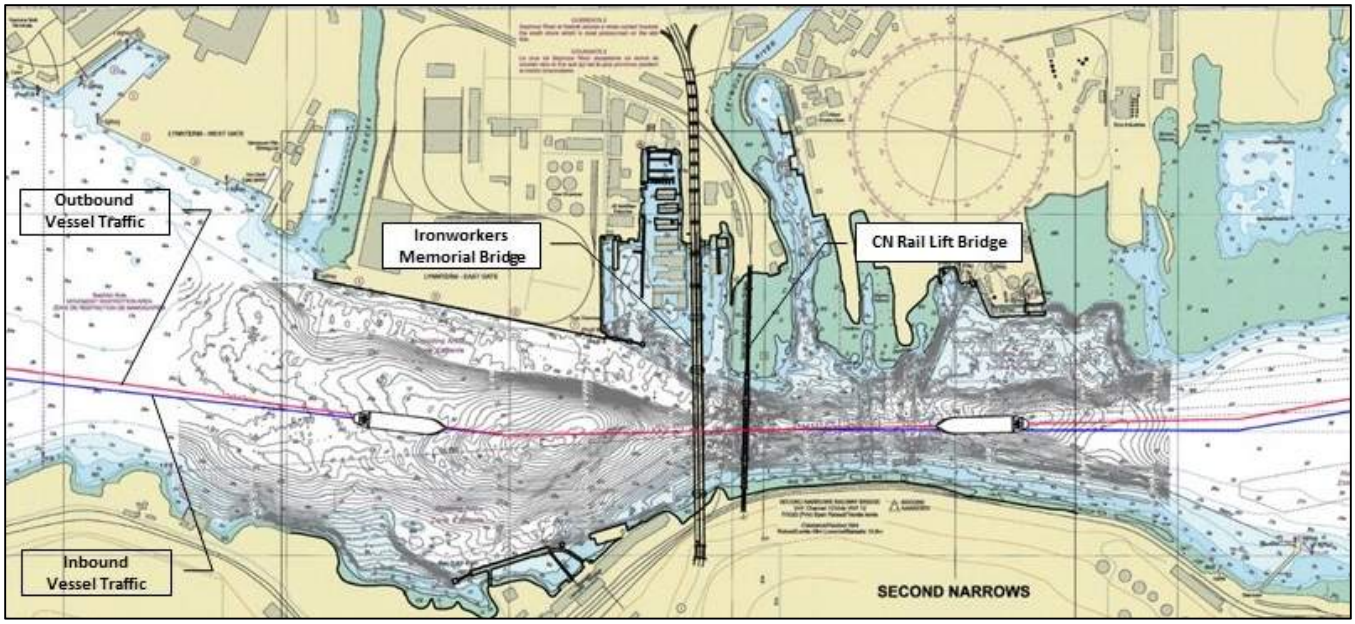


Figure 2.2: IWMB Vicinity Map

The navigation envelopes for vessels transiting Second Narrows are established by VFPA based on the size of the vessel and existing highway and rail bridge constraints. The maximum published vertical operational clearance is 44m above HHWLT (El 5.0m). Within the main navigation channel, the maximum vessel air draft allowed by the VFPA is 42m, allowing for a 2m minimum overhead clearance buffer between the bottom chord of the bridge structure and the top of the navigation clearance envelope. The minimum horizontal clearance width is 2.85 times the vessel beam. Based on the rail bridge channel width of 137.1m, the maximum beam of vessels permitted to transit Second Narrows is 48.1m. Specific vertical and horizontal clearances for different vessels sizes are shown in **Figure 2.3** and discussed in detail in the VFPA's Port Information Guide **(10)**.

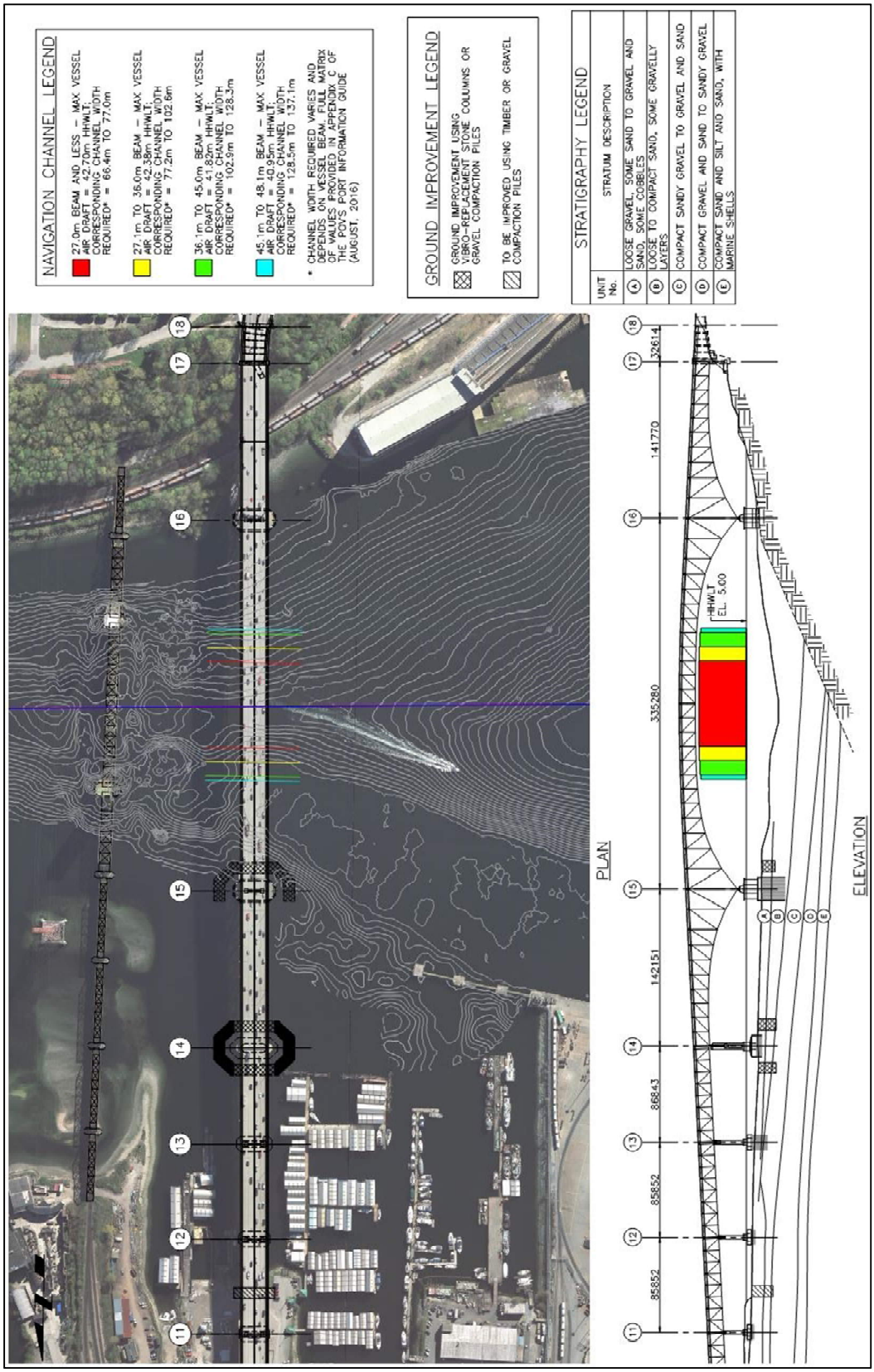


Figure 2.3: IWMB General Configuration and Navigational Channel Clearances

2.2 SECOND NARROWS BATHYMETRY

In addition to the water depths shown on the nautical charts, supplemental bathymetry was provided by the VFPA. **Figure 2.4** shows the bathymetry at the IWMB and CN Rail Lift Bridge, as well as the underwater remnants of the old rail/highway bridge that was demolished after the current rail lift bridge was constructed in 1969 (the old bridge foundations were cut-off at the seafloor). Water depths used throughout this study are referenced to Chart Datum (CD) where elevation "zero" is the lowest normal tide. Vertical navigational clearances are referenced to the distance above Higher High Water Large Tide (HHWLT) elevation.

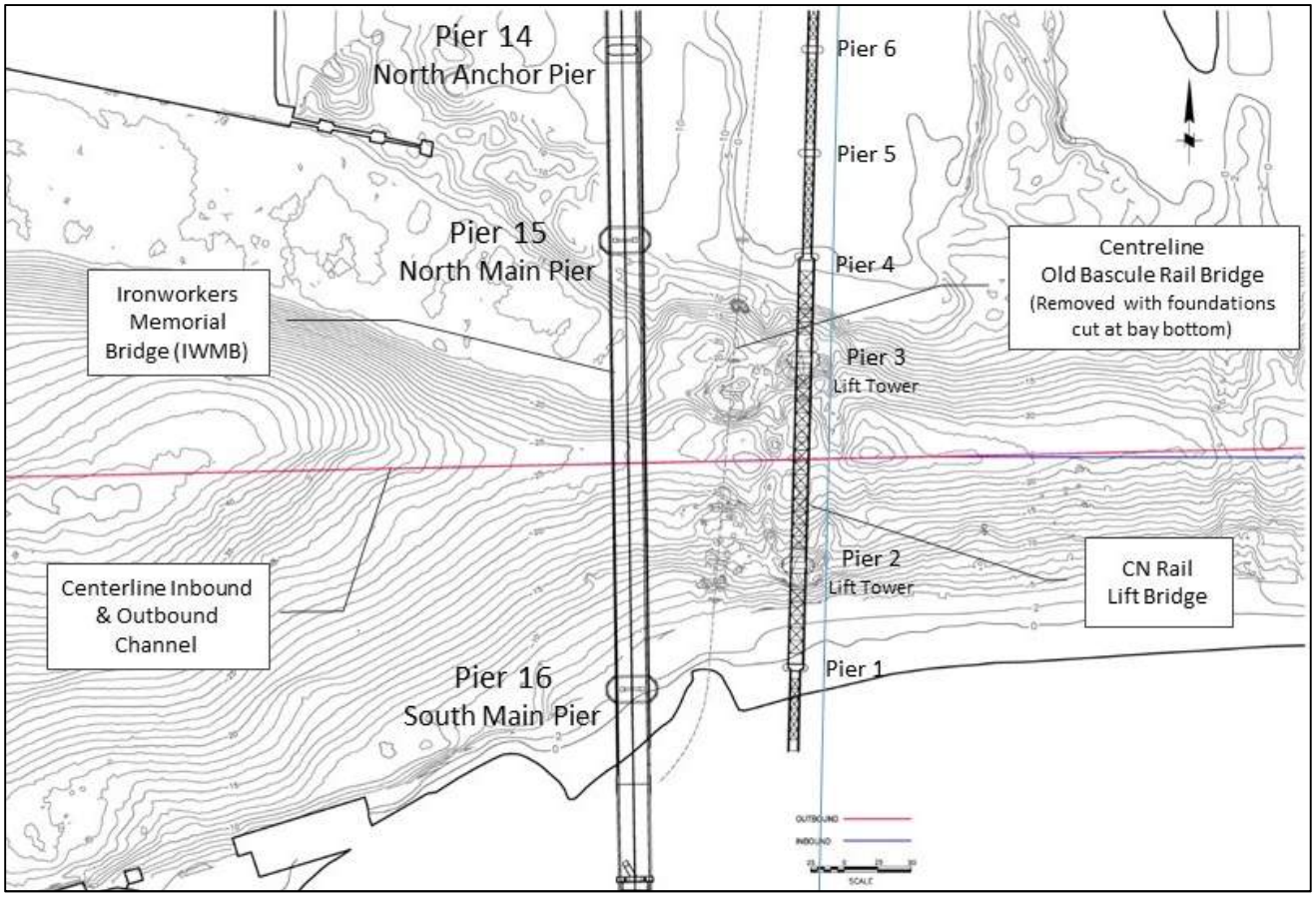


Figure 2.4: Bathymetry Map

2.3 TIDAL LEVELS AND CURRENTS

Tidal parameters for Burrard Inlet are summarized in **Table 2.1** based on Vancouver Tide Tables and data developed as part of this study. Vancouver experiences a mixed semidiurnal tide cycle: two high and two low tides of different size per day. The maximum tidal range in a cycle occurs during "spring tides" which occur twice per lunar month and can be as great as 5m.

Table 2.1: Tidal Elevations at Vancouver Harbour

TIDE LEVEL	ELEVATION (M)
Extreme Highest Water (EHHW)	5.60
Higher High Water Large Tide (HHWLT)	5.00
Higher High Water Mean Tide (HHWMT)	4.40
Mean High Water (MHW)	4.20
Mean Water Level (MWL)	3.10
Mean Low Water (MLW)	2.00
Chart Datum - CD	0.00
Lower Low Water Mean Tide (LLWMT)	1.10
Lower Low Water Large Tide (LLWLT)	-0.10
Extreme Lowest Low Water (ELLW)	-0.30

In accordance with Ministry policy, an adjustment for potential sea level rise due to climate change was included in the risk analysis and for developing mitigation concepts. The adjustment for sea level rise was projected 25 years, consistent with the mid-point of the 50-year study horizon of the bridge. The Geological Survey of Canada (GSC) **(11)** provides tabulated values of sea level projections in major Canadian locations. For this study's base case analyses, an increase in water elevation due to sea level rise was based on the GSC's most conservative projected values for Vancouver, a 0.1m increase in the next 25 years.

A hydrodynamic model of Burrard Inlet was developed for this study to investigate the hydraulic changes caused by the proposed physical mitigation measures. This analysis is described in further detail in **Section 8.3** and **Appendix C**. For the existing condition at Second Narrows, typical peak surface flows for both ebb (receding to the west) and flood (advancing to the east) tides are shown in **Figure 2.5** and **Figure 2.6,** respectively. Peak ebb tide surface currents at the IWMB crossing site are up to 3.5 m/s (6.8 knots) and relatively uniform and in a direction roughly parallel to the vessel transit paths. Peak flood tide surface currents at the IWMB crossing site are about 2.3 m/s (4.5 knots) with considerably higher peak surface currents of 4.0 m/s (7.8 knots) east of the rail bridge.

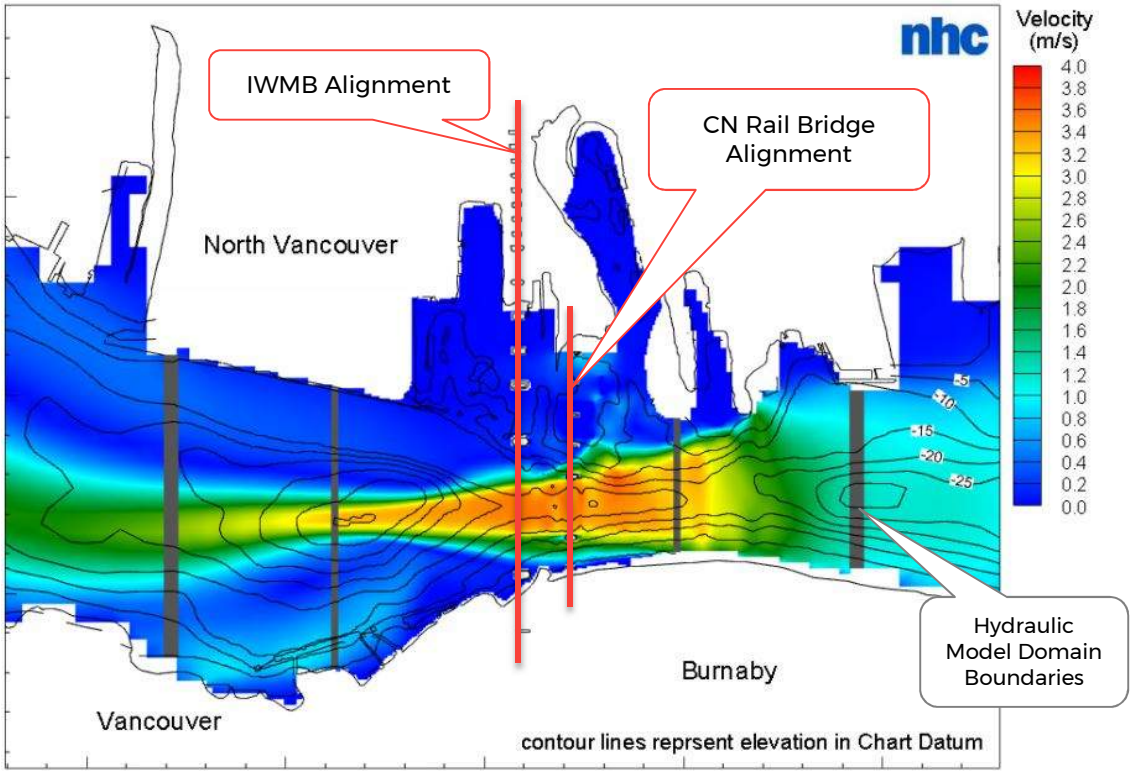


Figure 2.5: Peak Surface Velocities at Second Narrows – Existing Conditions – Ebb Tide

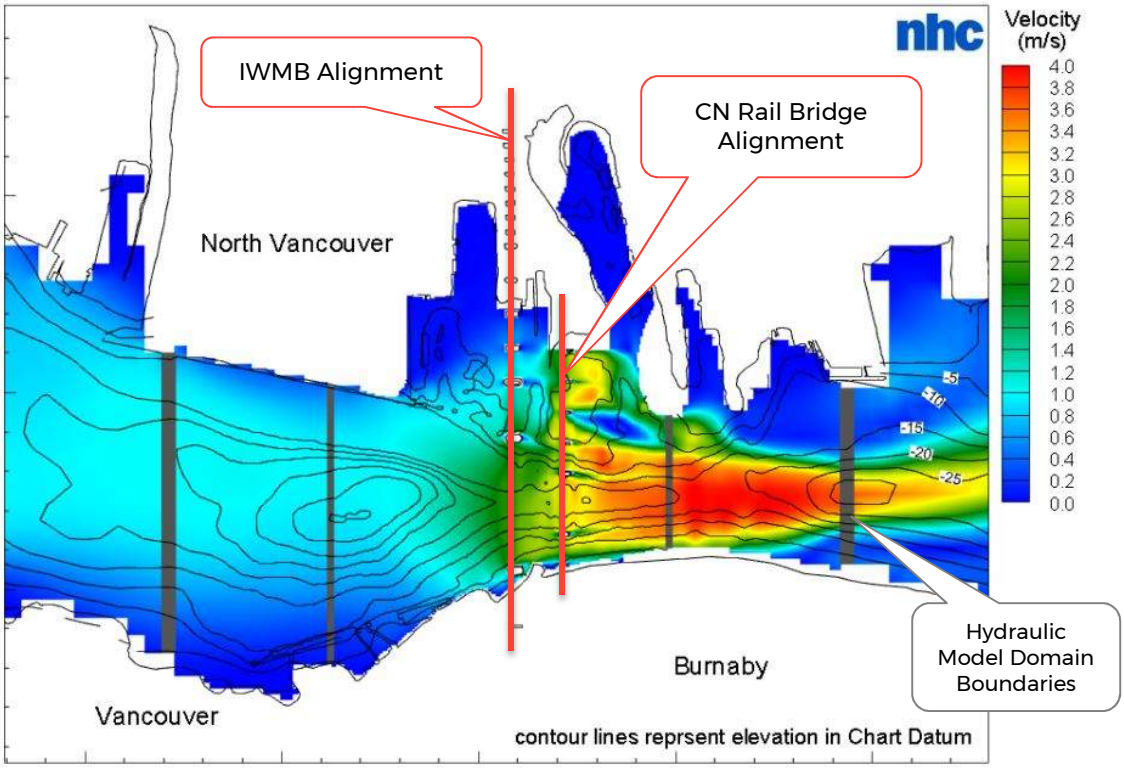


Figure 2.6: Peak Surface Velocities at Second Narrows – Existing Conditions – Flood Tide

2.4 PRACTICES AND RESTRICTIONS FOR VESSELS OPERATING IN THE PORT

A Vessel Traffic Services (VTS) system operated by the Canadian Coast Guard, Western Region, covers the harbour and its approaches **(9)**. Vancouver is located within Sector 3 of the Vancouver VTS and is administered by Victoria Traffic through the Coast Guard's Marine Communications and Traffic Services Centre (MCTS). A Traffic Separation Scheme (TSS) also exists on the east side of the entrance to Burrard Inlet as shown on the nautical charts.

The VFPA's Operations Centre is the primary point of contact for all vessels operating within the port and the VFPA's Port Information Guide **(10)** includes rules and regulations concerning: vessel notification, documentation and reporting; port description and navigation; port safety and security; nautical services and communication; port operations; and port services. The Guide also contains the vessel operating requirements for designated Traffic Control Zones (TCZ) within the harbour, including very stringent requirements for vessels transiting the Second Narrows (TCZ-2).

2.4.1 OPERATIONAL, PILOT AND TUG REQUIREMENTS AT SECOND NARROWS

Pilotage is compulsory for vessels over 350 gross tonnage (GT) and is provided by the Pacific Pilotage Authority (PPA). The pilot boarding station is located near Victoria at a location known as Brotchie Ledge. Unless noted otherwise in this report, the pilotage requirement is fulfilled by a single pilot onboard the vessel (special circumstances noted below require two pilots onboard).

Subsequent to the CN Rail Lift Bridge collapse in 1979 due to a vessel collision (**Section 1.4**) the VFPA in cooperation with the PPA imposed special transit restrictions at Second Narrows to minimize the risk of future bridge accidents. Previously referred to as a Movement Restriction Area, the TCZ-2 requirements have been periodically updated by the VFPA since their implementation in the early 1980's. Since the TCZ-2 was established, there have been no vessel collision incidents with the CN Rail Lift Bridge. There have been no historical accidents with IWMB since it was constructed.

The TCZ-2 includes transit requirements related to pilotage, vessel speed, transit windows based on water currents, daytime/nighttime transit restrictions, visibility, and requirements for tethered tugs. For purposes of the risk assessment, the key TCZ-2 requirements that apply to all deep draft vessels transiting Second Narrows are:

- **Pilotage:** Mandatory pilotage with a minimum of one pilot and sometimes two (see tables below)
- **Speed Limit:** Maximum speed limit of 6 knots.
- **Transit Windows:** Transits must occur only during transit windows on either side of high and low water slack tides and a predicted limiting current (see tables below).
- **Visibility:** Transits can only occur during good visibility. Vessels must be able to observe the bridges clearly before reaching Terminal Dock when inbound (eastbound) and before reaching Berry Point when outbound (westbound).
- **Tethered Tugs:** Mandatory for all vessels. The number of tugs required are based on vessel size and loading condition.

Table 2.2 summarizes the additional TCZ-2 transit requirements that apply to tankers in product (loaded tankers) and **Table 2.3** summarizes the requirements for all other vessels (bulk carriers, etc.) and tankers not in product (ballasted tankers). The most stringent TCZ-2 requirements apply to transits by the relatively large Aframax tankers (105,000 to 120,000 DWT) that transit the Second Narrows waterway. These tables were adapted from the detailed VFPA TCZ-2 requirements in **(10)**.

Table 2.2: TCZ-2 Requirements for Tankers in Product (loaded)

VESSEL TYPE	NIGHT TIME TRANSITS ALLOWED?	TIDAL CURRENT OPPOSING	TIDAL CURRENT FOLLOWING	TETHERED TUGS REQUIRED	NO. OF PILOTS REQUIRED
Tankers less than 40,000 DWT and LOA less than 185m	Yes	Less than 1.0 knots	Less than 0.5 knots	Yes	1
Tanker LOA equal to or greater than 185m	No	Less than 1.0 knots	Less than 0.5 knots	Yes	1
Tankers equal to or greater than 40,000 DWT	No	Less than 1.0 knots	Less than 0.5 knots	Yes	2

Table 2.3: TCZ-2 Requirements for All Other Vessels and Tankers not in Product (Ballasted)

VESSEL TYPE	NIGHT TIME TRANSITS ALLOWED?	TIDAL CURRENT OPPOSING	TIDAL CURRENT FOLLOWING	TETHERED TUGS REQUIRED	NO. OF PILOTS REQUIRED
Vessels with LOA less than 230m and Beam less than 35m (Approx. 100,000 DWT)	Yes	Less than 2.0 knots	Less than 0.5 knots	Yes	1
Vessels with LOA equal to or greater than 230m and Beam equal to or greater than 35m (Approx. 100,000 DWT)(1)	No	Less than 1.0 knots	Less than 0.5 knots	Yes	2

(1) This vessel type represents the Aframax Tankers 105,000 to 120,000 DWT

3 BRIDGE AND SITE CHARACTERISTICS

3.1 STRUCTURAL CONFIGURATION

The total length of the Ironworkers Memorial Bridge including the north approach is 1,292m. The central section of the bridge (**Figure 3.1**) is a 619m steel truss that consists of a north anchor span (142m), a main span over the navigation channel (335m), and a south anchor span (142m). The main span contains three sections, a north cantilever (116m), a suspended span (103m), and a south cantilever (116m). The portions of the bridge exposed to potential collision by deep draft merchant vessels transiting Second Narrows are the main span and north anchor span.

The central section of the steel truss bridge is supported by four piers, Pier 14 (north anchor pier), Pier 15 (north main pier), Pier 16 (south main pier), and Pier 17 (south anchor pier). The piers exposed to potential collision are Piers 14, 15 and 16 (Pier 17 is protected since it is located on land).

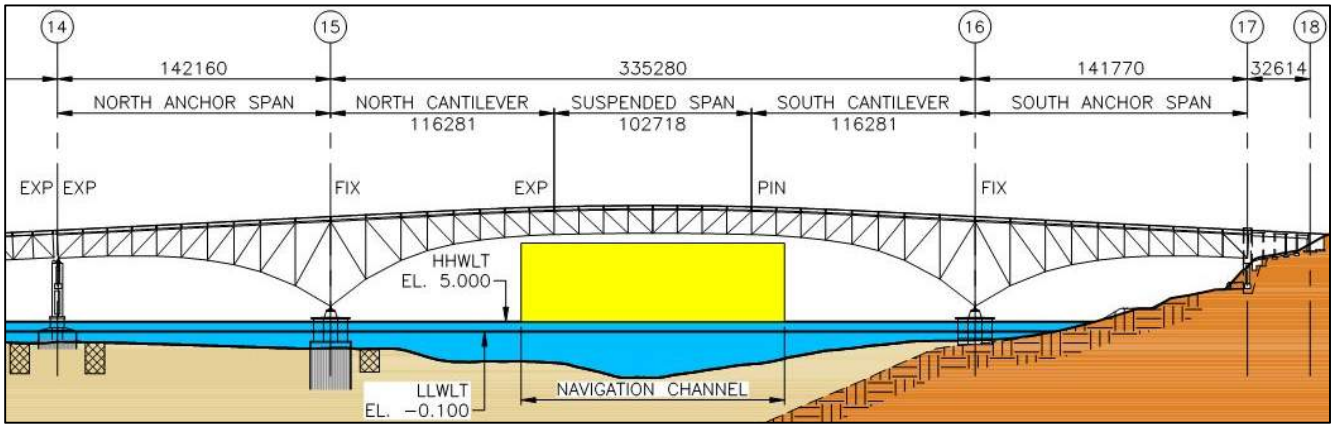


Figure 3.1: Elevation View of IWMB Main Span

3.2 GEOTECHNICAL CONDITIONS

The North Main Pier (Pier 15) and North Anchor Span Pier (Pier 14) are supported on pile foundations that extend into the Seymour River marine deltaic deposits, which consist of layered sand and gravel with some cobbles and silt. These deposits are described in detail in the Golder Associates report of December 1991 **(12)** and June 1993 **(13)** and are inferred to be loose to compact to a depth of about 40 m below seabed, then compact to dense to about 60 m below seabed, and dense to very dense below 60 m. Subsequently, ground improvement has been undertaken adjacent to the north main and anchor span pier foundations to improve seismic performance.

The South Main Pier (Pier 16) is supported on a shallow foundation supported directly on sandstone bedrock. The sandstone is part of a tertiary bedrock unit consisting of sandstone, siltstone, shale and conglomerate with minor volcanic rocks.

3.3 NAVIGATION CLEARANCES

Navigation clearances for vessels transiting through Second Narrows have been established by VFPA **(10)** based on waterway geometry at the IWMB, CN Rail Lift Bridge and the existing powerlines at Burns Point and the terminals east of the bridges. The advertised vertical clearance through Second Narrows is 44m at HHWLT based on the powerline crossings (IWMB has a limiting height of 44.38m). VFPA requires a 2m clearance between the bottom of the powerlines and the air draft of any vessel, therefore an operational clearance of 42m has been established through Second Narrows as part of the TCZ-2 requirements. **Figure 3.2** is a photograph by PPA showing the view of the IWMB and CN Rail Lift Bridge taken from the deckhouse of an inbound ship.

Due to the arc of the bottom chord of the truss span, the maximum allowable air draft (the distance from the surface of the water to the highest point on the vessel) is a function of the vessel size; the wider the vessel, the lower the maximum air draft. Appendix C of the VFPA's Port Information Guide **(10)** provides a matrix of clearances based on vessel beam, graphically presented in **Figure 2.3**.

Transits of vessels with an air draft in excess of 42m up to a maximum of 47m chart datum LLWLT are possible during tidal windows below HHWLT as the lesser water depth will increase the maximum available height between the lowest member of the bridge structure and water **(10)**. However, vessels with an air draft greater than 42m must obtain prior approval of the VFPA's Operations Center and comply with additional transit requirements.

Note that the vertical clearance of the rail bridge is 46m when the lift span is fully raised. In the closed position (lowest level) the vertical clearance is 10.8m over the channel.

With respect to channel width, the minimum required for transiting TCZ-2 is 2.85 times the vessel beam. The limiting horizontal clearance through Second Narrows is based on the CN Rail Lift Bridge, which provides 137m clear width between the rubbing fenders. Therefore, the maximum beam allowed for transiting TCZ-2 is 48.1m (137m/2.85) based on the distance between the rail bridge piers.



Figure 3.2: View of IWMB and Rail Lift Bridge from Inbound Ship

3.4 SUPERSTRUCTURE (SPAN) EXPOSURE TO SHIP CONTACT

Vessel collision assessments are usually based on an evaluation of bridge piers in the waterway being hit by an aberrant vessel; however, for arch-shaped bridges like IWMB an evaluation of potential superstructure collision must also be considered. For arch-shaped bridges the vertical clearance above water is reduced significantly between the edge of the channel and the piers supporting the arching superstructure. As shown in **Figure 3.3** potential superstructure collision could occur between the mast of the vessel hitting the lower chord of the steel truss, the deckhouse of the vessel hitting the truss, or the top of the bow of the ship hitting the truss above water. **Figure 3.3** also illustrates the potential pier collision scenario where the bulbous bow of an aberrant vessel hits the concrete pier supporting the bridge structure.

The location of the point of contact of an aberrant vessel mast, deckhouse or bow with the steel truss varies depending on the vessel size, draft (loaded or ballasted); geometry of the steel truss members; and the water elevation. The vessel impact force also varies depending upon which part of the ship contacts the bridge component. Mast impacts are smaller than deckhouse impacts, which are smaller than flared bow impacts and are less than the full bow impact force on the pier (the largest impact force). In general the mast of an aberrant ship would contact the bottom chord of the truss before potential contact was made with the ship deckhouse (**Figure 3.3**).

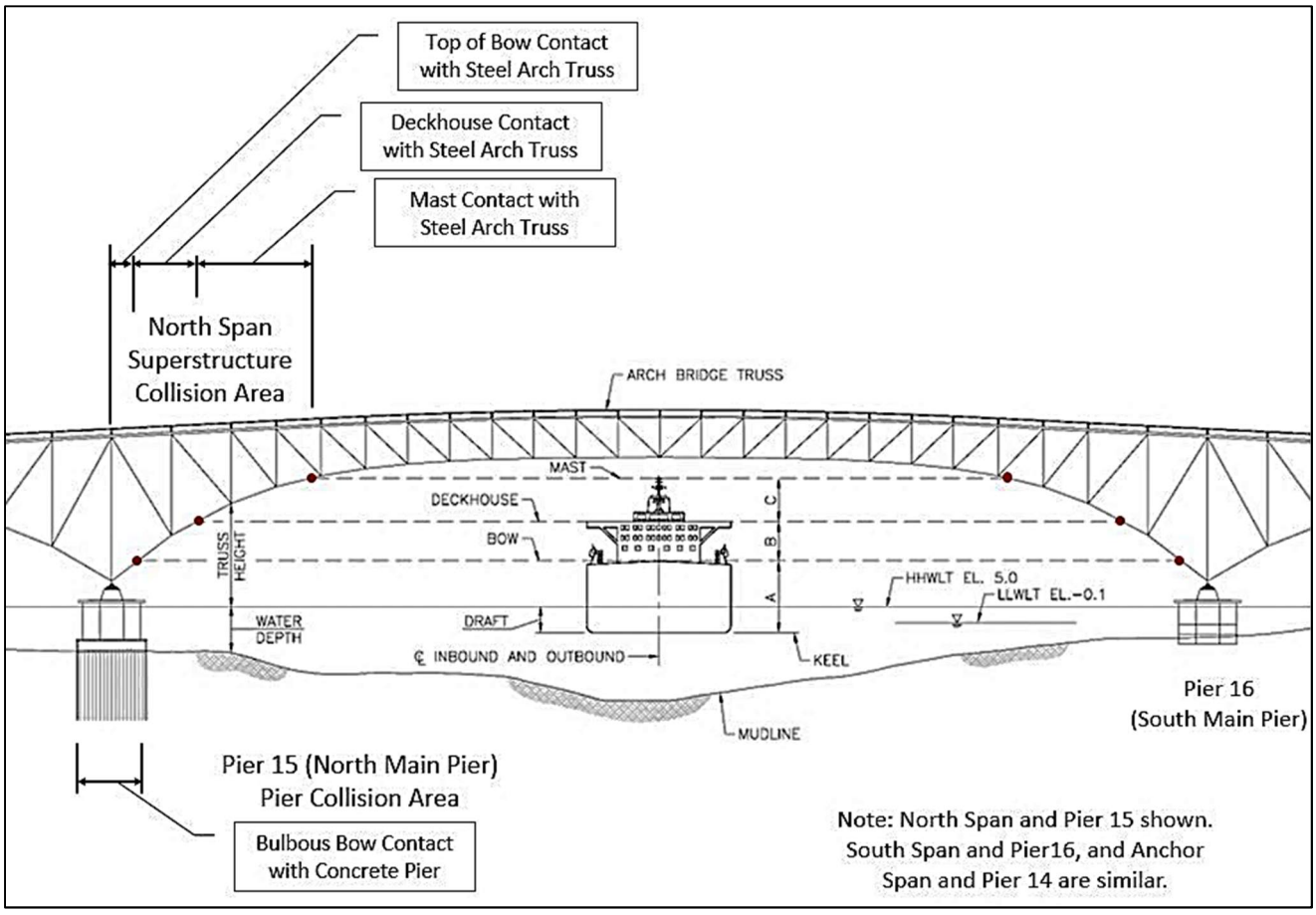


Figure 3.3: Superstructure (Span) Collision Geometry

3.5 BRIDGE RESISTANCE TO SHIP IMPACT

A key component of assessing the annual frequency of collapse (**Eq. 1**) is a probability of collapse (PC), which is based on the estimated impact force of the aberrant vessel (P) and the resistance strength of the bridge (H) to resist that impact force. The bridge resistance strengths of the piers for this risk assessment were based on values from a previous study of the IWMB **(2)**. Collision forces associated with vessel mast, deckhouse, flared bow and full bow impacts were used in conjunction with the ultimate resistance strength of the bridge pier and superstructure (span) components at the respective location of impact to estimate PC.

3.5.1 PIER COLLISION

The two main piers adjacent to the navigation channel and the north anchor pier of the IWMB are within the central zone of potential vessel collision in the waterway. The south main pier (Pier 16) is a reinforced concrete caisson founded directly on dense sandstone and has an estimated resistance strength of 90 MN. The north main pier (Pier 15) and north anchor pier (Pier 14) are reinforced concrete foundations bearing on steel or timber piles. Pier 15 has an estimated resistance strength of 100 MN and Pier 14 has an estimated resistance strength of 25 MN.

3.5.2 SUPERSTRUCTURE COLLISION

The bridge superstructure is configured to accommodate longitudinal expansion at the end of each anchor span and the north end of the suspended span. The transverse load path is through the bearing pedestals at each pier. The truss members are built-up riveted combinations of steel plate and angle sections (**Figure 3.4**). The structure was designed for horizontal wind loads and upgraded in the mid-1990's for the seismic requirements of the day. However, with respect to the vessels transiting the waterway, the truss members are relatively light members with minimal capacity for the concentrated lateral loads typically associated with vessel impact.

For the base case analyses, the bottom chord of the steel truss superstructure was modeled as having no lateral resistance strength for vessel impacts (H = 0.0 MN). This was a conservative assumption that reflects the high state of compression in bottom chord members, lack of redundancy, challenges of repair and potentially catastrophic consequences of a vessel impact. However, the analyses found that quantified risks were sensitive to the truss resistance strength and that, in practical terms, the truss does have limited strength capacity to resist small vessel impact loads. As such, a structural evaluation of the truss lateral capacity for vessel mast loading was completed. This work is summarized in a memo (**Appendix D**) that includes the assessment findings, local component capacities, global load path and governing mast collision force. The two key findings from this assessment are described as follows:

- **Bottom Chord Local Out-of-Plane Response:** The first contact of a vessel's mast with the bottom chord will generate an out-of-plane structural response that may include local member bending, shear and torsion. Neither the original bridge design, nor the subsequent strengthening works, considered this load scenario. A simplified calculation indicates that capacity for this response is low (mast collision loads of less than 1 MN) and should not be relied on given the importance of these members and the challenge in repairing them.

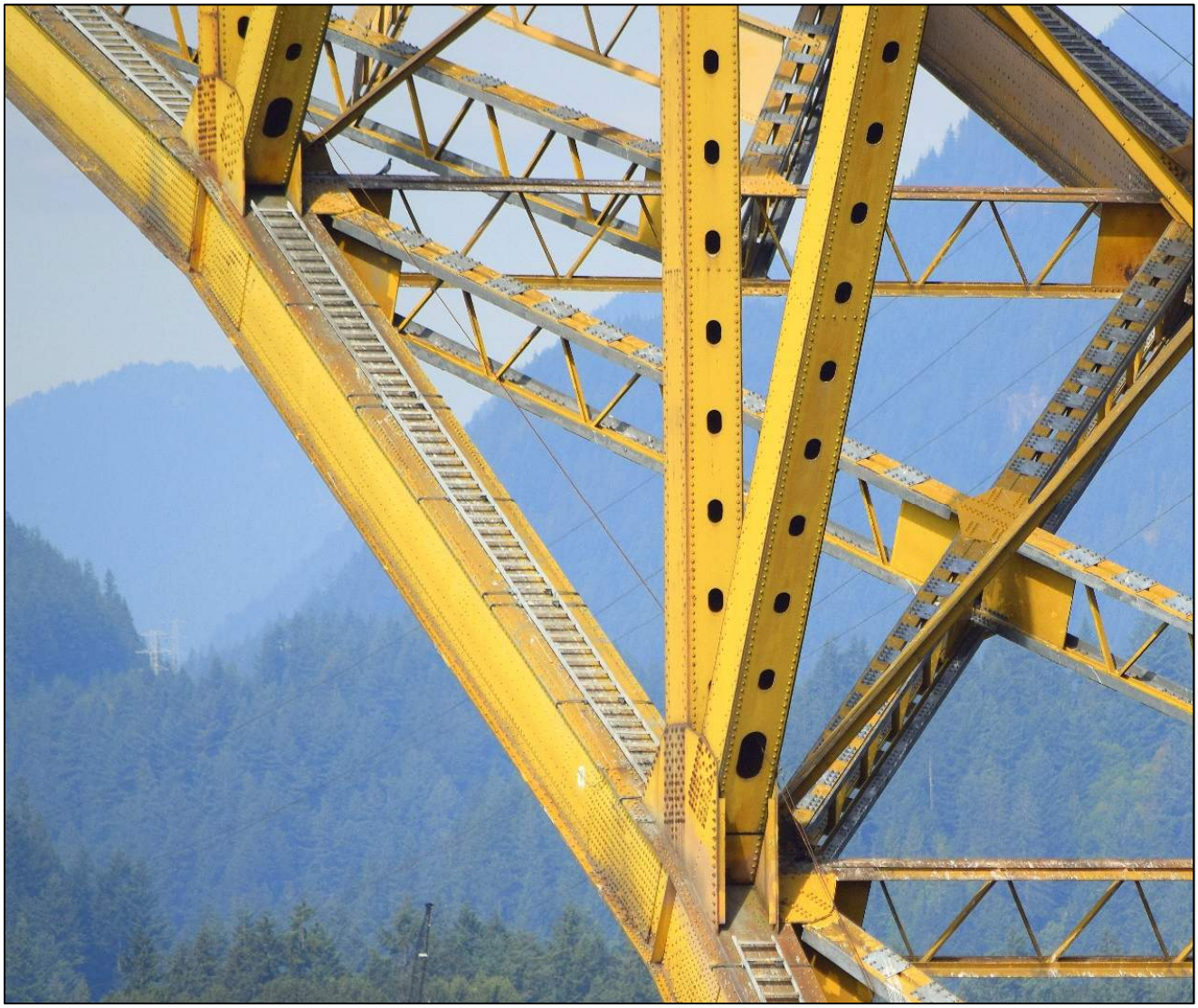


Figure 3.4: Built-Up Truss Component Sections

- **Global Truss Lateral Load Path:** A mast loading applied to the truss nodes would engage the lateral load path of the truss, as shown in **Figure 3.5**. This load path includes the axially loaded transverse struts and plan bracing ("X" and "K"), as well as the parallel bottom chord members acting as a tension/compression force couple. Unlike the bottom chord out-of-plane response, this is a conventional load path and its member's axial capacity can be reliably estimated. The governing mast collision load for the global truss lateral load path is approximately 3.5 MN. The limiting member is the bottom chord member directly adjacent to the pier acting in compression.

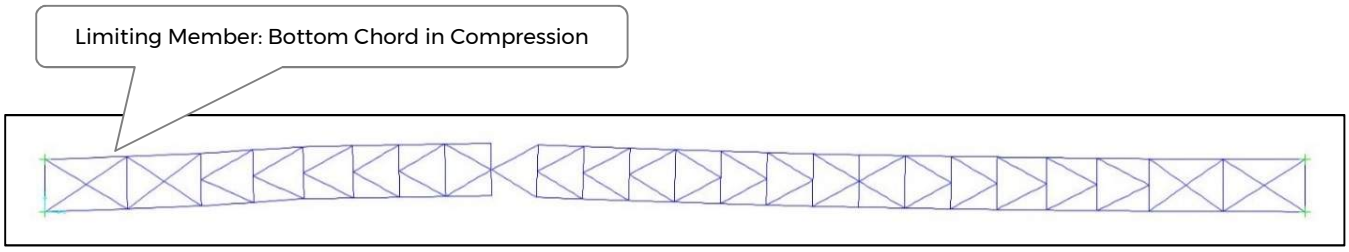


Figure 3.5: Plan View of Bottom Chord Model, Showing Deflected Shape and Limiting Member

Note that the code-based Method II risk analysis specifies a mast collision design load by simply taking 10% of a vessel's deck house collision force which is, in turn, 10% of a vessel's bow collision force. This approach is based on limited empirical data and intended to cover a wide range of mast / funnel geometries and stiffnesses. With appreciation of this code limitation, and the consequence of even minor damage, the project team used a reduction factor of 0.5 be applied to the calculated lateral resistance strength (H). Therefore, for inclusion in the risk analysis, the lateral resistance strength (H) was set as follows:

- H=0 for the truss in its current configuration.
- H=1.75 MN for the existing truss provided the bottom chord is protected in bays vulnerable to a mast collision, as shown in **Figure 3.6**. This protection could be provided by a fender, intercepting the initial mast contact and eliminating the local out-of-plane response of the bottom chord.

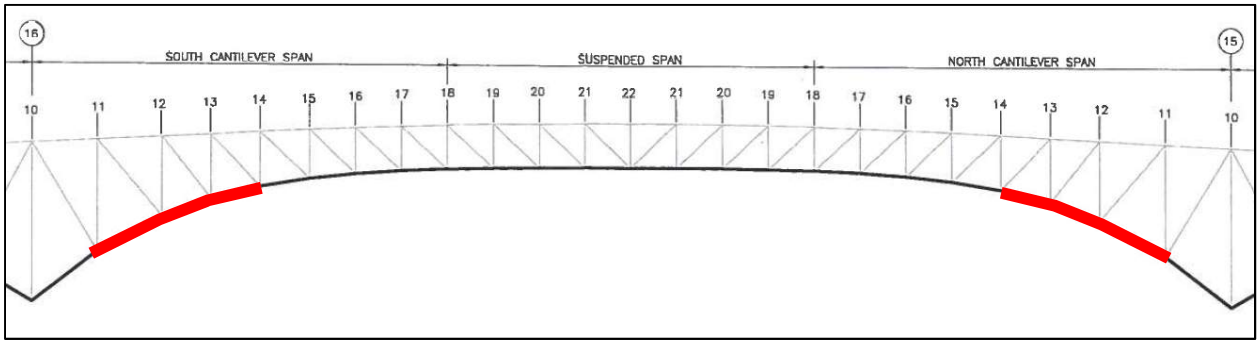


Figure 3.6: Main Span Truss with Bays Vulnerable to Mast Collision Highlighted by Red Line

3.6 DESIGN WATER DEPTHS

The ability of a vessel to contact a pier is generally controlled by the available water depth in the near vicinity of the piers and spans (**Figure 2.4**). Aberrant vessels with drafts less than the water depth can potentially contact bridge components, whereas vessels with a draft greater than the water depth run aground before contacting the bridge. For the risk analysis, a design water depth was determined for each pier based on the existing bathymetry, tide elevation, allowance for aberrant vessels to potentially ride-up or plow through soils at the sea floor, and an adjustment for potential sea level rise. Adjustments in water depth were also included in the risk analysis for vessels that might ride-up the rock slope a short distance at Pier 16, or plough through existing sand/gravel soils a short distance at Piers 15 and 14 before grounding. For all IWMB piers, the water depth was increased by 1m

to compensate for potential ride-up. The value was based on information derived from the detailed ride-up and grounding analysis of vessels impacting sloped rock surfaces and rock protective berms during the Lions Gate Bridge (LGB) risk assessment **(14)**. The 2m ride-up allowance used for LGB was reduced to 1m for IWMB due to lower vessel transit speeds at Second Narrows.

At the south main tower (Pier 16), the sea floor was set equal to El -6.0 for inbound vessel transits and El -5.0 for outbound vessels. At the north main pier (Pier 15) the seafloor was set equal to El -10.0 for inbound vessel transits and El -9.0 for outbound vessels. At the north anchor pier (Pier 14) the sand/gravel surface of the seafloor was set equal to El -5.0 for inbound vessel transits. Pier 14 has no exposure to outbound traffic since it is protected by a land mass on the east side.

The Code recommends a water elevation based on Mean High Water (MHW) for use in ship collision risk analysis. This represents an (intentionally) conservative assumption in which all vessels transiting the waterway are assumed to transit at the MHW level (and not at lower water levels in a tide cycle). The use of MHW is considered appropriate for most waterways where the tidal range is relatively low. However, for waterways with large tidal ranges – such as Vancouver with a 5m+ tide range – the tide cycle is usually broken into increments with vessel transits occurring at each incremental water level. Ship collision analysis based on the use of multiple water levels in large tide range locations is considered significantly more accurate than the use of a single water level.

For the IWMB, the analysis used four water levels to more accurately model the tide cycle. The following four slack water elevations were selected for the risk analysis: HHWLT = El 5.0m, MHW = El 4.2m, MLW = El 2.0m, and LLWLT = El -0.1. The total vessel fleet annual frequencies (N) were distributed equally to each of the four water levels (25%) and then adjustments were made for the largest vessels to shift them to a lower water level based on vertical clearance restrictions at Second Narrows. For example, a large ballasted vessel would have to transit only at MLW or LLWLT slack water elevations in order for the top of its mast (air draft) to meet TCZ-2 vertical clearance restrictions.

3.7 CN RAIL LIFT BRIDGE

The vessel collision risk assessment was conducted for IWMB only and not for the adjacent CN Rail Lift Bridge. However, the rail bridge was included in the highway bridge risk analysis as an existing waterway structure to be considered in the risk assessment. A sensitivity analysis was also conducted to evaluate the effect on the IWMB risk assessment if the rail bridge did not exist (no protection) or if only the rail piers provided outbound protection (not the spans). A plan and elevation of the rail bridge is shown in **Figure 3.7**.

The possibility of an outbound vessel collision with the rail bridge causing it to topple over and hit the highway bridge was geometrically reviewed. As shown in **Figure 3.8** the distance between the rail and highway bridge is sufficiently large that a rotational failure of the rail bridge main towers and lift span would not contact the IWMB. This is particularly true for lift bridges with massive counterweights and heavy lift spans similar to the CN Rail Lift Bridge. The weights of movable bridges are such that a horizontal displacement of the lift towers or piers due to vessel collision would cause the supporting steel columns to buckle and the entire structure would fall vertically in the water near the bridge location – not rotate as shown in **Figure 3.8**.

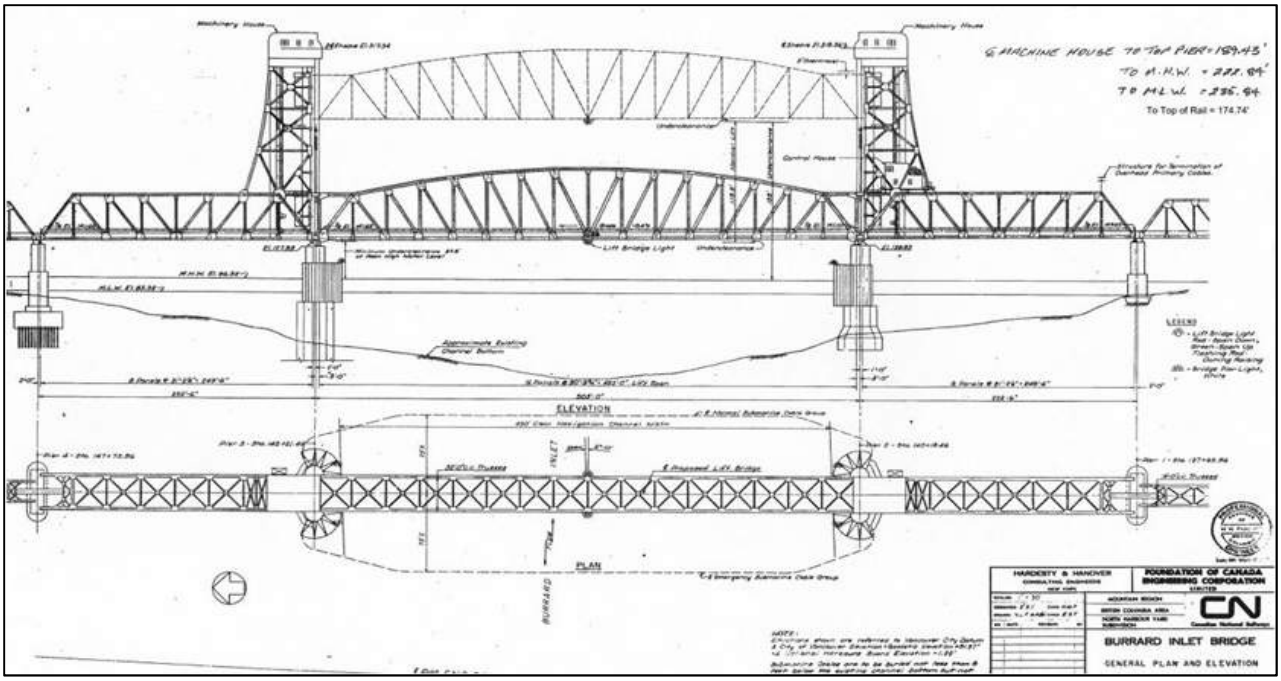


Figure 3.7: CN Rail Lift Bridge Plan & Elevation

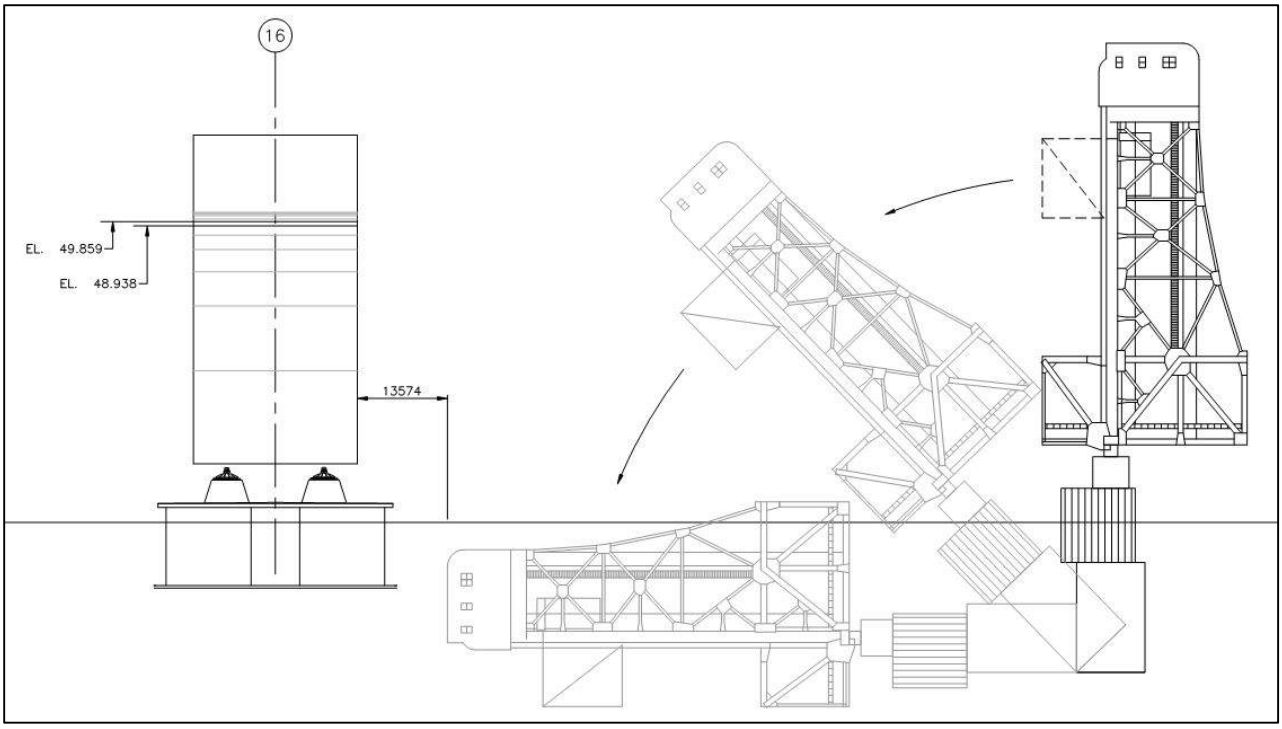


Figure 3.8: Rotational Collapse of the CN Rail Bridge Proximity to IWMB

3.8 ENVIRONMENTAL CONTEXT

The seafloor between the main piers is at depths ranging from -5 to -24m (CD). This zone is classified as the subtidal region of the neritic zone, also called coastal waters. This zone is not exposed to the atmosphere but is generally well-oxygenated water that receives ample sunlight and has low water pressure. This zone supports high production of photosynthetic life (e.g. phytoplankton) that provides a food source for fisheries.

3.9 PUBLIC CONTEXT

The IWMB is adjacent to a mix of industrial land (both port and railway), recreational boating marinas, parks and residential areas (**Figure 3.9**). The Trans Canada trail passes under the south end span of the bridge in Montrose Park, a popular day-use walking area (**Figure 3.10**). The bridge is prominently visible from the New Brighton Park, located about 1 km away. The south approach to the bridge is directly adjacent to the Capital Hill neighbourhood with the nearest home less than 250m from the South Main Pier (P16).

Traffic volumes on the bridge are very high with a 2016 Average Annual Daily Traffic (AADT) of 124,084 and a 7.5% percentage of truck traffic **(15)**. The hourly traffic volumes for a typical weekday are shown in **Figure 3.11**. Significant traffic volumes of over 2000 vehicles per hour start by 5am and extend until after 10pm.



Figure 3.9: Looking South-West at Terminals and Public Use Adjacent to IWMB



Figure 3.10: Looking East along Trans Canada Trail under the South Anchor Span

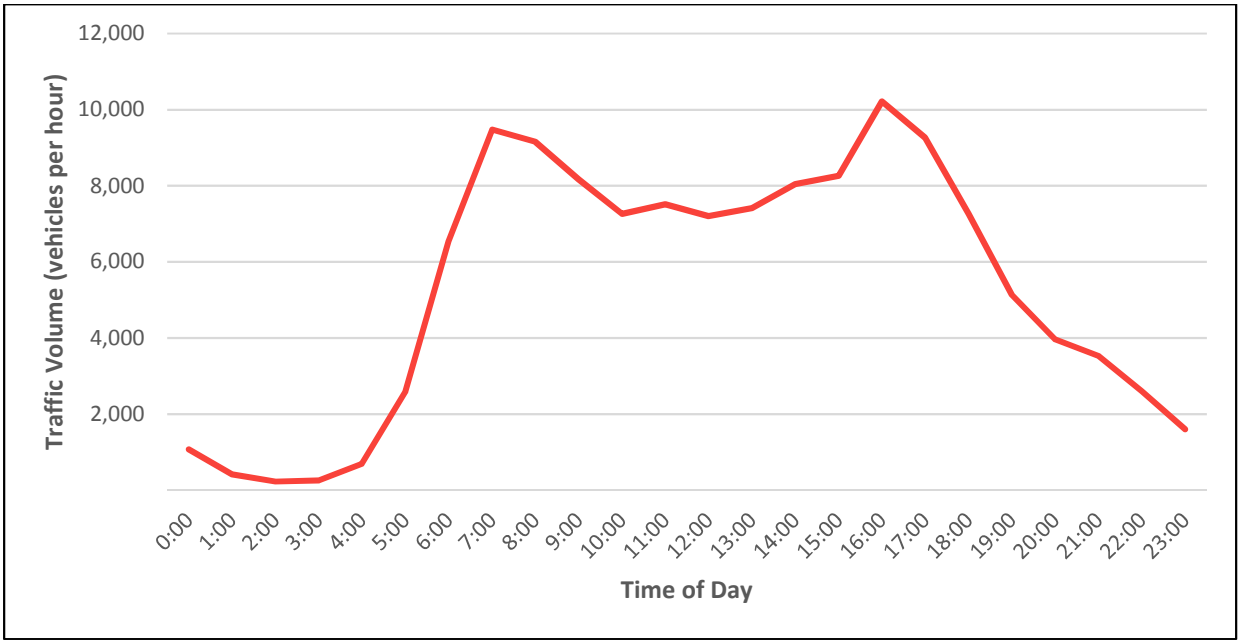


Figure 3.11: Typical Traffic Volumes on IWMB, both Directions (Wednesday, March 15, 2017)

4 VESSEL FLEET CHARACTERISTICS

The collision risk analysis is conducted by first determining the existing vessel fleet operating under the bridge and then projecting the number of annual transits (and sometimes size) of the vessels into the future to a year coinciding with the mid-point of the study's planning horizon. Due to the nature of the shipping industry, the type and sizes of vessels and the tonnage carried by vessels calling on a port often vary from year to year in accordance with national and global economic trends. Characterization of ship traffic operating in the vicinity of the IWMB was developed utilizing historical data collected from shipborne Automatic Identification Systems (AIS) for the calendar years 2014 and 2016 for Vancouver Harbour. The AIS data was compared to vessel information in databases maintained by the VFPA and PPA to identify and correct occasional reporting anomalies or incomplete information for specific vessels. AIS information relates to encoded VHF signals broadcast from vessels over 300 tonnes containing information such as vessel position, maneuvering characteristics, loading conditions, and navigational status.

The raw AIS database includes various parameters describing each vessel such as: Maritime Mobile Service Identity (MMSI) identification number, vessel name, vessel type, status, speed, position, heading, beam (width), length overall (LOA), draft and timestamp when data was collected. The broadcasted vessel transmissions are collected via satellites and terrestrial AIS base stations where the information can be stored and subsequently evaluated by specialized post-processing programs. It should be noted that current ship locations, including Vancouver Harbour, can be viewed real-time on a variety of websites available to the public

AIS data provides a powerful tool in the risk analysis process because it provides an accurate historical snapshot of every vessel transiting the harbour at the specific location of the bridge with their type, size, drafts, location, and speed. Because AIS data is transmitted real-time at frequent time intervals, plots of vessel tracks can be developed to map the entire passage of a vessel within the harbour. Plots of annual tanker, container and bulk carrier ship traffic within Vancouver Harbour for the year 2016 are shown in **Figure 4.1**, **Figure 4.2** and **Figure 4.3**.

4.1 VESSEL TYPES AND CATEGORIES

Based on the AIS data, the vessel fleet at IWMB was organized into 28 ship categories according to type of vessel and size based on 5,000 DWT (deadweight tonnage) increments. The primary deep draft vessels transiting Second Narrows are tankers and bulk carrier ships. Containers, general cargo, and cruise ships in the harbour are calling at facilities west of Second Narrows and do not transit under the IWMB. The vessel fleet consists of the following types and categories:

- **Bulk Carriers:** 11 Categories ranging from 30,000 DWT to 85,000 DWT
- **Tankers:** 15 Categories ranging from 15,000 DWT to 120,000 DWT (Aframax)
- **Articulated Tug Barges (ATBs) - Tankers:** 2 Categories, 25,000 and 30,000 DWT

Small vessels transiting the harbour, including fishing, tugs, log booms, small barges, and recreational craft were not included in the risk analysis since their collision forces are relatively low and they are

more maneuverable. Specialized vessels that operate in the harbour only on rare occasions were not included in the risk analysis since their numerical contribution to the risk analysis was negligible.

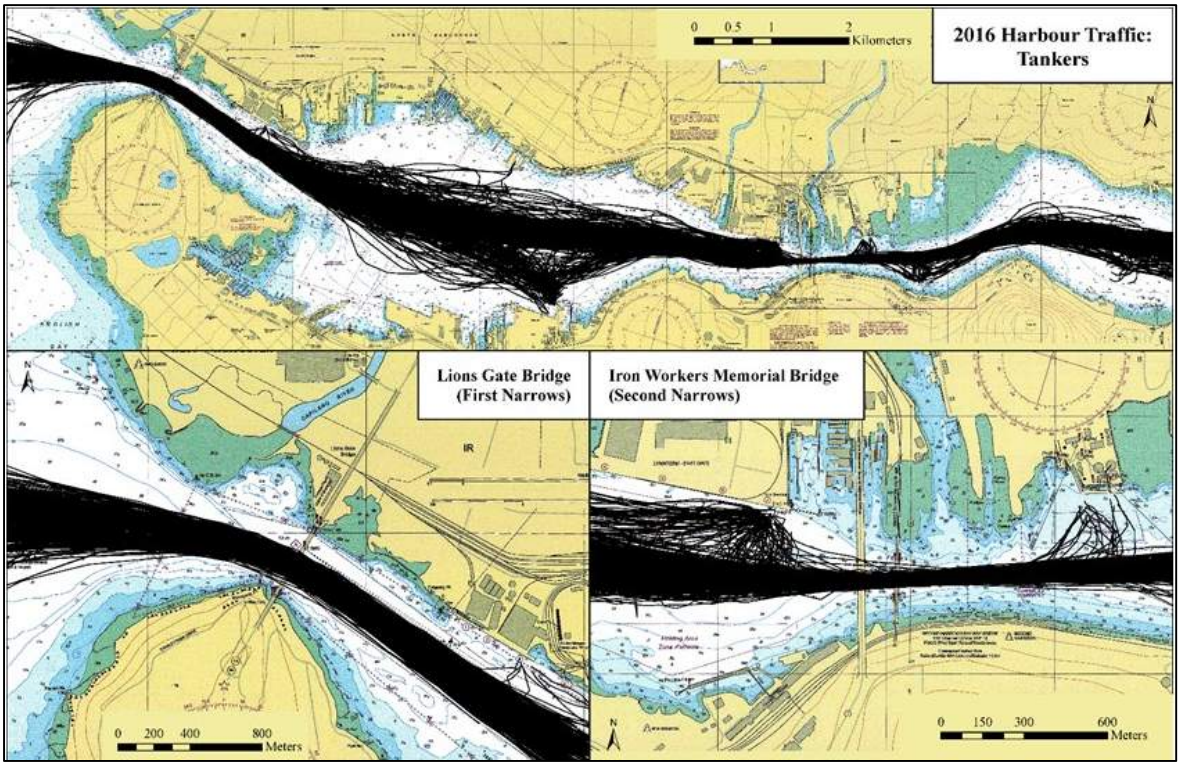


Figure 4.1: AIS Tanker Vessel Tracks

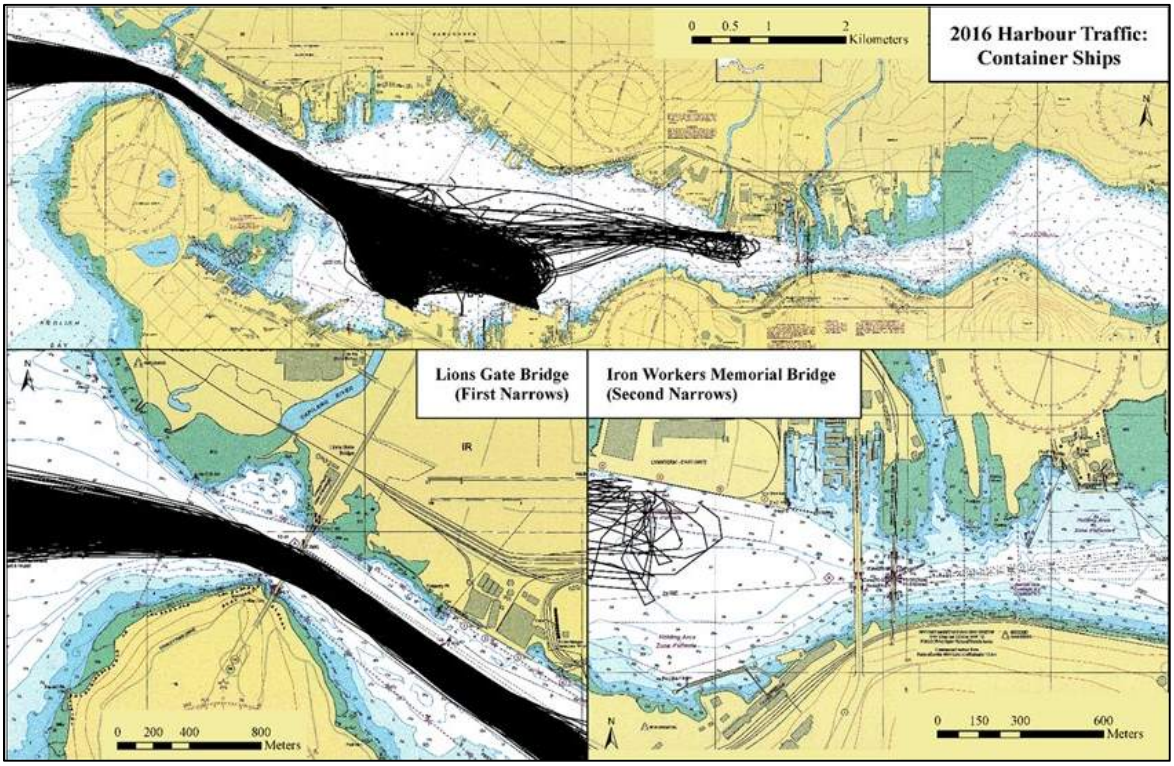


Figure 4.2: AIS Container Vessel Tracks

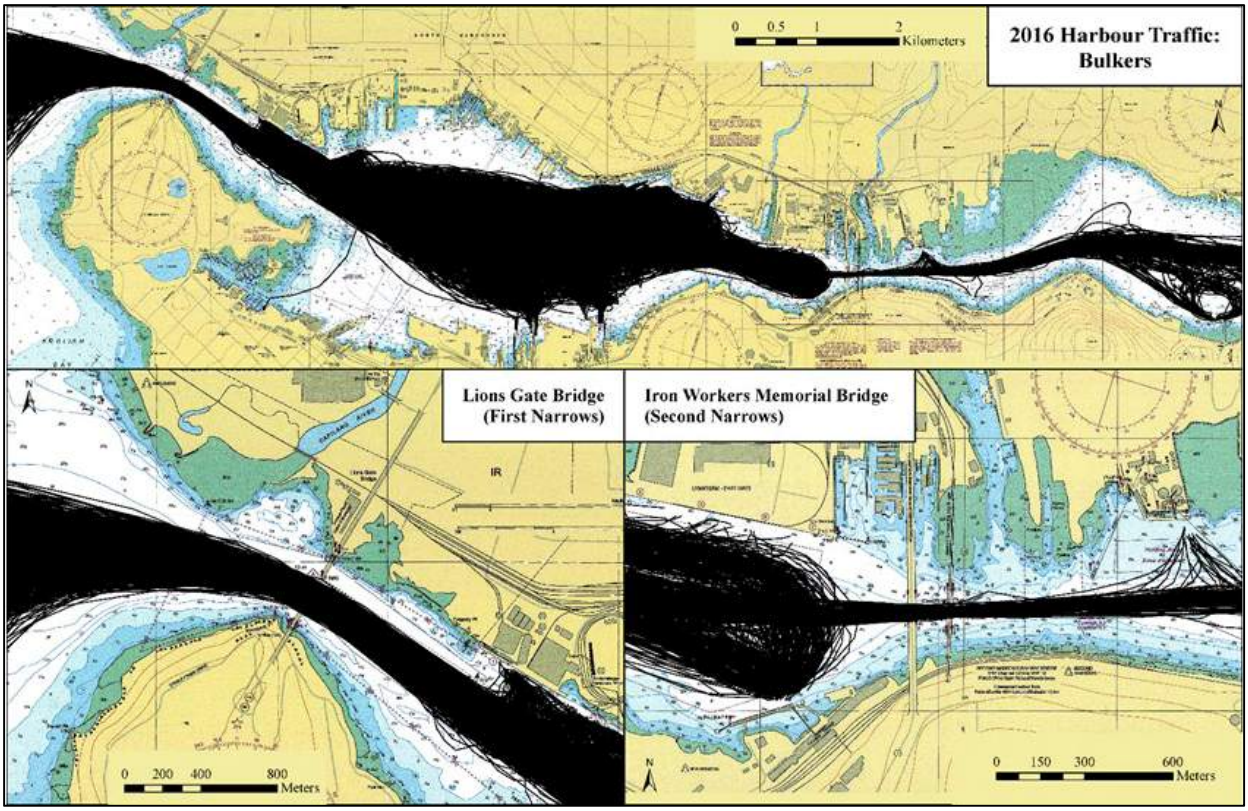


Figure 4.3: AIS Bulk Carrier Tracks

Photographs of representative vessels in Vancouver Harbour are shown in **Figure 4.4**. Details of the vessel fleet categories are shown in **Appendix A**. Each of the vessel categories has an assigned Vessel ID Number (from 1 to 28) for purposes of identifying them in the risk analysis.

Bulk carriers and tanker ships usually transit one-way loaded (either inbound or outbound depending on the cargo and marine terminal) and one-way ballasted when the ship is traveling without any cargo. Container ships, general cargo ships, and cruise ships usually transit loaded (or partially loaded) at all times.

4.2 VESSEL CHARACTERISTICS

Vessel physical characteristics were developed for each ship category, including DWT, LOA (length overall), beam (width), drafts (loaded and ballasted), displacement, and the height of mast, deckhouse, and bow features of the ship. Although ship characteristics can vary widely (even for similar size DWT's), information from various sources were used to estimate typical representative values for the vessel characteristics for each ship category in this study. Sources used to estimate typical vessel characteristics included the following:

- AIS data for the specific ships calling at the PoV in 2014 and 2016
- Clarkson's World Fleet Ship Register
- Q88 (Tanker Questionnaires Covering 75% of the World Fleet)



A. Bulk Carrier (Bulkers)



B. Container Ship



C. Tanker



D. Cruise Ship



E. General Cargo Ship



F. Articulated Tug Barge (ATB) - Tanker

Figure 4.4: Vessel Type Photographs

- Q88DRY (Bulk Carrier Questionnaire Database)
- Significant Ships (annual publication of the Royal Institution of Naval Architects)
- Canadian and AASHTO highway bridge codes
- PoV Burrard Inlet Vessel Call Database
- PPA Vessel Assignment Database

The physical characteristics established for each ship category are shown in **Appendix A**.

Ballasted (empty or light) ship transits often represent a significant component of vessel collision risk due to their relatively shallow draft when compared to the loaded ship draft. This allows them to potentially hit bridge piers located in shallower water where they might otherwise run aground if they had been fully loaded. **Figure 4.5** illustrates the typical geometry of a ballasted ship, where the drafts at stern and bow locations are significantly less than if the vessel were in a loaded condition. The ballasted drafts at the stern were developed from the vessel characteristic's sources above (in general the ballasted stern draft is approximately one-half of the fully loaded draft). The ballasted draft at the bow was estimated using a 1.5% slope of the bottom of the keel in accordance with International Association of Classification Services (IACS) and MARPOL IMO hull design guidelines.

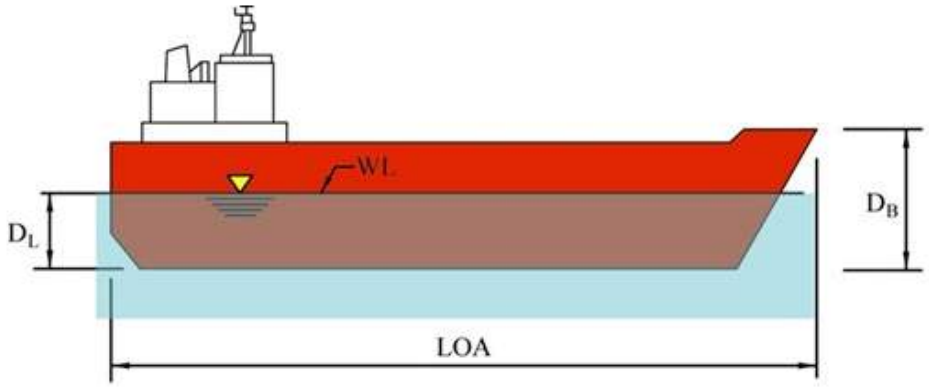
4.3 VESSEL TRAFFIC (ANNUAL TRIP FREQUENCIES)

Annual trip frequencies for the existing and future (25-year projection) vessel fleets transiting under IWMB were developed for each vessel category. The frequencies are shown in **Table 4.1** and are summarized in **Table 4.2** for the base case scenarios. The existing vessel fleet makes 600 trips/year under the IWMB and is projected to grow to 1,265 trips/year in the future. Details for the annual frequency distribution are shown in **Appendix A**.

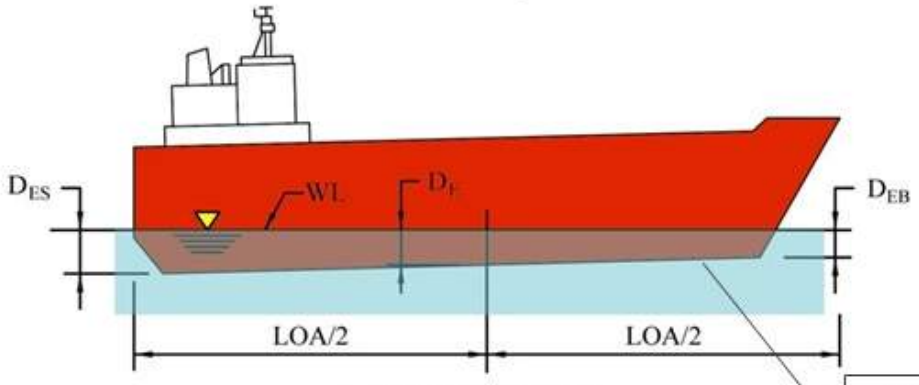
As shown in **Table 4.2**, the majority of vessels in the existing fleet are tankers (71.3%), followed by bulk carriers (14.7%) and then ATB's (14.0%). ATB vessels transiting the waterway are primarily transiting inbound loaded carrying jet fuel for subsequent distribution to the Vancouver International Airport. For the future fleet the majority of vessels remain tankers (82.5%), followed by bulk carriers (9.0%) and then ATB's (8.5%). The percentage of tankers is higher due to the planned expansion of the Kinder Morgan Westridge Marine Terminal as part of the Trans Mountain Project **(16)** in which the number of relatively large tankers (105,000 to 120,000 DWT Aframax ships) are projected to increase from the 40 trips/year in the existing fleet to approximately 408 trips/year in the future.



A. Bulk Carrier in Ballast Condition



a. Loaded Ship Profile.



b. Ballasted Ship Profile.

1.5% Slope of Keel

B. Typical Ship Profile: Loaded and Ballasted

Figure 4.5: Ballasted Vessels

Table 4.1: Annual Vessel Frequency

ID	TYPE	DESCR.	VESSEL CAPACITY, DWT (TONNES)	ANNUAL NUMBER OF TRIPS (N)						EXISTING TOTAL TRIPS	GROWTH FACTOR	FUTURE TOTAL TRIPS
				INBOUND			OUTBOUND					
				LOADED	BALLASTED	TOTAL	LOADED	BALLASTED	TOTAL			
1	Ship	Tanker	120,000	0	10	10	10	0	10	20	10.20	204
2	Ship	Tanker	110,000	0	9	9	9	0	9	18	10.20	184
3	Ship	Tanker	105,000	0	1	1	1	0	1	2	10.20	20
4	Ship	Bulk Carrier	85,000	0	5	5	5	0	5	10	1.28	13
5	Ship	Bulk Carrier	80,000	0	5	5	5	0	5	10	1.28	13
6	Ship	Tanker	75,000	0	7	7	7	0	7	14	1.64	23
7	Ship	Bulk Carrier	75,000	0	4	4	4	0	4	8	1.28	10
8	Ship	Tanker	70,000	0	1	1	1	0	1	2	1.64	3
9	Ship	Bulk Carrier	70,000	0	1	1	1	0	1	2	1.28	3
10	Ship	Tanker	65,000	0	4	4	4	0	4	8	1.64	13
11	Ship	Bulk Carrier	65,000	9	6	15	6	9	15	30	1.28	38
12	Ship	Bulk Carrier	60,000	0	2	2	2	0	2	4	1.28	5
13	Ship	Tanker	55,000	1	8	9	8	1	9	18	1.64	30
14	Ship	Bulk Carrier	55,000	0	3	3	3	0	3	6	1.28	8
15	Ship	Tanker	50,000	14	31	45	31	14	45	90	1.64	148
16	Ship	Bulk Carrier	50,000	0	1	1	1	0	1	2	1.28	3
17	Ship	Tanker	45,000	0	2	2	2	0	2	4	1.64	7
18	Ship	Tanker	40,000	2	19	21	19	2	21	42	1.64	69
19	Ship	Bulk Carrier	40,000	0	3	3	3	0	3	6	1.28	8
20	Ship	Tanker	35,000	4	8	12	8	4	12	24	1.64	39
21	Ship	Bulk Carrier	35,000	0	3	3	3	0	3	6	1.28	8
22	Ship	Tanker	30,000	1	28	29	28	1	29	58	1.64	95
23	Ship	Bulk Carrier	30,000	1	1	2	1	1	2	4	1.28	5
24	Ship	ATB	30,000	11	18	29	18	11	29	58	1.28	74
25	Ship	Tanker	25,000	1	4	5	4	1	5	10	1.64	16
26	Ship	ATB	25,000	5	8	13	8	5	13	26	1.28	33
27	Ship	Tanker	20,000	38	17	55	17	38	55	110	1.64	180
28	Ship	Tanker	15,000	0	4	4	4	0	4	8	1.64	13
Total Trips:				**87**	**213**	**300**	**213**	**87**	**300**	**600**		**1265**

Table 4.2: Vessel Fleet Annual Trip Frequency Summary

TYPE	EXISTING FLEET ANNUAL NO. TRIPS	EXISTING FLEET PERCENTAGE	FUTURE FLEET ANNUAL NO. TRIPS	FUTURE FLEET PERCENTAGE
Bulk Carriers	88	14.7%	114	9.0%
Tankers	428	71.3%	1,044	82.5%
ATBs	84	14.0%	107	8.5%
TOTAL	**600**	**100.0%**	**1,265**	**100.0%**

4.3.1 FUTURE FLEET GROWTH FACTORS

The base case scenarios were based on present day and then expanded to a 25-year projection of the number of vessels transiting under the bridge. Vessel traffic growth factors associated with tankers and bulk carriers, were based on either known expansion projects or forecasted annual increases in the number of transits for each vessel class over the study's planning horizon. Future forecasts were based on research conducted by Seaport Consultants Canada for the PoV area as part of the Trans Mountain project **(16)** [Termpol 3.2, Appendix B]. The forecasts by Seaport are in general agreement with traffic and tonnage estimates by the VFPA. A summary of the growth rates and growth factors used in the risk analysis base cases are shown in **Table 4.3**.

Note that, as part of the risk assessment (**Section 6**), sensitivity analyses were conducted to evaluate the effect of varying the growth rates on the estimated annual frequency of bridge collapse due to vessel collision. The growth rate sensitivity scenarios included; (1) one-half of the estimated base case growth; and (2) two times the estimated base case growth.

Table 4.3: Summary of Growth Rates and Growth Factors

VESSEL TYPE	ANNUAL GROWTH RATE	GROWTH FACTOR (25 YEARS)
Aframax Tankers (105,000 – 120,000 DWT)	n/a	10.2
Tankers (15,000 – 75,000 DWT)	2.0%	1.64
Bulk Carriers, Containers, General Cargo, ATBs	1.0%	1.28

4.4 VESSEL TRANSIT SPEEDS

Vessel transit speeds are an important component of the risk analysis in determining collision impact forces and energies. Using the Code's Method II procedures, typical vessel speeds are developed for vessels transiting the main navigation channel under normal conditions and are then reduced to determine an estimated aberrant vessel impact speed at each specific bridge pier or span location in the waterway. The vessel impact speed reduction is estimated using a normal distribution based on the pier's distance from the centerline of vessel transit path in the channel, overall channel geometry, and a standard deviation based on the vessel LOA (**Figure 4.6**). At a distance of three standard deviations from the centerline of vessel transit path, aberrant vessel speeds are assumed equal to the design current in the waterway (the vessel is assumed to be drifting with the current). For IWMB the design current was set equal to 2 knots for all vessels based on TCZ-2 slack water transit requirements (this is conservative since the largest vessels are limited to 0.5 knot currents). For a vessel without a tethered tug, the standard deviation would be set equal to the vessel LOA in accordance with the Code. For vessels with a tethered tug, which includes all tankers, bulk carriers and ATB's transiting Second Narrows, the standard deviation is a portion of the LOA as determined by the tug safety factor (**Section 5.4.1**).

For the IWMB, the maximum vessel speed in the channel was set equal to 6 knots based on TCZ-2 speed limit restrictions **(10)** as shown in **Table 4.4**. A comparison with recorded speeds at IWMB from the historical AIS data indicates that the 6-knot speed limit is closely followed by all vessels.

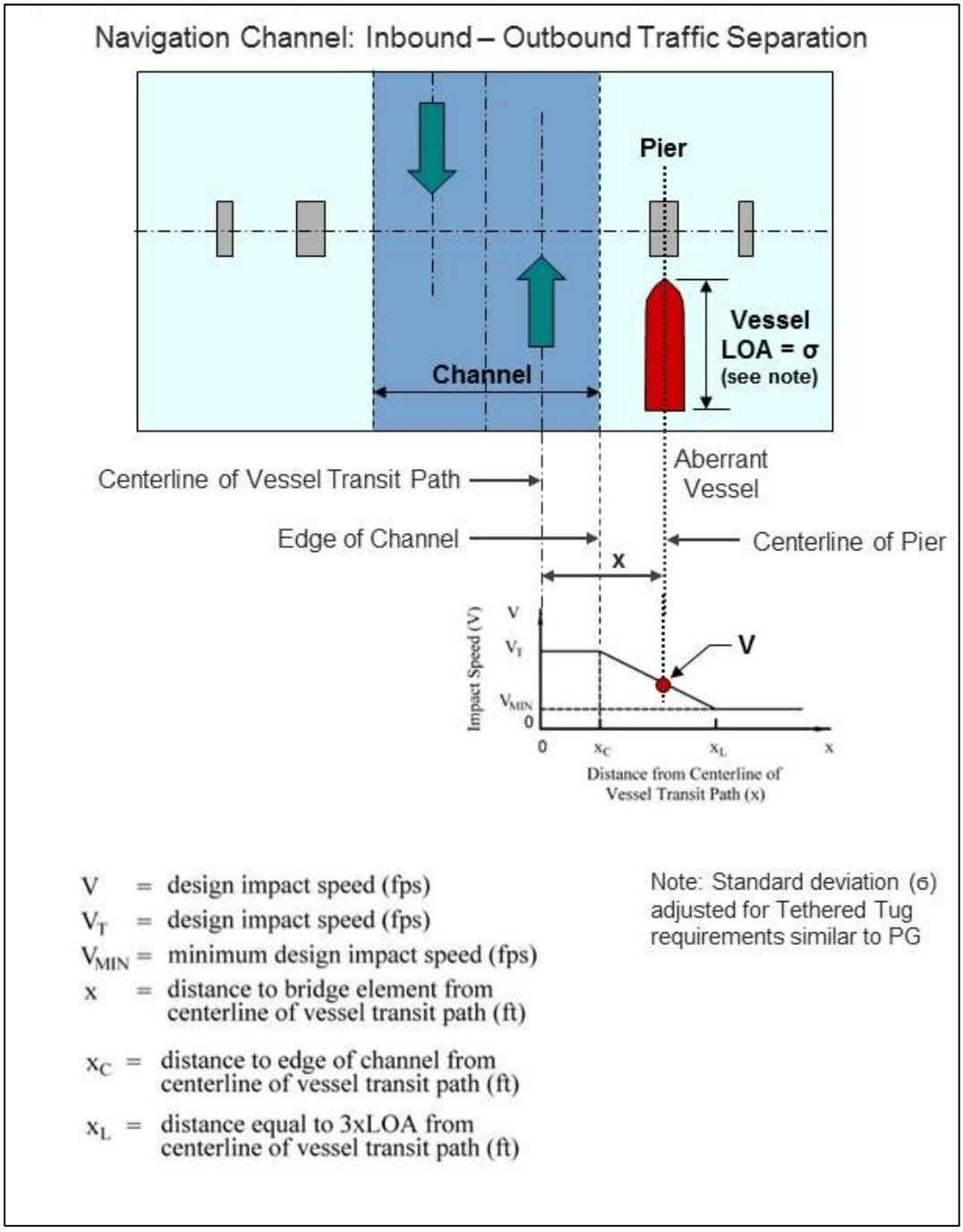


Figure 4.6: Vessel Speed Distribution

Note: *Generic navigation channel shown. At Second Narrows, large piloted vessels transit along channel centerline and do not pass each other in the same or opposite directions.*

Table 4.4: Vessel Speeds

ID	DESCR.	VESSEL CAPACITY DWT (TONNES)	VESSEL TRANSIT SPEEDS (KNOTS)				VESSEL TRANSIT SPEEDS (M/SEC)			
			INBOUND		OUTBOUND		INBOUND		OUTBOUND	
			LOADED	BALLASTED	LOADED	BALLASTED	LOADED	BALLASTED	LOADED	BALLASTED
1	Tanker	120,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
2	Tanker	110,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
3	Tanker	105,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
4	Bulk Carrier	85,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
5	Bulk Carrier	80,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
6	Tanker	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
7	Bulk Carrier	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
8	Tanker	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
9	Bulk Carrier	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
10	Tanker	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
11	Bulk Carrier	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
12	Bulk Carrier	60,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
13	Tanker	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
14	Bulk Carrier	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
15	Tanker	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
16	Bulk Carrier	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
17	Tanker	45,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
18	Tanker	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
19	Bulk Carrier	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
20	Tanker	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
21	Bulk Carrier	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
22	Tanker	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
23	Bulk Carrier	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
24	ATB	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
25	Tanker	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
26	ATB	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
27	Tanker	20,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
28	Tanker	15,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866

5 RISK ASSESSMENT METHODOLOGY

5.1 GENERAL

As noted, the vessel collision risk assessment was conducted in accordance with the Method II requirements and procedures of the Canadian Code **(5)**, supplemented by the AASHTO Standards **(6) (7)**. The Code advises that its provisions represent an analytical simplification of a very complex problem. Procedures on how to evaluate typical vessel impacts are provided and illustrated in the Code and general principles are discussed, but it does not explicitly cover every conceivable situation that may be encountered. Therefore, it is left to the designer to use experience-based engineering judgement in applying the general analysis principles to model site-specific and sometimes complex navigation channel geometries.

The Code provisions were initially adopted in 1991 based on accident data and vessel operating procedures and navigation systems in effect prior to the 1990's. As a result, adjustments of the Code's provisions are usually required to model recent advances in navigation technology (such as VTS, AIS, GPS, etc.) as well as site specific situations and restrictions (such as requirements for tethered tugs, multiple pilots, etc.). For the current IWMB study, the magnitude of each adjustment was established based on Code recommendations, published research, and previous risk studies that have been accepted by federal agencies as appropriate for similar marine risk analyses.

The vessel collision risk analysis was conducted based on site specific data related to the Second Narrows waterway characteristics, vessel fleet characteristics, and existing bridge characteristics. Data for the analysis was obtained from publicly available sources as referenced in this report. The information in the public domain was also validated with supplemental information and discussions with the VFPA and the PPA.

A variety of sensitivity runs were completed to evaluate the effect of changing some of the key input variables used in the vessel collision risk analysis. These sensitivity checks included variations to the (a) estimated growth rates for the vessel traffic; (b) probability of vessel aberrancy accident base rate; (c) tethered tug safety factor; (d) rail bridge protection; and (e) bridge superstructure (span) resistance strength.

In accordance with the Code, the primary area of interest for aberrant vessels near a bridge is a distance of 2,000m on each side of the crossing. It is assumed that aberrant vessels outside of the 2,000m limit will stop (i.e. the vessel has turned away, dropped anchor, or is drifting at the waterway current speed) prior to impacting the bridge. Within this distance the bridge is located in a straight, transition, or turn waterway region as defined by the Code. The inbound and outbound vessel transit paths and channel geometry within the 2,000m distance is modeled in the risk analysis using a series of tangents, called "legs" to represent bends and to define the straight, transition, or turn waterway regions.

Figure 5.1 shows the various legs used in the IWMB risk assessment. The inbound vessel transit path and channel is divided into three legs (Legs 1, 2 & 3) and the outbound direction is divided into three legs (Legs 4, 5 & 6). The length and angles of each leg varies depending on the channel alignment and bridge location region. The risk analysis is computed for each leg and each direction for each bridge

pier and span component. The sum of Legs 1, 2, and 3 represent the inbound vessel risk and the sum of Legs 4, 5 and 6 represent the outbound vessel risk for each pier and span component. The sum of the risks for the bridge pier and span components in each direction represents the risk for the respective inbound and outbound directions. The sum of the inbound and outbound risks represents the total bridge risk.

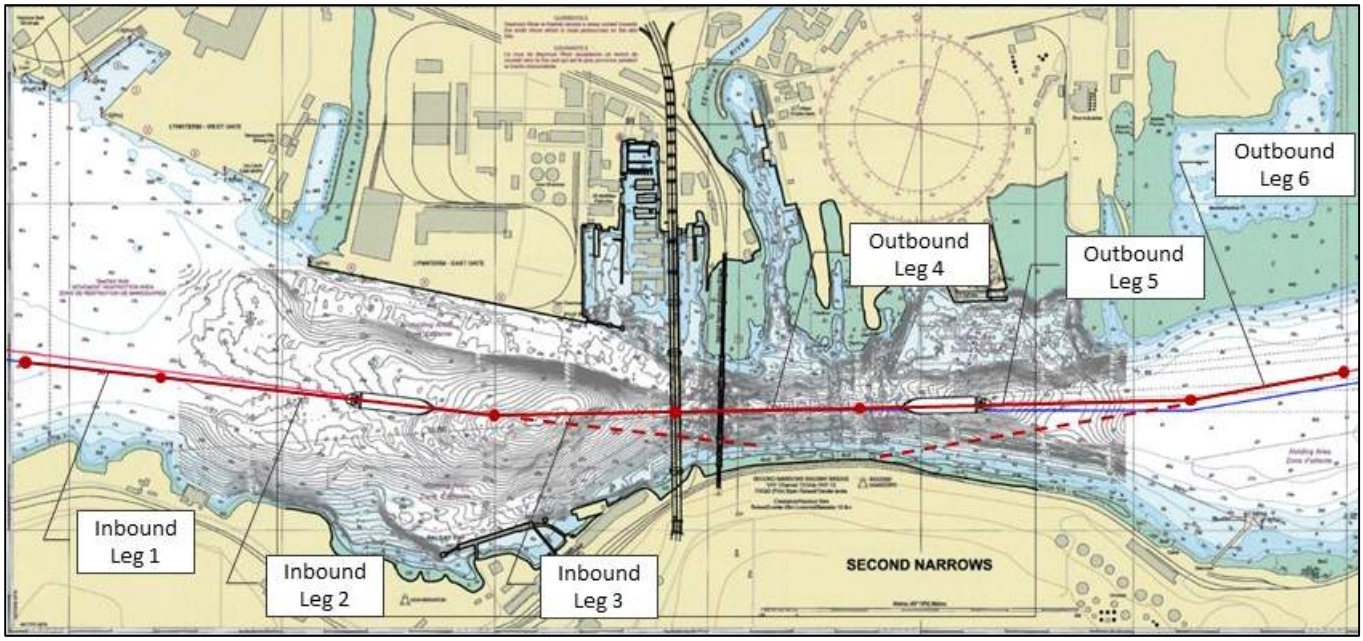


Figure 5.1: Inbound & Outbound Channel Legs

As introduced in **Section 1.3.2**, the basic risk equation can be shown as:

$$AFC = (N)\ (PA)\ (PG)\ (PC)\ (PF)\ (GF) \quad \text{(Eq. 1)}$$

A brief discussion of the key risk components as developed for the IWMB risk assessment is provided below.

5.2 VESSEL FREQUENCY (N)

The annual number of vessels (N) that could potentially strike a bridge element (pier or span) is based on the available water depth and the actual draft of the aberrant vessel. Vessels transiting with drafts deeper than the available water depth will run aground before contacting the piers, while those with drafts less than the available water depths can reach the towers. The vessel fleet and annual frequencies (N) were previously discussed in **Section 4.3** and are shown in **Table 4.1**.

5.3 PROBABILITY OF ABERRANCY (PA)

The probability of aberrancy (PA) is a measure of risk that a vessel is in trouble and may stray off-course due to human error, mechanical failure, or adverse environmental conditions. A multi-year study by the American Bureau of Shipping (ABS) reported that human error is the dominant factor in

maritime accidents **(17)**. Human error can be attributed to the vessel master, crew, or local pilot onboard the ship. Among all the human error types classified in the numerous databases and libraries of accident reports evaluated in the ABS study, human failures in situational awareness and situational assessment overwhelmingly predominate. According to accident data from the Canadian Transportation Safety Board (TSB Canada) evaluated in the ABS study, 84% of maritime accidents are directly associated with the occurrence of human error. This is consistent with the findings in other countries; 85% in Australia; 82% in United Kingdom; and 75%-96% by various studies in the U.S.

As documented by TSB Canada annual statistical summaries of marine incidents and a number of studies, the trend over the past three decades is one of steady decline in marine accidents leading to loss of property, life, and environmental damage. However, the magnitude of damage inflicted by a major shipping accident increases public attention to those accidents, and negatively influences the perceived safety of shipping **(17)**.

The Code provides a procedure to estimate PA that was calibrated based on historical ship collision accidents with bridges worldwide. The simplified relationships in the Code are used to estimate complex risk components. For purposes of this risk assessment, the Code procedure and accident base rate (BR) values were adjusted (described in the next section) to model the effect of modern ship navigation systems and waterway restrictions that apply to certain vessel types and locations in Vancouver Harbour.

5.3.1 SHIP ACCIDENT BASE RATE ADJUSTMENTS (BR)

PA is estimated based on the following equation using an accident base rate (BR), which is then modified for certain waterway and bridge location situations.

$$PA = BR \times RB \times RC \times RXC \times RD \quad \text{(Eq. 2)}$$

where,

- BR = Aberrancy base rate (assumed 0.6 x 10-4 for ships and 1.2 x 10-4 for barges)
- RB = Correction factor for bridge location
- RC = Correction factor for currents acting parallel to vessel transit path
- RXC = Correction factor for cross current acting perpendicular to vessel transit path
- RD = Correction factor for vessel traffic density

The aberrancy base rate (BR) for ships assumes that the bridge is located in a coastal area with a requirement for a local pilot to be on-board every vessel. As a result of the pilotage requirement, the base rate for ships is estimated at one-half of the accident base rate for barges. The Code PA base rate also assumes that vessels are transiting with no tug assistance (either escort or tethered tugs).

5.3.1.1 CODE BASE ADJUSTMENTS TO PA

The Code correction factor for bridge location, RB, is based on the relative location of the bridge to one of three waterway regions (straight, transition, and turn/bend). The bridge location factor is computed for each channel leg in the risk assessment.

The correction factors for currents acting parallel (RC) and cross currents (RXC) acting perpendicular to the vessel transit path are computed for each channel leg in the risk assessment using Code procedures. The typical currents near the bridge are in a direction roughly parallel to the vessel transit paths and cross currents on the vessels are minimal, therefore RXC = 1.0. Influence of the adjacent Seymour River on current flows in Second Narrows are minor **(9)**.

The Code correction factor for vessel traffic density (RD) in the immediate vicinity of the bridge is determined by whether the structure is located in a low, medium, or high density shipping area or whether vessels are allowed to meet, pass, or overtake each other near the bridge. In accordance with VFPA's TCZ-2 requirements at Second Narrows, ships are prohibited from meeting or passing in the vicinity of IWMB, therefore RD = 1.0 for both inbound and outbound vessel traffic.

5.3.1.2 TRAFFIC CONTROL ZONES AND MODERN NAVIGATION ADJUSTMENTS

As previously discussed, the Code assumes a single local pilot onboard ships transiting bridges in coastal locations and no tug assistance. The existing Code provisions do not include consideration of new safety measures based on modern navigation systems, vessel design, and regulatory requirements (crew training and certifications, vessel safety inspections, maneuvering restrictions, etc.) that have occurred since the Code's original adoption of AASHTO's vessel collision design provisions published in 1991 (over 25 years ago). The Code also does not provide guidelines for modeling additional navigation restrictions imposed by the TCZ areas in Vancouver Harbour, such as requirements for certain vessels to have multiple pilots, tethered tugs, daylight transits only, and visibility restrictions.

Modern improvements to navigation systems and the TCZ restrictions in the harbour should have the intended consequence of reducing the risk of human error in potential ship collisions with existing bridges. The use of tethered tugs should have the consequence of reducing the drift of aberrant ships in the channel and waterway.

For the IWMB risk assessment, it was important to include the effects of the above factors in potentially reducing the risk of collision. The base rate in the IWMB risk assessment was adjusted to reflect site-specific vessel operating practices in Second Narrows in accordance with existing TCZ-2 requirements by the VFPA. Adjustments to the aberrancy base rate depended on the size, type and loading condition of the transiting vessels and considered the number of pilots, vessel maneuverability, tug escort, water currents, traffic density, daylight and visibility restrictions, electronic navigation tools and port state control. The magnitude of each adjustment was established based on Code recommendations, published research, and previous risk studies that have been accepted by federal agencies as appropriate for similar marine risk analyses. Key sources of information for adjustments used in the study include:

- IABSE Publication SE-4 "Ship Collision with Bridges" **(18).**
- Det Norske Veritas (DNV) Report on "Effectiveness of Risk Reduction Options", Termpol 3.15, Appendix 4, Trans Mountain Project **(16).**

The potential variability of the PA adjustments was captured through sensitivity analyses. A summary of the PA adjustment factors used in the analysis is shown in **Table 5.1**. The PA adjustments were estimated for each channel leg and for each bridge component in the risk assessment as applicable for the vessel category and ship loading condition (loaded and ballasted). The adjustments and PA aberrancy rate computations for all vessel categories are provided in **Appendix A**.

Table 5.1: PA Adjustment Factors

ITEM / DESCRIPTON	FACTOR USED IN THE STUDY	DISCUSSION / SOURCE
Vessel Traffic Service (VTS)	0.80	20% reduction in risk attributed to VTS system and mandatory vessel participation in Vancouver Harbour **(16)**.
Electronic Chart Display and Information System (ECDIS)	0.81	Compliance with international ECDIS requirements are mandatory for all ships by July 2018 (most vessels calling on ports in Canada and the U.S. are already in compliance). The adjustment is based on 1/2 of the 38% reduction attributed to ECDIS **(16)** because of the overlap with the reduction due to pilots onboard the vessel.
Other Navigation Aids	1.00	Additional potential risk reductions **(16)** include: AIS (2-5%); ENC (0-13%); Conventional ATNs (0-13%); DGPS (0-8%); and PPU (0-10%). For purposes of this vessel collision risk analysis, these potential reduction factors were conservatively not included.
Port State Control (PSC)	0.94	PSC includes the inspection of foreign ships to verify compliance with international regulations on the condition of the ship, equipment, crew manning and operations (including rest periods). Studies have demonstrated that PSC activities reduce the rate of vessel accidents in waterways. The adjustment is based on 1/2 of the 12% reduction attributed to PSC **(16)** because of the overlap with the reduction due to pilots onboard the vessel.
Pilotage - 1 Pilot	1.00	The code base rate assumes a single pilot, therefore a further reduction is not applicable.
Pilotage - 2 Pilots (TCZ-2)	0.54	46% reduction in risk attributed to a second pilot onboard the vessel **(16)**.
Daytime Only Transit Restriction (TCZ-2)	0.5	Value based on (18) [Section 5.2 "Causation Probability - Darkness"], which states that the rate of collision/grounding accidents at night are 4 times the probability of such accidents in daytime (which implies a 75% reduction in risk, or a reduction factor of 0.25). For purposes of the vessel collision risk assessment, a conservative value of 0.5 was used.
Visibility Restrictions (TCZ-2)	0.5	Value based on (18) [Section 5.2 "Causation Probability - Visibility"] which states that the rate of collision/grounding accidents in fog when the visual range is less than 200m has been found to be 100 times the risk in clear weather. Visibility studies in Dover Strait, United Kingdom, by Wheatley found that reduced visibility increased the accident rate by 4.4 times as compared to clear visibility conditions (which implies a 77% reduction in risk, or a reduction factor of 0.23). For purposes of the vessel collision risk analysis, a conservative value of 0.5 was used.

ITEM / DESCRIPTON	FACTOR USED IN THE STUDY	DISCUSSION / SOURCE
Current Restrictions (TCZ-2)	Code Equation	Risk adjustment factors for vessels subject to TCZ-2 current restrictions were computed using the TCZ-2 imposed current limits rather than the normal (higher) currents in the waterway.
Passenger / Cruise Ships	0.17	Value based on (18) [Section 5.2 "Causation Probability - Vessel Type"]. which states that vessel accident studies in Japanese waters indicate that passenger vessels are 6 times safer than cargo ships and tankers (which implies an 83% reduction in risk, or a reduction factor of 0.17).

5.4 GEOMETRIC PROBABILITY

The geometric probability (PG) is the conditional probability that a vessel will hit a bridge component (pier or span) given that it has lost control (i.e. it is aberrant) in the vicinity of the bridge. The Code method of computing PG is based on a standard normal distribution curve (ϕ), with the mean located at the centerline of vessel transit path and a standard deviation (σ) equal to the length overall (LOA) of the vessel category under consideration. Bridge elements located beyond three (3) standard deviations from the centerline of vessel transit path do not influence the geometric probability of collision. The area under the normal distribution curve bounded by the limits of the centerline of vessel contacting either side of the pier or span is equal to the geometric probability of collision (**Figure 5.2**).

For this study, the distance between the centerline of bridge element relative to the centerline of all vessel transit paths (Legs 1, 2, and 3 inbound and Legs 4, 5 and 6 outbound) was determined and used to compute PG for each vessel category at all pier and span locations (**Appendix A**). (**Figure 5.3**) illustrates how the PG normal distribution was applied to each channel leg at the bridge location.

The standard deviation used to compute PG was adjusted for all tanker, bulk carrier and ATB transits at Second Narrows in accordance with TCZ-2 rules that require those vessels to have tethered tug assistance.

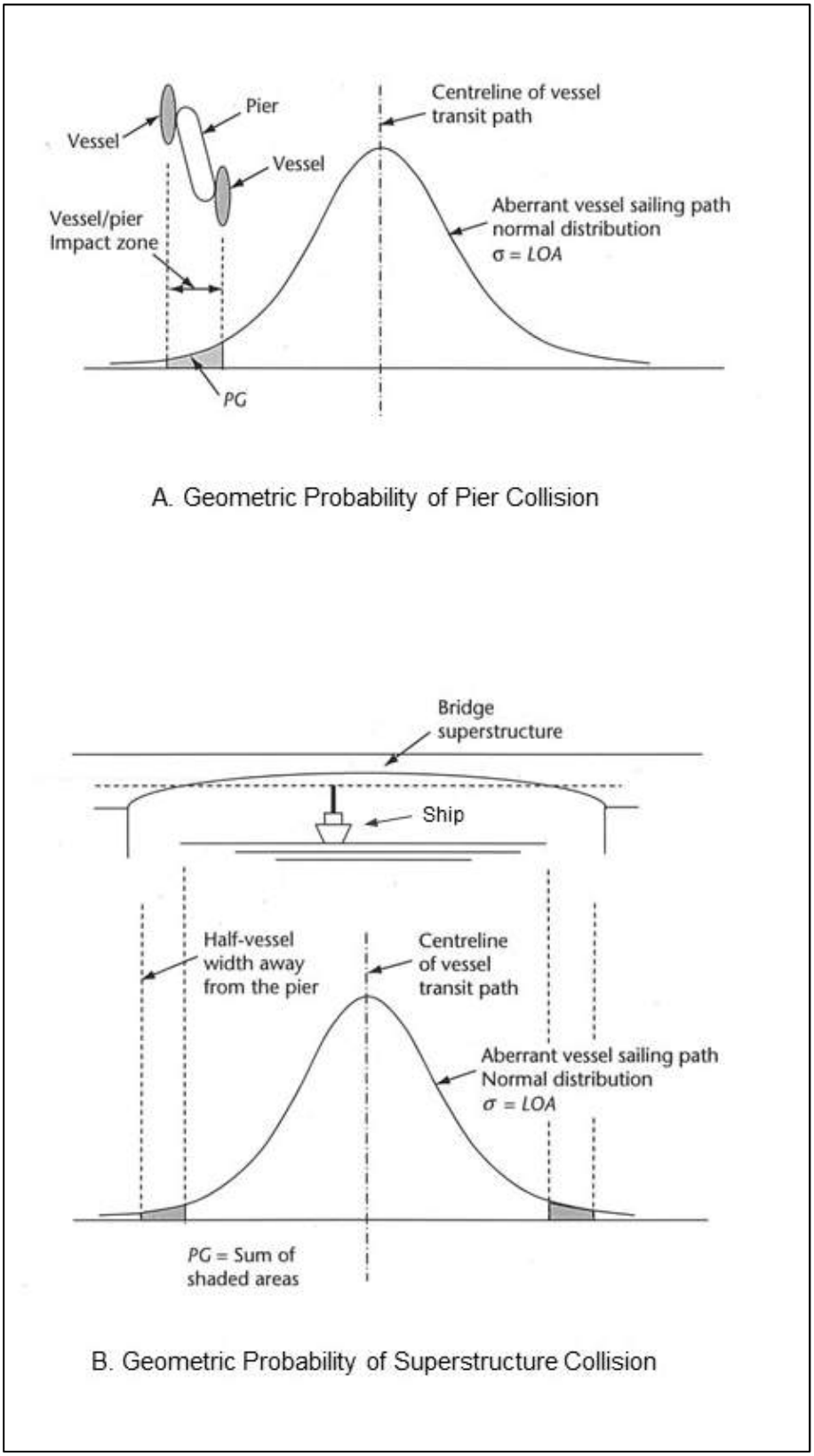


Figure 5.2: Geometric Probability PG (5)

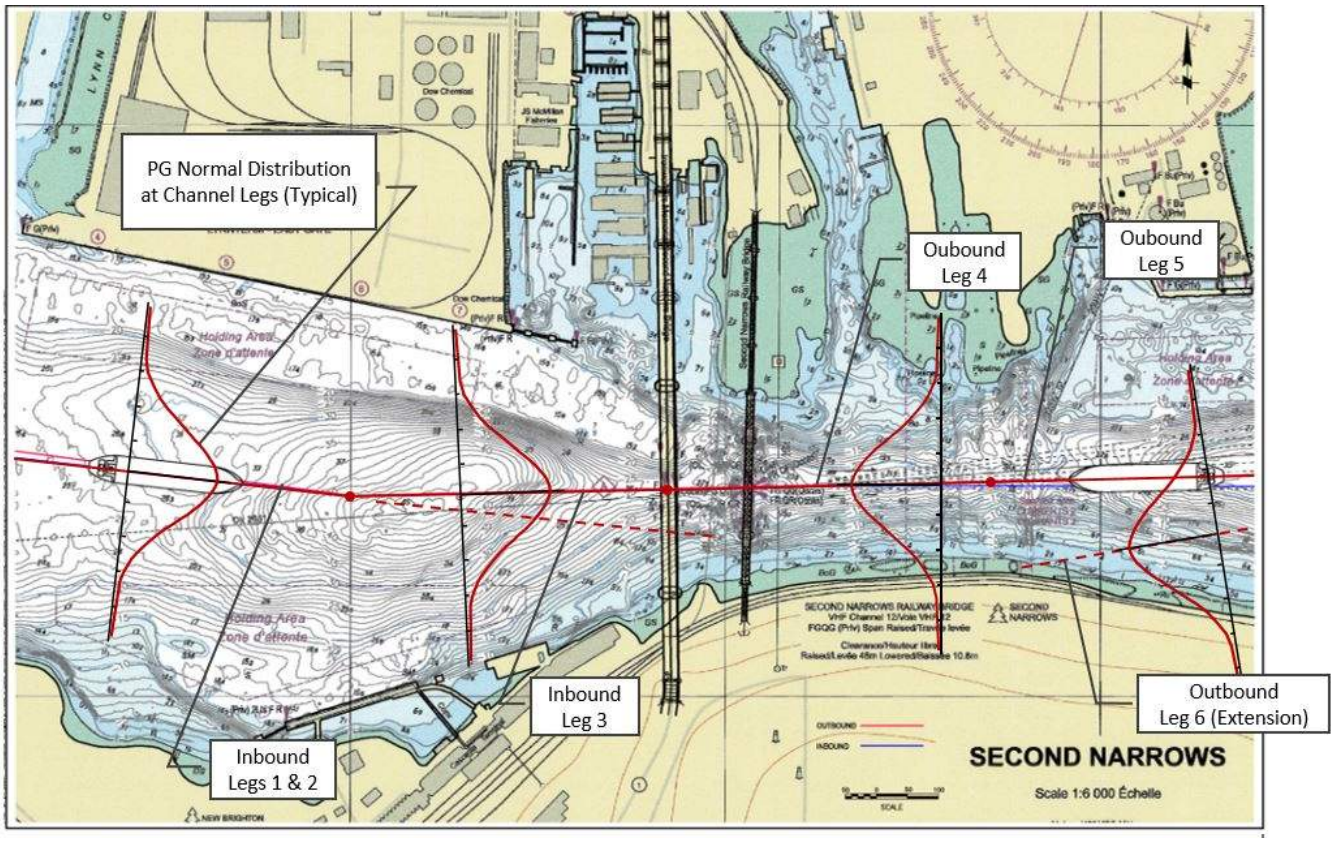


Figure 5.3: PG Normal Distribution Plan

5.4.1 ADJUSTMENT FOR TETHERED TUGS

Tug assistance during vessel transits provide an extra measure of security related to potential vessel collision as tugs assist in keeping an aberrant vessel in the navigation channel. The VFPA and PPA have undertaken several studies using ship simulators and actual in-water tests in Vancouver Harbour to validate the TCZ-2 tug procedures and requirements **(10)**. For purposes of this risk assessment study only tugs tethered to the vessel in accordance with the VFPA's TCZ criteria (which defines the size and number of tugs based on ship DWT) are considered. Because of potential time delays in hooking up with a vessel near the bridge location, escort tugs and tugs of opportunity were excluded from this risk assessment.

Within the context of the Code procedures for estimating the risk of vessel collision, the use of tugs may have a slight benefit in reducing the PA base rate (minor because the major cause of aberrancy is human error onboard the ship). The primary benefit will be to the PG factor in reducing the ability of an aberrant vessel to leave the navigation channel as the tugs can push the vessel back into the channel and keep it away from the bridge. The following equation was developed as part of this risk assessment to model the effect of tethered tugs on PG by introducing an adjustment factor (r_{tug}) to reduce the standard deviation (σ) based on a tug safety factor (f_{tug}), width of the channel (w), vessel LOA and properties of a standard normal distribution (ϕ).

$$r_{tug} = \frac{0.5w}{loa\Phi^{-1}\left(1 - \frac{1 - \Phi\left(\frac{0.5w}{loa}\right)}{f_{tug}}\right)}$$

A tug safety factor (f_{tug}) of 2.0 was selected for the risk assessment base cases following the data in **(16)** and other ship navigation studies. Although the tug adjustment factor (r_{tug}) varies based on vessel size, the typical reduction factor for the ships in the vessel fleet at IWMB is an adjusted standard deviation of approximately 1/3 of LOA (0.33). The effect of the adjustment to PG is shown in **Figure 5.4**. The use of a reduced standard deviation causes the spread of the normal distribution to "peak" closer to the mean (channel centerline). This reduces the PG associated with bridge piers and spans when compared to PG estimates without the adjustment.

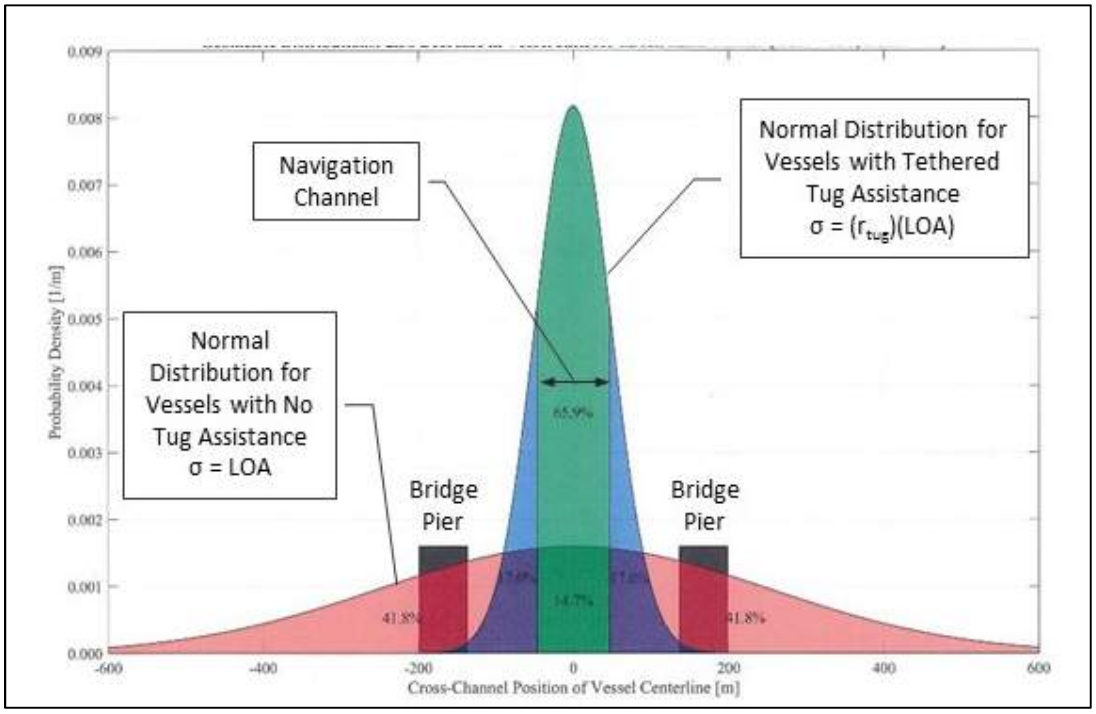


Figure 5.4: Tug Adjustment Factor

It should also be noted that the adjustment in the standard deviation used to estimate PG for vessels with tethered tugs are also made to the standard deviation used in the vessel speed distribution previously discussed in (**Section 4.4**)

5.5 PROBABILITY OF COLLAPSE (PC)

The probability of bridge collapse (PC) once an aberrant vessel has struck a pier or bridge element is a function of many variables including vessel size, type, bow shape, speed, direction of impact, mass, and dynamic response of both the vessel and the bridge. It is also dependent upon the ability of the structural element to resist collision impact loads. Based on historical accident data and ship collision

research, the probability of collapse in the Code is estimated based on the ratio of bridge element ultimate strength (H) to the vessel impact force (P) as illustrated in (**Figure 5.5**).

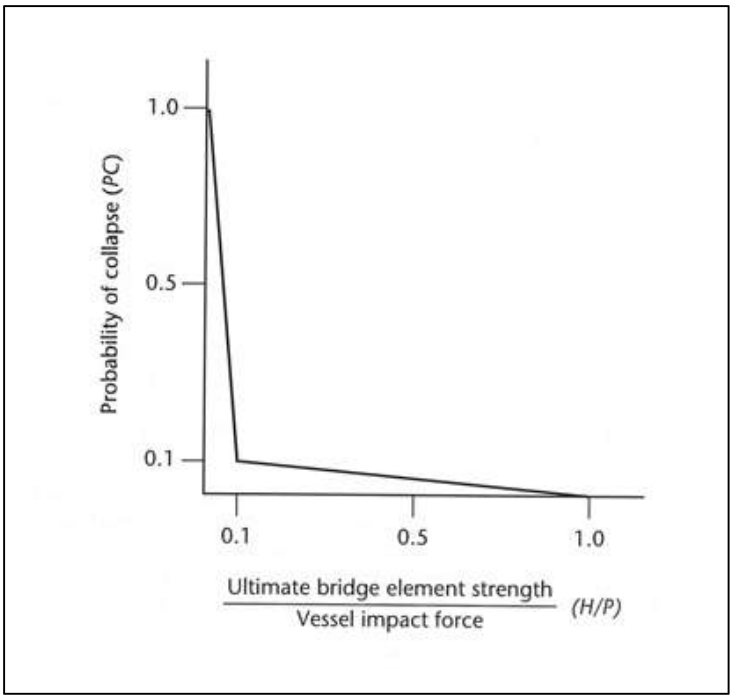


Figure 5.5: Probability of Collapse PC (5)

5.6 VESSEL COLLISION ANGLES AND PROTECTION FACTORS (PF)

The protection factor (PF) is used to model protection provided by upstream and/or downstream land masses (or other waterfront structures) adjacent to the bridge that would block an aberrant vessel from striking a bridge element, regardless of the actual water depth. The procedure used to compute the protection factor was based on the AASHTO **(6)** methodology for estimating the reduction in annual frequency of collapse due to pier protection structures, such as large diameter dolphins. The procedure is similar to the geometric probability. PF is based on a normal distribution curve, with the mean located at the centerline of assumed vessel transit path and a standard deviation equal to 30 degrees of rotation from the transit path. The location of adjacent land masses or protection structures with respect to the bridge are used to develop potential "collision angles", which are then used to estimate PF.

The collision angles for IWMB were based on typical ship turning diameters in conjunction with the land masses, bathymetry and bridge layouts at Second Narrows. In accordance with International Maritime Organization (IMO) requirements, ships are designed for emergency turns at maximum rudder angle (usually 35°) in which the ship must make a turning circle with a tactical diameter of less than 5xLOA and an advance course less than 4.5xLOA (**Figure 5.6**). As illustrated in **Figure 5.7** for inbound vessels on Pier 16, and **Figure 5.8** for outbound vessels on Pier 15, transit paths based on ship turning circles representing potential aberrant ship movements were plotted along each channel leg

for each pier and span component to determine collision angles and associated protection factors (PF). A summary of the collision angles for pier impacts are shown in **Figure 5.9** (span impacts are similar) and a tabulation of the pier and span protection factors are included in **Appendix A** for each leg in the risk assessment.

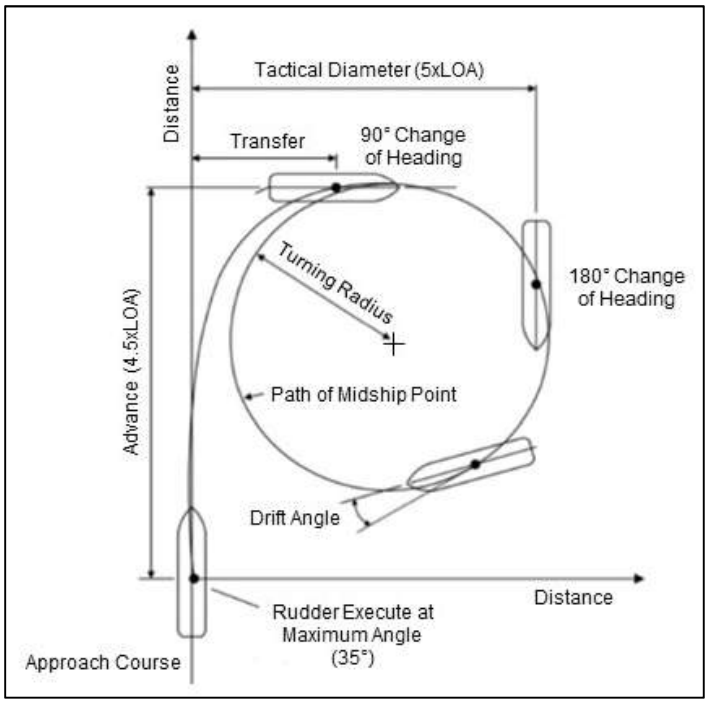


Figure 5.6: Ship Turning Circles

The protection factors developed for the IWMB piers and spans indicated that its primary exposure to collision is from inbound vessels (Legs 1, 2 and 3). The main cause for the greater exposure to inbound vessels occurs because the waterway on the west side of the bridge is much wider as compared the east side of the bridge where the waterway is narrower. Outbound vessels on the east side of the bridge are "funneled" into a narrower waterway corridor and aberrant outbound vessels would run aground relatively quickly due to shallow water depths adjacent to the navigation channel.

A reduction in vessel collision exposure to outbound vessels also is due to the potential protection provided by the existing rail bridge located west of the IWMB. Most of the aberrant outbound vessels would hit the rail bridge and be stopped before they could strike the IWMB, though there is a relatively small outbound vessel collision vulnerability as shown in **Figure 5.9**. That the rail bridge would stop an aberrant vessel before hitting the IWMB was an assumption for the base case risk analysis based on engineering judgement and historical vessel collision accidents with lift bridges. To evaluate the sensitivity of this assumption, the risk analysis was also conducted for the following two scenarios; (a) the rail bridge does not exist and there is no protection from outbound vessels; and (b) the rail bridge piers provide partial protection from outbound vessels but the rail bridge spans provide no protection.

The protection factors also indicated a greater vessel collision exposure to the southern portions of the bridge (Pier 16 and South Main Span) due to the effect of the inbound and outbound turns in the navigation channel approaches to IWMB.

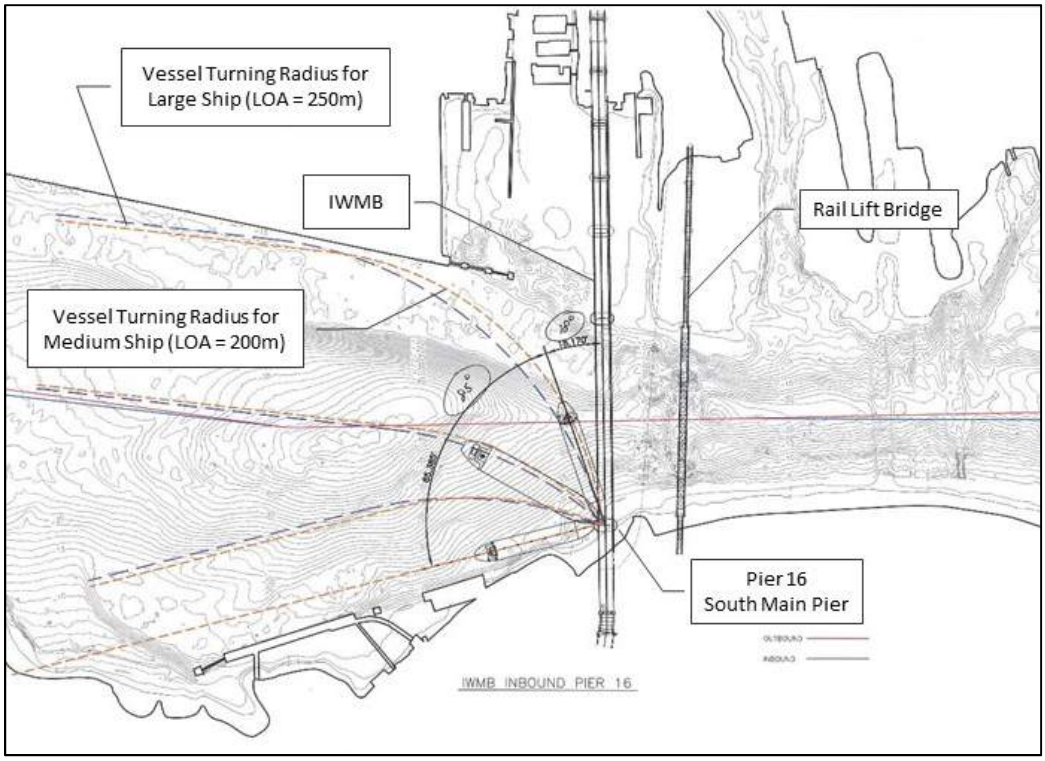


Figure 5.7: Inbound Pier 16 Vessel Collision Angles

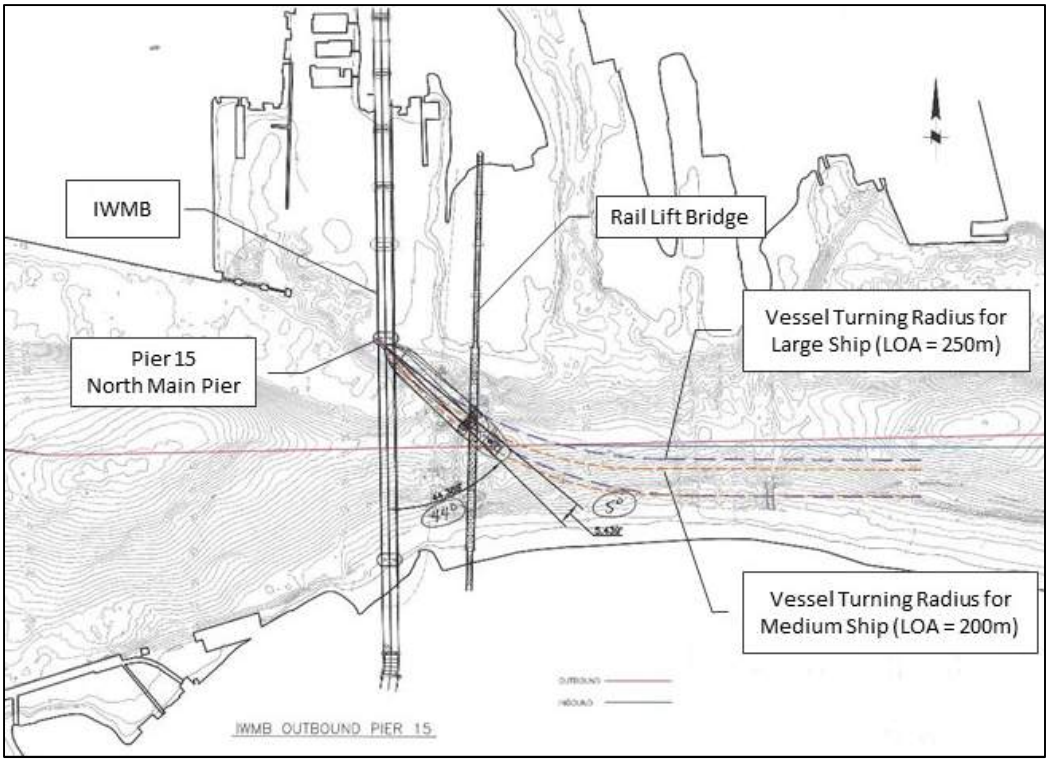


Figure 5.8: Outbound Pier 15 Vessel Collision Angles

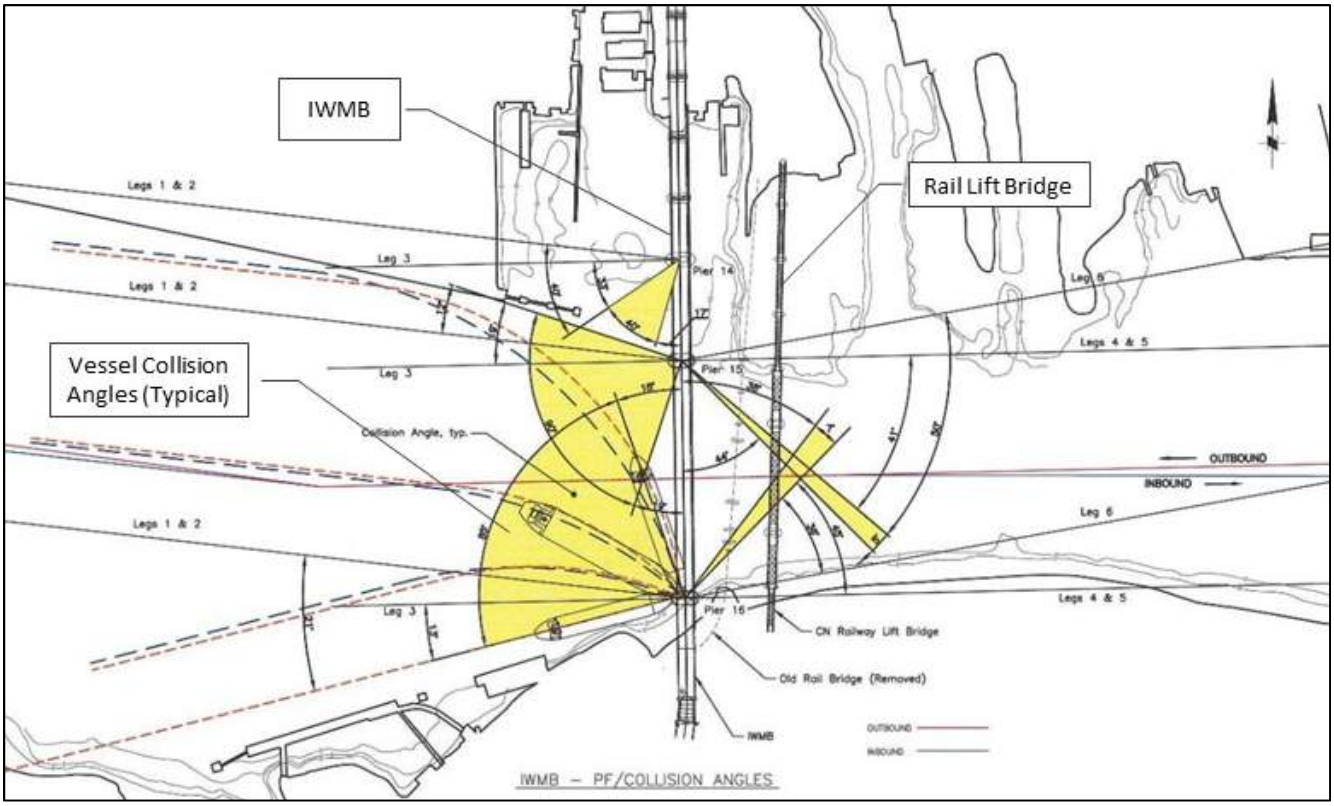


Figure 5.9: Summary of Pier Collision Angles

6 RISK ASSESSMENT RESULTS

6.1 BASE CASE SCENARIOS

Results of the base case risk analyses are summarized in **Table 6.1. Appendix A** provides details of the input and analysis files for both pier and span collisions, for the Future Vessel Traffic (25 Year Projection) Base Case.

Table 6.1: AFC Summary

BASE CASE	ANNUAL FREQUENCY OF COLLAPSE (AFC) Return Period (Years) (10,000 Years is Threshold for Class I Bridge)		
	Inbound Vessels	Outbound Vessels	Total
Present Day Vessel Traffic	1,409	14,142	**1,282**
Future Vessel Traffic (25 Year Horizon)	812	8,315	**740**

6.2 SENSITIVITY SCENARIOS

Factors used in a vessel collision risk study are intended to best reflect the reality of a bridge site, waterway and fleet characteristics. Nonetheless, each of the factors has an unavoidable degree of uncertainty. To gauge the significance of an uncertainty, a sensitivity analysis can be run where the factor is changed and its influence on the overall conclusion is evaluated.

Each of the factors used in the current study reflect the best estimate of reality based on relevant Codes, published research and previous risk studies that have been accepted by federal agencies for similar marine risk analyses. Several sensitivity runs were completed to evaluate the effect of varying key input variables. These sensitivity checks included variations to the (a) estimated growth rates for the vessel traffic; (b) probability of vessel aberrancy accident base rate; (c) tethered tug safety factor; (d) rail bridge protection; and (e) bridge superstructure (span) resistance strength. Note that all sensitivity analyses used the 25-year horizon for future vessel traffic as the Base Case for comparison.

6.2.1 GROWTH RATE SENSITIVITY

If the estimated 25-year growth rate was cut in half (50%) of that anticipated, the total bridge AFC return period would increase from 740 to 967 years.

If the estimated 25-year growth rate was doubled (2 times) of that anticipated, the total bridge AFC return period would decrease from 740 to 515 years. In this scenario, the number of vessels for the Kinder Morgan project were capped at 408 trips/year and all other vessel categories were increased at twice the base rate growth.

6.2.2 PROBABILITY OF ABERRANCY SENSITIVITY (PA)

If the probability of aberrancy base rate (BR) was half (50%) of that anticipated, the total bridge AFC return period would increase from 740 to 1,480 years. This represents an outcome if the assumed BR adjustment factors were overly conservative. For example, discussions with the VFPA and PPA indicate that the use of the portable Personal Pilot Units (PPU) carried by the pilots onboard each vessel provide a significant amount of navigation information and are being modified to receive real-time data of tides, currents and winds from measuring stations in the harbour. In the present study, no reduction in risk was (conservatively) attributed to the use of PPU units.

If the probability of aberrancy base rate (BR) was increased 1.5 times of that anticipated, the total bridge AFC return period would decrease from 740 to 493 years. This (and the following BR increases) would represent an outcome if the assumed BR adjustment factors were not adequately conservative and the BR rates were higher. If the probability of aberrancy base rate (BR) was increased 2.0 times of that anticipated, the total bridge AFC return period would decrease from 740 to 370 years.

6.2.3 TETHERED TUG PG SENSITIVITY

A sensitivity analysis was conducted to see the effect of increasing the tethered tug safety factor from 2.0 to 2.5 (the base case SF of 2.0 was considered conservative). Revising the safety factor from 2.0 to 2.5 changed the AFC return period from 740 years to 835 years.

6.2.4 RAIL BRIDGE PROTECTION SENSITIVITY

The risk assessment was conducted only for the IWMB and not the adjacent CN Rail Lift Bridge located west of IWMB. However, the existence of the rail bridge was included in the IWMB risk model for its potential protection of the highway bridge from outbound ships transiting Second Narrows. The base case scenarios assume that the rail bridge protects the IWMB from all outbound aberrant vessels except for those ships that pass through the rail bridge lift main span at an angle sufficient to hit the highway bridge pier or span components. A sensitivity analysis of this assumption was conducted for two alternate scenarios, (a) the rail bridge does not exist and there is no protection from outbound vessels, and (b) the rail bridge exists but only the bridge piers provide protection (no protection provided by the rail bridge spans).

For the scenario with no rail bridge protection, the AFC return period for the outbound ships decreases from 8,315 years to 5,642 years. However, the majority of the bridge risk is due to mast/deckhouse impacts by inbound ships (91%), therefore the total bridge risk was only reduced from 740 years to 710 years. A very similar result was calculated for the scenario that only considered rail piers as protection (no spans).

6.2.5 SPAN RESISTANCE STRENGTH SENSITIVITY

As noted previously in this report, a key component of the annual frequency of bridge collapse is the resistance strength of the bridge components to resist the impact force of an aberrant ship mast, deckhouse or bow. For impacts to the bottom chord of the steel truss by a vessel mast, deckhouse, or

flared bow, the lateral resistance strength of the steel truss was set equal to zero (H = 0 MN) for the base case scenario.

A sensitivity analysis was conducted to evaluate the effect of an increased span resistance strength. Increasing the span resistance from zero to H=1 MN increased the return period from 740 to 5,456 years. Increasing the span resistance to H = 2 MN increased the return period to 9,904 years, and increasing to H = 3 MN increased the return period to 15,474 years (above the 10,000 year acceptance criteria). As can be seen from these results, the risk analysis is highly sensitive to relatively small increases in span resistance strength of the steel truss superstructure. As context, it should be noted that a 1 MN load is comparable to the weight of two fully-loaded semi-trailer transport trucks.

The sensitivity of the annual frequency of collapse (AFC) to variations in bridge strength (H) is a result of how the probability of collapse (PC) is estimated using Code relationships based on the ratio H/P of bridge resistance strength (H) to the ship impact force (P) as shown in **Figure 5.5**. Where the impact force is high and the resistance strength is low (H/P between 0.0 and 0.1), the probability of collapse increases significantly (up to 100%). Where the impact force is low and the resistance strength is high (H/P between 0.1 and 1.0), the probability of collapse decreases significantly.

Based on the truss structural evaluation (summarized in **Section 3.5**, detailed in **Appendix D)**, a lateral resistance strength of zero (H=0) is appropriate for the existing structure. However, a lateral resistance strength (H) of 1.75 MN can be considered in the risk assessment, provided a fender is installed to intercept the initial mast contact and eliminate the local out-of-plane response of the bottom chord. In this case, the estimated AFC return period is significantly increased to over 5000 years, but still does not meet the criteria for a Class I (Critical Importance) highway bridge of 1 in 10,000 years.

6.3 KEY RISK ANALYSIS FINDINGS

The analysis estimated the AFC due to vessel collision for the Base Case (Present Day Vessel Traffic) has a return period of 1,282 years. The estimated AFC for the Base Case (Future Vessel Traffic) has a return period of 740 years. These results indicate that the AFC meets the criteria for a Class II (Regular Importance) highway bridge but does not meet the criteria for a Class I (Critical Importance) highway bridge.

1. Primary vulnerabilities are potential impacts of ship mast, deckhouse and bow with the lower chord of the steel truss over the navigation channel between the two main piers of the bridge (Piers 15 & 16). The south portion of the main span truss has a higher collision risk than the north portion due to the effect of the bend in the waterway on the approaches to the bridge.
2. Over 90% of the collision risks are due to inbound ships (masts and deckhouses) potentially impacting the bottom chord of the bridge truss. This proportioning can be attributed to several factors including (a) larger ships (all vessels greater than 65,000 DWT) are transiting the bridge inbound in a ballasted (unloaded condition) with relatively shallow drafts, which result in significantly higher mast and deckhouse heights above water (as compared to their heights when traveling outbound in a loaded condition with deeper drafts); (b) ballasted vessels have differing operational restrictions based on size and type; and (c) the inbound side of the waterway west of IWMB is wider than the outbound (east) side of the bridge.

3. The bottom chord of the steel truss superstructure was modeled in the base case as having no lateral resistance strength for vessel impacts (H = 0.0 MN). This was a conservative assumption that reflects the high state of compression in bottom chord members, lack of redundancy, challenges of repair and potentially catastrophic consequences of a vessel impact. However, the collision risk analysis is highly sensitive to relatively small increases in span resistance strength of the steel truss superstructure.
4. The potential vulnerabilities of the two main pier concrete substructure/foundations (Piers 15 & 16) are low since the resistance strength of the piers to vessel impact are relatively high (H = 90-100 MN) and the TCZ-2 operational restrictions reduce the probability of collision.
5. The potential vulnerabilities of the north anchor pier concrete substructure/foundation (Pier 14) and north anchor span are low since the resistance strength of the anchor pier to vessel impact is relatively high and the TCZ-2 operational restrictions reduce the probability of collision farther away from the navigation channel.
6. The CN Rail Bridge reduces the outbound collision risk by 32% (outbound "protected" return period = 8,315 years versus outbound "unprotected [no rail bridge]" = 5,642 years). This result indicates that the rail bridge may provide some protection for outbound vessels but, on its own, it is not sufficient to achieve the 10,000 year return period criteria for the IWMB. Also, the total bridge risk is dominated by inbound vessels in a ballasted condition so that the total bridge collapse risk is only reduced by 4% due to the presence of the rail bridge (total "protected" return period = 740 years versus total "unprotected [no rail bridge]" = 710 years).

6.4 DESIGN VESSELS

Design vessels are determined for each pier and span component by using the risk assessment model to identify the vessel in the fleet (and all other vessels smaller in size) that collectively trigger the acceptance criteria of 1 in 10,000 years for the total bridge. The total bridge acceptance criteria was distributed to each of the four water levels in accordance with the number of vessel transits at each water level. The portion of the total risk at each water level was then divided into the individual bridge components. A design vessel was determined for each bridge component based on the vessel size that triggered its portion of the acceptance criteria. Impact forces for the design vessel were selected using the largest impact load (speed, force or energy) from the six channel legs used in the risk analysis (the impact loads from each leg can vary depending on the bridge component).

The results of the risk assessment with the TCZ-2 navigation restrictions found that the IWMB bridge piers (Piers 14, 15 and 16) were located distances sufficiently far away from the channel and had relatively significant resistance strengths to impacts, such that their exposure to potential catastrophic collapse from aberrant vessels were very small (return periods exceeding 500,000 years). Because of the low risk, no design vessels were established for the piers.

The risk assessment also found that the north anchor span (the span between Pier 14 and Pier 13) was a low risk bridge component with a return period greater than 52,000 years; therefore, no design vessels were established for the north anchor span. The primary risk of bridge collapse due to vessel collision was found to be mast and deckhouse impacts to the north and south portions of the main bridge span. These bridge components represent 99% of the total bridge risk and represent an AFC return period of 751 years (out of the total bridge return period of 740 years). The south portion of the

main span has a greater exposure to vessel collision than the north portion due to the channels bends in the waterway at Second Narrows. The south portion of the main span represents 80% of the collision risk and the north portion represents 20% of the risk.

A summary of the south portion of the main span design vessels for each water elevation are shown in **Table 6.2**, and the north portion in **Table 6.3**. Slight variations of the impact kinetic energy for the same vessel at different water elevations occur due to changes in the hydrodynamic mass coefficient, which is based on the draft of the ship and water depth (under keel clearance). As shown in these tables the largest design vessel for potential ship collision mitigation is a ballasted 120,000 DWT Aframax tanker ship. The risk study found that the mast and deckhouse heights of ballasted vessels transiting at low water levels (LLWLT and MLW) due to vertical clearance restrictions at Second Narrows were higher than loaded vessels transiting at higher water levels (HHWLT and MHW). This is a result of greater differences between the ballasted and loaded drafts of ships as compared to the 5m difference in tide height. The higher heights of an aberrant ballasted vessel would contact the lower chord of the steel truss much closer to the channel than the same vessel in a loaded condition.

Table 6.2: South Portion of the Main Span Design Vessels

WATER ELEVATION (M) CHART DATUM	VESSEL ID #	VESSEL DESCRIPTION	MAXIMUM VESSEL IMPACT SPEED, V (M/SEC)			MAXIMUM VESSEL IMPACT FORCE, P (MN)				MAXIMUM COLLISION ENERGY, KE (MN-M)
			BOW	DECK HOUSE	MAST	SHIP	FLARED BOW	DECK HOUSE	MAST	
-0.1	1	120,000 DWT Tanker (Ballasted)	2.74	2.97	3.09	112.88	56.44	12.24	1.27	326.85
2.0	1	120,000 DWT Tanker (Ballasted)	2.78	3.03	3.09	114.51	57.25	12.48	1.27	286.21
4.2	10	65,000 DWT Tanker (Ballasted)	2.76	2.97	3.09	83.79	41.89	12.16	1.26	158.36
5.0	10	65,000 DWT Tanker (Loaded)	1.55	1.84	2.26	47.01	23.51	7.56	0.93	184.05

Table 6.3: North Portion of the Main Span Design Vessels

WATER ELEVATION (M) CHART DATUM	VESSEL ID #	VESSEL DESCRIPTION	MAXIMUM VESSEL IMPACT SPEED, V (M/SEC)			MAXIMUM VESSEL IMPACT FORCE, P (MN)				MAXIMUM COLLISION ENERGY, KE (MN-M)
			BOW	DECK HOUSE	MAST	SHIP	FLARED BOW	DECK HOUSE	MAST	
-0.1	2	110,000 DWT Tanker (Ballasted)	1.73	1.96	2.41	68.12	34.06	7.74	0.95	163.75
2.0	1	120,000 DWT Tanker (Ballasted)	1.79	2.04	2.52	73.81	36.91	8.41	1.04	182.42
4.2	10	65,000 DWT Tanker (Loaded)	1.56	1.85	2.25	47.50	23.75	7.59	0.92	166.01
5.0	11	65,000 DWT Bulk Carrier (Loaded)	1.88	2.14	2.64	57.15	28.57	8.78	1.08	249.31

7 PHYSICAL MITIGATION: OPTIONS AND SITE CONSIDERATIONS

7.1 TYPICAL PHYSICAL MITIGATION OPTIONS

Physical protection measures can be implemented to mitigate the risk of vessel collision. As part of a new bridge, or as an upgrade to an existing structure, physical protection provides a combination of strength resistance, energy absorption and vessel redirection. Physical protection systems are typically grouped into the following categories, listed as follows:

1. **Fenders** are structural components mounted to an existing structure and intended to absorb energy through plastic bending, crushing or buckling. They are typically made of timber, rubber, concrete and/or steel and can include both custom-designed and proprietary systems. Fenders are typical used in combination with other systems or intended for "*medium to small vessels at low impact speeds and at oblique angles.*" **(6)**. One such local example is the steel fendering at the Sea Island Bridge in Richmond, BC (**Figure 7.1**).



Figure 7.1: Steel Fendering at Sea Island Bridge, Richmond BC

2. **Pile-Supported Systems** are structural components that may be attached or independent of the pier it is protecting and can be a suitable option for a wide-range of vessel collision scenarios. They are typically made of timber, concrete and/or steel and are often designed as sacrificial components. One such local example is the timber piling to protect the piers at the Moray Bridge in Richmond, BC (**Figure 7.2**).



Figure 7.2: Timber Pile Supported Protection at Moray Bridge, Richmond BC

3. **Dolphins** are standalone components, typically comprised of driven steel sheet piling, filled with rock or concrete and topped with a concrete cap. They are most often circular to facilitate vessel redirection. They are typically a sacrificial component in high energy collision scenarios. Fender are often installed on the perimeter of the dolphins. A prominent and often-cited North American bridge example is the dolphins used for the Sunshine Skyway in Tampa Bay, Florida (**Figure 7.3**).
4. **Islands / Berms** are a rock fill embankment built up around a pier to ground the vessel and stop it in advance of contact. They are a conceptually simple solution, "*considered by most investigators to provide the highest level of ship collision protection*" **(6)**. Energy dissipation is achieved primarily through a combination of (a) vessel rotation / ride-up; (b) hull friction and ploughing into the rock fill; and (c) crushing and distortion of the vessel's hull. Rock fill berms have been used on many of the local bridges including the Alex Fraser Bridge, North Arm Bridge (Skytrain) and the North Tower of Lions Gate Bridge (**Figure 7.4**).
5. **Floating Protection** can include cable nets, anchored pontoons and floating booms. They are less common, typically only considered in deep water applications. They typically require a large area to deform and absorb collision energy and are not well suited to narrow channels. There is no floating protection systems installed at the local major bridges.



Figure 7.3: Dolphin Protection at Sunshine Skyway



Figure 7.4: Rock Berm Protection at Lions Gate Bridge North Tower

7.2 IWMB VESSEL COLLISION PROTECTION CONSIDERATIONS

7.2.1 VESSEL COLLISION PROTECTION GEOMETRIC REQUIREMENTS

The vessel collision angles shown in **Figure 5.9** are used for establishing the in-plan layout of potential protection measures (pier impacts shown; span impacts are similar). The primary exposure to collision is from inbound vessels because the waterway on the west side of the bridge is much wider as compared the east side of the bridge. Outbound vessels on the east side of the bridge are "funneled"

into a narrower waterway corridor and aberrant outbound vessels would run aground relatively quickly due to shallow water depths adjacent to the navigation channel. The existing rail bridge provides protection to the IWMB for outbound vessels; however, as noted in **Section 6.3**, the benefit of the rail bridge to the IWMB risk calculation is relatively small, increasing the AFC return period by only 4%.

For an arch-shaped bridge such as the IWMB, the vertical clearance above water is reduced significantly between the edge of the navigation channel and the piers supporting the arching superstructure. As shown in **Figure 3.3,** potential superstructure collision could occur between the mast of the vessel hitting the lower chord of the steel truss, the deckhouse of the vessel hitting the truss, or the top of the bow of the ship hitting the truss above water. **Figure 3.3** also illustrates the potential pier collision scenario where the bulbous bow of an aberrant vessel hits the concrete pier supporting the bridge structure.

The location of the point of contact of an aberrant vessel mast, deckhouse or bow with the steel truss varies depending on the vessel size, draft (loaded or ballasted); geometry of the steel truss members; and the water elevation. The vessel impact force also varies depending upon which part of the ship contacts the bridge component. The vessel collision risk analysis found that the greatest risk for IWMB collapse is due to mast and deckhouse impacts on the bottom chord of the steel arch truss from inbound ballasted ships. The risks associated with loaded outbound vessels and impacts to the bridge piers exist, but are lower risks than for inbound vessel impacts on portions of the main span. To minimize vessel collision risks to the IWMB, a physical protection system must withstand or re-direct a vessel such that it does not reach the main piers, nor the four truss bays closest to the main piers.

7.2.2 KEY SITE CONSTRAINTS FOR CONCEPT DEVELOPMENT

In developing protection concepts, the key site-specific considerations are as follows:

1. **Hydraulics:** The Burrard Inlet harbour has a relatively large daily tidal range that results in peak currents at the IWMB of 3.5 m/s (6.8 knots), generally uniform across the narrows in a direction roughly parallel to the vessel transit paths. Protection structures constructed adjacent to the main channel will result in minor increases in the currents through Second Narrows potentially reducing the allowable vessel transit windows as specified by the Port and thereby also reducing the number of vessels that can pass through the Second Narrows in a tide cycle. The tidal range and strong currents are a significant construction condition that influences the capital cost of the suggested protection measures.
2. **Port and Vessel Operations:** The main piers are located 100m from the edge of the navigation channel. The truss bays vulnerable to mast collision extend to within 35m of the edge of the navigation channel. In addition to transiting under the IWMB, commercial vessels are manoeuvering directly west of the bridge for berthing at the adjacent terminals, both north and south of the channel. All protection measures must be cognizant of potential disruption of commercial marine traffic during both construction and in their permanent configuration.
3. **Environmental Impacts:** The Burrard Inlet harbour is valued fisheries habitat and compensation measures for habitat loss will likely be required as a condition of the regulatory permits. The typical construction period for in-water construction is August to February to avoid adversely impacting migrant fish populations.

4. **Public Considerations:** Recreational vessel marinas are located along the north shore on both sides of the IWMB. Construction and permanent works will need to be cognizant of these users in terms of visibility, communication and component detailing. Construction during night-time hours will need to consider sound disturbance to nearby Capital Hill residents.
5. **Geotechnical and Bathymetry:** The seafloor conditions differ at the north and south main piers. A protection structure at the north pier will bear on marine deltaic deposits of layered sand and gravel. The south pier is bearing directly on sandstone. The sandstone is believed to be dipping to the north such that a protection structure will bear partly on marine deltaic deposits and partly on sandstone.

7.3 SCREENING OF PHYSICAL MITIGATION OPTIONS

Four physical protection options were considered for initial screening. These options follow the first four typical options described in **Section 7.1**. The fifth option, floating protection systems was not further considered given the narrow and widely trafficked channel.

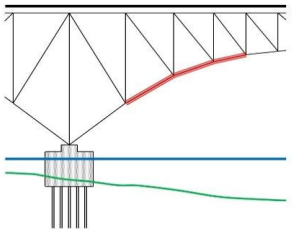
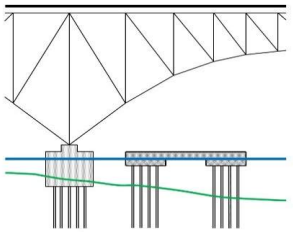
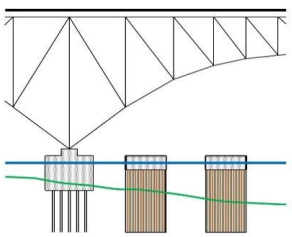
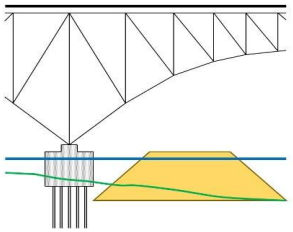
Each of the four screening options were assessed considering the site's geometric requirements (**Section 7.2.1**), high load/energy dissipation requirements (**Section 6.4**) and site-specific constraints (**Section 7.2.2**). These options are compared in **Table 7.1** and described in further detail in the following sections. Note that the evaluation is comparative and not absolute. For example, the rock fill island is ranked "Moderate" with respect to capital costs, but only as compared to other options. For some evaluation criteria (hydraulics, structural feasibility and costs), preliminary calculations were completed to help evaluate each option. For other evaluation criteria (constructability, vessel operation, environmental), the evaluation is based on qualitative expert opinion. As it relates to the two preferred options, further detail is provided in **Section 8** on each of the noted criteria.

7.3.1 TRUSS FENDER

As noted, a significant risk reduction can be achieved if the structure has capacity to resist only mast collisions. A lateral resistance strength (H) of 1.750 MN can be considered in the risk assessment provided a fender is mounted on the bridge truss to intercept the initial mast contact and eliminate the local out-of-plane response of the bottom chord.

Note that this proposed "truss fender" differs from a traditional bridge fender, supported from the main piers. A traditional bridge fender is a not a practical solution for IWMB given the large geometric and collision force/energy requirements.

A relatively light-weight "truss fender" can be installed to re-direct the mast impact loads to the truss nodes. This strategy is relatively inexpensive and would have no impacts to channel hydraulics, port operation, environment and the public. However, a truss fender strategy does not resolve all vessel collision risks at the IWMB. To do so would require extensive strengthening well beyond the practical limits of such works. Furthermore, a comprehensive strengthening approach would introduce significant operational restrictions (both vehicular and vessel) for both installation of the works, as well as assessment and damage repair after a collision event.

Criteria for Option Evaluation		1- Truss Fender	2-Pile-Supported Structure	3-Dolphins	4-Rock Fill Island
					
Risk Benefits and Load Path	Provides Protection for Mast Collisions	✓	✓	✓	✓
	Achieves AFC Return Period of 1:10,000?	✗	✓	✓	✓
	Energy Dissipation *Is it rigid or can it absorb energy?*	~	✓	✓	✓
	Resilience and Scaleabilty *Can it be fine-tuned for different risk levels?*	✗	✓	✓	✓
	Load Path (Impact) to Existing Bridge?	✗	✓	✓	✓
Impacts and/or Risks	2nd Narrows Hydraulics	✓	~	~	✗✗
	Commerical Port Operation	✓	~	~	✗✗
	Environmental Impacts	✓	~	~	~
	Public Considerations (*disruption to marine / roadway traffic, park users and local residents*)	✓	~	✓	✓
	Construction Duration	✓	✗	~	~
	Construction Complexity	✓	✗	~	✓
Costs	Capital	$	$$$$	$$$	$$
	Maintenance	~	~	~	✓
	Advance to Concept?	**Yes**	**No**	**Yes**	**No**

Legend ✓ *Good / Low Impact* ~ *Moderate / Some Impact* ✗ *Poor / High Impact / Potential "Show-Stopper"* ✗✗ *"Show-Stopper"*

Table 7.1: Physical Protection Options Screening

It is important to emphasize that a light-weight truss fender strategy is generally not compatible with the level of robustness and redundancy required for most collision protection structures, given the high degree of uncertainty in estimating the collision forces. Therefore, the truss fender strategy is recommended for further review, **understanding that this is a high-value interim solution to reduce the risks to the bridge that can be readily implemented while longer-term solutions are in development.**

7.3.2 PILE-SUPPORTED STRUCTURE

A standalone pile-supported structure can be installed in a variety of configurations at IWMB using both vertical and battered piles. The system would require a heavily reinforced pilecap to distribute and engage a large group of piles in the system. Energy dissipation in the system would be primarily through yielding of the steel piles in bending. The system could be designed for a variety of collision scenarios and eliminate all collision hazards to the bridge.

A key challenge of this option is the large number of piles required to achieve the necessary strength and energy dissipation. This is due, in large part, to the pile lengths of up to 15m-20m above the sea floor resulting in a very flexible structure. Pile driving within the granular fills is feasible but would require significant time and equipment costs due to the large tidal currents, the proximity to commercial vessel traffic and the fisheries work window restrictions. Additionally, the large number of piles in each structure effectively behaves as a block when considering impacts to tidal currents with the potential alteration to current directions and velocities, which may affect vessel navigation in the channel.

As compared to a dolphin strategy (described in the next section), this option would be significantly more expensive while offering no additional benefit. Therefore, this option was not advanced further to full concept development.

7.3.3 SHEET PILE CELL DOLPHINS

Sheet pile cell dolphins are a robust sacrificial protection system that have been used extensively at bridge sites worldwide. They could be configured in a variety of layouts at IWMB to suit a preferred level of risk protection. Their primary advantage over a pile-supported structure is the increased robustness and generally lower capital costs for a large vessel collision load. Installing the sheet pile cells will face similar challenges to the pile-supported structures in that construction in the high currents and in proximity to the navigation channel will result in an extended schedule and correspondingly increased costs when compared to installations without those constraints.

As with the piled-supported structure, each cell will behave as a block when considering impacts to the tidal currents with the potential to result in alteration to current directions and velocities which may affect vessel navigation in the channel. As part of this study, a hydraulic numerical modelling analysis has been completed which indicates that, while the dolphins will impact the currents, the effects are limited and manageable. Other impacts are mitigatable and, therefore, a dolphin strategy is a preferred solution and was advanced to full concept development in **Section 8**.

7.3.4 ROCK FILL ISLAND

A rock fill island could be installed between the main piers and the navigation channel to provide robust and reliable vessel collision protection to the piers and truss superstructure. This strategy was suggested in the 1992 study as a potential, albeit very preliminary, mitigation concept for ship impact protection **(2)**.

Compared to the other proposed in-water strategies, a rock fill island is low complexity and cost with respect to both construction and maintenance. However, the rock fill island would have a significantly larger footprint with correspondingly higher impacts to Second Narrows hydraulics and commercial vessel traffic. Based on the hydraulic analysis completed for the dolphin concept, it is clear that the much larger rock fill island would have significant hydraulic impacts. Therefore, this option was not advanced further to full concept development.

8 PHYSICAL MITIGATION CONCEPTS

8.1 CONCEPT TYPES AND CONFIGURATION

Based on the option screening review summarized in **Section 7.3**, the preferred long-term concept is the sheet pile cell dolphin strategy. As part of this concept development, three dolphin configurations were then considered in the study, shown in **Figure 8.1**. Conceptual details for the six-dolphin option (Configuration #1) are presented in **Drawings 01459-B002** and **01459-B003** in **Appendix B**.

A truss fender strategy is considered a "high-value" interim solution that could be readily implemented while the longer-term dolphin strategy is further developed. Conceptual details for one such fender option are presented in **Drawings 01459-B004** and **01459-B005** in **Appendix B**.

The current section provides a description of the design and construction implications for each option. Follow-up sections provide a summary of the updated risks and impacts to channel hydraulics, port operation, environment, the public and estimated costs.

8.1.1 SHEET PILE CELL DOLPHIN OPTION

Sheet pile cell dolphins are an effective and frequently used strategy for protection of lifeline structures exposed to large commercial vessel traffic. For the IWMB site, the proposed dolphins would be approximately 20m in diameter, with a crushed stone infill and a reinforced concrete cap. The dolphin layouts shown in **Figure 8.1** were developed based on the geometric requirements in **Section 7.2.1.**

Protection Mechanism: The dolphin cells are sacrificial structures that absorb energy through large deformations. As per the AASHTO Guide Specification **(6)**, "*Under design load conditions, the cell is permitted to undergo plastic deformation and partial collapse*". In a collision scenario, the vessel's kinetic energy is absorbed through a combination of primary mechanisms including (a) bow crushing, lifting and friction of the ship's bow against the dolphin; and (b) sliding, rotation and deformation of the dolphin itself (AASHTO illustration shown in **Figure 8.2**).

Detailed Design Approach: In terms of design, a force-based or stability check approach is not appropriate since non-linear crushing and movement of the cell is necessary to engage the primary energy absorbing mechanisms. Instead, the design methodology calls for a time-step analysis where, at each increment, the noted mechanisms are considered and the absorbed collision energy is calculated. The analysis is complete when all of the vessel's kinetic energy is absorbed, typically a 3-4 second period.

Concept Design Approach: A time-step energy-based analysis is beyond the scope of the current concept-level study, which is intended to evaluate high-level impacts and costs. Instead, the proposed IWMB dolphin concept has been developed based on review of existing dolphin systems in North America. Two such examples are listed in **Table 8.1**: the Sunshine Skyway in Tampa Bay, Florida (**Figure 8.3**) and the Dame Point Bridge in Jacksonville, Florida. The force and energy demands, as well as the depth of water, are comparable to the south side dolphins at IWMB and therefore, a 20m diameter is a reasonable initial estimate for the required size. The force and energy demands for the

north side dolphins are considerably lower, approximately 60% of the south side. However, the water depth is also somewhat deeper (up to 20m) and, therefore, a similarly-sized 20m diameter dolphin has been proposed for the north side also.

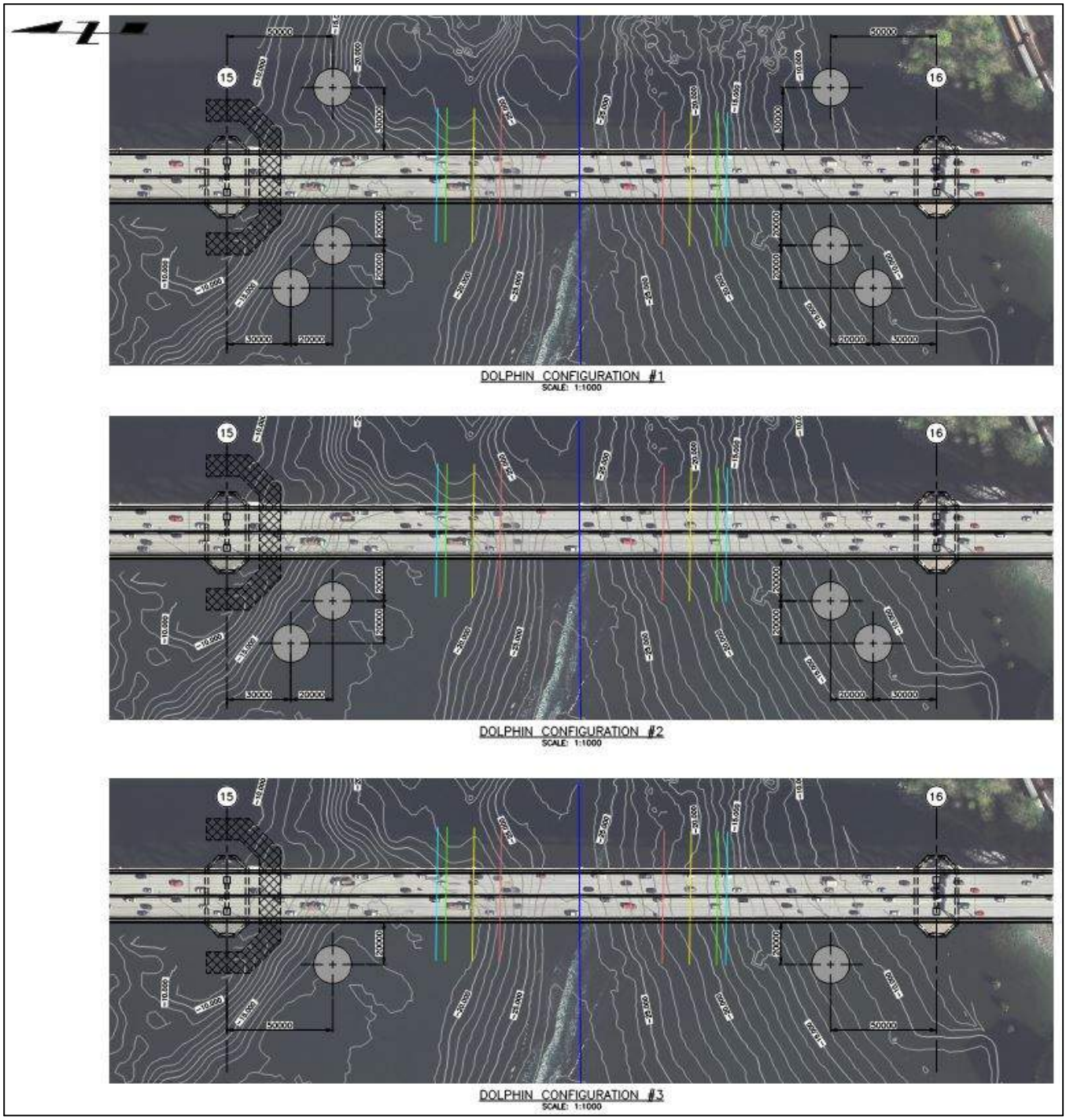


Figure 8.1: Dolphin Configurations

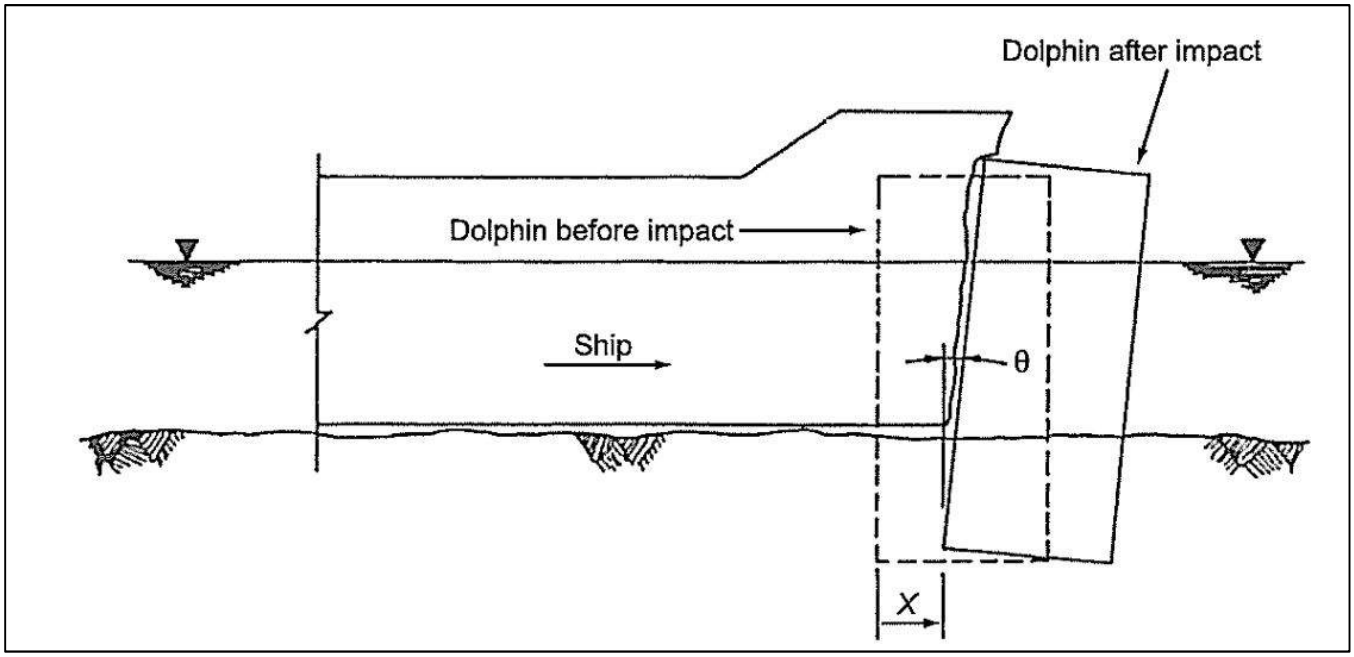


Figure 8.2: Collision Energy Absorbed by Dolphin Rotation and Sliding, and by Crushing of Vessel Bow (6)



Figure 8.3: Main Pier Dolphin (18.3m diameter) at the Sunshine Skyway Bridge

TABLE 8.1: EXISTING DOLPHIN EXAMPLES FOR CONCEPT CALIBRATION

Bridge	Collision Design Force (MN)	Collision Design Energy (MN-m)	Water Depth (m)	Cell Diameter (m)
Sunshine Skyway Bridge (Tampa Bay, Florida)	65-100	465-515	12	18.3 (60')
Dame Point Bridge (Jacksonville, Florida)	90-145	475-770	9	18.3 (60')
IWMB (South Side)	115	330	10-15	20
IWMB (North Side)	75	185	15-20	20

Geotechnical Considerations: For estimating purposes, a sheet pile embedment for the north side dolphins of 15m into the seafloor is proposed. This is a relatively deep but achievable embedment that reflects the sands and gravels of the area. On the south side, where bedrock may be encountered, anchorage of the dolphins could be achieved through tensioned steel anchors.

Concept Considerations: Past performance and research has indicated that a heavily reinforced concrete cap and wall encircling the top of the cell is an important feature to "*effectively 'fix' the top of the dolphin creating a rigid diaphragm which holds the cell together during the 1- to 3-second collision impact interval*" **(6)** . Also, a timber or rubber fender is proposed to mitigate (a) damage from lower energy collisions and (b) risk of fire from metal-on-metal contact during the ship collision. It is anticipated that, due to the large currents and dependent upon final pile penetration and design analysis, riprap around the cell base may be required for scour protection.

Impacts to the Existing Structure: The weight of a dolphin may induce a small settlement to the north main pier (Pier 15). The actual magnitude of settlement will depend on the number and layout of dolphins but is expected to be tolerably small (< 5mm). The south main pier (Pier 16) is bearing on bedrock and not expected to be impacted by the dolphins. Also, a collision loading of the north side dolphins could result in small elastic soil deformation and temporary lateral loading of the Pier 15 foundations. However, any such loading would be considerably less than the estimated pier capacity of 100 MN.

Construction Considerations: The method of construction for the sheet pile cells is as follows:

1. All work will be completed by floating marine plant (crane and supply barges) being held in position using anchor lines and anchors, as dictated by the water depths. One such example from the Sunshine Skyway is shown in **Figure 8.4**. The positioning of the floating equipment and anchorages will be sufficiently clear of the main navigation channel and positioned to minimize approaches to other wharves and facilities, to provide for safe navigation. All equipment and buoys will require navigation marking lights. A support tug and crew boats will be required. A decision on whether the floating plant can be left secured in position during the non-working hours will be dependent upon the contractor's preferences for equipment safety and the requirements of the Harbour Master.
2. The sheet piles will be coated on-shore or at the point of fabrication. Depending upon the source of supply and delivery method, the piles may have to also be splice welded to the required length on shore prior to being loaded onto the supply barge.

3. The cells will be installed by first installing a pre-fabricated driving template through which the sheet piles can be accurately positioned for driving. The template will be of steel fabrication, which will be secured in position using steel pipe piles. The desired construction schedule will determine if more than one template is required. Once the sheet piles are threaded into the template they will be driven to the specified penetration using a combination of vibration and impact driving. Placing of the driving templates and threading of the sheet piles will be somewhat restricted due to tidal currents.
4. Once the cell is closed, the interior fill will be placed and compacted. The fill will be transported to the site on a supply barge and placed in the cell interior by a transfer conveyor from the supply barge or placed from a floating crane equipped with a clamshell bucket. Gradation of the fill will be specified to minimize the amount of compaction required under water and the top of the fills will be consolidated to support the concrete cap.
5. Upon completion of the cell filling the concrete pile cap will be formed and poured. The concrete will be shuttled by supply barge from the shore yard and placed either by pumping and/or bucket. For the cells on the south side, the concrete pile cap will have block outs through which anchor rods can be drilled into the underlying bedrock and tensioned.



Figure 8.4: Dolphin Construction at the Sunshine Skyway in 1987

Construction Duration: The duration of construction will be determined by the restrictions imposed by the Agencies; optimization of the marine equipment plant (i.e. one or two marine cranes); geotechnical conditions, allowable working hours determined by community considerations and worker safety; climatic conditions and the requirement to work around large tidal currents. Significant additional analysis, beyond the scope of this study is required to develop an accurate project schedule.

It is estimated that two sheet pile cells can be constructed in each season. Other than for the two-dolphin alternative, it is considered that the work would extend over a period of two to three years.

Long-Term Maintenance Considerations: The sheet pile cells, in the absence of a collision which causes physical damage and deformation, can provide a service life of 50 years with minimal maintenance. The primary maintenance risk is the corrosion of the steel sheet piles which is hastened at this site by the large currents, fine suspended sediment and seabed sediment movement. Appropriate mitigation measures include coating the piles with a high durability coating, such as a flake glass polyester, combined with a corrosion allowance for the steel.

Future Repairability / Dismantling: In the case of a major collision event, a dolphin is not repairable; the original dolphin is either abandoned or dismantled. In Burrard Inlet, it would not be reasonable to abandon the structure and removal would be required. This would require controlled demolition of the concrete cap; removal of the infill material to a barge and pulling or cut-off of the sheet pile at the mudline. A new dolphin would need to be rebuilt following dismantling.

8.1.2 TRUSS FENDER OPTION

A fender mounted to the bottom chord of the steel truss will intercept the initial contact of a vessel mast and redirect the impact forces to the truss nodes, eliminating the undesirable out-of-plane response of the bottom chord. The proposed truss fender is a steel pipe that spans between the truss nodes and is vertically supported from hangers attached to the truss.

Protection Mechanism: The truss fender will be a sacrificial element that provides a measure of protection and repairability for collision incidents from vessel masts only. As noted, the truss fender strategy alone is generally not compatible with the level of robustness and redundancy required for most collision protection structures given the high degree of uncertainty in estimating the collision forces. As such, a truss fender is recommended only in combination with a dolphin strategy.

Truss Fender Collision Load Path: The steel pipe is 1219mm (4') diameter to match the height of the bottom chord. The pipe will be horizontally offset from the bottom chord such that, on mast impact, the pipe will deform without engaging the truss in the mid-chord locations (i.e. between the truss nodes). The pipe will be laterally supported at the truss node locations through an elastomeric bearing, fitted to engage the node uniformly. The pipe assembly will be laterally restrained using steel tie bars at regular spacing, connecting to the pipe assembly on each side of the bridge. A continuous steel plate will be mounted under the tie rods to restrain any vertical component of the mast collision load.

Truss Fender Vertical Support: The pipe assembly will be vertically supported using steel hanger rods anchored to the truss. While a number of anchor points have been considered, an anchorage at the top chord of the truss is preferred for ease of access and to mitigate unintended lateral loads to the vertical truss member. Anchorage of the rod directly to the floor beams is not feasible due to conflict with the maintenance traveler, shown in **Figure 8.5**. Vibration of the anchor rods against the truss's vertical members may require mid-height restraint.

Impacts to the Existing Structure: While very light-weight in relative terms, the truss fender will increase the dead load of the existing structure. As a preliminary check, the truss members were checked using the member demands and capacities provided for the widened sidewalk and new safety fence project in 2016 **(4)**. D/C ratios for both ULS1 (Dead+Live) and ULS4 (Dead+Wind) were found to be acceptable with the truss fender triggering an increase in D/C ratio of less than 1% for most cases. Two of the vertical truss members saw an increase of up to 3.5%; however, their capacity has adequate margin for this increase. A more detailed confirmation of all truss members is necessary once the truss fender concept has been finalized.

Construction Considerations: A temporary access platform is likely not required to complete this work. The IWMB is equipped with three fully operable inspection travellers that run the full length of the bridge: one runs between the main trusses and one is located under each deck cantilever. The travellers are each equipped with a swing stage that can be lowered to access all parts of the truss. The system installed under the west cantilever is shown in **Figure 8.5**. The travellers and swing stages are designed to support people, tools and light-weight materials only. Major truss fender components (pipe, hangers, rods) would be supplied from a marine-based crane on a barge below the truss. The connection details shown in **Appendix B** have been developed with expectation that the gusset plates could be first field-matched from the swing stage before mobilizing the marine crane for hanger installation.

Construction Duration: All components would be prefabricated off site prior to assembly on site. Total duration is likely three to six months with a marine crane and barge likely necessary for about three weeks.

Long-Term Maintenance Considerations: The fender's steelwork is expected to be coated to match the existing truss steel. As such, the fender's steelwork will have similar deterioration and maintenance requirements as the existing truss steel.

Future Repairability / Dismantling: The pipe section of the truss fender is intended to be sacrificial and would likely need to be replaced in the event of a mast collision. Similar to their construction, all elements of the truss fender are intended to be easily removed.



Figure 8.5: Maintenance Traveler Seen from the South Abutment, West Side

8.2 VESSEL COLLISION RISK IMPLICATIONS

The original risk assessment analysis considered the existing structure with no protection measures and span resistance strengths (H) of 0, 1 MN, 2MN and 3 MN. As noted in **Section 3.5**, a lateral

resistance strength of zero (H=0) is appropriate for the existing structure. However, a lateral resistance strength (H) up to 1.75 MN can be considered in the risk assessment, provided a truss fender is installed to eliminate the local out-of-plane response of the bottom chord. In this case, the estimated AFC return period is increased to over 5000 years, but still does not meet the criteria for a Class I (Critical Importance) highway bridge of 1 in 10,000 years.

As follow-up to the initial risk assessment, further analysis was completed for the three dolphin configurations shown in **Figure 8.1**. Dolphin Configuration 1 (6 Dolphins) would reduce the risk of collision and increase the AFC return period from 740 to 10,794 years. This would meet the Class I AFC criteria of 1 in 10,000 years. Dolphin Configuration 2 (4 Dolphins) would increase the AFC return period from 740 to 5,914 years. Dolphin Configuration 3 (2 Dolphins) would increase the AFC return period from 740 to 1,928 years. Both Configurations 2 and 3 are less than the Class I criteria. This risk analysis is summarized in **Appendix E**, using the future vessel traffic based on the 25-year horizon.

If the dolphins were installed in combination with an increase in span resistance strength from zero to H = 1.0 MN, then Dolphin Configurations 1 and 2 increase the AFC return period to 40,536 and 39,706 years respectively – both significantly exceeding the Class I bridge criteria. However, Dolphin Configuration 3 with span H = 1.0 MN only increases the AFC return period from 740 to 6,645 years – which is below the Class I criteria.

8.3 HYDRAULIC IMPLICATIONS

The hydraulic implications of the base case (six cell) dolphin configuration were analyzed by specialist sub-consultants Northwest Hydraulics Consultants (NHC). This analysis is summarized in the following sections with further detail provided in the NHC memo included in **Appendix C**. Note that the hydraulic analysis was based on an interim dolphin concept that called for 18m diameter dolphins. The finalized concept, shown in Drawing 01459-A002, is slightly larger with 20m diameter dolphins. The implications of this change are expected to be small but will require confirmation at the detailed design stage. Also, note that there are no hydraulic impacts associated with the truss fender strategy.

8.3.1 HYDRODYNAMIC ANALYSIS SUMMARY

A hydrodynamic model of Burrard Inlet was developed (**Figure 8.6**) that includes English Bay, Vancouver Harbour and Indian Arm. The model was developed using Delft3D, a 3D hydrodynamic model, which calculates non-steady flow and transport phenomena that result from tidal and river flow forcing on a rectilinear or a curvilinear grid. The Burrard Inlet model consists of three, 2-way coupled domains with a progressively finer resolution. The finest grid resolution is near the Second Narrows with a grid size of 5m. In the vertical direction, the model consists of 15 layers. Tides are simulated with amplitudes and phases of 16 locally-dominant tidal constituents along the open ocean boundary (Point Atkinson). The bathymetry is based on hydrographic charts and VFPA survey data. The model was validated against water levels at Vancouver Harbour and the 1981 Vancouver Harbour Tidal Current Atlas.

The hydraulic analysis relating to the proposed dolphins at IWMB was split into two phases:

1. An initial analysis considered the spatial distribution of impacts based on peak flows. This analysis covered the entire impacted area at three depths: surface, -5m and -10m (CD). For this

analysis, the November 14-15, 2012 tidal cycle was selected since it has a large tidal range of 4.1m. This work is summarized in the August 23, 2017 memo by NHC in **Appendix C**.

2. A second analysis considered the hydraulic impact of the dolphins to the vessel transit windows. As part of the TCZ-2 requirements, vessels of certain size, type and loading are restricted to slack, 1 knot or 2 knot current windows when transiting Second Narrows. The currents for establishing these transit windows are measured at the CN Rail lift bridge.

   For this hydrodynamic analysis, a time series of the average velocity in the upper two-thirds of the water columns was evaluated at the four locations shown in **Figure 8.7**. A 2-knot window was selected for the study and the change in available transit time was calculated. For this analysis, a 10-day tidal period was selected from January 4 to 13th, 2017 and then projected to estimate the annual impact. This work is summarized in the September 29, 2017 memo by NHC in **Appendix C**.



Figure 8.6: Hydrodynamic Model Extents



Figure 8.7: Transit Window Assessment Locations

8.3.2 ANALYSIS FINDINGS: PEAK FLOWS

The hydrodynamic model was run with and without the six-dolphin protection concept and the peak velocities were compared. The velocity difference for peak ebb and flood tides are shown in **Figure 8.8** and **Figure 8.9**, respectively. Note that these figures show surface flows. Velocity differences at EL. -5.00 and EL. -10.00 (CD) are included in **Appendix C** and indicate that the greatest impact is at the surface and decreases with depth. Key findings of this analysis are as follows:

- **Ebb Tide:** The most significant impact to the currents occur west of the bridge crossings where the dolphins effectively shift the currents northward, resulting in increased velocity of up to 0.8 m/s (1.5 knots) on the north side of the channel and decreased velocity of up 1.3 m/s (2.5 knots) on the south side of the channel. There is no significant change in currents at the CN Rail Location.
- **Flood Tide:** The impacts to the current during the flood tide occur at the bridge crossings and include a general increase across the channel of about 0.3 m/s (0.6 knots) and localized increases of up to 0.8 m/s (1.5 knots). Velocity decreases of up to 2.6 m/s (5 knots) are predicted in the leeward region of the dolphins.

The general flood tide increase of 0.3 m/s (0.6 knots) at the bridge crossings presents a potential disruption to the vessel transit windows and, therefore, a second time-series phase of analysis was completed, summarized in the following section.

8.3.3 ANALYSIS FINDINGS: HYDRAULIC IMPACT TO TRANSIT WINDOWS

Over a selected 10-day tide period, the average velocities were predicted for the upper two-thirds of the water column, for both the existing and six dolphin configurations. **Figure 8.10** illustrates the impact of the dolphins at the CN Rail Bridge over this period. A key finding of this figure is that, at the CN Bridge location, the increases in currents occur during large flood tides with little predicted change in currents during the ebb tides.

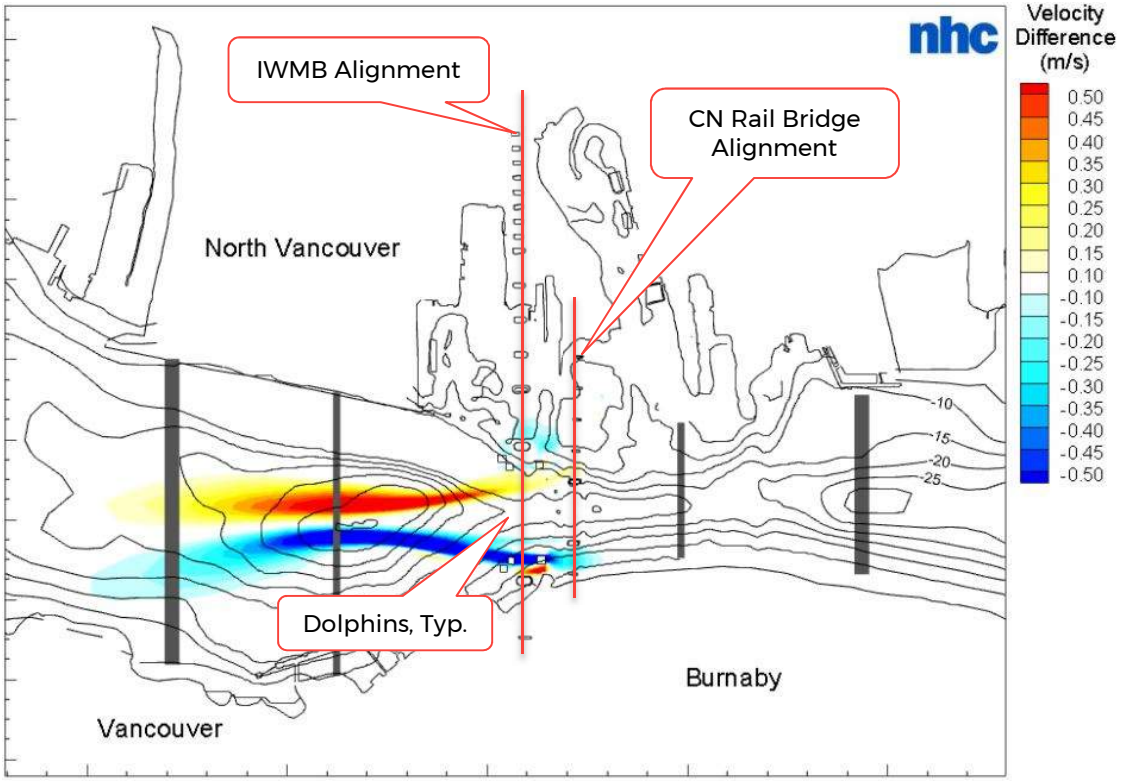


Figure 8.8: Change in Current Velocity due to Six Dolphin Configuration – Peak Ebb Tide

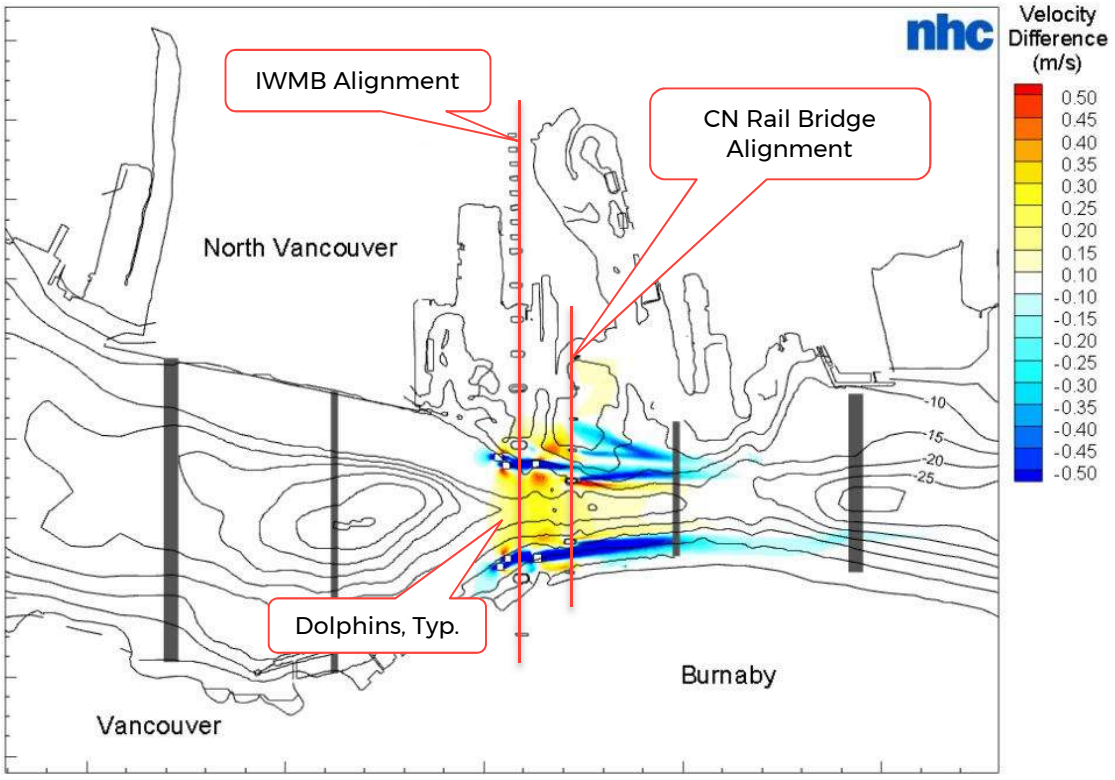


Figure 8.9: Change in Current Velocity due to Six Dolphin Configuration – Peak Flood Tide

Based on this 10-day time-series analysis, the reduction in available time for the 2-knot transit window was calculated. For the governing CN Bridge location, the 10-day losses were then projected to a full year using a correlation analysis that matched transit window time loss to the magnitude of tidal range. Findings for both the 10-day and annual analysis are summarized in **Table 8.2**.

TABLE 8.2: SUMMARY OF TIME LOSS FOR THE 2 KNOT TRANSIT WINDOWS

Location (See Figure 8.7)	**Change in Available Hours**	
	10-Day Period	**Projected for Annual Period**
West	-4 (-2.4%)	-
Center	-6 (-5.4%)	-
CN Bridge	**-8 (-8.7%)**	**-100 (-2.6%)**
East	-1 (-1.3%)	-

Note: Projected values for annual period are only calculated for the governing CN Bridge location, where the VFPA measures currents for transit window definition.

As a measure of the sensitivity of this analysis, note that four of the eight exceedance occurrences in the 10-day period at CN Bridge had a very small exceedance value of 1.05 m/s (2.05 knots), just slightly over the 2-knot threshold. The largest of the predicted exceedances had a velocity increase of 0.08 m/s (0.16 knots). The magnitude of these changes is small and fall within the natural variability in the tidal flow system and numerical model uncertainty. At a future design stage, the analysis could be refined by conducting simulations over additional periods.

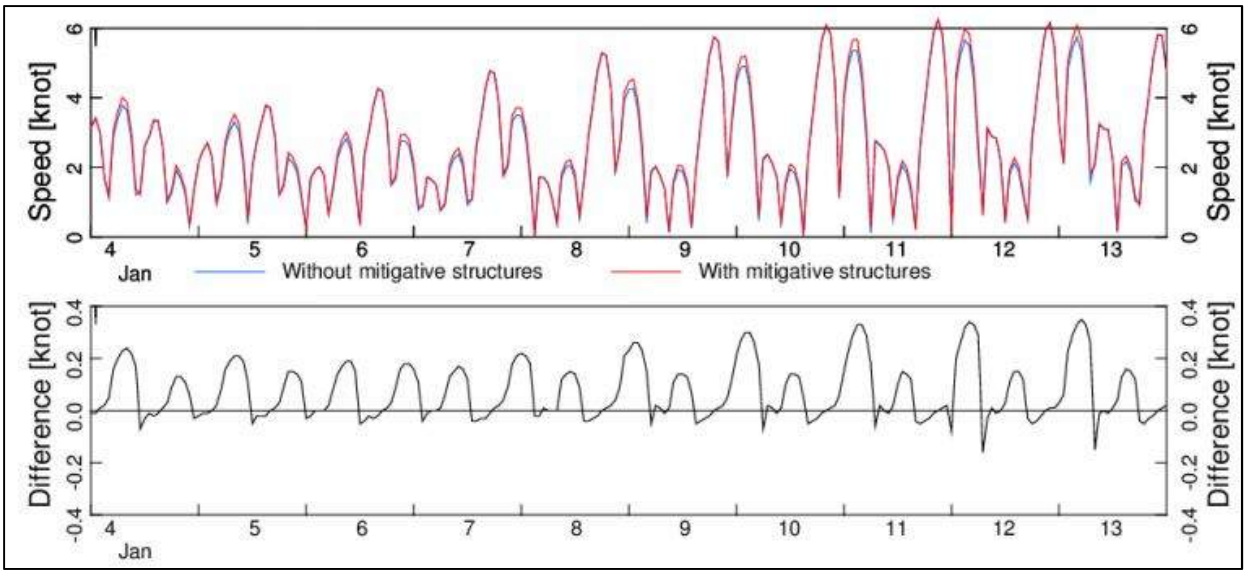


Figure 8.10: Current and Velocity Changes in the Upper Two-Thirds of the Water Column at the CN Rail Bridge

8.4 IMPACTS TO PORT AND VESSEL OPERATIONS

The dolphin strategy calls for permanent in-water structures located up to 50m north/south of the main pier centerlines and up to 40m offset (east/west) from the edge of the bridge truss. In this arrangement, the perimeter of the outer dolphins would be located a minimum of 40m from the navigation channel, which is governed by the 137m clear opening of the CN Rail bridge. Also, with reference to the AIS vessel tracks (**Figure 4.1**, **Figure 4.2** and **Figure 4.3**), the dolphins have been located such that they do not conflict with berthing vessels at adjacent terminals. Construction works, including barges and temporary work platforms, would be ideally positioned between the IMWB and new structures, away from vessel operations.

The truss fender concept would have no significant impact to the vertical clearance under the bridge. The truss fender would be installed on parts of the IWMB within 35m of the navigation channel and, as such, construction works would need to be coordinated with the schedule of transiting and berthing vessels.

In dialog with the VFPA, their primary concern is the impact of in-water protection structures to the currents through Seconds Narrows and its implications to the vessel transit windows. The TCZ-2 requirements **(10)** call for vessel transits to be restricted slack, 1 knot and 2 knot windows through Second Narrows, depending on vessel size, type and loading.

As part of this project, the hydraulic impact of the dolphins was studied by Northwest Hydraulics Consultants (NHC). Their findings are summarized in the previous section and further detailed in **Appendix C**. A key finding of this analysis is that, at the CN Bridge location, the estimated loss of available time over a full year for the 2-knot transit window is about 100 hours, a 2.6% reduction. In addition, the analysis revealed high sensitivity to small changes in exceedance values. For example, half of the transit window loss time was eliminated by an increase in the 2-knot threshold to 2.05 knots.

These findings indicate that the hydraulic impacts of the dolphins are likely manageable but will require further dialog with the VFPA and stakeholders. Furthermore, a refined study of the hydraulic impacts of dolphins and their impact to all transit windows is critical if this option is advanced to detailed design. Lastly, the findings of this hydraulic study indicate that the impacts to transit windows are sensitive to small changes in the analysis. As such, there may be benefit in reducing the number of dolphins (e.g. Dolphin Configurations #2 or #3) and/or geometrically shifting the dolphins away from the channel.

8.5 ENVIRONMENTAL CONSIDERATIONS

There are no significant impacts anticipated for the truss fender straty. The dolphin strategy has several environmental permitting considerations related primarily to impacts to fish and fish habitat, marine mammals, water quality, and fish habitat loss. Several permits are anticipated for this work, listed below:

- A **Fisheries Act Authorization** from Fisheries and Oceans Canada (DFO). The *Fisheries Act Authorization* process includes two steps with DFO: (1) the Request for Project Review and the (2) Application for Authorization, if DFO determines that an authorization is required, typically when serious harm to fish cannot be avoided or mitigated. The Application for Authorization

includes the content of the Environmental Assessment (completed as part of the Request for Project Review) plus an Offsetting Plan and a letter of credit to cover the costs of implementing the Plan.

- A **Project and Environmental Review Permit** from the VFPA. The project is expected to meet the VFPA's criteria of a Category B project and will require technical analysis and mitigation relating to fish and fish habitat, marine water quality, underwater noise related to impacts to marine mammals during installation and a construction environmental management plan. In addition to the application and technical reports, public notification and stakeholder / Indigenous Peoples consultation may be required. Prior to submitting the application, the Ministry will have to secure tenure with the VFPA's Real Estate department in what would be a similar arrangement to the tenure agreement for the bridges.

8.6 ESTIMATED COSTS

An order-of-magnitude cost estimate was prepared for each of the physical mitigation options and is summarized in **Table 8.3**. Further detail relating to these cost estimates are included in **Appendix F**. The cost estimates include material quantity take-offs and unit rates for key components. Construction unit rates were established in consultation with local contractors. In addition, these cost estimates consider pre-construction activities including geotechnical investigation, detailed analysis and design and permitting. The cost estimates also include the expected costs during construction including environmental compensation and contract administration services. A 50% contingency rate was used in the cost estimate to reflect the uncertainty associated with concept-level design development.

Table 8.3: Cost Estimate Summary

OPTION	COST ESTIMATE WITH CONTINGENCY
Truss Fender	**$3M**
6 Dolphins	**$55M**
Total	**$58M**

9 SUMMARY OF KEY FINDINGS

This report provides a summary of the detailed vessel collision risk analysis of the IWMB. The analysis estimated the AFC due to vessel collision for the Base Case (Present Day Vessel Traffic) has a return period of 1,282 years. The estimated AFC for the Base Case (Future Vessel Traffic; 25 Year Horizon) has a return period of 740 years. These results indicate that the AFC meets the criteria for a Class II (Regular Importance) highway bridge but does not meet the criteria for a Class I (Critical Importance) highway bridge. Key findings from the study were:

1. Primary vulnerabilities are potential impacts of ship mast, deckhouse and bow with the lower chord of the steel truss over the navigation channel between the two main piers of the bridge (Piers 15 & 16). The south portion of the main span truss has a higher collision risk than the north portion due to the effect of the bend in the waterway on the approaches to the bridge.
2. Over 90% of the collision risks are due to inbound ships (masts and deckhouses) potentially impacting the bottom chord of the bridge truss. This proportioning can be attributed to several factors including (a) larger ships (all vessels greater than 65,000 DWT) are transiting the bridge inbound in a ballasted (unloaded condition) with relatively shallow drafts, which result in significantly higher mast and deckhouse heights above water (as compared to their heights when traveling outbound in a loaded condition with deeper drafts); (b) ballasted vessels have differing operational restrictions based on size and type; and (c) the inbound side of the waterway west of IWMB is wider than the outbound (east) side of the bridge.
3. The bottom chord of the steel truss superstructure was modeled in the base case as having no lateral resistance strength for vessel impacts (H = 0.0 MN). This was a conservative assumption that reflects the high state of compression in bottom chord members, lack of redundancy, challenges of repair and potentially catastrophic consequences of a vessel impact. The collision risk analysis is highly sensitive to relatively small increases in span resistance strength of the steel truss superstructure. A lateral resistance strength (H) of up to 1.75 MN can be considered in the risk assessment, provided a fender is installed to intercept the initial mast contact and eliminate the local out-of-plane response of the bottom chord.
4. The potential vulnerabilities of the two main pier concrete substructure/foundations (Piers 15 & 16) are low since the resistance strength of the piers to vessel impact are relatively high (H = 90-100 MN) and the TCZ-2 operational restrictions reduce the probability of collision.
5. The potential vulnerabilities of the north anchor pier concrete substructure/foundation (Pier 14) and north anchor span are low since the resistance strength of the anchor pier to vessel impact is relatively high and the TCZ-2 operational restrictions reduce the probability of collision farther away from the navigation channel.
6. The CN Rail Bridge reduces the outbound collision risk by 32% (outbound "protected" return period = 8,315 years versus outbound "unprotected [no rail bridge]" = 5,642 years). This result indicates that the rail bridge may provide some protection for outbound vessels but, on its own, it is not sufficient to achieve the 10,000 year return period criteria for the IWMB. Also, the total bridge risk is dominated by inbound vessels in a ballasted condition so that the total bridge collapse risk is only reduced by 4% due to the presence of the rail bridge.

This report provides concept-level details and discussion of physical protection measures to address the noted risks. Design development first considered key site constraints in the screening of typical

physical protection systems. From this initial review, two main strategies were advanced to concept design development:

1. **Dolphins** comprised of steel sheet pile cells are an effective and frequently used strategy for robust protection of lifeline structures exposed to large commercial vessel traffic. This study has considered three layouts of dolphin comprised of 6, 4 and 2 cell configurations.
2. A **fender** mounted to the bottom chord of the steel truss could serve to intercept the initial contact of a vessel mast and redirect the impacts to the truss nodes, eliminating the undesirable out-of-plane response of the bottom chord. This study has developed details for one such concept.

Note that the truss fender strategy alone will not reduce the risk from deck house or bow collisions. Furthermore, given the high degree of uncertainty in estimating collision forces, this light-weight system is generally not compatible with the level of robustness and redundancy typically used for vessel collision protection structures. As such, a truss fender is recommended as a "high-value" interim solution that, subject to further verification, can be easily implemented while the longer-term dolphin strategy is further developed.

With appreciation for the differing nature of protection provided by the two strategies, a phased approach is recommended for the IWMB:

1. Construct Truss Fender on both Inbound and Outbound Sides: A light-weight fender can provide short-term protection for mast collisions while a robust dolphin protection strategy is further reviewed and developed.
2. Construct Six Dolphins (Four Inbound and Two Outbound): Configuration and number to be determined following detailed design.

The three phases are compared in **Table 9.1** based on a variety of factors. A green checkmark (✓) indicates a good rating or low impact. A brown tilde (~) indicates greater impacts or lesser performance compared to the other option. A red "x" (✘) indicates high impact or poor performance.

The dolphin strategy introduces hydraulic and environmental impacts to Second Narrows that will require detailed assessment and consideration during the design development in order to meet the VFPA, Indigenous Peoples and other stakeholders' expectations. Preliminary findings indicate that these impacts are manageable but will require dialog and technical support. The recommended phased approach provides the time necessary to advance this dialog and technical support while providing an initial level of protection from vessel mast collisions and introducing the dolphins into the water in 2 phases. Two phased dolphin installation provides an in-service verification opportunity after the first phase dolphins are installed.

Table 9.1: Summary of Vessel Collision Protection Concepts Based on Key Criteria

CRITERIA	TRUSS FENDER	6 DOLPHINS	COMBINED: FENDER + 6 DOLPHINS	COMMENT
Risk of Vessel Collision Measured as "AFC Return Period"[1]	5,456	10,794	40,536	The 6-dolphin concept achieves the threshold of 10,000 years.
Energy Dissipation and Reliance on Existing Bridge	✘	✓	✓	Dolphins are independent sacrificial elements intended for high energy absorption. The truss fender relies on the stiff lateral load path of the bottom chord of the existing bridge.
Hydraulic Impacts & Impacts to Port Operation	✓	~	~	A dolphin strategy will impact the currents through Second Narrows. The truss fender has no impact on currents. The hydraulic impacts of the dolphin strategy are likely manageable but will require further dialog with the VFPA and detailed analysis.
Environmental Impacts	✓	~	~	The dolphin strategy has environmental impacts that may require compensation. The truss fender has no environmental impacts.
Public Impacts	✓	✓	✓	Neither option has significant impacts to the public.
Design and Construction Duration	1 Year	3 Years	4 Years	Dolphin construction will be required over multiple environmental windows.
Construction Complexity	✓	~	~	Dolphin construction is challenged by high currents and proximity to vessel traffic.
Capital Cost	$3M	$55M	$58M	Dolphins are significantly higher cost than the fender concept.
Maintenance Cost	✓	✓	✓	Both strategies require minimal maintenance. The dolphins would be detailed for a 50-year service life. Maintenance of the truss fender would match the bridge program.
Future Reparability / Dismantling	✓	~	~	Both strategies feature sacrificial components that make repair unlikely. Replacement or dismantling will be similar in effort to the original construction.

[1] The risk of vessel collision is listed as the return period (or inverse) of the Annual Frequency of Collapse (AFC). The Code specifies a minimum threshold of 1 in 10,000 years for Class I highway bridges. For each direction (inbound and outbound), the minimum threshold is 1 in 20,000 years. For this tabulation, the fender provides H=1.0 MN minimum strength protection. All AFC values not achieving the Code threshold are highlighted in red. Note that the present-day risk of vessel collision with no protection is 1,282 years.

10 ACKNOWLEDGEMENTS

The project has served as an intensive collaboration between the Ministry and the consultant team, with key members of the Project Team all noted at the beginning of the report. In addition, special acknowledgement is extended to Kevin Baskin, the Ministry's former Chief Bridge Engineer who led the early stages of the project.

The project has required extensive and on-going co-operation with the VFPA. Grateful acknowledgement is extended to Sean Baxter, Egge Kloosterboer, Dave Hart and Jeffrey Pelton for their assistance and valued feedback.

In addition, the following people and organizations are acknowledged for their valuable insights relating to vessel operation in Burrard Inlet and BC coastal waters: (a) Paulo Ekkebus and Brian Young of the Pacific Pilotage Authority; (b) Paul Devries and Captain Robin Stewart of the BC Coast Pilots; and (c) Mohan Raman of the Transportation Safety Board of Canada.

Appreciation is extended to COWI (formerly Buckland & Taylor) for assisting in locating past files and reports related to the IWMB. Appreciation is also extended to Gord Helm of the Halifax Harbour Bridges for providing background and insight relating to similar issues for the Macdonald and MacKay Bridges in Halifax.

11 REFERENCES

1. **Swan Wooster & Partners.** *Second Narrows Crossing Design Drawings.* Vancouver : s.n., 1959.
2. **Buckland & Taylor.** *Second Narrows Bridge #1489 Widening & Seismic Study.* North Vancouver : s.n., 1992.
3. **Buckland & Taylor.** Second Narrows Bridge Seismic Safety Retrofit As-Built Drawings. North Vancouver : s.n., 2000.
4. **COWI.** Ironworkers Memorial Bridge No. 01489 Sidewalk and Fence Upgrades Record Drawings. North Vancouver : s.n., 2016.
5. **Canadian Standards Association.** Canadian Highway Bridge Design Code (CAN/CSA-S6-14). Toronto : s.n., 2014.
6. **American Association of State Highway and Transportation Officials (AASHTO).** Guide Specifications and Commentary for Vessel Collision Design of Highway Bridges, 2nd Edition, with 2010 Interim Revisions. Washington, DC : s.n., 2009.
7. **American Association of State Highway and Transportation Officials (AASHTO).** LFRD Bridge Design Specifications, 7th Edition. Washington, DC : s.n., 2014.
8. **Canadian Coast Guard, Transport Canada.** *Vulnerability of Bridges in Canadian Waters.* 1982.
9. **National Geospatial Intelligence Agency.** *Sailing Directions, British Columbia.* 2014.
10. **Vancouver Fraser Port Authority.** *Port Information Guide.* Vancouver : s.n., October 2017, Amended February 2018.
11. **Geological Suvey of Canada, National Resources of Canada.** *Tabulated Values of Relative Sea-Level Projections in Canada and the Adjacent Mainland United States.* 2015.
12. **Golder Associates Ltd.** Final Report on Preliminary Geotechnical Study on Seismic Retrofitting and Widening of the Second Narrows Bridge #1459. s.l. : British Columbia Ministry of Transportation and Infrastructure, December 1991.
13. **Golder Associates Ltd.** Report on Phase 1 & 2 Geotechnical Design Input Seismic Safety Retrofit Second Narrows Bridge #1459. s.l. : British Columbia Ministry of Transportation and Infrastructure, June 1993.
14. **MMM Group Limited.** *01481 Lions Gate Bridge Vessel Collision Risk Assessment Final Report.* Vancouver : British Columbia Ministry of Transportation and Infrastructure, 2017.
15. **BC Ministry of Transportation and Infrastructure.** BC Traffic Data Program. [Online] 2017. http://www.th.gov.bc.ca/trafficdata/.
16. **Trans Mountain Expansion Project.** Termpol Review Process Documents, 15 Volumes (Termpol 3.1 thru Thermpol 3.19) plus Supporting Documents and Reference Materials. November 29, 2013.
17. **Seah, C. and Baker A.** Maritime Accidents and Human Perfomance the Statistical Trail. s.l. : American Bureau of Shipping, 2004.
18. **Larsen, O. (Editor).** Ship Collision with Bridges: The interaction between Vessel Traffic and Bridge Structures. Structural Engineering Document 4. s.l. : International Association for Bridge and Structural Engineering (IABSE), 1993.

APPENDIX

A

BASE CASE (FUTURE VESSEL TRAFFIC; 25 YEAR HORIZON) VESSEL COLLSION RISK ANALYSIS

TABLE OF CONTENTS

**** Note ** All references to "Base Case 2" in Appendix A are equivalent to "Base Case (Future Vessel Traffic) as described in the report.**

APPENDIX A1 – GENERAL INFORMATION (2 TOTAL PAGES)

- Annual Frequency of Collapse – Total Bridge Summary (Base Case 2) (Page A1.1)
- Vessel Fleet Annual Trip Frequency – Distribution (Page A1.2)

APPENDIX A2 - SUBSTRUCTURE ANNUAL FREQUENCY OF COLLAPSE (WATER ELEVATION -5.0 CD) (24 TOTAL PAGES)

- Substructure Annual Frequency of Collapse (Page A2.1)
- Vessel Fleet Characteristics (Page A2.2)
- Vessel Fleet Annual Trip Frequency (Page A2.3)
- Vessel Fleet Transit Speeds in Main Channel (Page A2.4)
- Aberrancy Base Rate Computations (Page A2.5)
- Miscellaneous Information (Page A2.6)
- Annual Frequency of Collapse Computations (Page A2.7)
- Includes Individual Computations for Each Applicable Combination of Pier (Piers 14, 15 & 16), Vessel Direction (Inbound/Outbound) and Channel Leg (1-6)

APPENDIX A3 - SUPERSTRUCTURE ANNUAL FREQUENCY OF COLLAPSE (WATER ELEVATION -5.0 CD) (48 TOTAL PAGES)

- Superstructure Annual Frequency of Collapse (Page A3.1)
- Vessel Fleet Characteristics (Superstructure Only) (Page A3.2)
- Vessel Fleet Annual Trip Frequency (Superstructure Only) (Page A3.3)
- Vessel Fleet Transit Speeds in Main Channel (Superstructure Only) (Page A3.4)
- Aberrancy Base Rate Computations (Superstructure Only) (Page A3.5)
- Miscellaneous Information (Superstructure Only) (Page A3.6)
- Superstructure Contact Geometry – Main Span South (Page A3.7)
- Superstructure Contact Geometry – Main Span North (Page A3.9)
- Superstructure Contact Geometry – Anchor Span North (Page A3.11)
- Annual Frequency of Collapse Computations (Superstructure Only) (Page A3.13)

Includes Individual Computations for Each Applicable Combination of Span (Main Span South, Main Span North & Anchor Span North), Vessel Direction (Inbound/Outbound) and Channel Leg (1-6).

APPENDIX A4 - SUBSTRUCTURE ANNUAL FREQUENCY OF COLLAPSE (WATER ELEVATION -4.2 CD) (24 TOTAL PAGES)

- Substructure Annual Frequency of Collapse (Page A4.1)
- Vessel Fleet Characteristics (Page A4.2)

- Vessel Fleet Annual Trip Frequency (Page A4.3)
- Vessel Fleet Transit Speeds in Main Channel (Page A4.4)
- Aberrancy Base Rate Computations (Page A4.5)
- Miscellaneous Information (Page A4.6)
- Annual Frequency of Collapse Computations (Page A4.7)

Includes Individual Computations for Each Applicable Combination of Pier (Piers 14, 15 & 16), Vessel Direction (Inbound/Outbound) and Channel Leg (1-6).

APPENDIX A5 - SUPERSTRUCTURE ANNUAL FREQUENCY OF COLLAPSE (WATER ELEVATION -4.2 CD) (48 TOTAL PAGES)

- Superstructure Annual Frequency of Collapse (Page A5.1)
- Vessel Fleet Characteristics (Superstructure Only) (Page A5.2)
- Vessel Fleet Annual Trip Frequency (Superstructure Only) (Page A5.3)
- Vessel Fleet Transit Speeds in Main Channel (Superstructure Only) (Page A5.4)
- Aberrancy Base Rate Computations (Superstructure Only) (Page A5.5)
- Miscellaneous Information (Superstructure Only) (Page A5.6)
- Superstructure Contact Geometry – Main Span South (Page A5.7)
- Superstructure Contact Geometry – Main Span North (Page A5.9)
- Superstructure Contact Geometry – Anchor Span North (Page A5.11)
- Annual Frequency of Collapse Computations (Superstructure Only) (Page A5.13)

Includes Individual Computations for Each Applicable Combination of Span (Main Span South, Main Span North & Anchor Span North), Vessel Direction (Inbound/Outbound) and Channel Leg (1-6).

APPENDIX A6 - SUBSTRUCTURE ANNUAL FREQUENCY OF COLLAPSE (WATER ELEVATION -2.0 CD) (24 TOTAL PAGES)

- Substructure Annual Frequency of Collapse (Page A6.1)
- Vessel Fleet Characteristics (Page A6.2)
- Vessel Fleet Annual Trip Frequency (Page A6.3)
- Vessel Fleet Transit Speeds in Main Channel (Page A6.4)
- Aberrancy Base Rate Computations (Page A6.5)
- Miscellaneous Information (Page A6.6)
- Annual Frequency of Collapse Computations (Page A6.7)

Includes Individual Computations for Each Applicable Combination of Pier (Piers 14, 15 & 16), Vessel Direction (Inbound/Outbound) and Channel Leg (1-6).

APPENDIX A7 - SUPERSTRUCTURE ANNUAL FREQUENCY OF COLLAPSE (WATER ELEVATION -2.0 CD) (48 TOTAL PAGES)

- Superstructure Annual Frequency of Collapse (Page A7.1)
- Vessel Fleet Characteristics (Superstructure Only) (Page A7.2)
- Vessel Fleet Annual Trip Frequency (Superstructure Only) (Page A7.3)
- Vessel Fleet Transit Speeds in Main Channel (Superstructure Only) (Page A7.4)
- Aberrancy Base Rate Computations (Superstructure Only) (Page A7.5)
- Miscellaneous Information (Superstructure Only) (Page A7.6)
- Superstructure Contact Geometry – Main Span South (Page A7.7)
- Superstructure Contact Geometry – Main Span North (Page A7.9)
- Superstructure Contact Geometry – Anchor Span North (Page A7.11)
- Annual Frequency of Collapse Computations (Superstructure Only) (Page A7.13)

Includes Individual Computations for Each Applicable Combination of Span (Main Span South, Main Span North & Anchor Span North), Vessel Direction (Inbound/Outbound) and Channel Leg (1-6).

APPENDIX A8 - SUBSTRUCTURE ANNUAL FREQUENCY OF COLLAPSE (WATER ELEVATION -0.1 CD) (24 TOTAL PAGES)

- Substructure Annual Frequency of Collapse (Page A8.1)
- Vessel Fleet Characteristics (Page A8.2)
- Vessel Fleet Annual Trip Frequency (Page A8.3)
- Vessel Fleet Transit Speeds in Main Channel (Page A8.4)
- Aberrancy Base Rate Computations (Page A8.5)
- Miscellaneous Information (Page A8.6)
- Annual Frequency of Collapse Computations (Page A8.7)

Includes Individual Computations for Each Applicable Combination of Pier (Piers 14, 15 & 16), Vessel Direction (Inbound/Outbound) and Channel Leg (1-6).

APPENDIX A9 - SUPERSTRUCTURE ANNUAL FREQUENCY OF COLLAPSE (WATER ELEVATION -0.1 CD) (48 TOTAL PAGES)

- Superstructure Annual Frequency of Collapse (Page A9.1)
- Vessel Fleet Characteristics (Superstructure Only) (Page A9.2)
- Vessel Fleet Annual Trip Frequency (Superstructure Only) (Page A9.3)
- Vessel Fleet Transit Speeds in Main Channel (Superstructure Only) (Page A9.4)
- Aberrancy Base Rate Computations (Superstructure Only) (Page A9.5)
- Miscellaneous Information (Superstructure Only) (Page A9.6)
- Superstructure Contact Geometry – Main Span South (Page A9.7)
- Superstructure Contact Geometry – Main Span North (Page A9.9)
- Superstructure Contact Geometry – Anchor Span North (Page A9.11)
- Annual Frequency of Collapse Computations (Superstructure Only) (Page A9.13)

APPENDIX

Includes Individual Computations for Each Applicable Combination of Span (Main Span South, Main Span North & Anchor Span North), Vessel Direction (Inbound/Outbound) and Channel Leg (1-6).

ANNUAL FREQUENCY OF COLLAPSE - TOTAL BRIDGE SUMMARY (BASE CASE 2)

Description	Overall Annual Frequency of Collapse, AF									Return Period	% Risk
	Inbound				Outbound				Total		
	5.0m	4.2m	2.0m	-0.1m	5.0m	4.2m	2.0m	-0.1m			
Pier 14	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	11,339,172,180	0%
Pier 15	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	-	0%
Pier 16	0.00000000	0.00000000	0.00000090	0.00000087	0.00000000	0.00000000	0.00000000	0.00000000	0.00000177	564,998	0%
Main Span South	0.00025557	0.00021788	0.00026147	0.00029546	0.00001897	0.00001565	0.00000618	0.00000239	0.00107357	931	79%
Main Span North	0.00004123	0.00003669	0.00004598	0.00005604	0.00002678	0.00002390	0.00001620	0.00001020	0.00025702	3,891	19%
Anchor Span North	0.00000496	0.00000493	0.00000685	0.00000217	0.00000000	0.00000000	0.00000000	0.00000000	0.00001891	52,879	1%
Total for Bridge:	0.00030176	0.00025950	0.00031520	0.00035455	0.00004575	0.00003955	0.00002238	0.00001259	0.00135127	**740**	**100%**

Bridge Type: **Class I**

Minimum Return Period: **10,000**

VESSEL FLEET ANNUAL TRIP FREQUENCY - DISTRIBUTION

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Annual Number of Trips (N)						Existing Total Trips	Annual Number of Trips (N) Distribution for Variable Water Levels																Existing Total Trips
				Inbound			Outbound				Inbound									Outbound								
											Loaded				Ballasted				Total	Loaded				Ballasted				Total	
				Loaded	Ballasted	Total	Loaded	Ballasted	Total		5.0m	4.2m	2.0m	-0.1m	5.0m	4.2m	2.0m	-0.1m		5.0m	4.2m	2.0m	-0.1m	5.0m	4.2m	2.0m	-0.1m		
1	Ship	Tanker	120,000	0	10	10	10	0	10	20	0	0	0	0	0	0	5	5	10	5	5	0	0	0	0	0	0	10	20
2	Ship	Tanker	110,000	0	9	9	9	0	9	18	0	0	0	0	0	0	5	4	9	3	3	3	0	0	0	0	0	9	18
3	Ship	Tanker	105,000	0	1	1	1	0	1	2	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	2
4	Ship	Bulk Carrier	85,000	0	5	5	5	0	5	10	0	0	0	0	0	0	0	5	5	0	0	2	3	0	0	0	0	5	10
5	Ship	Bulk Carrier	80,000	0	5	5	5	0	5	10	0	0	0	0	0	0	0	5	5	0	0	2	3	0	0	0	0	5	10
6	Ship	Tanker	75,000	0	7	7	7	0	7	14	0	0	0	0	0	0	4	3	7	2	2	3	0	0	0	0	0	7	14
7	Ship	Bulk Carrier	75,000	0	4	4	4	0	4	8	0	0	0	0	0	0	0	4	4	0	1	1	2	0	0	0	0	4	8
8	Ship	Tanker	70,000	0	1	1	1	0	1	2	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	1	2
9	Ship	Bulk Carrier	70,000	0	1	1	1	0	1	2	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1	2
10	Ship	Tanker	65,000	0	4	4	4	0	4	8	0	0	0	0	1	1	1	1	4	2	2	0	0	0	0	0	0	4	8
11	Ship	Bulk Carrier	65,000	9	6	15	6	9	15	30	5	4	0	0	0	0	0	6	15	2	2	2	0	0	0	0	9	15	30
12	Ship	Bulk Carrier	60,000	0	2	2	2	0	2	4	0	0	0	0	0	0	0	2	2	1	1	0	0	0	0	0	0	2	4
13	Ship	Tanker	55,000	1	8	9	8	1	9	18	0	1	0	0	2	2	2	2	9	3	3	2	0	1	0	0	0	9	18
14	Ship	Bulk Carrier	55,000	0	3	3	3	0	3	6	0	0	0	0	0	0	0	3	3	1	1	1	0	0	0	0	0	3	6
15	Ship	Tanker	50,000	14	31	45	31	14	45	90	3	3	4	4	8	8	8	7	45	7	8	8	8	4	4	3	3	45	90
16	Ship	Bulk Carrier	50,000	0	1	1	1	0	1	2	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	1	2
17	Ship	Tanker	45,000	0	2	2	2	0	2	4	0	0	0	0	1	1	0	0	2	1	1	0	0	0	0	0	0	2	4
18	Ship	Tanker	40,000	2	19	21	19	2	21	42	0	0	1	1	5	5	5	4	21	5	4	5	5	0	1	1	0	21	42
19	Ship	Bulk Carrier	40,000	0	3	3	3	0	3	6	0	0	0	0	0	1	1	1	3	0	1	1	1	0	0	0	0	3	6
20	Ship	Tanker	35,000	4	8	12	8	4	12	24	1	1	1	1	2	2	2	2	12	2	2	2	2	1	1	1	1	12	24
21	Ship	Bulk Carrier	35,000	0	3	3	3	0	3	6	0	0	0	0	1	1	1	0	3	1	1	1	0	0	0	0	0	3	6
22	Ship	Tanker	30,000	1	28	29	28	1	29	58	0	0	1	0	7	7	7	7	29	7	7	7	7	1	0	0	0	29	58
23	Ship	Bulk Carrier	30,000	1	1	2	1	1	2	4	1	0	0	0	1	0	0	0	2	0	0	0	1	0	1	0	0	2	4
24	Ship	Articulated Tug/Barge	30,000	11	18	29	18	11	29	58	3	3	2	3	5	5	4	4	29	5	5	4	4	3	3	3	2	29	58
25	Ship	Tanker	25,000	1	4	5	4	1	5	10	0	1	0	0	1	1	1	1	5	1	1	1	1	0	0	1	0	5	10
26	Ship	Articulated Tug/Barge	25,000	5	8	13	8	5	13	26	2	1	1	1	2	2	2	2	13	2	2	2	2	1	1	2	1	13	26
27	Ship	Tanker	20,000	38	17	55	17	38	55	110	9	10	10	9	5	4	4	4	55	4	4	5	4	10	10	9	9	55	110
28	Ship	Tanker	15,000	0	4	4	4	0	4	8	0	0	0	0	1	1	1	1	4	1	1	1	1	0	0	0	0	4	8
		Total Trips:		87	213	300	213	87	300	600	24	24	20	19	42	42	54	75	300	58	57	53	45	21	21	20	25	300	600

SUBSTRUCTURE ANNUAL FREQUENCY OF COLLAPSE (WATER ELEVATION 5.0 CD)

Pier ID	Description	Ultimate Lateral Capacity, H (MN)	Annual Frequency of Collapse, AF			Return Period
		Foundation	Inbound	Outbound	Total	
1	Pier 14	**25**	0.00000000	0.00000000	0.00000000	71,591,011,591
2	Pier 15	**100**	0.00000000	0.00000000	0.00000000	-
3	Pier 16	**90**	0.00000000	0.00000000	0.00000000	5,078,058,313
	Total for Bridge Piers:		0.00000000	0.00000000	0.00000000	**4,741,720,905**

VESSEL FLEET CHARACTERISTICS

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Vessel Size (m)		Vessel Drafts (m)				Vessel Displacement (tonnes)		Channel Width, C (m)	Centerline Transit Path to Edge of Channel, x_C (m)	Minimum Design Impact Speed, V_{min} (m/sec)		Standard Deviation, σ (m)	
				Length Overall, LOA	Beam/ Width, B	Operational Loaded, D_O	Ballasted			Loaded, W_L	Ballasted, W_E			Loaded	Ballasted	Loaded	Ballasted
							Stern, D_{ES}	Bow, D_{EB}	Average, D_{AVG}								
1	Ship	Tanker	120,000	250	44	11.9	8.2	4.7	6.5	101,270	54,890	125.4	62.7	0.514	0.514	80	80
2	Ship	Tanker	110,000	240	44	11.8	8.3	4.9	6.6	95,920	53,650	125.4	62.7	0.514	0.514	79	79
3	Ship	Tanker	105,000	244	42	13.0	8.4	5.0	6.7	102,480	52,820	119.7	59.9	0.514	0.514	80	80
4	Ship	Bulk Carrier	85,000	229	32	11.7	8.6	5.4	7.0	67,920	40,640	110.0	55.0	1.029	1.029	78	78
5	Ship	Bulk Carrier	80,000	225	32	11.9	8.4	5.2	6.8	67,900	38,800	110.0	55.0	1.029	1.029	78	78
6	Ship	Tanker	75,000	228	34	11.3	8.3	5.1	6.7	66,730	39,570	110.0	55.0	0.514	1.029	78	78
7	Ship	Bulk Carrier	75,000	225	32	12.1	7.8	4.6	6.2	68,640	35,180	110.0	55.0	1.029	1.029	78	78
8	Ship	Tanker	70,000	228	32	11.0	7.4	4.2	5.8	62,330	32,870	110.0	55.0	0.514	1.029	78	78
9	Ship	Bulk Carrier	70,000	225	32	12.0	6.8	3.6	5.2	67,680	29,330	110.0	55.0	1.029	1.029	78	78
10	Ship	Tanker	65,000	214	32	10.9	7.5	4.5	6.0	57,520	31,660	110.0	55.0	0.514	1.029	77	77
11	Ship	Bulk Carrier	65,000	212	32	11.7	7.8	4.8	6.3	61,920	33,350	110.0	55.0	1.029	1.029	77	77
12	Ship	Bulk Carrier	60,000	193	32	11.6	7.2	4.5	5.9	55,590	28,040	110.0	55.0	1.029	1.029	75	75
13	Ship	Tanker	55,000	184	32	11.4	8.3	5.7	7.0	51,250	31,470	110.0	55.0	0.514	1.029	74	74
14	Ship	Bulk Carrier	55,000	190	32	10.9	6.3	3.6	5.0	51,210	23,260	110.0	55.0	1.029	1.029	75	75
15	Ship	Tanker	50,000	183	32	10.6	8.2	5.6	6.9	47,500	30,920	110.0	55.0	0.514	1.029	74	74
16	Ship	Bulk Carrier	50,000	199	30	12.2	7.0	4.2	5.6	56,210	25,810	110.0	55.0	1.029	1.029	76	76
17	Ship	Tanker	45,000	181	32	10.3	8.6	6.1	7.4	45,340	32,350	110.0	55.0	0.514	1.029	74	74
18	Ship	Tanker	40,000	179	28	10.1	7.5	5.0	6.3	38,430	23,780	110.0	55.0	0.514	1.029	74	74
19	Ship	Bulk Carrier	40,000	181	30	9.1	7.2	4.7	6.0	37,700	24,650	110.0	55.0	1.029	1.029	74	74
20	Ship	Tanker	35,000	173	27	10.2	7.3	4.9	6.1	35,600	21,290	110.0	55.0	1.029	1.029	73	73
21	Ship	Bulk Carrier	35,000	177	29	9.7	6.5	4.0	5.3	37,830	20,480	110.0	55.0	1.029	1.029	73	73
22	Ship	Tanker	30,000	159	27	9.2	6.5	4.3	5.4	29,160	17,120	110.0	55.0	1.029	1.029	71	71
23	Ship	Bulk Carrier	30,000	170	27	9.5	6.6	4.2	5.4	32,770	18,630	110.0	55.0	1.029	1.029	72	72
24	Ship	Articulated Tug/Barge	30,000	210	23	9.3	5.0	5.0	5.0	32,470	17,460	110.0	55.0	1.029	1.029	77	77
25	Ship	Tanker	25,000	146	24	9.2	6.5	4.5	5.5	22,970	13,740	110.0	55.0	1.029	1.029	69	69
26	Ship	Articulated Tug/Barge	25,000	184	24	8.3	5.0	5.0	5.0	26,090	15,720	110.0	55.0	1.029	1.029	74	74
27	Ship	Tanker	20,000	145	24	8.7	6.1	4.1	5.1	20,880	12,240	110.0	55.0	1.029	1.029	69	69
28	Ship	Tanker	15,000	127	20	8.1	6.3	4.5	5.4	14,280	9,520	110.0	55.0	1.029	1.029	65	65

Notes:

Weight of Water (W_W) = **0.9854** m^3/tonne (used to determine ship loaded/ballasted displacement tonnage based on approximate salinity of water in Vancouver Harbor)

VESSEL FLEET ANNUAL TRIP FREQUENCY

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Annual Number of Trips (N)						Existing Total Trips	Growth Factor [1]	Future Total Trips
				Inbound			Outbound					
				Loaded	Ballasted	Total	Loaded	Ballasted	Total			
1	Ship	Tanker	120,000	0	0	0	5	0	5	5	10.20	51
2	Ship	Tanker	110,000	0	0	0	3	0	3	3	10.20	31
3	Ship	Tanker	105,000	0	0	0	1	0	1	1	10.20	10
4	Ship	Bulk Carrier	85,000	0	0	0	0	0	0	0	1.28	0
5	Ship	Bulk Carrier	80,000	0	0	0	0	0	0	0	1.28	0
6	Ship	Tanker	75,000	0	0	0	2	0	2	2	1.64	3
7	Ship	Bulk Carrier	75,000	0	0	0	0	0	0	0	1.28	0
8	Ship	Tanker	70,000	0	0	0	1	0	1	1	1.64	2
9	Ship	Bulk Carrier	70,000	0	0	0	0	0	0	0	1.28	0
10	Ship	Tanker	65,000	0	1	1	2	0	2	3	1.64	5
11	Ship	Bulk Carrier	65,000	5	0	5	2	0	2	7	1.28	9
12	Ship	Bulk Carrier	60,000	0	0	0	1	0	1	1	1.28	1
13	Ship	Tanker	55,000	0	2	2	3	1	4	6	1.64	10
14	Ship	Bulk Carrier	55,000	0	0	0	1	0	1	1	1.28	1
15	Ship	Tanker	50,000	3	8	11	7	4	11	22	1.64	36
16	Ship	Bulk Carrier	50,000	0	0	0	1	0	1	1	1.28	1
17	Ship	Tanker	45,000	0	1	1	1	0	1	2	1.64	3
18	Ship	Tanker	40,000	0	5	5	5	0	5	10	1.64	16
19	Ship	Bulk Carrier	40,000	0	0	0	0	0	0	0	1.28	0
20	Ship	Tanker	35,000	1	2	3	2	1	3	6	1.64	10
21	Ship	Bulk Carrier	35,000	0	1	1	1	0	1	2	1.28	3
22	Ship	Tanker	30,000	0	7	7	7	1	8	15	1.64	25
23	Ship	Bulk Carrier	30,000	1	1	2	0	0	0	2	1.28	3
24	Ship	Articulated Tug/Barge	30,000	3	5	8	5	3	8	16	1.28	20
25	Ship	Tanker	25,000	0	1	1	1	0	1	2	1.64	3
26	Ship	Articulated Tug/Barge	25,000	2	2	4	2	1	3	7	1.28	9
27	Ship	Tanker	20,000	9	5	14	4	10	14	28	1.64	46
28	Ship	Tanker	15,000	0	1	1	1	0	1	2	1.64	3
			Total Trips:	24	42	66	58	21	79	145		301

Notes:

[1] As part of the risk analysis, vessel trips will include future growth in the waterway that are projected to the mid-point of the remaining design life (assumed 50 years) of the structure. This equates to growth rates per year as follows for a 25-year projection. GF = $(1+\text{PERCENT}/100)^{25}$

- Aframax Tankers (DWT greater than 100,000 tonnes) = 9.735%
- All Other Tankers = 2.0%
- All Other Vessels = 1.0%

VESSEL FLEET TRANSIT SPEEDS IN MAIN CHANNEL

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Vessel Transit Speeds (knots)				Vessel Transit Speeds (m/sec) [1]			
				Inbound		Outbound		Inbound		Outbound	
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted
1	Ship	Tanker	120,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
2	Ship	Tanker	110,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
3	Ship	Tanker	105,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
4	Ship	Bulk Carrier	85,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
5	Ship	Bulk Carrier	80,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
6	Ship	Tanker	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
7	Ship	Bulk Carrier	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
8	Ship	Tanker	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
9	Ship	Bulk Carrier	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
10	Ship	Tanker	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
11	Ship	Bulk Carrier	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
12	Ship	Bulk Carrier	60,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
13	Ship	Tanker	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
14	Ship	Bulk Carrier	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
15	Ship	Tanker	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
16	Ship	Bulk Carrier	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
17	Ship	Tanker	45,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
18	Ship	Tanker	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
19	Ship	Bulk Carrier	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
20	Ship	Tanker	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
21	Ship	Bulk Carrier	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
22	Ship	Tanker	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
23	Ship	Bulk Carrier	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
24	Ship	Articulated Tug/Barge	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
25	Ship	Tanker	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
26	Ship	Articulated Tug/Barge	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
27	Ship	Tanker	20,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
28	Ship	Tanker	15,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866

Notes:

[1] Conversion (knot to m/sec) = 0.51 (convert vessel transit speeds from knots to meters/second for use in risk assessment equations)

ABERRANCY BASE RATE COMPUTATIONS

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Code Recommended Aberrancy Base Rate, BR	Vessel Traffic Service, VTS	Electronic Chart Display & Information System, ECDIS	Other Navigation Aids	Port Control State, PCS	Pilotage 1 Pilot	Pilotage 2 Pilots (MRA-2)		Daytime Only Transit Restrictions (MRA-2)		Visibility Restrictions (MRA-2)	Adjusted Aberrancy Base Rate, BR [1]	
										Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
2	Ship	Tanker	110,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
3	Ship	Tanker	105,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
4	Ship	Bulk Carrier	85,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
5	Ship	Bulk Carrier	80,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
6	Ship	Tanker	75,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
7	Ship	Bulk Carrier	75,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
8	Ship	Tanker	70,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
9	Ship	Bulk Carrier	70,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
10	Ship	Tanker	65,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
11	Ship	Bulk Carrier	65,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
12	Ship	Bulk Carrier	60,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
13	Ship	Tanker	55,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
14	Ship	Bulk Carrier	55,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
15	Ship	Tanker	50,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
16	Ship	Bulk Carrier	50,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
17	Ship	Tanker	45,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
18	Ship	Tanker	40,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
19	Ship	Bulk Carrier	40,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
20	Ship	Tanker	35,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
21	Ship	Bulk Carrier	35,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
22	Ship	Tanker	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
23	Ship	Bulk Carrier	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
24	Ship	Articulated Tug/Barge	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
25	Ship	Tanker	25,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
26	Ship	Articulated Tug/Barge	25,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
27	Ship	Tanker	20,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
28	Ship	Tanker	15,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05

Notes:

[1] Adjustments to the aberrancy Base Rate (BR) due to waterway current restrictions are accounted for elsewhere in the vessel collision risk analysis (refer to correction factors R_C and R_{XC} for the Probability of Aberrancy at each transit leg).

MISCELLANEOUS INFORMATION

CHANNEL CHARACTERISTICS

Waterway Current Speed (V_{min}) =	**1.03**	m/sec
Mean High Water (MHW) Elevation =	**5.00**	m (based on Chart Datum)
Sea Level Rise Adjustment =	**0.10**	m
Soft Soil Allowance =	**1.00**	m (assumed depth that vessels can "plow" through soft bottom material)

AVAILABLE WATER DEPTH AT PIERS

Pier ID	Description	Mudline Elevation (m) [1]		Water Elevation (m)	Soft Soil Allowance (m)	Design Water Depth (m)	
		Inbound	Outbound			Inbound	Outbound
1	**Pier 14**	**-5.00**	**N/A**	5.10	1.00	11.10	0.00
2	**Pier 15**	**-10.00**	**-9.00**	5.10	1.00	16.10	15.10
3	**Pier 16**	**-6.00**	**-5.00**	5.10	1.00	12.10	11.10

Notes:

[1] Mudline elevation is based on Chart Datum (CD) and was obtained from Nautical Chart 3494

PROBABILITY OF ABERRANCY VARIABLES FOR EACH VESSEL TRANSIT PATH

Leg ID	Waterway Region for Bridge Location	Angle of Channel Turn, θ (deg) [1]	Correction Factor, R_B	Current Angle to Vessel Path (deg) [2]	Parallel Current, V_C (m/sec)	Perpendicular Current, V_{XC} (m/sec)	Correction Factor, R_C	Correction Factor, R_{XC}	Vessel Traffic Density	Correction Factor, R_D	Summation (R_B*R_C*R_{XC}*R_D)	Aberrancy Distribution [3]	
												Inbound	Outbound
1	**Transition**	**7.7227**	1.0858	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.3095	**0.24**	**N/A**
2	**Turn/Bend**	**7.7227**	1.1716	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4130	**0.50**	**N/A**
3	**Turn/Bend**	**7.7227**	1.1716	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4130	**0.26**	**N/A**
4	**Transition**	**8.8764**	1.0986	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.3249	**N/A**	**0.24**
5	**Turn/Bend**	**8.8764**	1.1973	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4439	**N/A**	**0.50**
6	**Turn/Bend**	**8.8764**	1.1973	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4439	**N/A**	**0.26**

Notes:

[1] Angle of the turn region in accordance with information shown on Nautical Chart 3494, AIS transit data near the bridge, and CAN/CSA S6-14 Figure A3.3.1

[2] The angle between the water current direction and each channel transition leg

[3] Distribution of the Probability of Aberrancy for each channel transition leg is established as a ratio of the length of each leg to the overall length being considered (approximately 1 nautical mile or 2000m)

GEOMETRIC PROBABILITY DISTANCES FOR NORMAL DISTRIBUTION

Pier ID	Description	Leg 1 [1]			Leg 2 [1]			Leg 3 [1]			Leg 4 [1]			Leg 5 [1]			Leg 6 [1]		
		x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)
1	Pier 14	**363.89**	375.26	**386.63**	**363.89**	375.26	**386.63**	**299.02**	308.72	**318.42**	**299.02**	308.72	**318.42**	**299.02**	308.72	**318.42**	**520.46**	532.27	**544.09**
2	Pier 15	**222.26**	234.22	**246.17**	**222.26**	234.22	**246.17**	**156.11**	166.57	**177.02**	**156.11**	166.57	**177.02**	**156.11**	166.57	**177.02**	**379.70**	392.04	**404.39**
3	Pier 16	**86.36**	98.32	**110.27**	**86.36**	98.32	**110.27**	**158.26**	168.71	**179.16**	**158.26**	168.71	**179.16**	**158.26**	168.71	**179.16**	**48.82**	61.17	**73.51**

Notes:

[1] Perpendicular distances at each channel transition leg from the centerline of vessel transit path to the bridge element being considered. Distance "x" is from the centerline of vessel transit path to the centerline of bridge element. Distance "x_1" (scaled from CADD drawing) is from the centerline of vessel transit path to the closest edge of the bridge element. Distance "x_2" (scaled from CADD drawing) is from the centerline of vessel transit path to the farthest edge of the bridge element.

PROTECTION FACTOR

Pier ID	Description	Leg 1		Leg 2		Leg 3		Leg 4		Leg 5		Leg 6	
		Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
1	Pier 14	**0.09**	**N/A**	**0.09**	**N/A**	**0.13**	**N/A**	**N/A**	**0.00**	**N/A**	**0.00**	**N/A**	**0.00**
2	Pier 15	**0.65**	**N/A**	**0.65**	**N/A**	**0.73**	**N/A**	**N/A**	**0.02**	**N/A**	**0.02**	**N/A**	**0.02**
3	Pier 16	**0.74**	**N/A**	**0.74**	**N/A**	**0.66**	**N/A**	**N/A**	**0.03**	**N/A**	**0.03**	**N/A**	**0.04**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.5140	0.00	7.61	0.00	21.20	0	0	10.20	0.000002	0.000002	0.000010	0.000010	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.5140	0.00	7.44	0.00	20.29	0	0	10.20	0.000002	0.000002	0.000008	0.000008	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.5140	0.00	7.33	0.00	19.83	0	0	10.20	0.000002	0.000002	0.000008	0.000008	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.0290	0.00	22.59	0.00	35.71	0	0	1.28	0.000006	0.000006	0.000005	0.000005	0.000000	0.033334	0.0900	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.0290	0.00	21.57	0.00	34.65	0	0	1.28	0.000006	0.000006	0.000004	0.000004	0.000000	0.030940	0.0900	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.0290	0.00	22.00	0.00	33.55	0	0	1.64	0.000002	0.000006	0.000005	0.000005	0.000000	0.028311	0.0900	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.0290	0.00	19.56	0.00	33.55	0	0	1.28	0.000006	0.000006	0.000004	0.000004	0.000000	0.028311	0.0900	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.5140	1.0290	10.29	18.27	16.19	32.41	0	0	1.64	0.000002	0.000006	0.000004	0.000004	0.000000	0.025405	0.0900	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.0290	0.00	16.30	0.00	32.41	0	0	1.28	0.000006	0.000006	0.000004	0.000004	0.000000	0.025405	0.0900	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.5140	1.0290	9.50	17.60	15.60	31.23	0	1	1.64	0.000002	0.000006	0.000003	0.000003	0.000000	0.022170	0.0900	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.0290	0.00	18.54	0.00	31.23	0	0	1.28	0.000006	0.000006	0.000003	0.000003	0.000000	0.022170	0.0900	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.0290	0.00	15.59	0.00	30.01	0	0	1.28	0.000006	0.000006	0.000002	0.000002	0.000000	0.018538	0.0900	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.0290	0.00	17.49	0.00	28.73	0	2	1.64	0.000002	0.000006	0.000001	0.000001	0.000000	0.014421	0.0900	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	33.89	12.93	28.73	28.73	0	0	1.28	0.000006	0.000006	0.000002	0.000002	0.014421	0.014421	0.0900	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.5140	1.0290	7.84	17.19	13.68	27.39	3	8	1.64	0.000002	0.000006	0.000001	0.000001	0.000000	0.009702	0.0900	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.0290	0.00	14.35	0.00	27.39	0	0	1.28	0.000006	0.000006	0.000002	0.000002	0.000000	0.009702	0.0900	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.5140	1.0290	7.49	17.98	12.98	25.99	0	1	1.64	0.000002	0.000006	0.000001	0.000001	0.000000	0.004217	0.0900	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.5140	1.0290	6.35	13.22	12.24	24.50	0	5	1.64	0.000002	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	23.75	13.70	24.50	24.50	0	0	1.28	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.0290	1.0290	23.56	11.83	22.92	22.92	1	2	1.64	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	24.59	11.38	22.92	22.92	0	1	1.28	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	18.48	9.52	21.22	21.22	0	7	1.64	0.000006	0.000006	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	21.09	10.36	21.22	21.22	1	1	1.28	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	20.68	9.71	21.22	21.22	3	5	1.28	0.000006	0.000006	0.000002	0.000002	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	14.55	7.64	19.37	19.37	0	1	1.64	0.000006	0.000006	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	15.63	8.74	19.37	19.37	2	2	1.28	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	12.85	6.80	17.32	17.32	9	5	1.64	0.000006	0.000006	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	8.43	5.29	15.00	15.00	0	1	1.64	0.000006	0.000006	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.5140	0.00	7.61	0.00	21.20	0	0	10.20	0.000003	0.000003	0.000010	0.000010	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.5140	0.00	7.44	0.00	20.29	0	0	10.20	0.000003	0.000003	0.000008	0.000008	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.5140	0.00	7.33	0.00	19.83	0	0	10.20	0.000003	0.000003	0.000008	0.000008	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.0290	0.00	22.59	0.00	35.71	0	0	1.28	0.000013	0.000013	0.000005	0.000005	0.000000	0.033334	0.0900	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.0290	0.00	21.57	0.00	34.65	0	0	1.28	0.000013	0.000013	0.000004	0.000004	0.000000	0.030940	0.0900	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.0290	0.00	22.00	0.00	33.55	0	0	1.64	0.000003	0.000013	0.000005	0.000005	0.000000	0.028311	0.0900	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.0290	0.00	19.56	0.00	33.55	0	0	1.28	0.000013	0.000013	0.000004	0.000004	0.000000	0.028311	0.0900	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.5140	1.0290	10.29	18.27	16.19	32.41	0	0	1.64	0.000003	0.000013	0.000004	0.000004	0.000000	0.025405	0.0900	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.0290	0.00	16.30	0.00	32.41	0	0	1.28	0.000013	0.000013	0.000004	0.000004	0.000000	0.025405	0.0900	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.5140	1.0290	9.50	17.60	15.60	31.23	0	1	1.64	0.000003	0.000013	0.000003	0.000003	0.000000	0.022170	0.0900	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.0290	0.00	18.54	0.00	31.23	0	0	1.28	0.000013	0.000013	0.000003	0.000003	0.000000	0.022170	0.0900	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.0290	0.00	15.59	0.00	30.01	0	0	1.28	0.000013	0.000013	0.000002	0.000002	0.000000	0.018538	0.0900	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.0290	0.00	17.49	0.00	28.73	0	2	1.64	0.000003	0.000013	0.000001	0.000001	0.000000	0.014421	0.0900	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	33.89	12.93	28.73	28.73	0	0	1.28	0.000013	0.000013	0.000002	0.000002	0.014421	0.014421	0.0900	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.5140	1.0290	7.84	17.19	13.68	27.39	3	8	1.64	0.000003	0.000013	0.000001	0.000001	0.000000	0.009702	0.0900	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.0290	0.00	14.35	0.00	27.39	0	0	1.28	0.000013	0.000013	0.000002	0.000002	0.000000	0.009702	0.0900	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.5140	1.0290	7.49	17.98	12.98	25.99	0	1	1.64	0.000003	0.000013	0.000001	0.000001	0.000000	0.004217	0.0900	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.5140	1.0290	6.35	13.22	12.24	24.50	0	5	1.64	0.000003	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	23.75	13.70	24.50	24.50	0	0	1.28	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.0290	1.0290	23.56	11.83	22.92	22.92	1	2	1.64	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	24.59	11.38	22.92	22.92	0	1	1.28	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	18.48	9.52	21.22	21.22	0	7	1.64	0.000013	0.000013	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	21.09	10.36	21.22	21.22	1	1	1.28	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	20.68	9.71	21.22	21.22	3	5	1.28	0.000013	0.000013	0.000002	0.000002	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	14.55	7.64	19.37	19.37	0	1	1.64	0.000013	0.000013	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	15.63	8.74	19.37	19.37	2	2	1.28	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	12.85	6.80	17.32	17.32	9	5	1.64	0.000013	0.000013	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	8.43	5.29	15.00	15.00	0	1	1.64	0.000013	0.000013	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.5140	0.00	7.61	0.00	21.20	0	0	10.20	0.000002	0.000002	0.000261	0.000261	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.5140	0.00	7.44	0.00	20.29	0	0	10.20	0.000002	0.000002	0.000232	0.000232	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.5140	0.00	7.33	0.00	19.83	0	0	10.20	0.000002	0.000002	0.000231	0.000231	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.0290	0.00	22.59	0.00	35.71	0	0	1.28	0.000007	0.000007	0.000146	0.000146	0.000000	0.033334	0.1300	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.0290	0.00	21.57	0.00	34.65	0	0	1.28	0.000007	0.000007	0.000137	0.000137	0.000000	0.030940	0.1300	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.0290	0.00	22.00	0.00	33.55	0	0	1.64	0.000002	0.000007	0.000150	0.000150	0.000000	0.028311	0.1300	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.0290	0.00	19.56	0.00	33.55	0	0	1.28	0.000007	0.000007	0.000137	0.000137	0.000000	0.028311	0.1300	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.5140	1.0290	10.29	18.27	16.19	32.41	0	0	1.64	0.000002	0.000007	0.000143	0.000143	0.000000	0.025405	0.1300	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.0290	0.00	16.30	0.00	32.41	0	0	1.28	0.000007	0.000007	0.000137	0.000137	0.000000	0.025405	0.1300	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.5140	1.0290	9.50	17.60	15.60	31.23	0	1	1.64	0.000002	0.000007	0.000116	0.000116	0.000000	0.022170	0.1300	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.0290	0.00	18.54	0.00	31.23	0	0	1.28	0.000007	0.000007	0.000112	0.000112	0.000000	0.022170	0.1300	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.0290	0.00	15.59	0.00	30.01	0	0	1.28	0.000007	0.000007	0.000078	0.000078	0.000000	0.018538	0.1300	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.0290	0.00	17.49	0.00	28.73	0	2	1.64	0.000002	0.000007	0.000064	0.000064	0.000000	0.014421	0.1300	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	33.89	12.93	28.73	28.73	0	0	1.28	0.000007	0.000007	0.000073	0.000073	0.014421	0.014421	0.1300	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.5140	1.0290	7.84	17.19	13.68	27.39	3	8	1.64	0.000002	0.000007	0.000062	0.000062	0.000000	0.009702	0.1300	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.0290	0.00	14.35	0.00	27.39	0	0	1.28	0.000007	0.000007	0.000083	0.000083	0.000000	0.009702	0.1300	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.5140	1.0290	7.49	17.98	12.98	25.99	0	1	1.64	0.000002	0.000007	0.000059	0.000059	0.000000	0.004217	0.1300	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.5140	1.0290	6.35	13.22	12.24	24.50	0	5	1.64	0.000002	0.000007	0.000050	0.000050	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	23.75	13.70	24.50	24.50	0	0	1.28	0.000007	0.000007	0.000056	0.000056	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.0290	1.0290	23.56	11.83	22.92	22.92	1	2	1.64	0.000007	0.000007	0.000041	0.000041	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	24.59	11.38	22.92	22.92	0	1	1.28	0.000007	0.000007	0.000049	0.000049	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	18.48	9.52	21.22	21.22	0	7	1.64	0.000007	0.000007	0.000027	0.000027	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	21.09	10.36	21.22	21.22	1	1	1.28	0.000007	0.000007	0.000038	0.000038	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	20.68	9.71	21.22	21.22	3	5	1.28	0.000007	0.000007	0.000081	0.000081	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	14.55	7.64	19.37	19.37	0	1	1.64	0.000007	0.000007	0.000015	0.000015	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	15.63	8.74	19.37	19.37	2	2	1.28	0.000007	0.000007	0.000050	0.000050	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	12.85	6.80	17.32	17.32	9	5	1.64	0.000007	0.000007	0.000014	0.000014	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	8.43	5.29	15.00	15.00	0	1	1.64	0.000007	0.000007	0.000005	0.000005	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000261	0.000261	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000232	0.000232	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000231	0.000231	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000146	0.000146	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000150	0.000150	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000143	0.000143	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000116	0.000116	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000112	0.000112	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000078	0.000078	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000064	0.000064	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000073	0.000073	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000062	0.000062	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000083	0.000083	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000059	0.000059	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000050	0.000050	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000056	0.000056	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000041	0.000041	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000049	0.000049	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000027	0.000027	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000038	0.000038	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000081	0.000081	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000015	0.000015	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000050	0.000050	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000014	0.000014	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000005	0.000005	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004	0.000261	0.000261	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004	0.000232	0.000232	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004	0.000231	0.000231	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000146	0.000146	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000150	0.000150	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000143	0.000143	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000116	0.000116	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000112	0.000112	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000078	0.000078	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000064	0.000064	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000073	0.000073	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000062	0.000062	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000083	0.000083	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000059	0.000059	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000050	0.000050	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000056	0.000056	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000041	0.000041	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000049	0.000049	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000027	0.000027	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000038	0.000038	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000081	0.000081	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000015	0.000015	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000050	0.000050	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000014	0.000014	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000005	0.000005	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
																			Total for Pier:			**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.6023	0.6023	20.64	10.45	24.84	24.84	0	0	10.20	0.000002	0.000002	0.005802	0.005802	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.5710	0.5710	17.48	9.18	22.54	22.54	0	0	10.20	0.000002	0.000002	0.005450	0.005450	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.5827	0.5827	20.54	9.42	22.48	22.48	0	0	10.20	0.000002	0.000002	0.005365	0.005365	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.0435	1.0435	41.12	23.23	36.22	36.22	0	0	1.28	0.000006	0.000006	0.003880	0.003880	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.0321	1.0321	40.63	21.70	34.75	34.75	0	0	1.28	0.000006	0.000006	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.5286	1.0407	10.14	22.50	17.23	33.93	0	0	1.64	0.000002	0.000006	0.003985	0.003985	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.0321	1.0321	41.48	19.67	33.65	33.65	0	0	1.28	0.000006	0.000006	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.5286	1.0407	9.30	18.69	16.65	32.78	0	0	1.64	0.000002	0.000006	0.003850	0.003850	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.0321	1.0321	40.70	16.40	32.51	32.51	0	0	1.28	0.000006	0.000006	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.5140	1.0290	8.07	17.60	15.60	31.23	0	1	1.64	0.000002	0.000006	0.003428	0.003428	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.0290	1.0290	36.45	18.54	31.23	31.23	5	0	1.28	0.000006	0.000006	0.003367	0.003367	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.0290	1.0290	32.55	15.59	30.01	30.01	0	0	1.28	0.000006	0.000006	0.002772	0.002772	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.5140	1.0290	7.41	17.49	14.35	28.73	0	2	1.64	0.000002	0.000006	0.002486	0.002486	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	28.78	12.93	28.73	28.73	0	0	1.28	0.000006	0.000006	0.002677	0.002677	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.5140	1.0290	6.59	17.19	13.68	27.39	3	8	1.64	0.000002	0.000006	0.002454	0.002454	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	1.0290	1.0290	33.93	14.35	27.39	27.39	0	0	1.28	0.000006	0.000006	0.002822	0.002822	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.5140	1.0290	6.29	17.98	12.98	25.99	0	1	1.64	0.000002	0.000006	0.002390	0.002390	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.5140	1.0290	5.33	13.22	12.24	24.50	0	5	1.64	0.000002	0.000006	0.002103	0.002103	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	20.96	13.70	24.50	24.50	0	0	1.28	0.000006	0.000006	0.002274	0.002274	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.0290	1.0290	19.79	11.83	22.92	22.92	1	2	1.64	0.000006	0.000006	0.001878	0.001878	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	21.03	11.38	22.92	22.92	0	1	1.28	0.000006	0.000006	0.002098	0.002098	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	16.21	9.52	21.22	21.22	0	7	1.64	0.000006	0.000006	0.001485	0.001485	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	18.22	10.36	21.22	21.22	1	1	1.28	0.000006	0.000006	0.001793	0.001793	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	18.05	9.71	21.22	21.22	3	5	1.28	0.000006	0.000006	0.002613	0.002613	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	12.77	7.64	19.37	19.37	0	1	1.64	0.000006	0.000006	0.001042	0.001042	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	14.50	8.74	19.37	19.37	2	2	1.28	0.000006	0.000006	0.002026	0.002026	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	11.61	6.80	17.32	17.32	9	5	1.64	0.000006	0.000006	0.001018	0.001018	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	7.94	5.29	15.00	15.00	0	1	1.64	0.000006	0.000006	0.000544	0.000544	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.6023	0.6023	20.64	10.45	24.84	24.84	0	0	10.20	0.000003	0.000003	0.005802	0.005802	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.5710	0.5710	17.48	9.18	22.54	22.54	0	0	10.20	0.000003	0.000003	0.005450	0.005450	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.5827	0.5827	20.54	9.42	22.48	22.48	0	0	10.20	0.000003	0.000003	0.005365	0.005365	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.0435	1.0435	41.12	23.23	36.22	36.22	0	0	1.28	0.000013	0.000013	0.003880	0.003880	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.0321	1.0321	40.63	21.70	34.75	34.75	0	0	1.28	0.000013	0.000013	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.5286	1.0407	10.14	22.50	17.23	33.93	0	0	1.64	0.000003	0.000013	0.003985	0.003985	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.0321	1.0321	41.48	19.67	33.65	33.65	0	0	1.28	0.000013	0.000013	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.5286	1.0407	9.30	18.69	16.65	32.78	0	0	1.64	0.000003	0.000013	0.003850	0.003850	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.0321	1.0321	40.70	16.40	32.51	32.51	0	0	1.28	0.000013	0.000013	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.5140	1.0290	8.07	17.60	15.60	31.23	0	1	1.64	0.000003	0.000013	0.003428	0.003428	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.0290	1.0290	36.45	18.54	31.23	31.23	5	0	1.28	0.000013	0.000013	0.003367	0.003367	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.0290	1.0290	32.55	15.59	30.01	30.01	0	0	1.28	0.000013	0.000013	0.002772	0.002772	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.5140	1.0290	7.41	17.49	14.35	28.73	0	2	1.64	0.000003	0.000013	0.002486	0.002486	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	28.78	12.93	28.73	28.73	0	0	1.28	0.000013	0.000013	0.002677	0.002677	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.5140	1.0290	6.59	17.19	13.68	27.39	3	8	1.64	0.000003	0.000013	0.002454	0.002454	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	1.0290	1.0290	33.93	14.35	27.39	27.39	0	0	1.28	0.000013	0.000013	0.002822	0.002822	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.5140	1.0290	6.29	17.98	12.98	25.99	0	1	1.64	0.000003	0.000013	0.002390	0.002390	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.5140	1.0290	5.33	13.22	12.24	24.50	0	5	1.64	0.000003	0.000013	0.002103	0.002103	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	20.96	13.70	24.50	24.50	0	0	1.28	0.000013	0.000013	0.002274	0.002274	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.0290	1.0290	19.79	11.83	22.92	22.92	1	2	1.64	0.000013	0.000013	0.001878	0.001878	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	21.03	11.38	22.92	22.92	0	1	1.28	0.000013	0.000013	0.002098	0.002098	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	16.21	9.52	21.22	21.22	0	7	1.64	0.000013	0.000013	0.001485	0.001485	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	18.22	10.36	21.22	21.22	1	1	1.28	0.000013	0.000013	0.001793	0.001793	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	18.05	9.71	21.22	21.22	3	5	1.28	0.000013	0.000013	0.002613	0.002613	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	12.77	7.64	19.37	19.37	0	1	1.64	0.000013	0.000013	0.001042	0.001042	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	14.50	8.74	19.37	19.37	2	2	1.28	0.000013	0.000013	0.002026	0.002026	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	11.61	6.80	17.32	17.32	9	5	1.64	0.000013	0.000013	0.001018	0.001018	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	7.94	5.29	15.00	15.00	0	1	1.64	0.000013	0.000013	0.000544	0.000544	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	1.5822	1.5822	142.41	72.14	65.25	65.25	0	0	10.20	0.000002	0.000002	0.040552	0.040552	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	1.5632	1.5632	131.00	68.83	61.72	61.72	0	0	10.20	0.000002	0.000002	0.039452	0.039452	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	1.5542	1.5542	146.14	66.98	59.95	59.95	0	0	10.20	0.000002	0.000002	0.038476	0.038476	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.8147	1.8147	124.36	70.26	62.99	62.99	0	0	1.28	0.000007	0.000007	0.030162	0.030162	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.8076	1.8076	124.64	66.56	60.87	60.87	0	0	1.28	0.000007	0.000007	0.029749	0.029749	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	1.4942	1.8130	81.02	68.28	48.71	59.11	0	0	1.64	0.000002	0.000007	0.031022	0.031022	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.8076	1.8076	127.25	60.35	58.93	58.93	0	0	1.28	0.000007	0.000007	0.029749	0.029749	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	1.4942	1.8130	74.32	56.72	47.06	57.10	0	0	1.64	0.000002	0.000007	0.030060	0.030060	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.8076	1.8076	124.86	50.31	56.93	56.93	0	0	1.28	0.000007	0.000007	0.029749	0.029749	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	1.4612	1.7866	65.18	53.05	44.35	54.22	0	1	1.64	0.000002	0.000007	0.028549	0.028549	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.7825	1.7825	109.38	55.63	54.10	54.10	5	0	1.28	0.000007	0.000007	0.028320	0.028320	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.7387	1.7387	92.94	44.50	50.70	50.70	0	0	1.28	0.000007	0.000007	0.025962	0.025962	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	1.3709	1.7144	52.68	48.56	38.28	47.86	0	2	1.64	0.000002	0.000007	0.024719	0.024719	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.7309	1.7309	81.43	36.59	48.33	48.33	0	0	1.28	0.000007	0.000007	0.025557	0.025557	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	1.3674	1.7115	46.62	47.55	36.40	45.56	3	8	1.64	0.000002	0.000007	0.024575	0.024575	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	1.7536	1.7536	98.54	41.67	46.68	46.68	0	0	1.28	0.000007	0.000007	0.025596	0.025596	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	1.3600	1.7057	44.03	49.41	34.35	43.07	0	1	1.64	0.000002	0.000007	0.024285	0.024285	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	1.3525	1.6997	36.91	36.07	32.20	40.47	0	5	1.64	0.000002	0.000007	0.021912	0.021912	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.7057	1.7057	57.58	37.65	40.61	40.61	0	0	1.28	0.000007	0.000007	0.023227	0.023227	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.6807	1.6807	52.79	31.57	37.43	37.43	1	2	1.64	0.000007	0.000007	0.020575	0.020575	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6935	1.6935	56.96	30.84	37.72	37.72	0	1	1.28	0.000007	0.000007	0.022143	0.022143	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6298	1.6298	40.66	23.87	33.61	33.61	0	7	1.64	0.000007	0.000007	0.018487	0.018487	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6706	1.6706	48.01	27.30	34.45	34.45	1	1	1.28	0.000007	0.000007	0.020146	0.020146	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7783	1.7783	53.91	28.99	36.67	36.67	3	5	1.28	0.000007	0.000007	0.022591	0.022591	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5722	1.5722	29.81	17.83	29.59	29.59	0	1	1.64	0.000007	0.000007	0.015153	0.015153	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.7144	1.7144	40.26	24.26	32.27	32.27	2	2	1.28	0.000007	0.000007	0.020518	0.020518	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5672	1.5672	26.92	15.78	26.39	26.39	9	5	1.64	0.000007	0.000007	0.014991	0.014991	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4620	1.4620	16.02	10.68	21.32	21.32	0	1	1.64	0.000007	0.000007	0.010643	0.010643	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	1.5822	1.5822	147.74	72.14	65.25	65.25	5	0	10.20	0.000002	0.000002	0.040552	0.040552	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	1.5632	1.5632	135.97	68.83	61.72	61.72	3	0	10.20	0.000002	0.000002	0.039452	0.039452	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	1.5542	1.5542	150.91	66.98	59.95	59.95	1	0	10.20	0.000002	0.000002	0.038476	0.038476	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.8147	1.8147	129.14	70.26	62.99	62.99	0	0	1.28	0.000006	0.000006	0.030162	0.030162	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.8076	1.8076	129.30	66.56	60.87	60.87	0	0	1.28	0.000006	0.000006	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	1.4942	1.8130	84.31	68.28	48.71	59.11	2	0	1.64	0.000002	0.000006	0.031022	0.031022	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.8076	1.8076	131.88	60.35	58.93	58.93	0	0	1.28	0.000006	0.000006	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	1.4942	1.8130	77.49	56.72	47.06	57.10	1	0	1.64	0.000002	0.000006	0.030060	0.030060	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.8076	1.8076	129.46	50.31	56.93	56.93	0	0	1.28	0.000006	0.000006	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	1.4612	1.7866	68.00	53.05	44.35	54.22	2	0	1.64	0.000002	0.000006	0.028549	0.028549	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.7825	1.7825	113.58	55.63	54.10	54.10	2	0	1.28	0.000006	0.000006	0.028320	0.028320	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.7387	1.7387	96.56	44.50	50.70	50.70	1	0	1.28	0.000006	0.000006	0.025962	0.025962	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	1.3709	1.7144	54.79	48.56	38.28	47.86	3	1	1.64	0.000002	0.000006	0.024719	0.024719	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.7309	1.7309	84.95	36.59	48.33	48.33	1	0	1.28	0.000006	0.000006	0.025557	0.025557	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	1.3674	1.7115	48.30	47.55	36.40	45.56	7	4	1.64	0.000002	0.000006	0.024575	0.024575	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	1.7536	1.7536	102.08	41.67	46.68	46.68	1	0	1.28	0.000006	0.000006	0.025596	0.025596	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	1.3600	1.7057	44.74	49.41	34.35	43.07	1	0	1.64	0.000002	0.000006	0.024285	0.024285	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	1.3525	1.6997	36.99	36.07	32.20	40.47	5	0	1.64	0.000002	0.000006	0.021912	0.021912	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.7057	1.7057	57.58	37.65	40.61	40.61	0	0	1.28	0.000006	0.000006	0.023227	0.023227	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.6807	1.6807	53.29	31.57	37.43	37.43	2	1	1.64	0.000006	0.000006	0.020575	0.020575	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6935	1.6935	56.96	30.84	37.72	37.72	1	0	1.28	0.000006	0.000006	0.022143	0.022143	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6298	1.6298	40.66	23.87	33.61	33.61	7	1	1.64	0.000006	0.000006	0.018487	0.018487	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6706	1.6706	48.01	27.30	34.45	34.45	0	0	1.28	0.000006	0.000006	0.020146	0.020146	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7783	1.7783	53.91	28.99	36.67	36.67	5	3	1.28	0.000006	0.000006	0.022591	0.022591	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5722	1.5722	29.81	17.83	29.59	29.59	1	0	1.64	0.000006	0.000006	0.015153	0.015153	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.7144	1.7144	40.26	24.26	32.27	32.27	2	1	1.28	0.000006	0.000006	0.020518	0.020518	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5672	1.5672	26.92	15.78	26.39	26.39	4	10	1.64	0.000006	0.000006	0.014991	0.014991	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4620	1.4620	16.02	10.68	21.32	21.32	1	0	1.64	0.000006	0.000006	0.010643	0.010643	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	1.5822	1.5822	147.74	72.14	65.25	65.25	5	0	10.20	0.000004	0.000004	0.040552	0.040552	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	1.5632	1.5632	135.97	68.83	61.72	61.72	3	0	10.20	0.000004	0.000004	0.039452	0.039452	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	1.5542	1.5542	150.91	66.98	59.95	59.95	1	0	10.20	0.000004	0.000004	0.038476	0.038476	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.8147	1.8147	129.14	70.26	62.99	62.99	0	0	1.28	0.000013	0.000013	0.030162	0.030162	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.8076	1.8076	129.30	66.56	60.87	60.87	0	0	1.28	0.000013	0.000013	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	1.4942	1.8130	84.31	68.28	48.71	59.11	2	0	1.64	0.000004	0.000013	0.031022	0.031022	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.8076	1.8076	131.88	60.35	58.93	58.93	0	0	1.28	0.000013	0.000013	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	1.4942	1.8130	77.49	56.72	47.06	57.10	1	0	1.64	0.000004	0.000013	0.030060	0.030060	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.8076	1.8076	129.46	50.31	56.93	56.93	0	0	1.28	0.000013	0.000013	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	1.4612	1.7866	68.00	53.05	44.35	54.22	2	0	1.64	0.000004	0.000013	0.028549	0.028549	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.7825	1.7825	113.58	55.63	54.10	54.10	2	0	1.28	0.000013	0.000013	0.028320	0.028320	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.7387	1.7387	96.56	44.50	50.70	50.70	1	0	1.28	0.000013	0.000013	0.025962	0.025962	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	1.3709	1.7144	54.79	48.56	38.28	47.86	3	1	1.64	0.000004	0.000013	0.024719	0.024719	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.7309	1.7309	84.95	36.59	48.33	48.33	1	0	1.28	0.000013	0.000013	0.025557	0.025557	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	1.3674	1.7115	48.30	47.55	36.40	45.56	7	4	1.64	0.000004	0.000013	0.024575	0.024575	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	1.7536	1.7536	102.08	41.67	46.68	46.68	1	0	1.28	0.000013	0.000013	0.025596	0.025596	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	1.3600	1.7057	44.74	49.41	34.35	43.07	1	0	1.64	0.000004	0.000013	0.024285	0.024285	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	1.3525	1.6997	36.99	36.07	32.20	40.47	5	0	1.64	0.000004	0.000013	0.021912	0.021912	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.7057	1.7057	57.58	37.65	40.61	40.61	0	0	1.28	0.000013	0.000013	0.023227	0.023227	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.6807	1.6807	53.29	31.57	37.43	37.43	2	1	1.64	0.000013	0.000013	0.020575	0.020575	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6935	1.6935	56.96	30.84	37.72	37.72	1	0	1.28	0.000013	0.000013	0.022143	0.022143	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6298	1.6298	40.66	23.87	33.61	33.61	7	1	1.64	0.000013	0.000013	0.018487	0.018487	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6706	1.6706	48.01	27.30	34.45	34.45	0	0	1.28	0.000013	0.000013	0.020146	0.020146	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7783	1.7783	53.91	28.99	36.67	36.67	5	3	1.28	0.000013	0.000013	0.022591	0.022591	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5722	1.5722	29.81	17.83	29.59	29.59	1	0	1.64	0.000013	0.000013	0.015153	0.015153	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.7144	1.7144	40.26	24.26	32.27	32.27	2	1	1.28	0.000013	0.000013	0.020518	0.020518	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5672	1.5672	26.92	15.78	26.39	26.39	4	10	1.64	0.000013	0.000013	0.014991	0.014991	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4620	1.4620	16.02	10.68	21.32	21.32	1	0	1.64	0.000013	0.000013	0.010643	0.010643	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.5140	0.5140	15.59	7.61	21.20	21.20	5	0	10.20	0.000002	0.000002	0.000004	0.000004	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.5140	0.5140	14.70	7.44	20.29	20.29	3	0	10.20	0.000002	0.000002	0.000003	0.000003	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.5140	0.5140	16.51	7.33	19.83	19.83	1	0	10.20	0.000002	0.000002	0.000003	0.000003	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.0290	1.0290	41.52	22.59	35.71	35.71	0	0	1.28	0.000007	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.0290	1.0290	41.90	21.57	34.65	34.65	0	0	1.28	0.000007	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.5140	1.0290	9.98	22.00	16.76	33.55	2	0	1.64	0.000002	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.0290	1.0290	42.74	19.56	33.55	33.55	0	0	1.28	0.000007	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.5140	1.0290	9.17	18.27	16.19	32.41	1	0	1.64	0.000002	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.0290	1.0290	41.95	16.30	32.41	32.41	0	0	1.28	0.000007	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.5140	1.0290	8.41	17.60	15.60	31.23	2	0	1.64	0.000002	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.0290	1.0290	37.85	18.54	31.23	31.23	2	0	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.0290	1.0290	33.82	15.59	30.01	30.01	1	0	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.5140	1.0290	7.70	17.49	14.35	28.73	3	1	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	30.02	12.93	28.73	28.73	1	0	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.5140	1.0290	6.83	17.19	13.68	27.39	7	4	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	1.0290	1.0290	35.15	14.35	27.39	27.39	1	0	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.5140	1.0290	6.39	17.98	12.98	25.99	1	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.5140	1.0290	5.34	13.22	12.24	24.50	5	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	20.96	13.70	24.50	24.50	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.0290	1.0290	19.97	11.83	22.92	22.92	2	1	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	21.03	11.38	22.92	22.92	1	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	16.21	9.52	21.22	21.22	7	1	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	18.22	10.36	21.22	21.22	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	18.05	9.71	21.22	21.22	5	3	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	12.77	7.64	19.37	19.37	1	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	14.50	8.74	19.37	19.37	2	1	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	11.61	6.80	17.32	17.32	4	10	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	7.94	5.29	15.00	15.00	1	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	2.5708	2.5708	418.30	190.45	106.02	106.02	0	0	10.20	0.000002	0.000002	0.161512	0.161512	0.016786	0.016786	0.7400	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	2.5643	2.5643	394.19	185.20	101.25	101.25	0	0	10.20	0.000002	0.000002	0.160908	0.160908	0.012342	0.012342	0.7400	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	2.5343	0.00	178.10	0.00	97.76	0	0	10.20	0.000002	0.000002	0.156289	0.156289	0.000000	0.008821	0.7400	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	2.5928	2.5928	285.38	143.44	89.99	89.99	0	0	1.28	0.000006	0.000006	0.131184	0.131184	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	2.5901	2.5901	284.69	136.65	87.21	87.21	0	0	1.28	0.000006	0.000006	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	2.4684	2.5921	254.11	139.59	80.48	84.51	0	0	1.64	0.000002	0.000006	0.134715	0.134715	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	2.5901	2.5901	287.79	123.90	84.44	84.44	0	0	1.28	0.000006	0.000006	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	2.4684	2.5921	237.35	115.95	77.75	81.64	0	0	1.64	0.000002	0.000006	0.131118	0.131118	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	2.5901	2.5901	283.77	103.30	81.58	81.58	0	0	1.28	0.000006	0.000006	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	2.4555	2.5819	215.89	110.80	74.53	78.36	0	1	1.64	0.000002	0.000006	0.130079	0.130079	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	2.5803	2.5803	257.66	116.57	78.32	78.32	5	0	1.28	0.000006	0.000006	0.129913	0.129913	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	2.5633	2.5633	228.29	96.73	74.75	74.75	0	0	1.28	0.000006	0.000006	0.128069	0.128069	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	2.4205	2.5539	187.67	107.76	67.58	71.30	0	2	1.64	0.000002	0.000006	0.126989	0.126989	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	2.5603	2.5603	208.95	80.05	71.48	71.48	0	0	1.28	0.000006	0.000006	0.127726	0.127726	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	2.4191	2.5527	170.85	105.78	64.40	67.95	3	8	1.64	0.000002	0.000006	0.126859	0.126859	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	2.5691	0.00	89.43	0.00	68.39	0	0	1.28	0.000006	0.000006	0.123982	0.123982	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	2.4163	2.5505	160.50	110.48	61.02	64.41	0	1	1.64	0.000002	0.000006	0.126593	0.126593	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	2.4134	2.5481	134.41	81.06	57.46	60.67	0	5	1.64	0.000002	0.000006	0.117002	0.117002	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	2.5505	2.5505	139.19	84.18	60.73	60.73	0	0	1.28	0.000006	0.000006	0.121920	0.121920	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	2.5408	2.5408	138.68	72.15	56.59	56.59	1	2	1.64	0.000006	0.000006	0.113859	0.113859	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	2.5457	2.5457	144.19	69.68	56.70	56.70	0	1	1.28	0.000006	0.000006	0.119052	0.119052	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	2.5210	2.5210	105.86	57.12	51.98	51.98	0	7	1.64	0.000006	0.000006	0.111576	0.111576	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	2.5368	2.5368	122.65	62.94	52.31	52.31	1	1	1.28	0.000006	0.000006	0.113415	0.113415	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	2.5787	2.5787	124.09	60.95	53.17	53.17	3	5	1.28	0.000006	0.000006	0.107501	0.107501	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	2.4986	2.4986	81.91	45.04	47.03	47.03	0	1	1.64	0.000006	0.000006	0.102204	0.102204	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	2.5539	2.5539	91.13	53.83	48.07	48.07	2	2	1.28	0.000006	0.000006	0.108342	0.108342	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	2.4967	2.4967	71.89	40.06	42.03	42.03	9	5	1.64	0.000006	0.000006	0.101978	0.101978	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	2.4559	2.4559	45.35	30.14	35.81	35.81	0	1	1.64	0.000006	0.000006	0.088583	0.088583	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	2.5708	2.5708	418.30	190.45	106.02	106.02	0	0	10.20	0.000003	0.000003	0.161512	0.161512	0.016786	0.016786	0.7400	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	2.5643	2.5643	394.19	185.20	101.25	101.25	0	0	10.20	0.000003	0.000003	0.160908	0.160908	0.012342	0.012342	0.7400	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	2.5343	0.00	178.10	0.00	97.76	0	0	10.20	0.000003	0.000003	0.156289	0.156289	0.000000	0.008821	0.7400	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	2.5928	2.5928	285.38	143.44	89.99	89.99	0	0	1.28	0.000013	0.000013	0.131184	0.131184	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	2.5901	2.5901	284.69	136.65	87.21	87.21	0	0	1.28	0.000013	0.000013	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	2.4684	2.5921	254.11	139.59	80.48	84.51	0	0	1.64	0.000003	0.000013	0.134715	0.134715	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	2.5901	2.5901	287.79	123.90	84.44	84.44	0	0	1.28	0.000013	0.000013	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	2.4684	2.5921	237.35	115.95	77.75	81.64	0	0	1.64	0.000003	0.000013	0.131118	0.131118	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	2.5901	2.5901	283.77	103.30	81.58	81.58	0	0	1.28	0.000013	0.000013	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	2.4555	2.5819	215.89	110.80	74.53	78.36	0	1	1.64	0.000003	0.000013	0.130079	0.130079	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	2.5803	2.5803	257.66	116.57	78.32	78.32	5	0	1.28	0.000013	0.000013	0.129913	0.129913	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	2.5633	2.5633	228.29	96.73	74.75	74.75	0	0	1.28	0.000013	0.000013	0.128069	0.128069	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	2.4205	2.5539	187.67	107.76	67.58	71.30	0	2	1.64	0.000003	0.000013	0.126989	0.126989	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	2.5603	2.5603	208.95	80.05	71.48	71.48	0	0	1.28	0.000013	0.000013	0.127726	0.127726	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	2.4191	2.5527	170.85	105.78	64.40	67.95	3	8	1.64	0.000003	0.000013	0.126859	0.126859	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	2.5691	0.00	89.43	0.00	68.39	0	0	1.28	0.000013	0.000013	0.123982	0.123982	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	2.4163	2.5505	160.50	110.48	61.02	64.41	0	1	1.64	0.000003	0.000013	0.126593	0.126593	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	2.4134	2.5481	134.41	81.06	57.46	60.67	0	5	1.64	0.000003	0.000013	0.117002	0.117002	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	2.5505	2.5505	139.19	84.18	60.73	60.73	0	0	1.28	0.000013	0.000013	0.121920	0.121920	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	2.5408	2.5408	138.68	72.15	56.59	56.59	1	2	1.64	0.000013	0.000013	0.113859	0.113859	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	2.5457	2.5457	144.19	69.68	56.70	56.70	0	1	1.28	0.000013	0.000013	0.119052	0.119052	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	2.5210	2.5210	105.86	57.12	51.98	51.98	0	7	1.64	0.000013	0.000013	0.111576	0.111576	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	2.5368	2.5368	122.65	62.94	52.31	52.31	1	1	1.28	0.000013	0.000013	0.113415	0.113415	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	2.5787	2.5787	124.09	60.95	53.17	53.17	3	5	1.28	0.000013	0.000013	0.107501	0.107501	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	2.4986	2.4986	81.91	45.04	47.03	47.03	0	1	1.64	0.000013	0.000013	0.102204	0.102204	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	2.5539	2.5539	91.13	53.83	48.07	48.07	2	2	1.28	0.000013	0.000013	0.108342	0.108342	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	2.4967	2.4967	71.89	40.06	42.03	42.03	9	5	1.64	0.000013	0.000013	0.101978	0.101978	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	2.4559	2.4559	45.35	30.14	35.81	35.81	0	1	1.64	0.000013	0.000013	0.088583	0.088583	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	1.5512	1.5512	152.29	69.34	63.97	63.97	0	0	10.20	0.000002	0.000002	0.038455	0.038455	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	1.5318	1.5318	140.66	66.09	60.48	60.48	0	0	10.20	0.000002	0.000002	0.037377	0.037377	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	1.5234	0.00	64.36	0.00	58.77	0	0	10.20	0.000002	0.000002	0.036459	0.036459	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.7903	1.7903	136.06	68.39	62.14	62.14	0	0	1.28	0.000007	0.000007	0.028514	0.028514	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.7831	1.7831	134.92	64.76	60.04	60.04	0	0	1.28	0.000007	0.000007	0.028111	0.028111	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	1.4636	1.7885	89.34	66.45	47.72	58.31	0	0	1.64	0.000002	0.000007	0.029327	0.029327	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.7831	1.7831	136.39	58.72	58.13	58.13	0	0	1.28	0.000007	0.000007	0.028111	0.028111	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	1.4636	1.7885	83.45	55.20	46.10	56.33	0	0	1.64	0.000002	0.000007	0.028414	0.028414	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.7831	1.7831	134.49	48.96	56.16	56.16	0	0	1.28	0.000007	0.000007	0.028111	0.028111	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	1.4300	1.7616	73.21	51.58	43.40	53.47	0	1	1.64	0.000002	0.000007	0.026939	0.026939	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.7574	1.7574	119.53	54.08	53.34	53.34	5	0	1.28	0.000007	0.000007	0.026716	0.026716	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.7129	1.7129	101.93	43.19	49.95	49.95	0	0	1.28	0.000007	0.000007	0.024421	0.024421	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	1.3380	1.6881	57.34	47.08	37.36	47.13	0	2	1.64	0.000002	0.000007	0.023214	0.023214	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.7049	1.7049	92.66	35.49	47.60	47.60	0	0	1.28	0.000007	0.000007	0.024028	0.024028	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	1.3343	1.6851	51.98	46.10	35.52	44.86	3	8	1.64	0.000002	0.000007	0.023075	0.023075	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.7280	0.00	40.46	0.00	46.00	0	0	1.28	0.000007	0.000007	0.024096	0.024096	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	1.3269	1.6791	48.40	47.89	33.51	42.40	0	1	1.64	0.000002	0.000007	0.022793	0.022793	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	1.3192	1.6730	40.16	34.94	31.41	39.83	0	5	1.64	0.000002	0.000007	0.020551	0.020551	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.6791	1.6791	60.33	36.49	39.98	39.98	0	0	1.28	0.000007	0.000007	0.021797	0.021797	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.6537	1.6537	58.75	30.57	36.83	36.83	1	2	1.64	0.000007	0.000007	0.019270	0.019270	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6667	1.6667	61.81	29.87	37.12	37.12	0	1	1.28	0.000007	0.000007	0.020760	0.020760	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6018	1.6018	42.74	23.06	33.03	33.03	0	7	1.64	0.000007	0.000007	0.017255	0.017255	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6434	1.6434	51.47	26.42	33.89	33.89	1	1	1.28	0.000007	0.000007	0.018856	0.018856	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7532	1.7532	57.36	28.17	36.15	36.15	3	5	1.28	0.000007	0.000007	0.021291	0.021291	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5431	1.5431	31.24	17.18	29.05	29.05	0	1	1.64	0.000007	0.000007	0.014084	0.014084	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.6881	1.6881	39.81	23.52	31.77	31.77	2	2	1.28	0.000007	0.000007	0.019256	0.019256	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5380	1.5380	27.28	15.20	25.89	25.89	9	5	1.64	0.000007	0.000007	0.013928	0.013928	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4308	1.4308	15.39	10.23	20.86	20.86	0	1	1.64	0.000007	0.000007	0.009812	0.009812	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	1.5512	0.00	69.34	0.00	63.97	0	0	10.20	0.000002	0.000002	0.038455	0.038455	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	1.5318	0.00	66.09	0.00	60.48	0	0	10.20	0.000002	0.000002	0.037377	0.037377	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	1.5234	0.00	64.36	0.00	58.77	0	0	10.20	0.000002	0.000002	0.036459	0.036459	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.7903	0.00	68.39	0.00	62.14	0	0	1.28	0.000006	0.000006	0.028514	0.028514	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.7831	0.00	64.76	0.00	60.04	0	0	1.28	0.000006	0.000006	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.7885	0.00	66.45	0.00	58.31	0	0	1.64	0.000002	0.000006	0.029327	0.029327	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.7831	0.00	58.72	0.00	58.13	0	0	1.28	0.000006	0.000006	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	1.4636	1.7885	83.45	55.20	46.10	56.33	1	0	1.64	0.000002	0.000006	0.028414	0.028414	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.7831	0.00	48.96	0.00	56.16	0	0	1.28	0.000006	0.000006	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	1.4300	1.7616	73.51	51.58	43.40	53.47	2	0	1.64	0.000002	0.000006	0.026939	0.026939	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.7574	0.00	54.08	0.00	53.34	0	0	1.28	0.000006	0.000006	0.026716	0.026716	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.7129	0.00	43.19	0.00	49.95	0	0	1.28	0.000006	0.000006	0.024421	0.024421	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.6881	0.00	47.08	0.00	47.13	0	1	1.64	0.000002	0.000006	0.023214	0.023214	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.7049	1.7049	93.03	35.49	47.60	47.60	1	0	1.28	0.000006	0.000006	0.024028	0.024028	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	1.3343	1.6851	52.86	46.10	35.52	44.86	7	4	1.64	0.000002	0.000006	0.023075	0.023075	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.7280	0.00	40.46	0.00	46.00	0	0	1.28	0.000006	0.000006	0.024096	0.024096	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	1.3269	1.6791	49.89	47.89	33.51	42.40	1	0	1.64	0.000002	0.000006	0.022793	0.022793	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	1.3192	1.6730	41.80	34.94	31.41	39.83	5	0	1.64	0.000002	0.000006	0.020551	0.020551	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.6791	1.6791	63.25	36.49	39.98	39.98	0	0	1.28	0.000006	0.000006	0.021797	0.021797	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.6537	1.6537	60.84	30.57	36.83	36.83	2	1	1.64	0.000006	0.000006	0.019270	0.019270	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6667	1.6667	64.52	29.87	37.12	37.12	1	0	1.28	0.000006	0.000006	0.020760	0.020760	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6018	1.6018	44.77	23.06	33.03	33.03	7	1	1.64	0.000006	0.000006	0.017255	0.017255	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6434	1.6434	53.80	26.42	33.89	33.89	0	0	1.28	0.000006	0.000006	0.018856	0.018856	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7532	1.7532	60.04	28.17	36.15	36.15	5	3	1.28	0.000006	0.000006	0.021291	0.021291	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5431	1.5431	32.73	17.18	29.05	29.05	1	0	1.64	0.000006	0.000006	0.014084	0.014084	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.6881	1.6881	42.05	23.52	31.77	31.77	2	1	1.28	0.000006	0.000006	0.019256	0.019256	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5380	1.5380	28.70	15.20	25.89	25.89	4	10	1.64	0.000006	0.000006	0.013928	0.013928	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4308	1.4308	16.30	10.23	20.86	20.86	1	0	1.64	0.000006	0.000006	0.009812	0.009812	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	1.5512	0.00	69.34	0.00	63.97	0	0	10.20	0.000004	0.000004	0.038455	0.038455	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	1.5318	0.00	66.09	0.00	60.48	0	0	10.20	0.000004	0.000004	0.037377	0.037377	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	1.5234	0.00	64.36	0.00	58.77	0	0	10.20	0.000004	0.000004	0.036459	0.036459	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.7903	0.00	68.39	0.00	62.14	0	0	1.28	0.000013	0.000013	0.028514	0.028514	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.7831	0.00	64.76	0.00	60.04	0	0	1.28	0.000013	0.000013	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.7885	0.00	66.45	0.00	58.31	0	0	1.64	0.000004	0.000013	0.029327	0.029327	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.7831	0.00	58.72	0.00	58.13	0	0	1.28	0.000013	0.000013	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	1.4636	1.7885	83.45	55.20	46.10	56.33	1	0	1.64	0.000004	0.000013	0.028414	0.028414	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.7831	0.00	48.96	0.00	56.16	0	0	1.28	0.000013	0.000013	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	1.4300	1.7616	73.51	51.58	43.40	53.47	2	0	1.64	0.000004	0.000013	0.026939	0.026939	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.7574	0.00	54.08	0.00	53.34	0	0	1.28	0.000013	0.000013	0.026716	0.026716	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.7129	0.00	43.19	0.00	49.95	0	0	1.28	0.000013	0.000013	0.024421	0.024421	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.6881	0.00	47.08	0.00	47.13	0	1	1.64	0.000004	0.000013	0.023214	0.023214	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.7049	1.7049	93.03	35.49	47.60	47.60	1	0	1.28	0.000013	0.000013	0.024028	0.024028	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	1.3343	1.6851	52.86	46.10	35.52	44.86	7	4	1.64	0.000004	0.000013	0.023075	0.023075	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.7280	0.00	40.46	0.00	46.00	0	0	1.28	0.000013	0.000013	0.024096	0.024096	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	1.3269	1.6791	49.89	47.89	33.51	42.40	1	0	1.64	0.000004	0.000013	0.022793	0.022793	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	1.3192	1.6730	41.80	34.94	31.41	39.83	5	0	1.64	0.000004	0.000013	0.020551	0.020551	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.6791	1.6791	63.25	36.49	39.98	39.98	0	0	1.28	0.000013	0.000013	0.021797	0.021797	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.6537	1.6537	60.84	30.57	36.83	36.83	2	1	1.64	0.000013	0.000013	0.019270	0.019270	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6667	1.6667	64.52	29.87	37.12	37.12	1	0	1.28	0.000013	0.000013	0.020760	0.020760	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6018	1.6018	44.77	23.06	33.03	33.03	7	1	1.64	0.000013	0.000013	0.017255	0.017255	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6434	1.6434	53.80	26.42	33.89	33.89	0	0	1.28	0.000013	0.000013	0.018856	0.018856	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7532	1.7532	60.04	28.17	36.15	36.15	5	3	1.28	0.000013	0.000013	0.021291	0.021291	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5431	1.5431	32.73	17.18	29.05	29.05	1	0	1.64	0.000013	0.000013	0.014084	0.014084	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.6881	1.6881	42.05	23.52	31.77	31.77	2	1	1.28	0.000013	0.000013	0.019256	0.019256	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5380	1.5380	28.70	15.20	25.89	25.89	4	10	1.64	0.000013	0.000013	0.013928	0.013928	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4308	1.4308	16.30	10.23	20.86	20.86	1	0	1.64	0.000013	0.000013	0.009812	0.009812	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	3.0866	0.00	274.55	0.00	127.29	0	0	10.20	0.000002	0.000002	0.252334	0.252334	0.000000	0.032551	0.0400	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	3.0866	0.00	268.35	0.00	121.87	0	0	10.20	0.000002	0.000002	0.253318	0.253318	0.000000	0.029058	0.0400	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	3.0678	0.00	260.97	0.00	118.34	0	0	10.20	0.000002	0.000002	0.245736	0.245736	0.000000	0.026610	0.0400	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	3.0164	0.00	194.12	0.00	104.69	0	0	1.28	0.000007	0.000007	0.210874	0.210874	0.000000	0.015593	0.0400	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	3.0160	0.00	185.29	0.00	101.55	0	0	1.28	0.000007	0.000007	0.211233	0.211233	0.000000	0.012640	0.0400	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	3.0163	0.00	189.00	0.00	98.34	0	0	1.64	0.000002	0.000007	0.216444	0.216444	0.000000	0.009421	0.0400	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	3.0160	0.00	168.00	0.00	98.33	0	0	1.28	0.000007	0.000007	0.211233	0.211233	0.000000	0.009411	0.0400	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	2.9986	3.0163	350.29	157.00	94.45	95.00	1	0	1.64	0.000002	0.000007	0.210963	0.210963	0.005233	0.005851	0.0400	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	3.0160	0.00	140.06	0.00	94.99	0	0	1.28	0.000007	0.000007	0.211233	0.211233	0.000000	0.005841	0.0400	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	2.9968	3.0148	322.86	151.07	90.96	91.50	2	0	1.64	0.000002	0.000007	0.212262	0.212262	0.001169	0.001825	0.0400	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	3.0146	0.00	159.11	0.00	91.50	0	0	1.28	0.000007	0.000007	0.212456	0.212456	0.000000	0.001817	0.0400	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	3.0122	0.00	133.56	0.00	87.84	0	0	1.28	0.000007	0.000007	0.214409	0.214409	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	3.0108	0.00	149.77	0.00	84.06	0	1	1.64	0.000002	0.000007	0.215404	0.215404	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	3.0117	3.0117	290.31	110.76	84.08	84.08	1	0	1.28	0.000007	0.000007	0.214736	0.214736	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	2.9916	3.0106	265.70	147.14	79.64	80.14	7	4	1.64	0.000002	0.000007	0.215518	0.215518	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	3.0130	0.00	123.01	0.00	80.20	0	0	1.28	0.000007	0.000007	0.206349	0.206349	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	2.9912	3.0103	253.55	153.91	75.54	76.02	1	0	1.64	0.000002	0.000007	0.215746	0.215746	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	2.9908	3.0100	214.85	113.11	71.21	71.67	5	0	1.64	0.000002	0.000007	0.200954	0.200954	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	3.0103	3.0103	203.29	117.27	71.67	71.67	0	0	1.28	0.000007	0.000007	0.208250	0.208250	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	3.0089	3.0089	201.45	101.20	67.01	67.01	2	1	1.64	0.000007	0.000007	0.197827	0.197827	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	3.0097	3.0097	210.37	97.39	67.03	67.03	1	0	1.28	0.000007	0.000007	0.204934	0.204934	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	3.0061	3.0061	157.68	81.22	61.99	61.99	7	1	1.64	0.000007	0.000007	0.199365	0.199365	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	3.0084	3.0084	180.29	88.52	62.03	62.03	0	0	1.28	0.000007	0.000007	0.198151	0.198151	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	3.0143	3.0143	177.49	83.29	62.15	62.15	5	3	1.28	0.000007	0.000007	0.177852	0.177852	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	3.0029	3.0029	123.94	65.05	56.52	56.52	1	0	1.64	0.000007	0.000007	0.189289	0.189289	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	3.0108	3.0108	133.78	74.81	56.67	56.67	2	1	1.28	0.000007	0.000007	0.185399	0.185399	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	3.0027	3.0027	109.38	57.94	50.55	50.55	4	10	1.64	0.000007	0.000007	0.189394	0.189394	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	2.9969	2.9969	71.49	44.89	43.70	43.70	1	0	1.64	0.000007	0.000007	0.175586	0.175586	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

SUPERSTRUCTURE ANNUAL FREQUENCY OF COLLAPSE (WATER ELEVATION 5.0 CD)

Pier ID	Description	Ultimate Lateral Capacity, H (MN)	Annual Frequency of Collapse, AF			Return Period
		Superstructure	Inbound	Outbound	Total	
1	Main Span South	**0**	0.00025557	0.00001897	0.00027455	3,642
2	Main Span North	**0**	0.00004123	0.00002678	0.00006801	14,704
3	Anchor Span North	**0**	0.00000496	0.00000000	0.00000496	201,807
Total for Bridge Superstructure:			0.00030176	0.00004575	0.00034751	**2,878**

VESSEL FLEET CHARACTERISTICS (SUPERSTRUCTURE ONLY)

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Vessel Size (m)		Vessel Drafts (m)				Vessel Heights (m)									Vessel Displacement (tonnes) [3]		Channel Width, C (m)	Centerline Transit Path to Edge of Channel, x_C (m)	Minimum Design Impact Speed, V_{min} (m/sec)		Standard Deviation, σ (m)	
				Length Overall, LOA	Beam/ Width, B	Operational Loaded, D_O	Ballasted			Baseline [1]			Loaded [2]			Ballasted [2]			Loaded, W_L	Ballasted, W_E						
							Stern, D_{ES}	Bow, D_{EB}	Average, D_{AVG}	Bow, H_{BH}	Deckhouse, H_{DH}	Mast, H_{MT}	Bow, H_{BH}	Deckhouse, H_{DH}	Mast, H_{MT}	Bow, H_{BH}	Deckhouse, H_{DH}	Mast, H_{MT}					Loaded	Ballasted	Loaded	Ballasted
1	Ship	Tanker	120,000	250	44	11.9	8.2	4.7	6.5	26.53	40.24	51.50	14.63	28.34	39.60	21.83	32.04	43.30	101,270	54,890	125.4	62.7	0.514	0.514	80	80
2	Ship	Tanker	110,000	240	44	11.8	8.3	4.9	6.6	26.31	39.96	52.09	14.51	28.16	40.29	21.41	31.66	43.79	95,920	53,650	125.4	62.7	0.514	0.514	79	79
3	Ship	Tanker	105,000	244	42	13.0	8.4	5.0	6.7	26.19	39.80	52.29	13.19	26.80	39.29	21.19	31.40	43.89	102,480	52,820	119.7	59.9	0.514	0.514	80	80
4	Ship	Bulk Carrier	85,000	229	32	11.7	8.6	5.4	7.0	27.69	42.80	55.70	15.99	31.10	44.00	22.29	34.20	47.10	67,920	40,640	110.0	55.0	1.029	1.029	78	78
5	Ship	Bulk Carrier	80,000	225	32	11.9	8.4	5.2	6.8	27.34	42.25	55.19	15.44	30.35	43.29	22.14	33.85	46.79	67,900	38,800	110.0	55.0	1.029	1.029	78	78
6	Ship	Tanker	75,000	228	34	11.3	8.3	5.1	6.7	25.36	38.69	51.41	14.06	27.39	40.11	20.26	30.39	43.11	66,730	39,570	110.0	55.0	0.514	1.029	78	78
7	Ship	Bulk Carrier	75,000	225	32	12.1	7.8	4.6	6.2	26.96	41.67	54.64	14.86	29.57	42.54	22.36	33.87	46.84	68,640	35,180	110.0	55.0	1.029	1.029	78	78
8	Ship	Tanker	70,000	228	32	11.0	7.4	4.2	5.8	25.18	38.46	49.61	14.18	27.46	38.61	20.98	31.06	42.21	62,330	32,870	110.0	55.0	0.514	1.029	78	78
9	Ship	Bulk Carrier	70,000	225	32	12.0	6.8	3.6	5.2	26.56	41.04	54.06	14.56	29.04	42.06	22.96	34.24	47.26	67,680	29,330	110.0	55.0	1.029	1.029	78	78
10	Ship	Tanker	65,000	214	32	10.9	7.5	4.5	6.0	25.00	38.22	49.43	14.10	27.32	38.53	20.50	30.72	41.93	57,520	31,660	110.0	55.0	0.514	1.029	77	77
11	Ship	Bulk Carrier	65,000	212	32	11.7	7.8	4.8	6.3	26.12	40.36	53.43	14.42	28.66	41.73	21.32	32.56	45.63	61,920	33,350	110.0	55.0	1.029	1.029	77	77
12	Ship	Bulk Carrier	60,000	193	32	11.6	7.2	4.5	5.9	25.66	39.63	52.75	14.06	28.03	41.15	21.16	32.43	45.55	55,590	28,040	110.0	55.0	1.029	1.029	75	75
13	Ship	Tanker	55,000	184	32	11.4	8.3	5.7	7.0	24.58	37.66	49.38	13.18	26.26	37.98	18.88	29.36	41.08	51,250	31,470	110.0	55.0	0.514	1.029	74	74
14	Ship	Bulk Carrier	55,000	190	32	10.9	6.3	3.6	5.0	25.15	38.84	52.01	14.25	27.94	41.11	21.55	32.54	45.71	51,210	23,260	110.0	55.0	1.029	1.029	75	75
15	Ship	Tanker	50,000	183	32	10.6	8.2	5.6	6.9	24.35	37.35	49.65	13.75	26.75	39.05	18.75	29.15	41.45	47,500	30,920	110.0	55.0	0.514	1.029	74	74
16	Ship	Bulk Carrier	50,000	199	30	12.2	7.0	4.2	5.6	24.59	37.98	51.21	12.39	25.78	39.01	20.39	30.98	44.21	56,210	25,810	110.0	55.0	1.029	1.029	76	76
17	Ship	Tanker	45,000	181	32	10.3	8.6	6.1	7.4	24.08	37.00	49.13	13.78	26.70	38.83	17.98	28.40	40.53	45,340	32,350	110.0	55.0	0.514	1.029	74	74
18	Ship	Tanker	40,000	179	28	10.1	7.5	5.0	6.3	23.79	36.61	47.60	13.69	26.51	37.50	18.79	29.11	40.10	38,430	23,780	110.0	55.0	0.514	1.029	74	74
19	Ship	Bulk Carrier	40,000	181	30	9.1	7.2	4.7	6.0	23.29	35.95	49.32	14.19	26.85	40.22	18.59	28.75	42.12	37,700	24,650	110.0	55.0	1.029	1.029	74	74
20	Ship	Tanker	35,000	173	27	10.2	7.3	4.9	6.1	23.46	36.17	46.68	13.26	25.97	36.48	18.56	28.87	39.38	35,600	21,290	110.0	55.0	1.029	1.029	73	73
21	Ship	Bulk Carrier	35,000	177	29	9.7	6.5	4.0	5.3	22.51	34.73	48.19	12.81	25.03	38.49	18.51	28.23	41.69	37,830	20,480	110.0	55.0	1.029	1.029	73	73
22	Ship	Tanker	30,000	159	27	9.2	6.5	4.3	5.4	23.08	35.66	44.78	13.88	26.46	35.58	18.78	29.16	38.28	29,160	17,120	110.0	55.0	1.029	1.029	71	71
23	Ship	Bulk Carrier	30,000	170	27	9.5	6.6	4.2	5.4	21.61	33.33	46.89	12.11	23.83	37.39	17.41	26.73	40.29	32,770	18,630	110.0	55.0	1.029	1.029	72	72
24	Ship	Articulated Tug/Barge	30,000	210	23	9.3	5.0	5.0	5.0	23.08	35.66	44.78	13.78	26.36	35.48	18.08	30.66	39.78	32,470	17,460	110.0	55.0	1.029	1.029	77	77
25	Ship	Tanker	25,000	146	24	9.2	6.5	4.5	5.5	22.62	35.06	43.64	13.42	25.86	34.44	18.12	28.56	37.14	22,970	13,740	110.0	55.0	1.029	1.029	69	69
26	Ship	Articulated Tug/Barge	25,000	184	24	8.3	5.0	5.0	5.0	22.62	35.06	43.64	14.32	26.76	35.34	17.62	30.06	38.64	26,090	15,720	110.0	55.0	1.029	1.029	74	74
27	Ship	Tanker	20,000	145	24	8.7	6.1	4.1	5.1	22.07	34.32	42.76	13.37	25.62	34.06	17.97	28.22	36.66	20,880	12,240	110.0	55.0	1.029	1.029	69	69
28	Ship	Tanker	15,000	127	20	8.1	6.3	4.5	5.4	21.52	33.58	40.63	13.42	25.48	32.53	17.02	27.28	34.33	14,280	9,520	110.0	55.0	1.029	1.029	65	65

Notes:

[1] Vessel heights as measured from the baseline/keel of the vessel.

[2] Vessel heights as measured from the waterline. Use Operational Loaded Draft (D_O) for all loaded vessel heights. Use Ballasted Bow (D_{EB}) for ballasted vessel heights at the bow and Ballasted Stern (D_{ES}) for ballasted vessel heights at the deckhouse and mast.

[3] Weight of Water (W_W) = **0.9854** m^3/tonne (used to determine ship loaded/ballasted displacement tonnage based on approximate salinity of water in Vancouver Harbor)

VESSEL FLEET ANNUAL TRIP FREQUENCY (SUPERSTRUCTURE ONLY)

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Annual Number of Trips (N)						Existing Total Trips	Growth Factor [1]	Future Total Trips
				Inbound			Outbound					
				Loaded	Ballasted	Total	Loaded	Ballasted	Total			
1	Ship	Tanker	120,000	0	0	0	5	0	5	5	10.20	51
2	Ship	Tanker	110,000	0	0	0	3	0	3	3	10.20	31
3	Ship	Tanker	105,000	0	0	0	1	0	1	1	10.20	10
4	Ship	Bulk Carrier	85,000	0	0	0	0	0	0	0	1.28	0
5	Ship	Bulk Carrier	80,000	0	0	0	0	0	0	0	1.28	0
6	Ship	Tanker	75,000	0	0	0	2	0	2	2	1.64	3
7	Ship	Bulk Carrier	75,000	0	0	0	0	0	0	0	1.28	0
8	Ship	Tanker	70,000	0	0	0	1	0	1	1	1.64	2
9	Ship	Bulk Carrier	70,000	0	0	0	0	0	0	0	1.28	0
10	Ship	Tanker	65,000	0	1	1	2	0	2	3	1.64	5
11	Ship	Bulk Carrier	65,000	5	0	5	2	0	2	7	1.28	9
12	Ship	Bulk Carrier	60,000	0	0	0	1	0	1	1	1.28	1
13	Ship	Tanker	55,000	0	2	2	3	1	4	6	1.64	10
14	Ship	Bulk Carrier	55,000	0	0	0	1	0	1	1	1.28	1
15	Ship	Tanker	50,000	3	8	11	7	4	11	22	1.64	36
16	Ship	Bulk Carrier	50,000	0	0	0	1	0	1	1	1.28	1
17	Ship	Tanker	45,000	0	1	1	1	0	1	2	1.64	3
18	Ship	Tanker	40,000	0	5	5	5	0	5	10	1.64	16
19	Ship	Bulk Carrier	40,000	0	0	0	0	0	0	0	1.28	0
20	Ship	Tanker	35,000	1	2	3	2	1	3	6	1.64	10
21	Ship	Bulk Carrier	35,000	0	1	1	1	0	1	2	1.28	3
22	Ship	Tanker	30,000	0	7	7	7	1	8	15	1.64	25
23	Ship	Bulk Carrier	30,000	1	1	2	0	0	0	2	1.28	3
24	Ship	Articulated Tug/Barge	30,000	3	5	8	5	3	8	16	1.28	20
25	Ship	Tanker	25,000	0	1	1	1	0	1	2	1.64	3
26	Ship	Articulated Tug/Barge	25,000	2	2	4	2	1	3	7	1.28	9
27	Ship	Tanker	20,000	9	5	14	4	10	14	28	1.64	46
28	Ship	Tanker	15,000	0	1	1	1	0	1	2	1.64	3
			Total Trips:	24	42	66	58	21	79	145		301

Notes:

[1] As part of the risk analysis, vessel trips will include future growth in the waterway that are projected to the mid-point of the remaining design life (assumed 50 years) of the structure. This equates to growth rates per year as follows for a 25-year projection. GF = $(1+PERCENT/100)^{25}$

- Aframax Tankers (DWT greater than 100,000 tonnes) = 9.735%
- All Other Tankers = 2.0%
- All Other Vessels = 1.0%

VESSEL FLEET TRANSIT SPEEDS IN MAIN CHANNEL (SUPERSTRUCTURE ONLY)

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Vessel Transit Speeds (knots)				Vessel Transit Speeds (m/sec) [1]			
				Inbound		Outbound		Inbound		Outbound	
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted
1	Ship	Tanker	120,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
2	Ship	Tanker	110,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
3	Ship	Tanker	105,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
4	Ship	Bulk Carrier	85,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
5	Ship	Bulk Carrier	80,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
6	Ship	Tanker	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
7	Ship	Bulk Carrier	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
8	Ship	Tanker	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
9	Ship	Bulk Carrier	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
10	Ship	Tanker	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
11	Ship	Bulk Carrier	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
12	Ship	Bulk Carrier	60,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
13	Ship	Tanker	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
14	Ship	Bulk Carrier	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
15	Ship	Tanker	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
16	Ship	Bulk Carrier	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
17	Ship	Tanker	45,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
18	Ship	Tanker	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
19	Ship	Bulk Carrier	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
20	Ship	Tanker	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
21	Ship	Bulk Carrier	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
22	Ship	Tanker	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
23	Ship	Bulk Carrier	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
24	Ship	Articulated Tug/Barge	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
25	Ship	Tanker	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
26	Ship	Articulated Tug/Barge	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
27	Ship	Tanker	20,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
28	Ship	Tanker	15,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866

Notes:

[1] Conversion (knot to m/sec) = 0.51 (convert vessel transit speeds from knots to meters/second for use in risk assessment equations)

ABERRANCY BASE RATE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Code Recommended Aberrancy Base Rate, BR	Vessel Traffic Service, VTS	Electronic Chart Display & Information System, ECDIS	Other Navigation Aids	Port Control State, PCS	Pilotage 1 Pilot	Pilotage 2 Pilots (MRA-2)		Daytime Only Transit Restrictions (MRA-2)		Visibility Restrictions (MRA-2)	Adjusted Aberrancy Base Rate, BR [1]	
										Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
2	Ship	Tanker	110,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
3	Ship	Tanker	105,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
4	Ship	Bulk Carrier	85,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
5	Ship	Bulk Carrier	80,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
6	Ship	Tanker	75,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
7	Ship	Bulk Carrier	75,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
8	Ship	Tanker	70,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
9	Ship	Bulk Carrier	70,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
10	Ship	Tanker	65,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
11	Ship	Bulk Carrier	65,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
12	Ship	Bulk Carrier	60,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
13	Ship	Tanker	55,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
14	Ship	Bulk Carrier	55,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
15	Ship	Tanker	50,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
16	Ship	Bulk Carrier	50,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
17	Ship	Tanker	45,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
18	Ship	Tanker	40,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
19	Ship	Bulk Carrier	40,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
20	Ship	Tanker	35,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
21	Ship	Bulk Carrier	35,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
22	Ship	Tanker	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
23	Ship	Bulk Carrier	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
24	Ship	Articulated Tug/Barge	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
25	Ship	Tanker	25,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
26	Ship	Articulated Tug/Barge	25,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
27	Ship	Tanker	20,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
28	Ship	Tanker	15,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05

Notes:

[1] Adjustments to the aberrancy Base Rate (BR) due to waterway current restrictions are accounted for elsewhere in the vessel collision risk analysis (refer to correction factors R_C and R_{XC} for the Probability of Aberrancy at each transit leg).

MISCELLANEOUS INFORMATION (SUPERSTRUCTURE ONLY)

CHANNEL CHARACTERISTICS

Waterway Current Speed (V_{min}) =	**1.03**	m/sec
Mean High Water (MHW) Elevation =	**5.00**	m (based on Chart Datum)
Sea Level Rise Adjustment =	**0.10**	m
Soft Soil Allowance =	**1.00**	m (assumed depth that vessels can "plow" through soft bottom material)

AVAILABLE WATER DEPTH AT PIERS

Pier ID	Description	Mudline Elevation (m) [1]		Water Elevation (m)	Soft Soil Allowance (m)	Design Water Depth (m)	
		Inbound	Outbound			Inbound	Outbound
1	**Main Span South**	**-6.00**	**-5.00**	5.10	1.00	12.10	11.10
2	**Main Span North**	**-10.00**	**-9.00**	5.10	1.00	16.10	15.10
3	**Anchor Span North**	**-5.00**	**N/A**	5.10	1.00	11.10	0.00

Notes:
[1] Mudline elevation is based on Chart Datum (CD) and was obtained from Nautical Chart 3494

PROBABILITY OF ABERRANCY VARIABLES FOR EACH VESSEL TRANSIT PATH

Leg ID	Waterway Region for Bridge Location	Angle of Channel Turn, θ (deg) [1]	Correction Factor, R_B	Current Angle to Vessel Path (deg) [2]	Parallel Current, V_C (m/sec)	Perpendicular Current, V_{XC} (m/sec)	Correction Factor, R_C	Correction Factor, R_{XC}	Vessel Traffic Density	Correction Factor, R_D	Summation (R_B*R_C*R_{XC}*R_D)	Aberrancy Distribution [3]	
												Inbound	Outbound
1	**Transition**	**7.7227**	1.0858	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.3095	**0.24**	**N/A**
2	**Turn/Bend**	**7.7227**	1.1716	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4130	**0.50**	**N/A**
3	**Turn/Bend**	**7.7227**	1.1716	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4130	**0.26**	**N/A**
4	**Transition**	**8.8764**	1.0986	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.3249	**N/A**	**0.24**
5	**Turn/Bend**	**8.8764**	1.1973	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4439	**N/A**	**0.50**
6	**Turn/Bend**	**8.8764**	1.1973	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4439	**N/A**	**0.26**

Notes:
[1] Angle of the turn region in accordance with information shown on Nautical Chart 3494, AIS transit data near the bridge, and CAN/CSA S6-14 Figure A3.3.1
[2] The angle between the water current direction and each channel transition leg
[3] Distribution of the Probability of Aberrancy for each channel transition leg is established as a ratio of the length of each leg to the overall length being considered (approximately 1 nautical mile or 2000m)

PROTECTION FACTOR

Pier ID	Description	Leg 1		Leg 2		Leg 3		Leg 4		Leg 5		Leg 6	
		Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
1	Main Span South	**0.63**	**N/A**	**0.63**	**N/A**	**0.66**	**N/A**	**N/A**	**0.29**	**N/A**	**0.29**	**N/A**	**0.36**
2	Main Span North	**0.72**	**N/A**	**0.72**	**N/A**	**0.80**	**N/A**	**N/A**	**0.23**	**N/A**	**0.23**	**N/A**	**0.18**
3	Anchor Span North	**0.58**	**N/A**	**0.58**	**N/A**	**0.67**	**N/A**	**N/A**	**0.00**	**N/A**	**0.00**	**N/A**	**0.00**

SUPERSTRUCTURE CONTACT GEOMETRY - MAIN SPAN SOUTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Main Span South (Pier 16)																				
				Leg 1 [1]							Leg 2 [1]							Leg 3 [1]						
				Centerline of Pier 16	Loaded			Ballasted			Centerline of Pier 16	Loaded			Ballasted			Centerline of Pier 16	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	98.319	89.538	68.242	37.291	80.221	61.176	13.203	98.319	89.538	68.242	37.291	80.221	61.176	13.203	168.710	159.855	138.386	107.180	150.464	131.261	82.893
2	Ship	Tanker	110,000	98.319	89.691	68.577	34.443	80.764	62.069	8.681	98.319	89.691	68.577	34.443	80.764	62.069	8.681	168.710	160.011	138.724	104.308	151.011	132.161	78.334
3	Ship	Tanker	105,000	98.319	91.399	71.106	38.549	81.049	62.552	7.520	98.319	91.399	71.106	38.549	81.049	62.552	7.520	168.710	161.733	141.274	108.448	151.298	132.649	77.163
4	Ship	Bulk Carrier	85,000	98.319	87.776	63.110	5.998	79.493	55.421	-68.079	98.319	87.776	63.110	5.998	79.493	55.421	-68.079	168.710	158.081	133.211	75.628	149.730	125.459	0.941
5	Ship	Bulk Carrier	80,000	98.319	88.488	64.505	13.295	79.772	56.353	-68.079	98.319	88.488	64.505	13.295	79.772	56.353	-68.079	168.710	158.798	134.618	82.986	126.399	150.011	0.941
6	Ship	Tanker	75,000	98.319	90.273	70.009	35.222	82.252	64.430	14.956	98.319	90.273	70.009	35.222	82.252	64.430	14.956	168.710	160.598	140.167	105.094	152.511	134.543	84.661
7	Ship	Bulk Carrier	75,000	98.319	89.238	65.955	20.217	79.363	56.300	-68.079	98.319	89.238	65.955	20.217	79.363	56.300	-68.079	168.710	159.555	136.080	89.964	149.599	126.345	0.941
8	Ship	Tanker	70,000	98.319	90.118	69.879	41.308	81.321	63.184	22.516	98.319	90.118	69.879	41.308	81.321	63.184	22.516	168.710	160.442	140.036	111.230	151.572	133.286	92.283
9	Ship	Bulk Carrier	70,000	98.319	89.626	66.941	23.448	78.247	55.314	-68.079	98.319	89.626	66.941	23.448	78.247	55.314	-68.079	168.710	159.946	137.074	93.223	125.351	148.474	0.941
10	Ship	Tanker	65,000	98.319	90.221	70.139	41.633	81.942	63.817	24.256	98.319	90.221	70.139	41.633	81.942	63.817	24.256	168.710	160.546	140.299	111.557	152.198	133.924	94.037
11	Ship	Bulk Carrier	65,000	98.319	89.807	67.647	25.498	80.881	59.790	-33.804	98.319	89.807	67.647	25.498	80.881	59.790	-33.804	168.710	160.129	137.786	95.289	151.129	129.864	35.499
12	Ship	Bulk Carrier	60,000	98.319	90.273	68.819	29.101	81.088	60.137	-29.059	98.319	90.273	68.819	29.101	81.088	60.137	-29.059	168.710	160.598	138.968	98.922	151.338	130.214	40.283
13	Ship	Tanker	55,000	98.319	91.411	72.111	43.864	84.037	66.346	29.535	98.319	91.411	72.111	43.864	84.037	66.346	29.535	168.710	161.746	142.286	113.807	154.311	136.474	99.360
14	Ship	Bulk Carrier	55,000	98.319	90.027	68.986	29.349	80.583	59.844	-38.927	98.319	90.027	68.986	29.349	80.583	59.844	-38.927	168.710	160.351	139.136	99.172	150.829	129.918	30.333
15	Ship	Tanker	50,000	98.319	90.674	71.199	39.523	84.206	66.736	27.237	98.319	90.674	71.199	39.523	84.206	66.736	27.237	168.710	161.003	141.367	109.430	154.481	136.868	97.043
16	Ship	Bulk Carrier	50,000	98.319	92.433	73.003	39.685	82.084	63.333	3.091	98.319	92.433	73.003	39.685	82.084	63.333	3.091	168.710	162.777	143.186	109.594	152.342	133.436	72.697
17	Ship	Tanker	45,000	98.319	90.635	71.292	40.416	85.202	68.131	32.952	98.319	90.635	71.292	40.416	85.202	68.131	32.952	168.710	160.964	141.461	110.330	155.485	138.274	102.805
18	Ship	Tanker	40,000	98.319	90.752	71.646	45.812	84.154	66.811	35.263	98.319	90.752	71.646	45.812	84.154	66.811	35.263	168.710	161.081	141.817	115.771	154.429	136.943	105.135
19	Ship	Bulk Carrier	40,000	98.319	90.105	71.013	34.776	84.413	67.480	23.075	98.319	90.105	71.013	34.776	84.413	67.480	23.075	168.710	160.429	141.180	104.644	154.690	137.618	92.847
20	Ship	Tanker	35,000	98.319	91.308	72.650	49.345	84.451	67.257	38.184	98.319	91.308	72.650	49.345	84.451	67.257	38.184	168.710	161.642	142.830	119.333	154.729	137.393	108.080
21	Ship	Bulk Carrier	35,000	98.319	91.890	74.398	41.795	84.516	68.447	25.746	98.319	91.890	74.398	41.795	84.516	68.447	25.746	168.710	162.229	144.592	111.721	154.794	138.593	95.540
22	Ship	Tanker	30,000	98.319	90.506	71.739	51.743	84.167	66.718	42.647	98.319	90.506	71.739	51.743	84.167	66.718	42.647	168.710	160.833	141.911	121.751	154.442	136.849	112.580
23	Ship	Bulk Carrier	30,000	98.319	92.796	76.629	46.258	85.939	71.236	34.443	98.319	92.796	76.629	46.258	85.939	71.236	34.443	168.710	163.142	146.842	116.221	156.229	141.405	104.308
24	Ship	Articulated Tug/Barge	30,000	98.319	90.635	71.925	52.010	85.072	63.928	36.561	98.319	90.635	71.925	52.010	85.072	63.928	36.561	168.710	160.964	142.099	122.020	155.355	134.036	106.444
25	Ship	Tanker	25,000	98.319	91.101	72.854	54.781	85.021	67.833	47.273	98.319	91.101	72.854	54.781	85.021	67.833	47.273	168.710	161.433	143.036	124.814	155.303	137.974	117.243
26	Ship	Articulated Tug/Barge	25,000	98.319	89.937	71.181	52.383	85.668	65.044	41.187	98.319	89.937	71.181	52.383	85.668	65.044	41.187	168.710	160.259	141.349	122.396	155.955	135.161	111.107
27	Ship	Tanker	20,000	98.319	91.166	73.301	55.794	85.215	68.466	48.866	98.319	91.166	73.301	55.794	85.215	68.466	48.866	168.710	161.498	143.486	125.835	155.498	138.611	118.850
28	Ship	Tanker	15,000	98.319	91.101	73.561	59.870	86.444	70.214	55.074	98.319	91.101	73.561	59.870	86.444	70.214	55.074	168.710	161.433	143.749	129.945	156.736	140.374	125.109

Notes:

[1] Perpendicular distances at each channel transition leg (as measured in CADD drawing) from the centerline of vessel transit path to where the loaded/ballasted vessel bow, deckhouse, or mast makes first contact with the bottom chord of the truss superstructure adjacent to Pier 16. The absolute boundaries for "Main Span South" are the centerline of main span (between Piers 15-16) and the centerline of Pier 16. Note that the values for Leg 6 are shown as "N/A" since the extension of this particular vessel transit path occurs well south of the centerline of pier boundary.

SUPERSTRUCTURE CONTACT GEOMETRY - MAIN SPAN SOUTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Main Span South (Pier 16)																				
				Leg 4 [1]							Leg 5 [1]							Leg 6 [1]						
				Centerline of Pier 16	Loaded			Ballasted			Centerline of Pier 16	Loaded			Ballasted			Centerline of Pier 16	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	168.710	159.855	138.386	107.180	150.464	131.261	82.893	168.710	159.855	138.386	107.180	150.464	131.261	82.893	61.162	N/A	N/A	N/A	N/A	N/A	N/A
2	Ship	Tanker	110,000	168.710	160.011	138.724	104.308	151.011	132.161	78.334	168.710	160.011	138.724	104.308	151.011	132.161	78.334	61.162	N/A	N/A	N/A	N/A	N/A	N/A
3	Ship	Tanker	105,000	168.710	161.733	141.274	108.448	151.298	132.649	77.163	168.710	161.733	141.274	108.448	151.298	132.649	77.163	61.162	N/A	N/A	N/A	N/A	N/A	N/A
4	Ship	Bulk Carrier	85,000	168.710	158.081	133.211	75.628	149.730	125.459	0.941	168.710	158.081	133.211	75.628	149.730	125.459	0.941	61.162	N/A	N/A	N/A	N/A	N/A	N/A
5	Ship	Bulk Carrier	80,000	168.710	158.798	134.618	82.986	126.399	150.011	0.941	168.710	158.798	134.618	82.986	126.399	150.011	0.941	61.162	N/A	N/A	N/A	N/A	N/A	N/A
6	Ship	Tanker	75,000	168.710	160.598	140.167	105.094	152.511	134.543	84.661	168.710	160.598	140.167	105.094	152.511	134.543	84.661	61.162	N/A	N/A	N/A	N/A	N/A	N/A
7	Ship	Bulk Carrier	75,000	168.710	159.555	136.080	89.964	149.599	126.345	0.941	168.710	159.555	136.080	89.964	149.599	126.345	0.941	61.162	N/A	N/A	N/A	N/A	N/A	N/A
8	Ship	Tanker	70,000	168.710	160.442	140.036	111.230	151.572	133.286	92.283	168.710	160.442	140.036	111.230	151.572	133.286	92.283	61.162	N/A	N/A	N/A	N/A	N/A	N/A
9	Ship	Bulk Carrier	70,000	168.710	159.946	137.074	93.223	125.351	148.474	0.941	168.710	159.946	137.074	93.223	125.351	148.474	0.941	61.162	N/A	N/A	N/A	N/A	N/A	N/A
10	Ship	Tanker	65,000	168.710	160.546	140.299	111.557	152.198	133.924	94.037	168.710	160.546	140.299	111.557	152.198	133.924	94.037	61.162	N/A	N/A	N/A	N/A	N/A	N/A
11	Ship	Bulk Carrier	65,000	168.710	160.129	137.786	95.289	151.129	129.864	35.499	168.710	160.129	137.786	95.289	151.129	129.864	35.499	61.162	N/A	N/A	N/A	N/A	N/A	N/A
12	Ship	Bulk Carrier	60,000	168.710	160.598	138.968	98.922	151.338	130.214	40.283	168.710	160.598	138.968	98.922	151.338	130.214	40.283	61.162	N/A	N/A	N/A	N/A	N/A	N/A
13	Ship	Tanker	55,000	168.710	161.746	142.286	113.807	154.311	136.474	99.360	168.710	161.746	142.286	113.807	154.311	136.474	99.360	61.162	N/A	N/A	N/A	N/A	N/A	N/A
14	Ship	Bulk Carrier	55,000	168.710	160.351	139.136	99.172	150.829	129.918	30.333	168.710	160.351	139.136	99.172	150.829	129.918	30.333	61.162	N/A	N/A	N/A	N/A	N/A	N/A
15	Ship	Tanker	50,000	168.710	161.003	141.367	109.430	154.481	136.868	97.043	168.710	161.003	141.367	109.430	154.481	136.868	97.043	61.162	N/A	N/A	N/A	N/A	N/A	N/A
16	Ship	Bulk Carrier	50,000	168.710	162.777	143.186	109.594	152.342	133.436	72.697	168.710	162.777	143.186	109.594	152.342	133.436	72.697	61.162	N/A	N/A	N/A	N/A	N/A	N/A
17	Ship	Tanker	45,000	168.710	160.964	141.461	110.330	155.485	138.274	102.805	168.710	160.964	141.461	110.330	155.485	138.274	102.805	61.162	N/A	N/A	N/A	N/A	N/A	N/A
18	Ship	Tanker	40,000	168.710	161.081	141.817	115.771	154.429	136.943	105.135	168.710	161.081	141.817	115.771	154.429	136.943	105.135	61.162	N/A	N/A	N/A	N/A	N/A	N/A
19	Ship	Bulk Carrier	40,000	168.710	160.429	141.180	104.644	154.690	137.618	92.847	168.710	160.429	141.180	104.644	154.690	137.618	92.847	61.162	N/A	N/A	N/A	N/A	N/A	N/A
20	Ship	Tanker	35,000	168.710	161.642	142.830	119.333	154.729	137.393	108.080	168.710	161.642	142.830	119.333	154.729	137.393	108.080	61.162	N/A	N/A	N/A	N/A	N/A	N/A
21	Ship	Bulk Carrier	35,000	168.710	162.229	144.592	111.721	154.794	138.593	95.540	168.710	162.229	144.592	111.721	154.794	138.593	95.540	61.162	N/A	N/A	N/A	N/A	N/A	N/A
22	Ship	Tanker	30,000	168.710	160.833	141.911	121.751	154.442	136.849	112.580	168.710	160.833	141.911	121.751	154.442	136.849	112.580	61.162	N/A	N/A	N/A	N/A	N/A	N/A
23	Ship	Bulk Carrier	30,000	168.710	163.142	146.842	116.221	156.229	141.405	104.308	168.710	163.142	146.842	116.221	156.229	141.405	104.308	61.162	N/A	N/A	N/A	N/A	N/A	N/A
24	Ship	Articulated Tug/Barge	30,000	168.710	160.964	142.099	122.020	155.355	134.036	106.444	168.710	160.964	142.099	122.020	155.355	134.036	106.444	61.162	N/A	N/A	N/A	N/A	N/A	N/A
25	Ship	Tanker	25,000	168.710	161.433	143.036	124.814	155.303	137.974	117.243	168.710	161.433	143.036	124.814	155.303	137.974	117.243	61.162	N/A	N/A	N/A	N/A	N/A	N/A
26	Ship	Articulated Tug/Barge	25,000	168.710	160.259	141.349	122.396	155.955	135.161	111.107	168.710	160.259	141.349	122.396	155.955	135.161	111.107	61.162	N/A	N/A	N/A	N/A	N/A	N/A
27	Ship	Tanker	20,000	168.710	161.498	143.486	125.835	155.498	138.611	118.850	168.710	161.498	143.486	125.835	155.498	138.611	118.850	61.162	N/A	N/A	N/A	N/A	N/A	N/A
28	Ship	Tanker	15,000	168.710	161.433	143.749	129.945	156.736	140.374	125.109	168.710	161.433	143.749	129.945	156.736	140.374	125.109	61.162	N/A	N/A	N/A	N/A	N/A	N/A

SUPERSTRUCTURE CONTACT GEOMETRY - MAIN SPAN NORTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Main Span North (Pier 15)																				
				Leg 1 [1]							Leg 2 [1]							Leg 3 [1]						
				Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	234.213	225.429	204.136	173.185	216.115	197.070	149.097	234.213	225.429	204.136	173.185	216.115	197.070	149.097	166.562	157.707	136.268	105.032	148.315	129.113	80.745
2	Ship	Tanker	110,000	234.213	225.585	204.471	170.337	216.658	197.962	144.575	234.213	225.585	204.471	170.337	216.658	197.962	144.575	166.562	157.863	136.576	102.160	148.863	130.013	76.185
3	Ship	Tanker	105,000	234.213	227.292	207.000	174.443	216.943	198.446	143.414	234.213	227.292	207.000	174.443	216.943	198.446	143.414	166.562	159.585	139.126	106.300	149.150	130.501	75.015
4	Ship	Bulk Carrier	85,000	234.213	223.670	199.004	141.891	215.387	191.314	68.079	234.213	223.670	199.004	141.891	215.387	191.314	68.079	166.562	155.933	131.063	73.480	147.582	123.310	-0.941
5	Ship	Bulk Carrier	80,000	234.213	224.382	200.399	149.189	215.666	192.247	68.079	234.213	224.382	200.399	149.189	215.666	192.247	68.079	166.562	156.650	132.469	80.838	147.863	124.251	-0.941
6	Ship	Tanker	75,000	234.213	226.167	205.903	171.116	218.146	200.324	150.850	234.213	226.167	205.903	171.116	218.146	200.324	150.850	166.562	158.450	138.019	102.946	150.363	132.394	82.513
7	Ship	Bulk Carrier	75,000	234.213	225.132	201.849	156.110	215.257	192.194	68.079	234.213	225.132	201.849	156.110	215.257	192.194	68.079	166.562	157.407	133.932	87.816	147.450	124.197	-0.941
8	Ship	Tanker	70,000	234.213	226.012	205.773	177.202	217.215	199.078	158.410	234.213	226.012	205.773	177.202	217.215	199.078	158.410	166.562	158.294	137.888	109.082	149.424	131.138	90.155
9	Ship	Bulk Carrier	70,000	234.213	225.520	202.835	159.342	214.141	191.208	68.079	234.213	225.520	202.835	159.342	214.141	191.208	68.079	166.562	157.798	134.926	91.074	146.325	123.203	-0.941
10	Ship	Tanker	65,000	234.213	226.115	206.033	177.527	217.836	199.710	160.149	234.213	226.115	206.033	177.527	217.836	199.710	160.149	166.562	158.398	138.151	109.409	150.050	131.776	91.888
11	Ship	Bulk Carrier	65,000	234.213	225.701	203.541	161.392	216.775	195.684	102.090	234.213	225.701	203.541	161.392	216.775	195.684	102.090	166.562	157.981	135.638	93.141	148.981	127.716	33.351
12	Ship	Bulk Carrier	60,000	234.213	226.167	204.713	164.995	216.982	196.031	106.835	234.213	226.167	204.713	164.995	216.982	196.031	106.835	166.562	158.450	136.819	96.774	149.189	128.066	38.134
13	Ship	Tanker	55,000	234.213	227.305	208.004	179.758	219.931	202.240	165.429	234.213	227.305	208.004	179.758	219.931	202.240	165.429	166.562	159.598	140.138	111.659	152.163	134.326	97.212
14	Ship	Bulk Carrier	55,000	234.213	225.921	204.880	165.243	216.477	195.738	96.967	234.213	225.921	204.880	165.243	216.477	195.738	96.967	166.562	158.202	136.988	97.024	148.681	127.770	28.185
15	Ship	Tanker	50,000	234.213	226.568	207.093	175.417	220.100	202.630	163.131	234.213	226.568	207.093	175.417	220.100	202.630	163.131	166.562	158.855	139.219	107.282	152.333	134.719	94.895
16	Ship	Bulk Carrier	50,000	234.213	228.327	208.897	175.579	217.978	199.227	138.985	234.213	228.327	208.897	175.579	217.978	199.227	138.985	166.562	160.628	141.038	107.445	150.194	131.288	70.549
17	Ship	Tanker	45,000	234.213	226.529	207.186	176.309	221.096	204.025	168.846	234.213	226.529	207.186	176.309	221.096	204.025	168.846	166.562	158.815	139.313	108.182	153.337	136.126	100.657
18	Ship	Tanker	40,000	234.213	226.646	207.539	181.706	220.048	202.704	171.157	234.213	226.646	207.539	181.706	220.048	202.704	171.157	166.562	158.933	139.669	113.623	152.281	134.794	102.986
19	Ship	Bulk Carrier	40,000	234.213	225.999	206.907	170.670	220.307	203.374	158.969	234.213	225.999	206.907	170.670	220.307	203.374	158.969	166.562	158.281	139.032	102.496	152.542	135.469	90.699
20	Ship	Tanker	35,000	234.213	227.202	208.544	185.239	220.345	203.151	174.078	234.213	227.202	208.544	185.239	220.345	203.151	174.078	166.562	159.494	140.682	117.185	152.581	135.244	105.932
21	Ship	Bulk Carrier	35,000	234.213	227.784	210.292	177.689	220.410	204.341	161.640	234.213	227.784	210.292	177.689	220.410	204.341	161.640	166.562	160.081	142.444	109.573	152.646	136.444	93.392
22	Ship	Tanker	30,000	234.213	226.400	207.632	187.637	220.061	202.611	178.541	234.213	226.400	207.632	187.637	220.061	202.611	178.541	166.562	158.685	139.763	119.603	152.294	134.701	110.432
23	Ship	Bulk Carrier	30,000	234.213	228.690	212.523	182.152	221.833	207.130	170.337	234.213	228.690	212.523	182.152	221.833	207.130	170.337	166.562	160.994	144.694	114.073	154.081	139.257	102.160
24	Ship	Articulated Tug/Barge	30,000	234.213	226.529	207.818	187.904	220.966	199.822	172.455	234.213	226.529	207.818	187.904	220.966	199.822	172.455	166.562	158.815	139.950	119.872	153.207	131.888	104.295
25	Ship	Tanker	25,000	234.213	226.995	208.748	190.675	220.915	203.183	183.166	234.213	226.995	208.748	190.675	220.915	203.183	183.166	166.562	159.285	140.888	122.666	153.155	135.826	115.095
26	Ship	Articulated Tug/Barge	25,000	234.213	225.831	207.075	188.277	221.561	200.938	177.080	234.213	225.831	207.075	188.277	221.561	200.938	177.080	166.562	158.111	139.200	120.248	153.807	133.013	108.959
27	Ship	Tanker	20,000	234.213	227.060	209.195	191.687	221.109	204.360	184.760	234.213	227.060	209.195	191.687	221.109	204.360	184.760	166.562	159.350	141.338	123.687	153.350	136.463	116.702
28	Ship	Tanker	15,000	234.213	226.995	209.455	195.764	222.338	206.108	190.968	234.213	226.995	209.455	195.764	222.338	206.108	190.968	166.562	159.285	141.600	127.797	154.589	138.226	122.961

Notes:

[1] Perpendicular distances at each channel transition leg (as measured in CADD drawing) from the centerline of vessel transit path to where the loaded/ballasted vessel bow, deckhouse, or mast makes first contact with the bottom chord of the truss superstructure adjacent to Pier 15. The absolute boundaries for "Main Span North" are the centerline of main span (between Piers 15-16) and the centerline of Pier 15.

SUPERSTRUCTURE CONTACT GEOMETRY - MAIN SPAN NORTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Main Span North (Pier 15)																				
				Leg 4 [1]							Leg 5 [1]							Leg 6 [1]						
				Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	166.562	157.707	136.268	105.032	148.315	129.113	80.745	166.562	157.707	136.268	105.032	148.315	129.113	80.745	392.040	383.320	362.113	331.316	374.033	355.082	307.348
2	Ship	Tanker	110,000	166.562	157.863	136.576	102.160	148.863	130.013	76.185	166.562	157.863	136.576	102.160	148.863	130.013	76.185	392.040	383.455	362.447	328.482	374.573	355.970	302.848
3	Ship	Tanker	105,000	166.562	159.585	139.126	106.300	149.150	130.501	75.015	166.562	159.585	139.126	106.300	149.150	130.501	75.015	392.040	385.154	364.963	332.568	374.856	356.451	301.693
4	Ship	Bulk Carrier	85,000	166.562	155.933	131.063	73.480	147.582	123.310	-0.941	166.562	155.933	131.063	73.480	147.582	123.310	-0.941	392.040	381.550	357.006	300.178	373.308	349.355	226.732
5	Ship	Bulk Carrier	80,000	166.562	156.650	132.469	80.838	147.863	124.251	-0.941	166.562	156.650	132.469	80.838	147.863	124.251	-0.941	392.040	382.258	358.394	307.439	373.586	350.283	226.732
6	Ship	Tanker	75,000	166.562	158.450	138.019	102.946	150.363	132.394	82.513	166.562	158.450	138.019	102.946	150.363	132.394	82.513	392.040	384.034	363.871	329.257	376.054	358.320	309.092
7	Ship	Bulk Carrier	75,000	166.562	157.407	133.932	87.816	147.450	124.197	-0.941	166.562	157.407	133.932	87.816	147.450	124.197	-0.941	392.040	383.005	359.838	314.326	373.179	350.230	226.732
8	Ship	Tanker	70,000	166.562	158.294	137.888	109.082	149.424	131.138	90.155	166.562	158.294	137.888	109.082	149.424	131.138	90.155	392.040	383.880	363.742	335.313	375.127	357.080	316.615
9	Ship	Bulk Carrier	70,000	166.562	157.798	134.926	91.074	146.325	123.203	-0.941	166.562	157.798	134.926	91.074	146.325	123.203	-0.941	392.040	383.391	360.818	317.542	372.069	349.249	226.732
10	Ship	Tanker	65,000	166.562	158.398	138.151	109.409	150.050	131.776	91.888	166.562	158.398	138.151	109.409	150.050	131.776	91.888	392.040	383.983	364.001	335.636	375.745	357.710	318.345
11	Ship	Bulk Carrier	65,000	166.562	157.981	135.638	93.141	148.981	127.716	33.351	166.562	157.981	135.638	93.141	148.981	127.716	33.351	392.040	383.571	361.521	319.581	374.689	353.703	260.575
12	Ship	Bulk Carrier	60,000	166.562	158.450	136.819	96.774	149.189	128.066	38.134	166.562	158.450	136.819	96.774	149.189	128.066	38.134	392.040	384.034	362.687	323.166	374.895	354.048	265.296
13	Ship	Tanker	55,000	166.562	159.598	140.138	111.659	152.163	134.326	97.212	166.562	159.598	140.138	111.659	152.163	134.326	97.212	392.040	385.167	365.962	337.857	377.830	360.226	323.599
14	Ship	Bulk Carrier	55,000	166.562	158.202	136.988	97.024	148.681	127.770	28.185	166.562	158.202	136.988	97.024	148.681	127.770	28.185	392.040	383.790	362.854	323.414	374.393	353.756	255.477
15	Ship	Tanker	50,000	166.562	158.855	139.219	107.282	152.333	134.719	94.895	166.562	158.855	139.219	107.282	152.333	134.719	94.895	392.040	384.434	365.056	333.537	377.997	360.615	321.312
16	Ship	Bulk Carrier	50,000	166.562	160.628	141.038	107.445	150.194	131.288	70.549	166.562	160.628	141.038	107.445	150.194	131.288	70.549	392.040	386.184	366.850	333.698	375.886	357.228	297.286
17	Ship	Tanker	45,000	166.562	158.815	139.313	108.182	153.337	136.126	100.657	166.562	158.815	139.313	108.182	153.337	136.126	100.657	392.040	384.395	365.148	334.425	378.988	362.002	326.998
18	Ship	Tanker	40,000	166.562	158.933	139.669	113.623	152.281	134.794	102.986	166.562	158.933	139.669	113.623	152.281	134.794	102.986	392.040	384.511	365.500	339.794	377.946	360.689	329.298
19	Ship	Bulk Carrier	40,000	166.562	158.281	139.032	102.496	152.542	135.469	90.699	166.562	158.281	139.032	102.496	152.542	135.469	90.699	392.040	383.867	364.871	328.813	378.203	361.355	317.171
20	Ship	Tanker	35,000	166.562	159.494	140.682	117.185	152.581	135.244	105.932	166.562	159.494	140.682	117.185	152.581	135.244	105.932	392.040	385.064	366.499	343.310	378.242	361.133	332.205
21	Ship	Bulk Carrier	35,000	166.562	160.081	142.444	109.573	152.646	136.444	93.392	166.562	160.081	142.444	109.573	152.646	136.444	93.392	392.040	385.644	368.238	335.798	378.306	362.317	319.829
22	Ship	Tanker	30,000	166.562	158.685	139.763	119.603	152.294	134.701	110.432	166.562	158.685	139.763	119.603	152.294	134.701	110.432	392.040	384.266	265.592	645.696	377.959	360.596	336.645
23	Ship	Bulk Carrier	30,000	166.562	160.994	144.694	114.073	154.081	139.257	102.160	166.562	160.994	144.694	114.073	154.081	139.257	102.160	392.040	386.545	370.459	340.239	379.722	365.093	328.482
24	Ship	Articulated Tug/Barge	30,000	166.562	158.815	139.950	119.872	153.207	131.888	104.295	166.562	158.815	139.950	119.872	153.207	131.888	104.295	392.040	384.395	365.777	345.962	378.860	357.821	3300.590
25	Ship	Tanker	25,000	166.562	159.285	140.888	122.666	153.155	135.826	115.095	166.562	159.285	140.888	122.666	153.155	135.826	115.095	392.040	384.858	366.702	348.719	378.808	361.706	341.248
26	Ship	Articulated Tug/Barge	25,000	166.562	158.111	139.200	120.248	153.807	133.013	108.959	166.562	158.111	139.200	120.248	153.807	133.013	108.959	392.040	383.700	365.037	346.333	379.452	358.931	335.192
27	Ship	Tanker	20,000	166.562	159.350	141.338	123.687	153.350	136.463	116.702	166.562	159.350	141.338	123.687	153.350	136.463	116.702	392.040	384.923	367.147	349.726	379.001	362.336	342.833
28	Ship	Tanker	15,000	166.562	159.285	141.600	127.797	154.589	138.226	122.961	166.562	159.285	141.600	127.797	154.589	138.226	122.961	392.040	384.858	367.406	353.783	380.224	364.075	349.011

SUPERSTRUCTURE CONTACT GEOMETRY - ANCHOR SPAN NORTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Anchor Span North (Pier 15)																				
				Leg 1 [1]							Leg 2 [1]							Leg 3 [1]						
				Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	234.213	245.148	179.058	375.210	259.854	298.183	375.210	234.213	245.148	179.058	375.210	259.854	298.183	375.210	166.562	177.615	211.778	308.722	192.415	231.060	308.722
2	Ship	Tanker	110,000	234.213	244.971	278.374	375.210	258.812	295.709	375.210	234.213	244.971	278.374	375.210	258.812	295.709	375.210	166.562	177.409	211.088	308.722	191.365	228.566	308.722
3	Ship	Tanker	105,000	234.213	242.726	272.177	375.210	258.267	294.212	375.210	234.213	242.726	272.177	375.210	258.267	294.212	375.210	166.562	175.146	204.840	308.722	190.815	227.056	308.722
4	Ship	Bulk Carrier	85,000	234.213	247.487	292.484	375.210	260.994	375.210	375.210	234.213	247.487	292.484	375.210	260.994	375.210	375.210	166.562	179.946	225.314	308.722	193.565	308.722	308.722
5	Ship	Bulk Carrier	80,000	234.213	246.552	288.165	375.210	260.623	319.588	375.210	234.213	246.552	288.165	375.210	260.623	319.588	375.210	166.562	179.004	220.959	308.722	193.190	252.642	308.722
6	Ship	Tanker	75,000	234.213	244.206	275.450	375.210	255.961	288.395	375.210	234.213	244.206	275.450	375.210	255.961	288.395	375.210	166.562	176.638	208.139	308.722	188.490	221.192	308.722
7	Ship	Bulk Carrier	75,000	234.213	245.566	283.730	375.210	261.168	319.976	375.210	234.213	245.566	283.730	375.210	261.168	319.976	375.210	166.562	178.009	216.488	308.722	193.740	253.033	308.722
8	Ship	Tanker	70,000	234.213	244.410	275.716	375.210	257.746	292.254	375.210	234.213	244.410	275.716	375.210	257.746	292.254	375.210	166.562	176.844	208.407	308.722	190.290	225.082	308.722
9	Ship	Bulk Carrier	70,000	234.213	245.056	281.717	375.210	262.656	375.210	375.210	234.213	245.056	281.717	375.210	262.656	375.210	375.210	166.562	177.495	214.458	308.722	195.240	308.722	308.722
10	Ship	Tanker	65,000	234.213	256.556	275.184	375.210	256.556	290.296	375.210	234.213	256.556	275.184	375.210	256.556	290.296	375.210	166.562	176.706	207.871	308.722	189.090	223.108	308.722
11	Ship	Bulk Carrier	65,000	234.213	244.818	280.274	375.210	258.589	3003.069	375.210	234.213	244.818	280.274	375.210	258.589	3003.069	375.210	166.562	177.255	213.003	308.722	191.140	235.986	308.722
12	Ship	Bulk Carrier	60,000	234.213	244.206	277.881	375.210	258.193	301.848	375.210	234.213	244.206	277.881	375.210	258.193	301.848	375.210	166.562	176.638	210.590	308.722	190.740	234.755	308.722
13	Ship	Tanker	55,000	234.213	242.709	271.158	375.210	252.539	282.933	375.210	234.213	242.709	271.158	375.210	252.539	282.933	375.210	166.562	175.129	203.812	308.722	185.040	215.684	308.722
14	Ship	Bulk Carrier	55,000	234.213	244.529	277.539	375.210	259.160	302.881	375.210	234.213	244.529	277.539	375.210	259.160	302.881	375.210	166.562	176.964	210.246	308.722	191.715	235.797	308.722
15	Ship	Tanker	50,000	234.213	243.679	273.019	375.210	252.217	282.135	375.210	234.213	243.679	273.019	375.210	252.217	282.135	375.210	166.562	176.106	205.688	308.722	184.715	214.880	308.722
16	Ship	Bulk Carrier	50,000	234.213	241.366	269.648	375.210	256.283	291.793	375.210	234.213	241.366	269.648	375.210	256.283	291.793	375.210	166.562	173.775	202.290	308.722	188.815	224.617	308.722
17	Ship	Tanker	45,000	234.213	243.730	272.829	375.210	250.871	279.286	375.210	234.213	243.730	272.829	375.210	250.871	279.286	375.210	166.562	176.158	205.497	308.722	183.358	212.007	308.722
18	Ship	Tanker	40,000	234.213	243.577	272.107	375.210	252.316	281.983	375.210	234.213	243.577	272.107	375.210	252.316	281.983	375.210	166.562	176.003	204.769	308.722	184.815	214.726	308.722
19	Ship	Bulk Carrier	40,000	234.213	244.427	273.399	375.210	251.908	280.615	375.210	234.213	244.427	273.399	375.210	251.908	280.615	375.210	166.562	176.861	206.071	308.722	184.404	213.348	308.722
20	Ship	Tanker	35,000	234.213	242.846	270.119	375.210	251.857	281.071	375.210	234.213	242.846	270.119	375.210	251.857	281.071	375.210	166.562	175.266	202.765	308.722	184.352	213.807	308.722
21	Ship	Bulk Carrier	35,000	234.213	242.080	267.788	375.210	251.772	278.640	375.210	234.213	242.080	267.788	375.210	251.772	278.640	375.210	166.562	174.495	200.415	308.722	184.266	211.356	308.722
22	Ship	Tanker	30,000	234.213	243.900	271.917	375.210	252.291	282.173	375.210	234.213	243.900	271.917	375.210	252.291	282.173	375.210	166.562	176.329	204.578	308.722	184.790	214.918	308.722
23	Ship	Bulk Carrier	30,000	234.213	240.890	264.813	375.210	249.902	272.943	375.210	234.213	240.890	264.813	375.210	249.902	272.943	375.210	166.562	173.295	197.415	308.722	182.381	205.612	308.722
24	Ship	Articulated Tug/Barge	30,000	234.213	243.730	271.537	375.210	251.041	289.950	375.210	234.213	243.730	271.537	375.210	251.041	289.950	375.210	166.562	176.158	204.195	308.722	183.529	222.759	308.722
25	Ship	Tanker	25,000	234.213	243.118	269.846	375.210	251.109	279.894	375.210	234.213	243.118	269.846	375.210	251.109	279.894	375.210	166.562	175.541	202.490	308.722	183.598	212.620	308.722
26	Ship	Articulated Tug/Barge	25,000	234.213	244.648	273.057	375.210	250.259	286.495	375.210	234.213	244.648	273.057	375.210	250.259	286.495	375.210	166.562	177.084	205.727	308.722	182.741	219.275	308.722
27	Ship	Tanker	20,000	234.213	243.033	269.251	323.657	250.854	278.602	375.210	234.213	243.033	269.251	323.657	250.854	278.602	375.210	166.562	175.455	201.890	256.744	183.341	211.318	308.722
28	Ship	Tanker	15,000	234.213	243.118	268.904	300.719	249.239	275.032	375.210	234.213	243.118	268.904	300.719	249.239	275.032	375.210	166.562	175.541	201.540	233.617	181.712	207.718	308.722

Notes:

[1] Perpendicular distances at each channel transition leg (as measured in CADD drawing) from the centerline of vessel transit path to where the loaded/ballasted vessel bow, deckhouse, or mast makes first contact with the bottom chord of the truss superstructure adjacent to Pier 15. The absolute boundaries for "Anchor Span North" are the centerline of Pier 15 and the centerline of Pier 14.

SUPERSTRUCTURE CONTACT GEOMETRY - ANCHOR SPAN NORTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Anchor Span North (Pier 15)																				
				Leg 4 [1]							Leg 5 [1]							Leg 6 [1]						
				Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	166.562	177.615	211.778	308.722	192.415	231.060	308.722	166.562	177.615	211.778	308.722	192.415	231.060	308.722	392.040	402.948	436.663	532.337	417.554	455.693	532.337
2	Ship	Tanker	110,000	166.562	177.409	211.088	308.722	191.365	228.566	308.722	166.562	177.409	211.088	308.722	191.365	228.566	308.722	392.040	402.745	435.982	532.337	416.518	453.231	532.337
3	Ship	Tanker	105,000	166.562	175.146	204.840	308.722	190.815	227.056	308.722	166.562	175.146	204.840	308.722	190.815	227.056	308.722	392.040	400.512	429.816	532.337	415.975	451.741	532.337
4	Ship	Bulk Carrier	85,000	166.562	179.946	225.314	308.722	193.565	308.722	308.722	166.562	179.946	225.314	308.722	193.565	308.722	308.722	392.040	405.249	450.022	532.337	418.689	532.337	532.337
5	Ship	Bulk Carrier	80,000	166.562	179.004	220.959	308.722	193.190	252.642	308.722	166.562	179.004	220.959	308.722	193.190	252.642	308.722	392.040	404.318	445.724	532.337	418.319	476.992	532.337
6	Ship	Tanker	75,000	166.562	176.638	208.139	308.722	188.490	221.192	308.722	166.562	176.638	208.139	308.722	188.490	221.192	308.722	392.040	401.984	433.072	532.337	413.680	445.953	532.337
7	Ship	Bulk Carrier	75,000	166.562	178.009	216.488	308.722	193.740	253.033	308.722	166.562	178.009	216.488	308.722	193.740	253.033	308.722	392.040	403.337	441.312	532.337	418.862	477.377	532.337
8	Ship	Tanker	70,000	166.562	176.844	208.407	308.722	190.290	225.082	308.722	166.562	176.844	208.407	308.722	190.290	225.082	308.722	392.040	402.187	433.337	532.337	415.457	449.793	532.337
9	Ship	Bulk Carrier	70,000	166.562	177.495	214.458	308.722	195.240	308.722	308.722	166.562	177.495	214.458	308.722	195.240	308.722	308.722	392.040	402.830	439.308	532.337	420.342	532.337	532.337
10	Ship	Tanker	65,000	166.562	176.706	207.871	308.722	189.090	223.108	308.722	166.562	176.706	207.871	308.722	189.090	223.108	308.722	392.040	402.051	432.808	532.337	414.273	447.844	532.337
11	Ship	Bulk Carrier	65,000	166.562	177.255	213.003	308.722	191.140	235.986	308.722	166.562	177.255	213.003	308.722	191.140	235.986	308.722	392.040	402.593	437.872	532.337	416.296	460.554	532.337
12	Ship	Bulk Carrier	60,000	166.562	176.638	210.590	308.722	190.740	234.755	308.722	166.562	176.638	210.590	308.722	190.740	234.755	308.722	392.040	401.984	435.491	532.337	415.901	459.339	532.337
13	Ship	Tanker	55,000	166.562	175.129	203.812	308.722	185.040	215.684	308.722	166.562	175.129	203.812	308.722	185.040	215.684	308.722	392.040	400.495	428.801	532.337	410.276	440.518	532.337
14	Ship	Bulk Carrier	55,000	166.562	176.964	210.246	308.722	191.715	235.797	308.722	166.562	176.964	210.246	308.722	191.715	235.797	308.722	392.040	402.305	435.151	532.337	416.863	460.367	532.337
15	Ship	Tanker	50,000	166.562	176.106	205.688	308.722	184.715	214.880	308.722	166.562	176.106	205.688	308.722	184.715	214.880	308.722	392.040	401.459	430.653	532.337	409.955	439.724	532.337
16	Ship	Bulk Carrier	50,000	166.562	173.775	202.290	308.722	188.815	224.617	308.722	166.562	173.775	202.290	308.722	188.815	224.617	308.722	392.040	399.158	427.299	532.337	414.001	449.334	532.337
17	Ship	Tanker	45,000	166.562	176.158	205.497	308.722	183.358	212.007	308.722	166.562	176.158	205.497	308.722	183.358	212.007	308.722	392.040	401.510	430.464	532.337	408.616	436.889	532.337
18	Ship	Tanker	40,000	166.562	176.003	204.769	308.722	184.815	214.726	308.722	166.562	176.003	204.769	308.722	184.815	214.726	308.722	392.040	401.358	429.746	532.337	410.054	439.573	532.337
19	Ship	Bulk Carrier	40,000	166.562	176.861	206.071	308.722	184.404	213.348	308.722	166.562	176.861	206.071	308.722	184.404	213.348	308.722	392.040	402.204	431.031	532.337	409.648	438.212	532.337
20	Ship	Tanker	35,000	166.562	175.266	202.765	308.722	184.352	213.807	308.722	166.562	175.266	202.765	308.722	184.352	213.807	308.722	392.040	400.630	438.666	532.337	409.597	438.666	532.337
21	Ship	Bulk Carrier	35,000	166.562	174.495	200.415	308.722	184.266	211.356	308.722	166.562	174.495	200.415	308.722	184.266	211.356	308.722	392.040	399.869	425.449	532.337	409.512	436.247	532.337
22	Ship	Tanker	30,000	166.562	176.329	204.578	308.722	184.790	214.918	308.722	166.562	176.329	204.578	308.722	184.790	214.918	308.722	392.040	401.679	429.557	532.337	410.029	439.762	532.337
23	Ship	Bulk Carrier	30,000	166.562	173.295	197.415	308.722	182.381	205.612	308.722	166.562	173.295	197.415	308.722	182.381	205.612	308.722	392.040	398.685	422.488	532.337	407.651	430.578	532.337
24	Ship	Articulated Tug/Barge	30,000	166.562	176.158	204.195	308.722	183.529	222.759	308.722	166.562	176.158	204.195	308.722	183.529	222.759	308.722	392.040	401.510	429.179	532.337	408.785	447.500	532.337
25	Ship	Tanker	25,000	166.562	175.541	202.490	308.722	183.598	212.620	308.722	166.562	175.541	202.490	308.722	183.598	212.620	308.722	392.040	400.901	427.497	532.337	408.852	437.494	532.337
26	Ship	Articulated Tug/Barge	25,000	166.562	177.084	205.727	308.722	182.741	219.275	308.722	166.562	177.084	205.727	308.722	182.741	219.275	308.722	392.040	402.423	430.691	532.337	408.007	444.062	532.337
27	Ship	Tanker	20,000	166.562	175.455	201.890	256.744	183.341	211.318	308.722	166.562	175.455	201.890	256.744	183.341	211.318	308.722	392.040	400.816	426.905	481.040	408.599	436.209	532.337
28	Ship	Tanker	15,000	166.562	175.541	201.540	233.617	181.712	207.718	308.722	166.562	175.541	201.540	233.617	181.712	207.718	308.722	392.040	400.901	426.559	458.216	406.991	432.656	532.337

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	2.6979	3.0064	3.0866	2.8329	3.0866	3.0866	55.63	12.40	1.27	58.41	12.73	1.27	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	2.6908	3.0004	3.0866	2.8217	3.0866	3.0866	53.12	11.85	1.22	55.71	12.19	1.22	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	2.7822	3.0478	3.0866	0.00	0.00	0.00	53.66	11.76	1.19	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	2.7130	2.9942	3.0866	2.8074	3.0818	2.9375	47.08	11.95	1.23	48.72	12.30	1.17	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	2.7027	2.9777	3.0866	2.8026	3.0711	2.9367	45.50	12.03	1.25	47.19	12.41	1.19	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	2.5832	2.8724	3.0866	2.7755	2.9790	3.0866	42.11	11.71	1.26	45.24	12.14	1.26	0	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	2.6941	2.9610	3.0866	2.8073	3.0717	2.9367	43.92	12.07	1.26	45.76	12.52	1.20	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	2.5854	2.8743	3.0866	2.7862	2.9932	3.0866	40.72	11.77	1.26	43.88	12.26	1.26	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	2.6897	2.9497	3.0866	2.8201	3.0830	2.9367	42.36	12.08	1.26	44.41	12.62	1.20	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	2.5735	2.8661	3.0866	2.7727	2.9839	3.0866	39.05	11.74	1.26	42.08	12.23	1.26	0	1	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	2.6798	2.9388	3.0866	2.7841	3.0306	3.0866	40.67	12.04	1.26	42.25	12.42	1.26	5	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	2.6605	2.9197	3.0866	2.7715	3.0246	3.0866	38.79	11.92	1.26	40.41	12.35	1.26	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	2.5267	2.8235	3.0866	2.7295	2.9471	3.0866	35.27	11.43	1.25	38.10	11.93	1.25	0	2	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	2.6610	2.9167	3.0866	2.7758	3.0278	3.0866	37.15	11.81	1.25	38.75	12.26	1.25	0	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	2.5369	2.8370	3.0866	2.7267	2.9420	3.0866	33.77	11.33	1.23	36.29	11.75	1.23	3	8	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	2.7630	2.9871	3.0866	0.00	0.00	0.00	36.78	11.93	1.23	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	2.5351	2.8345	3.0866	2.7128	2.9241	3.0866	32.01	11.10	1.21	34.25	11.45	1.21	0	1	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	2.5309	2.8279	3.0866	2.7242	2.9398	3.0866	30.13	10.77	1.18	32.43	11.20	1.18	0	5	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	2.6521	2.8884	3.0866	2.7226	2.9322	3.0866	31.57	11.00	1.18	32.41	11.17	1.18	0	0	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	2.6291	2.8642	3.0866	2.7155	2.9322	3.0866	29.28	10.53	1.13	30.24	10.78	1.13	1	2	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	2.6260	2.8444	3.0866	2.7181	2.9187	3.0866	29.24	10.45	1.13	30.27	10.73	1.13	0	1	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	2.6230	2.8681	3.0866	2.7058	2.9336	3.0866	27.04	10.05	1.08	27.90	10.28	1.08	0	7	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	2.6069	2.8121	3.0866	2.6939	2.8806	3.0866	26.88	9.86	1.08	27.77	10.10	1.08	1	1	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	2.6687	2.8882	3.0866	2.7340	2.9819	3.0866	27.51	10.12	1.08	28.19	10.45	1.08	3	5	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	2.5966	2.8443	3.0866	2.6791	2.9124	3.0866	24.44	9.37	1.02	25.21	9.59	1.02	0	1	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	2.6569	2.8876	3.0866	2.7094	2.9631	3.0866	25.01	9.51	1.02	25.50	9.76	1.02	2	2	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	2.5941	2.8374	3.0758	2.6751	2.9032	3.0866	21.84	8.60	0.93	22.52	8.80	0.94	9	5	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	2.5609	2.8164	3.0157	2.6287	2.8651	3.0856	18.67	7.60	0.81	19.16	7.73	0.83	0	1	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.021995	0.065298	0.123646	0.048464	0.064219	0.212022	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.021510	0.064559	0.138375	0.046722	0.062659	0.239361	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.017058	0.060415	0.128185	0.045916	0.061683	0.246221	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.026548	0.078965	0.258847	0.050414	0.084482	0.567033	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.024578	0.075814	0.227861	0.049506	0.081740	0.572666	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.019868	0.061161	0.140674	0.042152	0.058532	0.218738	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.022572	0.072596	0.198568	0.050749	0.080705	0.572457	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.020275	0.061198	0.112747	0.044902	0.060336	0.176818	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.021543	0.070118	0.186215	0.054176	0.081179	0.568557	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.019859	0.060528	0.113052	0.042838	0.059971	0.172479	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.020919	0.068086	0.180430	0.045944	0.071961	0.450909	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000002	0.000004	0.000000	0.000000	0.000000	0.000006
0.019437	0.065064	0.169452	0.044894	0.071505	0.438946	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.016392	0.056564	0.111704	0.036094	0.056922	0.159807	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.020023	0.063813	0.169231	0.046312	0.071172	0.486906	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.018239	0.057758	0.128666	0.035588	0.055994	0.172868	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000001	0.000002	0.000003	0.000008	0.000014
0.014032	0.056400	0.132598	0.042110	0.062289	0.282213	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.018301	0.057308	0.124992	0.032743	0.053805	0.149721	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.017966	0.056369	0.101709	0.035614	0.055563	0.134016	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000004	0.000007
0.019655	0.056902	0.150832	0.034946	0.053909	0.197095	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.016450	0.054267	0.089805	0.034583	0.054761	0.122217	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000001	0.000000	0.000001	0.000001	0.000004
0.015077	0.050059	0.129243	0.034534	0.050751	0.187559	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.018113	0.054915	0.076958	0.034814	0.055755	0.100426	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000004	0.000008
0.012736	0.044956	0.116516	0.030373	0.044960	0.154585	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000001	0.000000	0.000000	0.000001	0.000002
0.018736	0.055532	0.074627	0.033759	0.068598	0.114408	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000001	0.000001	0.000001	0.000002	0.000003	0.000007
0.016246	0.052107	0.068122	0.031799	0.053819	0.083906	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.020145	0.055948	0.071433	0.031536	0.066212	0.099136	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000001	0.000001	0.000000	0.000001	0.000001	0.000003
0.016055	0.050739	0.065364	0.031217	0.052065	0.078971	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000001	0.000003	0.000004	0.000001	0.000002	0.000002	0.000012
0.015447	0.048541	0.049640	0.026761	0.048388	0.058361	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
																		Total for Pier:	**0.000072**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	2.6979	3.0064	3.0866	2.8329	3.0866	3.0866	55.63	12.40	1.27	58.41	12.73	1.27	0	0	10.20	0.000003	0.000003
2	Ship	Tanker	110,000	2.6908	3.0004	3.0866	2.8217	3.0866	3.0866	53.12	11.85	1.22	55.71	12.19	1.22	0	0	10.20	0.000003	0.000003
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	2.7822	3.0478	3.0866	0.00	0.00	0.00	53.66	11.76	1.19	0	0	10.20	0.000003	0.000003
4	Ship	Bulk Carrier	85,000	2.7130	2.9942	3.0866	2.8074	3.0818	2.9375	47.08	11.95	1.23	48.72	12.30	1.17	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	2.7027	2.9777	3.0866	2.8026	3.0711	2.9367	45.50	12.03	1.25	47.19	12.41	1.19	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	2.5832	2.8724	3.0866	2.7755	2.9790	3.0866	42.11	11.71	1.26	45.24	12.14	1.26	0	0	1.64	0.000003	0.000013
7	Ship	Bulk Carrier	75,000	2.6941	2.9610	3.0866	2.8073	3.0717	2.9367	43.92	12.07	1.26	45.76	12.52	1.20	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	2.5854	2.8743	3.0866	2.7862	2.9932	3.0866	40.72	11.77	1.26	43.88	12.26	1.26	0	0	1.64	0.000003	0.000013
9	Ship	Bulk Carrier	70,000	2.6897	2.9497	3.0866	2.8201	3.0830	2.9367	42.36	12.08	1.26	44.41	12.62	1.20	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	2.5735	2.8661	3.0866	2.7727	2.9839	3.0866	39.05	11.74	1.26	42.08	12.23	1.26	0	1	1.64	0.000003	0.000013
11	Ship	Bulk Carrier	65,000	2.6798	2.9388	3.0866	2.7841	3.0306	3.0866	40.67	12.04	1.26	42.25	12.42	1.26	5	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	2.6605	2.9197	3.0866	2.7715	3.0246	3.0866	38.79	11.92	1.26	40.41	12.35	1.26	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	2.5267	2.8235	3.0866	2.7295	2.9471	3.0866	35.27	11.43	1.25	38.10	11.93	1.25	0	2	1.64	0.000003	0.000013
14	Ship	Bulk Carrier	55,000	2.6610	2.9167	3.0866	2.7758	3.0278	3.0866	37.15	11.81	1.25	38.75	12.26	1.25	0	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	2.5369	2.8370	3.0866	2.7267	2.9420	3.0866	33.77	11.33	1.23	36.29	11.75	1.23	3	8	1.64	0.000003	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	2.7630	2.9871	3.0866	0.00	0.00	0.00	36.78	11.93	1.23	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	2.5351	2.8345	3.0866	2.7128	2.9241	3.0866	32.01	11.10	1.21	34.25	11.45	1.21	0	1	1.64	0.000003	0.000013
18	Ship	Tanker	40,000	2.5309	2.8279	3.0866	2.7242	2.9398	3.0866	30.13	10.77	1.18	32.43	11.20	1.18	0	5	1.64	0.000003	0.000013
19	Ship	Bulk Carrier	40,000	2.6521	2.8884	3.0866	2.7226	2.9322	3.0866	31.57	11.00	1.18	32.41	11.17	1.18	0	0	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	2.6291	2.8642	3.0866	2.7155	2.9322	3.0866	29.28	10.53	1.13	30.24	10.78	1.13	1	2	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	2.6260	2.8444	3.0866	2.7181	2.9187	3.0866	29.24	10.45	1.13	30.27	10.73	1.13	0	1	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	2.6230	2.8681	3.0866	2.7058	2.9336	3.0866	27.04	10.05	1.08	27.90	10.28	1.08	0	7	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	2.6069	2.8121	3.0866	2.6939	2.8806	3.0866	26.88	9.86	1.08	27.77	10.10	1.08	1	1	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	2.6687	2.8882	3.0866	2.7340	2.9819	3.0866	27.51	10.12	1.08	28.19	10.45	1.08	3	5	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	2.5966	2.8443	3.0866	2.6791	2.9124	3.0866	24.44	9.37	1.02	25.21	9.59	1.02	0	1	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	2.6569	2.8876	3.0866	2.7094	2.9631	3.0866	25.01	9.51	1.02	25.50	9.76	1.02	2	2	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	2.5941	2.8374	3.0758	2.6751	2.9032	3.0866	21.84	8.60	0.93	22.52	8.80	0.94	9	5	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	2.5609	2.8164	3.0157	2.6287	2.8651	3.0856	18.67	7.60	0.81	19.16	7.73	0.83	0	1	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.021995	0.065298	0.123646	0.048464	0.064219	0.212022	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.021510	0.064559	0.138375	0.046722	0.062659	0.239361	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.017058	0.060415	0.128185	0.045916	0.061683	0.246221	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.026548	0.078965	0.258847	0.050414	0.084482	0.567033	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.024578	0.075814	0.227861	0.049506	0.081740	0.572666	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.019868	0.061161	0.140674	0.042152	0.058532	0.218738	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.022572	0.072596	0.198568	0.050749	0.080705	0.572457	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.020275	0.061198	0.112747	0.044902	0.060336	0.176818	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.021543	0.070118	0.186215	0.054176	0.081179	0.568557	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.019859	0.060528	0.113052	0.042838	0.059971	0.172479	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002	0.000004
0.020919	0.068086	0.180430	0.045944	0.071961	0.450909	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000001	0.000004	0.000009	0.000000	0.000000	0.000000	0.000014
0.019437	0.065064	0.169452	0.044894	0.071505	0.438946	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.016392	0.056564	0.111704	0.036094	0.056922	0.159807	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000004	0.000007
0.020023	0.063813	0.169231	0.046312	0.071172	0.486906	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.018239	0.057758	0.128666	0.035588	0.055994	0.172868	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000001	0.000001	0.000004	0.000006	0.000018	0.000030
0.014032	0.056400	0.132598	0.042110	0.062289	0.282213	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.018301	0.057308	0.124992	0.032743	0.053805	0.149721	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.017966	0.056369	0.101709	0.035614	0.055563	0.134016	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000002	0.000004	0.000009	0.000015
0.019655	0.056902	0.150832	0.034946	0.053909	0.197095	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.016450	0.054267	0.089805	0.034583	0.054761	0.122217	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000001	0.000001	0.000001	0.000001	0.000003	0.000008
0.015077	0.050059	0.129243	0.034534	0.050751	0.187559	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.018113	0.054915	0.076958	0.034814	0.055755	0.100426	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000003	0.000005	0.000009	0.000018
0.012736	0.044956	0.116516	0.030373	0.044960	0.154585	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000001	0.000000	0.000000	0.000002	0.000004
0.018736	0.055532	0.074627	0.033759	0.068598	0.114408	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000001	0.000002	0.000002	0.000002	0.000004	0.000006	0.000016
0.016246	0.052107	0.068122	0.031799	0.053819	0.083906	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002
0.020145	0.055948	0.071433	0.031536	0.066212	0.099136	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000001	0.000001	0.000001	0.000001	0.000002	0.000007
0.016055	0.050739	0.065364	0.031217	0.052065	0.078971	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000002	0.000006	0.000008	0.000002	0.000003	0.000005	0.000027
0.015447	0.048541	0.049640	0.026761	0.048388	0.058361	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002
																		Total for Pier:	**0.000160**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	1.6794	1.9903	2.4424	1.8154	2.0936	2.7942	34.63	8.21	1.01	37.43	8.63	1.15	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	1.6593	1.9716	2.4764	1.7913	2.0678	2.8573	32.76	7.78	0.98	35.36	8.16	1.13	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.7734	2.0412	2.8380	0.00	0.00	0.00	34.21	7.87	1.09	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	1.9115	2.1950	2.8515	2.0067	2.2834	3.0866	33.17	8.76	1.14	34.82	9.11	1.23	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	1.8967	2.1739	2.7658	2.2681	1.9974	3.0866	31.93	8.78	1.12	38.19	8.07	1.25	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	1.5794	1.8710	2.3716	1.9734	2.1786	2.7480	25.75	7.62	0.97	32.17	8.88	1.12	0	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	1.8880	2.1571	2.6858	2.0021	2.2687	3.0866	30.78	8.79	1.09	32.64	9.25	1.26	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	1.5816	1.8729	2.2840	1.9841	2.1929	2.6610	24.91	7.67	0.94	31.25	8.98	1.09	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	1.8835	2.1457	2.6484	2.2801	2.0150	3.0866	29.66	8.79	1.08	35.91	8.25	1.26	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	1.5489	1.8439	2.2626	1.9540	2.1669	2.6317	23.51	7.56	0.93	29.65	8.88	1.08	0	1	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	1.8577	2.1189	2.6157	1.9629	2.2115	3.0866	28.19	8.68	1.07	29.79	9.06	1.26	5	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	1.8108	2.0722	2.5560	1.9227	2.1779	3.0866	26.40	8.46	1.04	28.03	8.89	1.26	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	1.4451	1.7443	2.1823	1.8651	2.0845	2.5410	20.17	7.06	0.88	26.04	8.44	1.03	0	2	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	1.8064	2.0642	2.5499	1.9221	2.1763	3.0866	25.22	8.36	1.03	26.83	8.81	1.25	0	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	1.4531	1.7557	2.2478	1.8605	2.0776	2.5684	19.34	7.01	0.90	24.76	8.30	1.03	3	8	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.9235	2.1494	2.8752	0.00	0.00	0.00	25.60	8.58	1.15	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	1.4467	1.7485	2.2303	1.8428	2.0559	2.4949	18.27	6.84	0.87	23.27	8.05	0.98	0	1	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	1.4378	1.7372	2.1420	1.8505	2.0679	2.4634	17.12	6.62	0.82	22.03	7.88	0.94	0	5	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	1.7816	2.0199	2.4721	1.8527	2.0640	2.6182	21.21	7.69	0.94	22.06	7.86	1.00	0	0	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	1.7427	1.9798	2.2759	1.8298	2.0483	2.4177	19.41	7.28	0.84	20.38	7.53	0.89	1	2	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	1.7476	1.9679	2.3783	1.8405	2.0428	2.5804	19.46	7.23	0.87	20.50	7.51	0.95	0	1	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	1.7046	1.9517	2.2150	1.7881	2.0178	2.3347	17.57	6.84	0.78	18.43	7.07	0.82	0	7	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	1.7140	1.9209	2.3096	1.8018	1.9899	2.4608	17.67	6.73	0.81	18.58	6.98	0.86	1	1	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	1.8440	2.0652	2.3007	1.9098	2.1598	2.4833	19.01	7.24	0.81	19.69	7.57	0.87	3	5	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	1.6418	1.8916	2.1389	1.7250	1.9603	2.2417	15.45	6.23	0.70	16.24	6.46	0.74	0	1	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	1.7920	2.0246	2.2577	1.8449	2.1007	2.3965	16.87	6.67	0.74	17.36	6.92	0.79	2	2	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	1.6362	1.8815	2.1219	1.7179	1.9479	2.2171	13.77	5.70	0.64	14.46	5.90	0.67	9	5	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	1.5367	1.7943	1.9953	1.6051	1.8434	2.0657	11.20	4.84	0.54	11.70	4.97	0.56	0	1	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.005393	0.019042	0.048414	0.012570	0.020479	0.099732	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005131	0.018347	0.054138	0.011776	0.019397	0.113887	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004072	0.016916	0.048626	0.011673	0.019178	0.118428	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.006205	0.022832	0.122812	0.012422	0.026760	0.440230	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005648	0.021413	0.101673	0.037477	0.025446	0.467721	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004559	0.016649	0.053155	0.010173	0.017207	0.097044	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005163	0.020233	0.084025	0.012366	0.025185	0.442201	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004656	0.016687	0.040960	0.010902	0.017966	0.075035	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004915	0.019377	0.076755	0.038940	0.025641	0.466454	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004348	0.015797	0.039635	0.009900	0.017052	0.070195	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.004558	0.017996	0.071182	0.010618	0.021010	0.276545	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000001	0.000002	0.000000	0.000000	0.000000	0.000003
0.003904	0.015887	0.061764	0.009609	0.019528	0.254375	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003125	0.012890	0.034866	0.007249	0.014104	0.057218	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.003971	0.015393	0.060985	0.009815	0.019312	0.301344	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003477	0.013244	0.041536	0.007103	0.013759	0.062651	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000001	0.000004	0.000005
0.002853	0.013532	0.044601	0.009183	0.016909	0.129512	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003452	0.013011	0.039772	0.006421	0.012896	0.051254	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.003350	0.012632	0.030782	0.006963	0.013404	0.045084	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000002	0.000002
0.003722	0.012984	0.050166	0.006892	0.013042	0.072997	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002950	0.011665	0.025670	0.006522	0.012764	0.039221	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.002757	0.010809	0.039421	0.006660	0.011956	0.066836	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002976	0.010992	0.020274	0.006010	0.012078	0.029329	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002
0.002218	0.009138	0.032919	0.005564	0.009921	0.049393	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.004031	0.014103	0.023925	0.007531	0.018938	0.042421	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000003
0.002388	0.009361	0.016056	0.004914	0.010495	0.021766	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003880	0.012943	0.021064	0.006260	0.016411	0.032806	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002337	0.009002	0.015125	0.004773	0.010008	0.019998	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000001	0.000001	0.000000	0.000000	0.000001	0.000003
0.001846	0.007205	0.009507	0.003339	0.007662	0.011973	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000024**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	1.8154	2.0936	2.7942	0.00	0.00	0.00	37.43	8.63	1.15	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	1.7913	2.0678	2.8573	0.00	0.00	0.00	35.36	8.16	1.13	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.7734	2.0412	2.8380	0.00	0.00	0.00	34.21	7.87	1.09	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	2.0067	2.2834	3.0866	0.00	0.00	0.00	34.82	9.11	1.23	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	2.2681	1.9974	3.0866	0.00	0.00	0.00	38.19	8.07	1.25	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.9734	2.1786	2.7480	0.00	0.00	0.00	32.17	8.88	1.12	0	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	2.0021	2.2687	3.0866	0.00	0.00	0.00	32.64	9.25	1.26	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	1.5816	1.8729	2.2840	1.9841	2.1929	2.6610	24.91	7.67	0.94	31.25	8.98	1.09	1	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	2.2801	2.0150	3.0866	0.00	0.00	0.00	35.91	8.25	1.26	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	1.5489	1.8439	2.2626	1.9540	2.1669	2.6317	23.51	7.56	0.93	29.65	8.88	1.08	2	0	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.9629	2.2115	3.0866	0.00	0.00	0.00	29.79	9.06	1.26	0	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.9227	2.1779	3.0866	0.00	0.00	0.00	28.03	8.89	1.26	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.8651	2.0845	2.5410	0.00	0.00	0.00	26.04	8.44	1.03	0	1	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	1.8064	2.0642	2.5499	1.9221	2.1763	3.0866	25.22	8.36	1.03	26.83	8.81	1.25	1	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	1.4531	1.7557	2.2478	1.8605	2.0776	2.5684	19.34	7.01	0.90	24.76	8.30	1.03	7	4	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.9235	2.1494	2.8752	0.00	0.00	0.00	25.60	8.58	1.15	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	1.4467	1.7485	2.2303	1.8428	2.0559	2.4949	18.27	6.84	0.87	23.27	8.05	0.98	1	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	1.4378	1.7372	2.1420	1.8505	2.0679	2.4634	17.12	6.62	0.82	22.03	7.88	0.94	5	0	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	1.7816	2.0199	2.4721	1.8527	2.0640	2.6182	21.21	7.69	0.94	22.06	7.86	1.00	0	0	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	1.7427	1.9798	2.2759	1.8298	2.0483	2.4177	19.41	7.28	0.84	20.38	7.53	0.89	2	1	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	1.7476	1.9679	2.3783	1.8405	2.0428	2.5804	19.46	7.23	0.87	20.50	7.51	0.95	1	0	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	1.7046	1.9517	2.2150	1.7881	2.0178	2.3347	17.57	6.84	0.78	18.43	7.07	0.82	7	1	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	1.7140	1.9209	2.3096	1.8018	1.9899	2.4608	17.67	6.73	0.81	18.58	6.98	0.86	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	1.8440	2.0652	2.3007	1.9098	2.1598	2.4833	19.01	7.24	0.81	19.69	7.57	0.87	5	3	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	1.6418	1.8916	2.1389	1.7250	1.9603	2.2417	15.45	6.23	0.70	16.24	6.46	0.74	1	0	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	1.7920	2.0246	2.2577	1.8449	2.1007	2.3965	16.87	6.67	0.74	17.36	6.92	0.79	2	1	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	1.6362	1.8815	2.1219	1.7179	1.9479	2.2171	13.77	5.70	0.64	14.46	5.90	0.67	4	10	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	1.5367	1.7943	1.9953	1.6051	1.8434	2.0657	11.20	4.84	0.54	11.70	4.97	0.56	1	0	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.005393	0.019042	0.048414	0.012570	0.020479	0.099732	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005131	0.018347	0.054138	0.011776	0.019397	0.113887	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004072	0.016916	0.048626	0.011673	0.019178	0.118428	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.006205	0.022832	0.122812	0.012422	0.026760	0.440230	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005648	0.021413	0.101673	0.037477	0.025446	0.467721	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004559	0.016649	0.053155	0.010173	0.017207	0.097044	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005163	0.020233	0.084025	0.012366	0.025185	0.442201	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004656	0.016687	0.040960	0.010902	0.017966	0.075035	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004915	0.019377	0.076755	0.038940	0.025641	0.466454	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004348	0.015797	0.039635	0.009900	0.017052	0.070195	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004558	0.017996	0.071182	0.010618	0.021010	0.276545	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003904	0.015887	0.061764	0.009609	0.019528	0.254375	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003125	0.012890	0.034866	0.007249	0.014104	0.057218	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003971	0.015393	0.060985	0.009815	0.019312	0.301344	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003477	0.013244	0.041536	0.007103	0.013759	0.062651	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.002853	0.013532	0.044601	0.009183	0.016909	0.129512	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003452	0.013011	0.039772	0.006421	0.012896	0.051254	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003350	0.012632	0.030782	0.006963	0.013404	0.045084	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003722	0.012984	0.050166	0.006892	0.013042	0.072997	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002950	0.011665	0.025670	0.006522	0.012764	0.039221	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002757	0.010809	0.039421	0.006660	0.011956	0.066836	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002976	0.010992	0.020274	0.006010	0.012078	0.029329	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002218	0.009138	0.032919	0.005564	0.009921	0.049393	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004031	0.014103	0.023925	0.007531	0.018938	0.042421	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002388	0.009361	0.016056	0.004914	0.010495	0.021766	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003880	0.012943	0.021064	0.006260	0.016411	0.032806	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002337	0.009002	0.015125	0.004773	0.010008	0.019998	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.001846	0.007205	0.009507	0.003339	0.007662	0.011973	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000006**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	1.8154	2.0936	2.7942	0.00	0.00	0.00	37.43	8.63	1.15	0	0	10.20	0.000004	0.000004
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	1.7913	2.0678	2.8573	0.00	0.00	0.00	35.36	8.16	1.13	0	0	10.20	0.000004	0.000004
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.7734	2.0412	2.8380	0.00	0.00	0.00	34.21	7.87	1.09	0	0	10.20	0.000004	0.000004
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	2.0067	2.2834	3.0866	0.00	0.00	0.00	34.82	9.11	1.23	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	2.2681	1.9974	3.0866	0.00	0.00	0.00	38.19	8.07	1.25	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.9734	2.1786	2.7480	0.00	0.00	0.00	32.17	8.88	1.12	0	0	1.64	0.000004	0.000013
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	2.0021	2.2687	3.0866	0.00	0.00	0.00	32.64	9.25	1.26	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	1.5816	1.8729	2.2840	1.9841	2.1929	2.6610	24.91	7.67	0.94	31.25	8.98	1.09	1	0	1.64	0.000004	0.000013
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	2.2801	2.0150	3.0866	0.00	0.00	0.00	35.91	8.25	1.26	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	1.5489	1.8439	2.2626	1.9540	2.1669	2.6317	23.51	7.56	0.93	29.65	8.88	1.08	2	0	1.64	0.000004	0.000013
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.9629	2.2115	3.0866	0.00	0.00	0.00	29.79	9.06	1.26	0	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.9227	2.1779	3.0866	0.00	0.00	0.00	28.03	8.89	1.26	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.8651	2.0845	2.5410	0.00	0.00	0.00	26.04	8.44	1.03	0	1	1.64	0.000004	0.000013
14	Ship	Bulk Carrier	55,000	1.8064	2.0642	2.5499	1.9221	2.1763	3.0866	25.22	8.36	1.03	26.83	8.81	1.25	1	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	1.4531	1.7557	2.2478	1.8605	2.0776	2.5684	19.34	7.01	0.90	24.76	8.30	1.03	7	4	1.64	0.000004	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.9235	2.1494	2.8752	0.00	0.00	0.00	25.60	8.58	1.15	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	1.4467	1.7485	2.2303	1.8428	2.0559	2.4949	18.27	6.84	0.87	23.27	8.05	0.98	1	0	1.64	0.000004	0.000013
18	Ship	Tanker	40,000	1.4378	1.7372	2.1420	1.8505	2.0679	2.4634	17.12	6.62	0.82	22.03	7.88	0.94	5	0	1.64	0.000004	0.000013
19	Ship	Bulk Carrier	40,000	1.7816	2.0199	2.4721	1.8527	2.0640	2.6182	21.21	7.69	0.94	22.06	7.86	1.00	0	0	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	1.7427	1.9798	2.2759	1.8298	2.0483	2.4177	19.41	7.28	0.84	20.38	7.53	0.89	2	1	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	1.7476	1.9679	2.3783	1.8405	2.0428	2.5804	19.46	7.23	0.87	20.50	7.51	0.95	1	0	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	1.7046	1.9517	2.2150	1.7881	2.0178	2.3347	17.57	6.84	0.78	18.43	7.07	0.82	7	1	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	1.7140	1.9209	2.3096	1.8018	1.9899	2.4608	17.67	6.73	0.81	18.58	6.98	0.86	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	1.8440	2.0652	2.3007	1.9098	2.1598	2.4833	19.01	7.24	0.81	19.69	7.57	0.87	5	3	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	1.6418	1.8916	2.1389	1.7250	1.9603	2.2417	15.45	6.23	0.70	16.24	6.46	0.74	1	0	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	1.7920	2.0246	2.2577	1.8449	2.1007	2.3965	16.87	6.67	0.74	17.36	6.92	0.79	2	1	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	1.6362	1.8815	2.1219	1.7179	1.9479	2.2171	13.77	5.70	0.64	14.46	5.90	0.67	4	10	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	1.5367	1.7943	1.9953	1.6051	1.8434	2.0657	11.20	4.84	0.54	11.70	4.97	0.56	1	0	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.005393	0.019042	0.048414	0.012570	0.020479	0.099732	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005131	0.018347	0.054138	0.011776	0.019397	0.113887	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004072	0.016916	0.048626	0.011673	0.019178	0.118428	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.006205	0.022832	0.122812	0.012422	0.026760	0.440230	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005648	0.021413	0.101673	0.037477	0.025446	0.467721	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004559	0.016649	0.053155	0.010173	0.017207	0.097044	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005163	0.020233	0.084025	0.012366	0.025185	0.442201	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004656	0.016687	0.040960	0.010902	0.017966	0.075035	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004915	0.019377	0.076755	0.038940	0.025641	0.466454	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004348	0.015797	0.039635	0.009900	0.017052	0.070195	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004558	0.017996	0.071182	0.010618	0.021010	0.276545	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003904	0.015887	0.061764	0.009609	0.019528	0.254375	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003125	0.012890	0.034866	0.007249	0.014104	0.057218	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003971	0.015393	0.060985	0.009815	0.019312	0.301344	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003477	0.013244	0.041536	0.007103	0.013759	0.062651	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000002	0.000003
0.002853	0.013532	0.044601	0.009183	0.016909	0.129512	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003452	0.013011	0.039772	0.006421	0.012896	0.051254	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003350	0.012632	0.030782	0.006963	0.013404	0.045084	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003722	0.012984	0.050166	0.006892	0.013042	0.072997	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002950	0.011665	0.025670	0.006522	0.012764	0.039221	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002757	0.010809	0.039421	0.006660	0.011956	0.066836	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002976	0.010992	0.020274	0.006010	0.012078	0.029329	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000002
0.002218	0.009138	0.032919	0.005564	0.009921	0.049393	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004031	0.014103	0.023925	0.007531	0.018938	0.042421	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000001	0.000000	0.000000	0.000001	0.000002
0.002388	0.009361	0.016056	0.004914	0.010495	0.021766	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003880	0.012943	0.021064	0.006260	0.016411	0.032806	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002337	0.009002	0.015125	0.004773	0.010008	0.019998	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000003
0.001846	0.007205	0.009507	0.003339	0.007662	0.011973	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000013**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	1	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	2	0	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	1	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	1	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	7	4	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	1	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	5	0	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	2	1	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	1	0	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	7	1	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	5	3	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	1	0	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	2	1	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	4	10	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	1	0	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.277428	0.000000	0.000000	0.277428	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.279537	0.000000	0.000000	0.279537	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.278673	0.000000	0.000000	0.278673	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.282064	0.000000	0.000000	0.282064	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.283043	0.000000	0.000000	0.283043	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.282306	0.000000	0.000000	0.282306	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.283043	0.000000	0.000000	0.283043	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.282306	0.000000	0.000000	0.282306	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.283043	0.000000	0.000000	0.283043	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.285918	0.000000	0.000000	0.285918	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.286471	0.000000	0.000000	0.286471	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.292284	0.000000	0.000000	0.292284	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.295439	0.000000	0.000000	0.295439	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.293303	0.000000	0.000000	0.293303	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.295807	0.000000	0.000000	0.295807	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.290333	0.000000	0.000000	0.290333	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.296557	0.000000	0.000000	0.296557	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.297322	0.000000	0.000000	0.297322	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.296557	0.000000	0.000000	0.296557	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.299719	0.000000	0.000000	0.299719	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.298104	0.000000	0.000000	0.298104	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.305977	0.000000	0.000000	0.305977	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.300978	0.000000	0.000000	0.300978	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.287035	0.000000	0.000000	0.287035	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.312789	0.000000	0.000000	0.312789	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.295439	0.000000	0.000000	0.295439	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.313360	0.000000	0.000000	0.313360	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.325034	0.000000	0.000000	0.325034	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.7296	1.0380	1.4863	0.8645	1.1403	1.8352	15.04	4.28	0.61	17.83	4.70	0.76	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.6975	1.0072	1.5079	0.8285	1.1027	1.8857	13.77	3.98	0.60	16.36	4.35	0.74	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.6821	0.9735	1.4411	0.8308	1.0964	1.8866	13.16	3.76	0.56	16.02	4.23	0.73	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	1.1637	1.4449	2.0960	1.2581	1.5326	2.9375	20.19	5.77	0.84	21.83	6.12	1.17	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	1.1448	1.4198	2.0068	1.2447	1.5132	2.9367	19.27	5.74	0.81	20.96	6.11	1.19	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.6435	0.9327	1.4292	1.2241	1.4276	1.9924	10.49	3.80	0.58	19.95	5.82	0.81	0	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	1.1362	1.4031	1.9275	1.2494	1.5138	2.9367	18.52	5.72	0.79	20.37	6.17	1.20	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.6457	0.9346	1.3424	1.2347	1.4418	1.9061	10.17	3.83	0.55	19.45	5.90	0.78	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	1.1318	1.3918	1.8904	1.2622	1.5251	2.9367	17.82	5.70	0.77	19.88	6.24	1.20	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.5936	0.8861	1.3015	1.1891	1.4003	1.8613	9.01	3.63	0.53	18.05	5.74	0.76	0	1	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	1.0912	1.3502	1.8429	1.1955	1.4421	2.5362	16.56	5.53	0.76	18.14	5.91	1.04	5	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	1.0290	1.2779	1.7577	1.1296	1.3827	2.4604	15.00	5.22	0.72	16.47	5.65	1.00	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.5140	0.7337	1.1681	1.0580	1.2756	1.7284	7.18	2.97	0.47	14.77	5.16	0.70	0	2	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	1.0290	1.2653	1.7470	1.1244	1.3764	2.5767	14.36	5.12	0.71	15.70	5.57	1.04	0	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.5140	0.7428	1.2309	1.0517	1.2670	1.7539	6.84	2.97	0.49	14.00	5.06	0.70	3	8	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	1.0290	1.2478	1.6459	1.1393	1.3633	2.0831	13.70	4.98	0.66	15.16	5.44	0.83	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	0.5140	0.7314	1.2092	1.0307	1.2420	1.6774	6.49	2.86	0.47	13.01	4.86	0.66	0	1	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	0.5140	0.7156	1.1172	1.0348	1.2504	1.6426	6.12	2.73	0.43	12.32	4.76	0.63	0	5	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	1.0290	1.2063	1.6549	1.0404	1.2500	1.7997	12.25	4.60	0.63	12.39	4.76	0.69	0	0	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	1.0290	1.1516	1.4453	1.0290	1.2196	1.5860	11.46	4.23	0.53	11.46	4.48	0.58	1	2	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	1.0290	1.1475	1.5546	1.0290	1.2218	1.7550	11.46	4.22	0.57	11.46	4.49	0.64	0	1	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	1.0290	1.0935	1.3546	1.0290	1.1591	1.4734	10.61	3.83	0.47	10.61	4.06	0.52	0	7	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	1.0290	1.0872	1.4727	1.0290	1.1557	1.6227	10.61	3.81	0.52	10.61	4.05	0.57	1	1	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	1.0751	1.2945	1.5280	1.1403	1.3883	1.7092	11.08	4.54	0.54	11.76	4.87	0.60	3	5	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	1.0290	1.0290	1.2449	1.0290	1.0751	1.3468	9.68	3.39	0.41	9.68	3.54	0.44	0	1	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.2161	1.4473	1.0380	1.2916	1.5851	9.68	4.01	0.48	9.77	4.25	0.52	2	2	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	1.0290	1.0290	1.2251	1.0290	1.0525	1.3194	8.66	3.12	0.37	8.66	3.19	0.40	9	5	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	1.0290	1.0290	1.0368	1.0290	1.0290	1.1067	7.50	2.78	0.28	7.50	2.78	0.30	0	1	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000716	0.002966	0.009898	0.001760	0.003455	0.024408	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000656	0.002754	0.010935	0.001585	0.003142	0.027946	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000524	0.002519	0.009591	0.001592	0.003137	0.029547	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000766	0.003429	0.029712	0.001612	0.004364	0.185488	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000682	0.003127	0.022973	0.001531	0.004057	0.184921	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000552	0.002360	0.010224	0.001292	0.002612	0.021876	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000621	0.002919	0.017992	0.001578	0.004024	0.184907	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000565	0.002369	0.007572	0.001392	0.002759	0.016120	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000590	0.002773	0.016015	0.001709	0.004141	0.184659	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000493	0.002104	0.006927	0.001180	0.002452	0.014170	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000513	0.002417	0.013943	0.001262	0.003086	0.086941	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000391	0.001908	0.010806	0.001023	0.002593	0.072915	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000292	0.001420	0.005134	0.000712	0.001674	0.009615	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000391	0.001814	0.010485	0.001028	0.002531	0.092929	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000324	0.001463	0.006306	0.000691	0.001617	0.010643	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000293	0.001620	0.007310	0.001008	0.002262	0.028980	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000317	0.001417	0.005924	0.000612	0.001474	0.008190	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000303	0.001352	0.004342	0.000658	0.001532	0.007031	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000343	0.001420	0.007814	0.000660	0.001503	0.012645	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000253	0.001181	0.003372	0.000586	0.001389	0.005748	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000243	0.001111	0.005595	0.000618	0.001329	0.011037	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000225	0.000995	0.002354	0.000475	0.001173	0.003750	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000183	0.000870	0.004260	0.000482	0.001017	0.007190	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000446	0.001818	0.003809	0.000863	0.002634	0.007741	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000154	0.000727	0.001594	0.000333	0.000917	0.002322	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000366	0.001445	0.002930	0.000608	0.001951	0.005082	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000149	0.000688	0.001470	0.000318	0.000822	0.002112	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000089	0.000424	0.000702	0.000167	0.000477	0.000942	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000003**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.7296	1.0380	1.4863	0.8645	1.1403	1.8352	15.04	4.28	0.61	17.83	4.70	0.76	0	0	10.20	0.000003	0.000003
2	Ship	Tanker	110,000	0.6975	1.0072	1.5079	0.8285	1.1027	1.8857	13.77	3.98	0.60	16.36	4.35	0.74	0	0	10.20	0.000003	0.000003
3	Ship	Tanker	105,000	0.6821	0.9735	1.4411	0.8308	1.0964	1.8866	13.16	3.76	0.56	16.02	4.23	0.73	0	0	10.20	0.000003	0.000003
4	Ship	Bulk Carrier	85,000	1.1637	1.4449	2.0960	1.2581	1.5326	2.9375	20.19	5.77	0.84	21.83	6.12	1.17	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	1.1448	1.4198	2.0068	1.2447	1.5132	2.9367	19.27	5.74	0.81	20.96	6.11	1.19	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.6435	0.9327	1.4292	1.2241	1.4276	1.9924	10.49	3.80	0.58	19.95	5.82	0.81	0	0	1.64	0.000003	0.000013
7	Ship	Bulk Carrier	75,000	1.1362	1.4031	1.9275	1.2494	1.5138	2.9367	18.52	5.72	0.79	20.37	6.17	1.20	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.6457	0.9346	1.3424	1.2347	1.4418	1.9061	10.17	3.83	0.55	19.45	5.90	0.78	0	0	1.64	0.000003	0.000013
9	Ship	Bulk Carrier	70,000	1.1318	1.3918	1.8904	1.2622	1.5251	2.9367	17.82	5.70	0.77	19.88	6.24	1.20	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.5936	0.8861	1.3015	1.1891	1.4003	1.8613	9.01	3.63	0.53	18.05	5.74	0.76	0	1	1.64	0.000003	0.000013
11	Ship	Bulk Carrier	65,000	1.0912	1.3502	1.8429	1.1955	1.4421	2.5362	16.56	5.53	0.76	18.14	5.91	1.04	5	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	1.0290	1.2779	1.7577	1.1296	1.3827	2.4604	15.00	5.22	0.72	16.47	5.65	1.00	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.5140	0.7337	1.1681	1.0580	1.2756	1.7284	7.18	2.97	0.47	14.77	5.16	0.70	0	2	1.64	0.000003	0.000013
14	Ship	Bulk Carrier	55,000	1.0290	1.2653	1.7470	1.1244	1.3764	2.5767	14.36	5.12	0.71	15.70	5.57	1.04	0	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.5140	0.7428	1.2309	1.0517	1.2670	1.7539	6.84	2.97	0.49	14.00	5.06	0.70	3	8	1.64	0.000003	0.000013
16	Ship	Bulk Carrier	50,000	1.0290	1.2478	1.6459	1.1393	1.3633	2.0831	13.70	4.98	0.66	15.16	5.44	0.83	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	0.5140	0.7314	1.2092	1.0307	1.2420	1.6774	6.49	2.86	0.47	13.01	4.86	0.66	0	1	1.64	0.000003	0.000013
18	Ship	Tanker	40,000	0.5140	0.7156	1.1172	1.0348	1.2504	1.6426	6.12	2.73	0.43	12.32	4.76	0.63	0	5	1.64	0.000003	0.000013
19	Ship	Bulk Carrier	40,000	1.0290	1.2063	1.6549	1.0404	1.2500	1.7997	12.25	4.60	0.63	12.39	4.76	0.69	0	0	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	1.0290	1.1516	1.4453	1.0290	1.2196	1.5860	11.46	4.23	0.53	11.46	4.48	0.58	1	2	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	1.0290	1.1475	1.5546	1.0290	1.2218	1.7550	11.46	4.22	0.57	11.46	4.49	0.64	0	1	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	1.0290	1.0935	1.3546	1.0290	1.1591	1.4734	10.61	3.83	0.47	10.61	4.06	0.52	0	7	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	1.0290	1.0872	1.4727	1.0290	1.1557	1.6227	10.61	3.81	0.52	10.61	4.05	0.57	1	1	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	1.0751	1.2945	1.5280	1.1403	1.3883	1.7092	11.08	4.54	0.54	11.76	4.87	0.60	3	5	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	1.0290	1.0290	1.2449	1.0290	1.0751	1.3468	9.68	3.39	0.41	9.68	3.54	0.44	0	1	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.2161	1.4473	1.0380	1.2916	1.5851	9.68	4.01	0.48	9.77	4.25	0.52	2	2	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	1.0290	1.0290	1.2251	1.0290	1.0525	1.3194	8.66	3.12	0.37	8.66	3.19	0.40	9	5	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	1.0290	1.0290	1.0368	1.0290	1.0290	1.1067	7.50	2.78	0.28	7.50	2.78	0.30	0	1	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000716	0.002966	0.009898	0.001760	0.003455	0.024408	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000656	0.002754	0.010935	0.001585	0.003142	0.027946	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000524	0.002519	0.009591	0.001592	0.003137	0.029547	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000766	0.003429	0.029712	0.001612	0.004364	0.185488	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000682	0.003127	0.022973	0.001531	0.004057	0.184921	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000552	0.002360	0.010224	0.001292	0.002612	0.021876	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000621	0.002919	0.017992	0.001578	0.004024	0.184907	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000565	0.002369	0.007572	0.001392	0.002759	0.016120	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000590	0.002773	0.016015	0.001709	0.004141	0.184659	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000493	0.002104	0.006927	0.001180	0.002452	0.014170	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000513	0.002417	0.013943	0.001262	0.003086	0.086941	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000001
0.000391	0.001908	0.010806	0.001023	0.002593	0.072915	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000292	0.001420	0.005134	0.000712	0.001674	0.009615	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000391	0.001814	0.010485	0.001028	0.002531	0.092929	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000324	0.001463	0.006306	0.000691	0.001617	0.010643	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.000293	0.001620	0.007310	0.001008	0.002262	0.028980	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000317	0.001417	0.005924	0.000612	0.001474	0.008190	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000303	0.001352	0.004342	0.000658	0.001532	0.007031	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000343	0.001420	0.007814	0.000660	0.001503	0.012645	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000253	0.001181	0.003372	0.000586	0.001389	0.005748	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000243	0.001111	0.005595	0.000618	0.001329	0.011037	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000225	0.000995	0.002354	0.000475	0.001173	0.003750	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000183	0.000870	0.004260	0.000482	0.001017	0.007190	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000446	0.001818	0.003809	0.000863	0.002634	0.007741	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000154	0.000727	0.001594	0.000333	0.000917	0.002322	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000366	0.001445	0.002930	0.000608	0.001951	0.005082	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000149	0.000688	0.001470	0.000318	0.000822	0.002112	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000089	0.000424	0.000702	0.000167	0.000477	0.000942	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000007**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	1.7105	2.0210	2.4735	1.8465	2.1247	2.8253	35.27	8.33	1.02	38.07	8.76	1.17	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	1.6908	2.0031	2.5079	1.8229	2.0993	2.8888	33.38	7.91	0.99	35.99	8.29	1.14	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	1.6544	1.9482	2.4196	1.8043	2.0721	2.8689	31.91	7.52	0.93	34.80	7.99	1.11	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	1.9359	2.2195	2.8760	2.0311	2.3079	3.0866	33.60	8.86	1.15	35.25	9.21	1.23	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	1.9213	2.1985	2.7904	2.0220	2.2927	3.0866	32.35	8.88	1.13	34.04	9.26	1.25	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	1.6100	1.9017	2.4023	1.9979	2.2031	2.7725	26.25	7.75	0.98	32.57	8.98	1.13	0	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	1.9126	2.1817	2.7104	2.0268	2.2933	3.0866	31.18	8.89	1.10	33.04	9.35	1.26	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	1.6123	1.9035	2.3147	2.0087	2.2174	2.6853	25.39	7.79	0.95	31.63	9.08	1.10	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	1.9081	2.1703	2.6731	2.0397	2.3047	3.0866	30.05	8.89	1.09	32.12	9.44	1.26	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	1.5802	1.8752	2.2939	1.9790	2.1920	2.6568	23.98	7.68	0.94	30.03	8.98	1.09	0	1	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	1.8828	2.1440	2.6408	1.9880	2.2366	3.0866	28.57	8.78	1.08	30.17	9.16	1.26	5	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	1.8368	2.0981	2.5819	1.9487	2.2039	3.0866	26.78	8.57	1.05	28.41	9.00	1.26	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	1.4781	1.7774	2.2153	1.8915	2.1109	2.5674	20.63	7.20	0.90	26.41	8.55	1.04	0	2	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	1.8325	2.0903	2.5760	1.9482	2.2024	3.0866	25.58	8.46	1.04	27.20	8.92	1.25	0	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	1.4862	1.7888	2.2809	1.8869	2.1041	2.5949	19.78	7.14	0.91	25.12	8.40	1.04	3	8	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	1.8245	2.0586	2.4600	1.9492	2.1751	2.9008	24.28	8.22	0.98	25.94	8.69	1.16	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	1.4800	1.7818	2.2636	1.8694	2.0824	2.5215	18.69	6.97	0.89	23.60	8.15	0.99	0	1	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	1.4711	1.7706	2.1754	1.8772	2.0946	2.4901	17.51	6.75	0.83	22.35	7.98	0.95	0	5	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	1.8082	2.0465	2.4987	1.8792	2.0906	2.6448	21.53	7.80	0.95	22.37	7.96	1.01	0	0	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	1.7698	2.0068	2.3030	1.8569	2.0754	2.4448	19.71	7.37	0.85	20.68	7.63	0.90	1	2	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	1.7745	1.9947	2.4052	1.8673	2.0696	2.6072	19.76	7.33	0.88	20.79	7.61	0.96	0	1	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	1.7327	1.9798	2.2430	1.8161	2.0459	2.3628	17.86	6.94	0.79	18.72	7.17	0.83	0	7	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	1.7413	1.9482	2.3368	1.8290	2.0172	2.4881	17.95	6.83	0.82	18.86	7.07	0.87	1	1	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	1.8692	2.0904	2.3259	1.9349	2.1850	2.5085	19.27	7.33	0.82	19.95	7.66	0.88	3	5	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	1.6710	1.9207	2.1681	1.7542	1.9894	2.2709	15.73	6.33	0.71	16.51	6.55	0.75	0	1	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	1.8184	2.0510	2.2841	1.8713	2.1271	2.4229	17.11	6.76	0.75	17.61	7.01	0.80	2	2	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	1.6655	1.9108	2.1512	1.7472	1.9772	2.2463	14.02	5.79	0.65	14.71	5.99	0.68	9	5	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	1.5680	1.8256	2.0266	1.6364	1.8747	2.0970	11.43	4.92	0.55	11.93	5.06	0.57	0	1	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.005695	0.019969	0.050437	0.013253	0.021454	0.103225	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005424	0.019292	0.056372	0.012428	0.020344	0.117852	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004304	0.017795	0.050677	0.012315	0.020111	0.122495	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.006566	0.024002	0.127119	0.013123	0.028055	0.446683	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005980	0.022530	0.105455	0.012716	0.026693	0.448849	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004826	0.017536	0.055422	0.010754	0.018083	0.100668	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005467	0.021296	0.087300	0.013070	0.026417	0.448771	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004930	0.017574	0.042761	0.011522	0.018871	0.077901	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005206	0.020401	0.079816	0.014053	0.026885	0.447321	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004612	0.016666	0.041438	0.010483	0.017943	0.073048	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.004836	0.018979	0.074145	0.011245	0.022091	0.283866	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000001	0.000003	0.000000	0.000000	0.000000	0.000003
0.004154	0.016808	0.064531	0.010207	0.020587	0.261734	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003332	0.013670	0.036620	0.007717	0.014919	0.059839	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.004228	0.016291	0.063747	0.010429	0.020367	0.309361	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003707	0.014042	0.043580	0.007563	0.014560	0.065494	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000005	0.000007
0.003035	0.014319	0.046711	0.009746	0.017827	0.134290	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003683	0.013800	0.041752	0.006842	0.013657	0.053682	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.003575	0.013406	0.032369	0.007420	0.014194	0.047253	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.003970	0.013770	0.052589	0.007342	0.013809	0.076260	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003153	0.012398	0.027049	0.006960	0.013534	0.041177	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.002945	0.011485	0.041443	0.007101	0.012671	0.069920	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.003192	0.011717	0.021433	0.006435	0.012845	0.030907	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.002374	0.009731	0.034701	0.005944	0.010539	0.051867	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.004278	0.014893	0.025086	0.007985	0.019947	0.044283	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000001	0.000000	0.000001	0.000002	0.000003
0.002572	0.010021	0.017046	0.005284	0.011207	0.023041	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004136	0.013720	0.022163	0.006667	0.017358	0.034397	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002518	0.009641	0.016068	0.005135	0.010692	0.021186	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000001	0.000001	0.000000	0.000000	0.000001	0.000004
0.002004	0.007771	0.010174	0.003619	0.008248	0.012787	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000031**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	1.7105	2.0210	2.4735	1.8465	2.1247	2.8253	35.27	8.33	1.02	38.07	8.76	1.17	5	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	1.6908	2.0031	2.5079	1.8229	2.0993	2.8888	33.38	7.91	0.99	35.99	8.29	1.14	3	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	1.6544	1.9482	2.4196	1.8043	2.0721	2.8689	31.91	7.52	0.93	34.80	7.99	1.11	1	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	1.9359	2.2195	2.8760	2.0311	2.3079	3.0866	33.60	8.86	1.15	35.25	9.21	1.23	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	1.9213	2.1985	2.7904	2.0220	2.2927	3.0866	32.35	8.88	1.13	34.04	9.26	1.25	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	1.6100	1.9017	2.4023	1.9979	2.2031	2.7725	26.25	7.75	0.98	32.57	8.98	1.13	2	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	1.9126	2.1817	2.7104	2.0268	2.2933	3.0866	31.18	8.89	1.10	33.04	9.35	1.26	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	1.6123	1.9035	2.3147	2.0087	2.2174	2.6853	25.39	7.79	0.95	31.63	9.08	1.10	1	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	1.9081	2.1703	2.6731	2.0397	2.3047	3.0866	30.05	8.89	1.09	32.12	9.44	1.26	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	1.5802	1.8752	2.2939	1.9790	2.1920	2.6568	23.98	7.68	0.94	30.03	8.98	1.09	2	0	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	1.8828	2.1440	2.6408	1.9880	2.2366	3.0866	28.57	8.78	1.08	30.17	9.16	1.26	2	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	1.8368	2.0981	2.5819	1.9487	2.2039	3.0866	26.78	8.57	1.05	28.41	9.00	1.26	1	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	1.4781	1.7774	2.2153	1.8915	2.1109	2.5674	20.63	7.20	0.90	26.41	8.55	1.04	3	1	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	1.8325	2.0903	2.5760	1.9482	2.2024	3.0866	25.58	8.46	1.04	27.20	8.92	1.25	1	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	1.4862	1.7888	2.2809	1.8869	2.1041	2.5949	19.78	7.14	0.91	25.12	8.40	1.04	7	4	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	1.8245	2.0586	2.4600	1.9492	2.1751	2.9008	24.28	8.22	0.98	25.94	8.69	1.16	1	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	1.4800	1.7818	2.2636	1.8694	2.0824	2.5215	18.69	6.97	0.89	23.60	8.15	0.99	1	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	1.4711	1.7706	2.1754	1.8772	2.0946	2.4901	17.51	6.75	0.83	22.35	7.98	0.95	5	0	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	1.8082	2.0465	2.4987	1.8792	2.0906	2.6448	21.53	7.80	0.95	22.37	7.96	1.01	0	0	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	1.7698	2.0068	2.3030	1.8569	2.0754	2.4448	19.71	7.37	0.85	20.68	7.63	0.90	2	1	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	1.7745	1.9947	2.4052	1.8673	2.0696	2.6072	19.76	7.33	0.88	20.79	7.61	0.96	1	0	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	1.7327	1.9798	2.2430	1.8161	2.0459	2.3628	17.86	6.94	0.79	18.72	7.17	0.83	7	1	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	1.7413	1.9482	2.3368	1.8290	2.0172	2.4881	17.95	6.83	0.82	18.86	7.07	0.87	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	1.8692	2.0904	2.3259	1.9349	2.1850	2.5085	19.27	7.33	0.82	19.95	7.66	0.88	5	3	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	1.6710	1.9207	2.1681	1.7542	1.9894	2.2709	15.73	6.33	0.71	16.51	6.55	0.75	1	0	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	1.8184	2.0510	2.2841	1.8713	2.1271	2.4229	17.11	6.76	0.75	17.61	7.01	0.80	2	1	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	1.6655	1.9108	2.1512	1.7472	1.9772	2.2463	14.02	5.79	0.65	14.71	5.99	0.68	4	10	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	1.5680	1.8256	2.0266	1.6364	1.8747	2.0970	11.43	4.92	0.55	11.93	5.06	0.57	1	0	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.005695	0.019969	0.050437	0.013253	0.021454	0.103225	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000001
0.005424	0.019292	0.056372	0.012428	0.020344	0.117852	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000001
0.004304	0.017795	0.050677	0.012315	0.020111	0.122495	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.006566	0.024002	0.127119	0.013123	0.028055	0.446683	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005980	0.022530	0.105455	0.012716	0.026693	0.448849	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004826	0.017536	0.055422	0.010754	0.018083	0.100668	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005467	0.021296	0.087300	0.013070	0.026417	0.448771	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004930	0.017574	0.042761	0.011522	0.018871	0.077901	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005206	0.020401	0.079816	0.014053	0.026885	0.447321	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004612	0.016666	0.041438	0.010483	0.017943	0.073048	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004836	0.018979	0.074145	0.011245	0.022091	0.283866	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004154	0.016808	0.064531	0.010207	0.020587	0.261734	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003332	0.013670	0.036620	0.007717	0.014919	0.059839	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004228	0.016291	0.063747	0.010429	0.020367	0.309361	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003707	0.014042	0.043580	0.007563	0.014560	0.065494	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.003035	0.014319	0.046711	0.009746	0.017827	0.134290	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003683	0.013800	0.041752	0.006842	0.013657	0.053682	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003575	0.013406	0.032369	0.007420	0.014194	0.047253	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003970	0.013770	0.052589	0.007342	0.013809	0.076260	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003153	0.012398	0.027049	0.006960	0.013534	0.041177	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002945	0.011485	0.041443	0.007101	0.012671	0.069920	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003192	0.011717	0.021433	0.006435	0.012845	0.030907	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002374	0.009731	0.034701	0.005944	0.010539	0.051867	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004278	0.014893	0.025086	0.007985	0.019947	0.044283	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002572	0.010021	0.017046	0.005284	0.011207	0.023041	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004136	0.013720	0.022163	0.006667	0.017358	0.034397	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002518	0.009641	0.016068	0.005135	0.010692	0.021186	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002004	0.007771	0.010174	0.003619	0.008248	0.012787	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000008**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	1.7105	2.0210	2.4735	1.8465	2.1247	2.8253	35.27	8.33	1.02	38.07	8.76	1.17	5	0	10.20	0.000004	0.000004
2	Ship	Tanker	110,000	1.6908	2.0031	2.5079	1.8229	2.0993	2.8888	33.38	7.91	0.99	35.99	8.29	1.14	3	0	10.20	0.000004	0.000004
3	Ship	Tanker	105,000	1.6544	1.9482	2.4196	1.8043	2.0721	2.8689	31.91	7.52	0.93	34.80	7.99	1.11	1	0	10.20	0.000004	0.000004
4	Ship	Bulk Carrier	85,000	1.9359	2.2195	2.8760	2.0311	2.3079	3.0866	33.60	8.86	1.15	35.25	9.21	1.23	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	1.9213	2.1985	2.7904	2.0220	2.2927	3.0866	32.35	8.88	1.13	34.04	9.26	1.25	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	1.6100	1.9017	2.4023	1.9979	2.2031	2.7725	26.25	7.75	0.98	32.57	8.98	1.13	2	0	1.64	0.000004	0.000013
7	Ship	Bulk Carrier	75,000	1.9126	2.1817	2.7104	2.0268	2.2933	3.0866	31.18	8.89	1.10	33.04	9.35	1.26	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	1.6123	1.9035	2.3147	2.0087	2.2174	2.6853	25.39	7.79	0.95	31.63	9.08	1.10	1	0	1.64	0.000004	0.000013
9	Ship	Bulk Carrier	70,000	1.9081	2.1703	2.6731	2.0397	2.3047	3.0866	30.05	8.89	1.09	32.12	9.44	1.26	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	1.5802	1.8752	2.2939	1.9790	2.1920	2.6568	23.98	7.68	0.94	30.03	8.98	1.09	2	0	1.64	0.000004	0.000013
11	Ship	Bulk Carrier	65,000	1.8828	2.1440	2.6408	1.9880	2.2366	3.0866	28.57	8.78	1.08	30.17	9.16	1.26	2	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	1.8368	2.0981	2.5819	1.9487	2.2039	3.0866	26.78	8.57	1.05	28.41	9.00	1.26	1	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	1.4781	1.7774	2.2153	1.8915	2.1109	2.5674	20.63	7.20	0.90	26.41	8.55	1.04	3	1	1.64	0.000004	0.000013
14	Ship	Bulk Carrier	55,000	1.8325	2.0903	2.5760	1.9482	2.2024	3.0866	25.58	8.46	1.04	27.20	8.92	1.25	1	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	1.4862	1.7888	2.2809	1.8869	2.1041	2.5949	19.78	7.14	0.91	25.12	8.40	1.04	7	4	1.64	0.000004	0.000013
16	Ship	Bulk Carrier	50,000	1.8245	2.0586	2.4600	1.9492	2.1751	2.9008	24.28	8.22	0.98	25.94	8.69	1.16	1	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	1.4800	1.7818	2.2636	1.8694	2.0824	2.5215	18.69	6.97	0.89	23.60	8.15	0.99	1	0	1.64	0.000004	0.000013
18	Ship	Tanker	40,000	1.4711	1.7706	2.1754	1.8772	2.0946	2.4901	17.51	6.75	0.83	22.35	7.98	0.95	5	0	1.64	0.000004	0.000013
19	Ship	Bulk Carrier	40,000	1.8082	2.0465	2.4987	1.8792	2.0906	2.6448	21.53	7.80	0.95	22.37	7.96	1.01	0	0	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	1.7698	2.0068	2.3030	1.8569	2.0754	2.4448	19.71	7.37	0.85	20.68	7.63	0.90	2	1	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	1.7745	1.9947	2.4052	1.8673	2.0696	2.6072	19.76	7.33	0.88	20.79	7.61	0.96	1	0	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	1.7327	1.9798	2.2430	1.8161	2.0459	2.3628	17.86	6.94	0.79	18.72	7.17	0.83	7	1	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	1.7413	1.9482	2.3368	1.8290	2.0172	2.4881	17.95	6.83	0.82	18.86	7.07	0.87	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	1.8692	2.0904	2.3259	1.9349	2.1850	2.5085	19.27	7.33	0.82	19.95	7.66	0.88	5	3	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	1.6710	1.9207	2.1681	1.7542	1.9894	2.2709	15.73	6.33	0.71	16.51	6.55	0.75	1	0	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	1.8184	2.0510	2.2841	1.8713	2.1271	2.4229	17.11	6.76	0.75	17.61	7.01	0.80	2	1	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	1.6655	1.9108	2.1512	1.7472	1.9772	2.2463	14.02	5.79	0.65	14.71	5.99	0.68	4	10	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	1.5680	1.8256	2.0266	1.6364	1.8747	2.0970	11.43	4.92	0.55	11.93	5.06	0.57	1	0	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.005695	0.019969	0.050437	0.013253	0.021454	0.103225	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000001	0.000002	0.000000	0.000000	0.000000	0.000003
0.005424	0.019292	0.056372	0.012428	0.020344	0.117852	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000002
0.004304	0.017795	0.050677	0.012315	0.020111	0.122495	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.006566	0.024002	0.127119	0.013123	0.028055	0.446683	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005980	0.022530	0.105455	0.012716	0.026693	0.448849	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004826	0.017536	0.055422	0.010754	0.018083	0.100668	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005467	0.021296	0.087300	0.013070	0.026417	0.448771	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004930	0.017574	0.042761	0.011522	0.018871	0.077901	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005206	0.020401	0.079816	0.014053	0.026885	0.447321	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004612	0.016666	0.041438	0.010483	0.017943	0.073048	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004836	0.018979	0.074145	0.011245	0.022091	0.283866	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000001
0.004154	0.016808	0.064531	0.010207	0.020587	0.261734	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003332	0.013670	0.036620	0.007717	0.014919	0.059839	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.004228	0.016291	0.063747	0.010429	0.020367	0.309361	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003707	0.014042	0.043580	0.007563	0.014560	0.065494	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.003035	0.014319	0.046711	0.009746	0.017827	0.134290	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003683	0.013800	0.041752	0.006842	0.013657	0.053682	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003575	0.013406	0.032369	0.007420	0.014194	0.047253	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003970	0.013770	0.052589	0.007342	0.013809	0.076260	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003153	0.012398	0.027049	0.006960	0.013534	0.041177	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002945	0.011485	0.041443	0.007101	0.012671	0.069920	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003192	0.011717	0.021433	0.006435	0.012845	0.030907	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000002
0.002374	0.009731	0.034701	0.005944	0.010539	0.051867	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004278	0.014893	0.025086	0.007985	0.019947	0.044283	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.002572	0.010021	0.017046	0.005284	0.011207	0.023041	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004136	0.013720	0.022163	0.006667	0.017358	0.034397	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002518	0.009641	0.016068	0.005135	0.010692	0.021186	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002
0.002004	0.007771	0.010174	0.003619	0.008248	0.012787	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000019**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.5140	0.5140	0.5140	0.5140	0.5140	0.5140	10.60	2.12	0.21	10.60	2.12	0.21	5	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.5140	0.5140	0.5140	0.5140	0.5140	0.5140	10.15	2.03	0.20	10.15	2.03	0.20	3	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.5140	0.5140	0.5140	0.5140	0.5140	0.5140	9.91	1.98	0.20	9.91	1.98	0.20	1	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.1288	17.86	4.11	0.41	17.86	4.11	0.45	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.1179	17.32	4.16	0.42	17.32	4.16	0.45	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	8.38	2.09	0.21	16.77	4.19	0.42	2	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.1179	16.77	4.19	0.42	16.77	4.19	0.46	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	8.09	2.10	0.21	16.21	4.21	0.42	1	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.1179	16.21	4.21	0.42	16.21	4.21	0.46	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	7.80	2.11	0.21	15.62	4.22	0.42	2	0	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	15.62	4.22	0.42	15.62	4.22	0.42	2	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	15.00	4.20	0.42	15.00	4.20	0.42	1	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	7.18	2.08	0.21	14.36	4.17	0.42	3	1	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	14.36	4.17	0.42	14.36	4.17	0.42	1	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.84	2.05	0.21	13.70	4.11	0.41	7	4	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	13.70	4.11	0.41	13.70	4.11	0.41	1	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.49	2.01	0.20	12.99	4.03	0.40	1	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.12	1.96	0.20	12.25	3.92	0.39	5	0	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	12.25	3.92	0.39	12.25	3.92	0.39	0	0	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	11.46	3.78	0.38	11.46	3.78	0.38	2	1	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	11.46	3.78	0.38	11.46	3.78	0.38	1	0	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	7	1	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	5	3	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	9.68	3.39	0.34	9.68	3.39	0.34	1	0	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	9.68	3.39	0.34	9.68	3.39	0.34	2	1	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	8.66	3.12	0.31	8.66	3.12	0.31	4	10	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	7.50	2.78	0.28	7.50	2.78	0.28	1	0	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] $AF = (N)(GF)(PA)(PG)(PC)(PF)$

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000000	0.000002	0.000015	0.000001	0.000003	0.000058	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000002	0.000015	0.000001	0.000002	0.000064	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000002	0.000013	0.000001	0.000003	0.000072	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000002	0.000063	0.000001	0.000003	0.001931	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000002	0.000040	0.000001	0.000003	0.001857	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000012	0.000001	0.000002	0.000038	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000002	0.000027	0.000001	0.000003	0.001857	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000008	0.000001	0.000002	0.000024	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000022	0.000001	0.000003	0.001857	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000006	0.000000	0.000001	0.000017	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000015	0.000000	0.000002	0.000355	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000008	0.000000	0.000001	0.000205	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000002	0.000000	0.000000	0.000006	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000007	0.000000	0.000001	0.000316	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000003	0.000000	0.000000	0.000006	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000005	0.000000	0.000001	0.000042	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000003	0.000000	0.000000	0.000004	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000002	0.000000	0.000000	0.000003	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000004	0.000000	0.000000	0.000008	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000002	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000002	0.000000	0.000000	0.000006	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000089	0.000089	0.000000	0.000000	0.000001	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000003	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000002	0.000000	0.000001	0.000001	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000002	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	10.60	2.12	0.21	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	10.15	2.03	0.20	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	9.91	1.98	0.20	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	17.86	4.11	0.41	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	17.32	4.16	0.42	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.77	4.19	0.42	0	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.77	4.19	0.42	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	8.09	2.10	0.21	16.21	4.21	0.42	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.21	4.21	0.42	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	7.80	2.11	0.21	15.62	4.22	0.42	0	1	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.62	4.22	0.42	0	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.00	4.20	0.42	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	14.36	4.17	0.42	0	2	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	14.36	4.17	0.42	14.36	4.17	0.42	0	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.84	2.05	0.21	13.70	4.11	0.41	3	8	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	13.70	4.11	0.41	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.49	2.01	0.20	12.99	4.03	0.40	0	1	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.12	1.96	0.20	12.25	3.92	0.39	0	5	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	12.25	3.92	0.39	12.25	3.92	0.39	0	0	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	11.46	3.78	0.38	11.46	3.78	0.38	1	2	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	11.46	3.78	0.38	11.46	3.78	0.38	0	1	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	0	7	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	1	1	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	3	5	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	9.68	3.39	0.34	9.68	3.39	0.34	0	1	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	9.68	3.39	0.34	9.68	3.39	0.34	2	2	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	8.66	3.12	0.31	8.66	3.12	0.31	9	5	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	7.50	2.78	0.28	7.50	2.78	0.28	0	1	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000623	0.000623	0.001727	0.001139	0.000491	0.000097	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000571	0.000786	0.000225	0.001028	0.000458	0.000096	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000485	0.000839	0.000316	0.001048	0.000483	0.000110	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000615	0.000711	0.000096	0.000981	0.000441	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000561	0.000691	0.000113	0.000938	0.000406	0.000021	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000487	0.000700	0.000221	0.000860	0.000431	0.000117	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000526	0.000698	0.000141	0.000949	0.000396	0.000020	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000495	0.000695	0.000218	0.000903	0.000409	0.000096	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000507	0.000702	0.000156	0.000976	0.000388	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000762	0.000262	0.000181	0.000762	0.000360	0.000084	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000439	0.000602	0.000136	0.000785	0.000393	0.000001	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000335	0.000466	0.000108	0.000616	0.000264	0.000029	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000259	0.000401	0.000126	0.000459	0.000260	0.000067	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000330	0.000434	0.000103	0.000603	0.000239	0.000025	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000279	0.000382	0.000112	0.000447	0.000257	0.000068	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000273	0.000534	0.000185	0.000635	0.000299	0.000058	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000272	0.000367	0.000108	0.000412	0.000258	0.000076	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000260	0.000353	0.000107	0.000421	0.000236	0.000062	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000288	0.000354	0.000105	0.000429	0.000247	0.000071	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000221	0.000320	0.000102	0.000375	0.000213	0.000056	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000218	0.000347	0.000128	0.000400	0.000223	0.000071	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000186	0.000226	0.000062	0.000289	0.000151	0.000034	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000169	0.000310	0.000126	0.000328	0.000196	0.000081	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000394	0.000551	0.000204	0.000607	0.000462	0.000080	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000128	0.000163	0.000044	0.000202	0.000109	0.000024	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000306	0.000366	0.000114	0.000421	0.000311	0.000055	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000124	0.000157	0.000043	0.000195	0.000105	0.000025	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000071	0.000082	0.000018	0.000102	0.000057	0.000013	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	10.60	2.12	0.21	0	0	10.20	0.000003	0.000003
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	10.15	2.03	0.20	0	0	10.20	0.000003	0.000003
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	9.91	1.98	0.20	0	0	10.20	0.000003	0.000003
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	17.86	4.11	0.41	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	17.32	4.16	0.42	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.77	4.19	0.42	0	0	1.64	0.000003	0.000013
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.77	4.19	0.42	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	8.09	2.10	0.21	16.21	4.21	0.42	0	0	1.64	0.000003	0.000013
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.21	4.21	0.42	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	7.80	2.11	0.21	15.62	4.22	0.42	0	1	1.64	0.000003	0.000013
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.62	4.22	0.42	0	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.00	4.20	0.42	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	14.36	4.17	0.42	0	2	1.64	0.000003	0.000013
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	14.36	4.17	0.42	14.36	4.17	0.42	0	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.84	2.05	0.21	13.70	4.11	0.41	3	8	1.64	0.000003	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	13.70	4.11	0.41	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.49	2.01	0.20	12.99	4.03	0.40	0	1	1.64	0.000003	0.000013
18	Ship	Tanker	40,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.12	1.96	0.20	12.25	3.92	0.39	0	5	1.64	0.000003	0.000013
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	12.25	3.92	0.39	12.25	3.92	0.39	0	0	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	11.46	3.78	0.38	11.46	3.78	0.38	1	2	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	11.46	3.78	0.38	11.46	3.78	0.38	0	1	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	0	7	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	1	1	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	3	5	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	9.68	3.39	0.34	9.68	3.39	0.34	0	1	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	9.68	3.39	0.34	9.68	3.39	0.34	2	2	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	8.66	3.12	0.31	8.66	3.12	0.31	9	5	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	7.50	2.78	0.28	7.50	2.78	0.28	0	1	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000623	0.000623	0.001727	0.001139	0.000491	0.000097	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000571	0.000786	0.000225	0.001028	0.000458	0.000096	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000485	0.000839	0.000316	0.001048	0.000483	0.000110	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000615	0.000711	0.000096	0.000981	0.000441	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000561	0.000691	0.000113	0.000938	0.000406	0.000021	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000487	0.000700	0.000221	0.000860	0.000431	0.000117	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000526	0.000698	0.000141	0.000949	0.000396	0.000020	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000495	0.000695	0.000218	0.000903	0.000409	0.000096	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000507	0.000702	0.000156	0.000976	0.000388	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000762	0.000262	0.000181	0.000762	0.000360	0.000084	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000439	0.000602	0.000136	0.000785	0.000393	0.000001	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000335	0.000466	0.000108	0.000616	0.000264	0.000029	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000259	0.000401	0.000126	0.000459	0.000260	0.000067	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000330	0.000434	0.000103	0.000603	0.000239	0.000025	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000279	0.000382	0.000112	0.000447	0.000257	0.000068	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000273	0.000534	0.000185	0.000635	0.000299	0.000058	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000272	0.000367	0.000108	0.000412	0.000258	0.000076	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000260	0.000353	0.000107	0.000421	0.000236	0.000062	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000288	0.000354	0.000105	0.000429	0.000247	0.000071	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000221	0.000320	0.000102	0.000375	0.000213	0.000056	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000218	0.000347	0.000128	0.000400	0.000223	0.000071	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000186	0.000226	0.000062	0.000289	0.000151	0.000034	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000169	0.000310	0.000126	0.000328	0.000196	0.000081	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000394	0.000551	0.000204	0.000607	0.000462	0.000080	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000128	0.000163	0.000044	0.000202	0.000109	0.000024	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000306	0.000366	0.000114	0.000421	0.000311	0.000055	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000124	0.000157	0.000043	0.000195	0.000105	0.000025	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000071	0.000082	0.000018	0.000102	0.000057	0.000013	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	1.2078	0.6480	0.5140	0.00	0.00	0.00	24.90	2.67	0.21	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	1.1995	0.6538	0.5140	0.00	0.00	0.00	23.68	2.58	0.20	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.2060	0.6855	0.5140	0.00	0.00	0.00	23.26	2.64	0.20	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.5069	1.0290	1.0290	0.00	0.00	0.00	26.15	4.11	0.41	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.5024	1.0290	1.0290	0.00	0.00	0.00	25.29	4.16	0.42	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.5627	1.1893	1.0290	0.00	0.00	0.00	25.47	4.85	0.42	0	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.4961	1.0290	1.0290	0.00	0.00	0.00	24.39	4.19	0.42	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	1.3475	0.8970	0.5140	1.5421	1.1449	1.0290	21.22	3.67	0.21	24.29	4.69	0.42	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.4789	1.0290	1.0290	0.00	0.00	0.00	23.29	4.21	0.42	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	1.3134	0.8594	0.5140	1.5241	1.1277	1.0290	19.93	3.52	0.21	23.13	4.62	0.42	0	1	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.4952	1.0290	1.0290	0.00	0.00	0.00	22.69	4.22	0.42	0	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.4467	1.0290	1.0290	0.00	0.00	0.00	21.09	4.20	0.42	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.4872	1.1102	1.0290	0.00	0.00	0.00	20.76	4.49	0.42	0	2	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	1.6046	1.2001	1.0290	1.4253	1.0290	1.0290	22.40	4.86	0.42	19.90	4.17	0.42	0	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	1.2203	0.7644	0.5140	1.4878	1.1160	1.0290	16.24	3.05	0.21	19.80	4.46	0.41	3	8	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.4877	1.0599	1.0290	0.00	0.00	0.00	19.80	4.23	0.41	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	1.2116	0.7575	0.5140	1.4978	1.1432	1.0290	15.30	2.97	0.20	18.91	4.47	0.40	0	1	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	1.2058	0.7587	0.5140	1.4728	1.1009	1.0290	14.35	2.89	0.20	17.53	4.19	0.39	0	5	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	1.5782	1.2167	1.0290	1.4849	1.1266	1.0290	18.79	4.63	0.39	17.68	4.29	0.39	0	0	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	1.5710	1.2245	1.0290	1.4565	1.0853	1.0290	17.49	4.50	0.38	16.22	3.99	0.38	1	2	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	1.5945	1.2708	1.0290	1.4725	1.1342	1.0290	17.76	4.67	0.38	16.40	4.17	0.38	0	1	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	1.5023	1.1334	1.0290	1.3918	1.0290	1.0290	15.49	3.97	0.36	14.35	3.61	0.36	0	7	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	1.5852	1.2790	1.0290	1.4698	1.1750	1.0290	16.34	4.48	0.36	15.15	4.12	0.36	1	1	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	1.6658	1.3370	1.0290	1.5794	1.1193	1.0290	17.17	4.69	0.36	16.28	3.92	0.36	3	5	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	1.4503	1.0845	1.0290	1.3409	1.0290	1.0290	13.65	3.57	0.34	12.62	3.39	0.34	0	1	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	1.5850	1.2327	1.0290	1.5154	1.0661	1.0290	14.92	4.06	0.34	14.26	3.51	0.34	2	2	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	1.4461	1.0861	1.0290	1.3387	1.0290	1.0290	12.17	3.29	0.31	11.27	3.12	0.31	9	5	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	1.3313	1.0290	1.0290	1.2414	1.0290	1.0290	9.71	2.78	0.28	9.05	2.78	0.28	0	1	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.005493	0.009202	0.004041	0.010642	0.006191	0.001902	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005226	0.008787	0.003861	0.009973	0.005962	0.001939	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004319	0.008890	0.005014	0.009970	0.006121	0.002132	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005981	0.008890	0.002008	0.010089	0.006790	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005539	0.008656	0.002310	0.009820	0.006110	0.000575	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004688	0.008167	0.003931	0.008715	0.005718	0.002353	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005165	0.008574	0.002766	0.009952	0.005989	0.000564	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004771	0.008125	0.003891	0.009211	0.005567	0.002008	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004967	0.008540	0.002998	0.010298	0.006207	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004439	0.007493	0.003510	0.008323	0.005226	0.001893	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004600	0.007836	0.002807	0.008742	0.005440	0.001060	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003947	0.006815	0.002504	0.007738	0.004661	0.000867	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003240	0.006077	0.002959	0.006034	0.004455	0.001787	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003981	0.006512	0.002446	0.007782	0.004369	0.000789	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003533	0.005930	0.002700	0.005913	0.004427	0.001824	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.003049	0.007100	0.003758	0.007598	0.004822	0.001487	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003500	0.005789	0.002649	0.005501	0.004431	0.002007	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003403	0.005652	0.002656	0.005762	0.004219	0.001730	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003717	0.005636	0.002585	0.005753	0.004292	0.001893	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003032	0.005339	0.002650	0.005390	0.003994	0.001637	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002883	0.005500	0.003100	0.005548	0.003990	0.001944	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002956	0.004471	0.001937	0.004815	0.003345	0.001204	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002361	0.005133	0.003178	0.004815	0.003618	0.002238	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004151	0.006991	0.003900	0.006626	0.006578	0.001838	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002387	0.003760	0.001634	0.003949	0.002826	0.001005	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003865	0.005679	0.002732	0.005464	0.005285	0.001526	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002338	0.003676	0.001554	0.003856	0.002756	0.001045	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.001805	0.002616	0.000856	0.002713	0.001992	0.000749	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000004**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.005493	0.009202	0.004041	0.010642	0.006191	0.001902	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005226	0.008787	0.003861	0.009973	0.005962	0.001939	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004319	0.008890	0.005014	0.009970	0.006121	0.002132	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005981	0.008890	0.002008	0.010089	0.006790	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005539	0.008656	0.002310	0.009820	0.006110	0.000575	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004688	0.008167	0.003931	0.008715	0.005718	0.002353	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005165	0.008574	0.002766	0.009952	0.005989	0.000564	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004771	0.008125	0.003891	0.009211	0.005567	0.002008	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004967	0.008540	0.002998	0.010298	0.006207	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004439	0.007493	0.003510	0.008323	0.005226	0.001893	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004600	0.007836	0.002807	0.008742	0.005440	0.001060	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003947	0.006815	0.002504	0.007738	0.004661	0.000867	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003240	0.006077	0.002959	0.006034	0.004455	0.001787	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003981	0.006512	0.002446	0.007782	0.004369	0.000789	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003533	0.005930	0.002700	0.005913	0.004427	0.001824	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003049	0.007100	0.003758	0.007598	0.004822	0.001487	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003500	0.005789	0.002649	0.005501	0.004431	0.002007	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003403	0.005652	0.002656	0.005762	0.004219	0.001730	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003717	0.005636	0.002585	0.005753	0.004292	0.001893	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003032	0.005339	0.002650	0.005390	0.003994	0.001637	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002883	0.005500	0.003100	0.005548	0.003990	0.001944	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002956	0.004471	0.001937	0.004815	0.003345	0.001204	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002361	0.005133	0.003178	0.004815	0.003618	0.002238	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004151	0.006991	0.003900	0.006626	0.006578	0.001838	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002387	0.003760	0.001634	0.003949	0.002826	0.001005	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003865	0.005679	0.002732	0.005464	0.005285	0.001526	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002338	0.003676	0.001554	0.003856	0.002756	0.001045	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001805	0.002616	0.000856	0.002713	0.001992	0.000749	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.005493	0.009202	0.004041	0.010642	0.006191	0.001902	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005226	0.008787	0.003861	0.009973	0.005962	0.001939	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004319	0.008890	0.005014	0.009970	0.006121	0.002132	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005981	0.008890	0.002008	0.010089	0.006790	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005539	0.008656	0.002310	0.009820	0.006110	0.000575	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004688	0.008167	0.003931	0.008715	0.005718	0.002353	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005165	0.008574	0.002766	0.009952	0.005989	0.000564	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004771	0.008125	0.003891	0.009211	0.005567	0.002008	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004967	0.008540	0.002998	0.010298	0.006207	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004439	0.007493	0.003510	0.008323	0.005226	0.001893	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004600	0.007836	0.002807	0.008742	0.005440	0.001060	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003947	0.006815	0.002504	0.007738	0.004661	0.000867	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003240	0.006077	0.002959	0.006034	0.004455	0.001787	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003981	0.006512	0.002446	0.007782	0.004369	0.000789	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003533	0.005930	0.002700	0.005913	0.004427	0.001824	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003049	0.007100	0.003758	0.007598	0.004822	0.001487	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003500	0.005789	0.002649	0.005501	0.004431	0.002007	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003403	0.005652	0.002656	0.005762	0.004219	0.001730	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003717	0.005636	0.002585	0.005753	0.004292	0.001893	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003032	0.005339	0.002650	0.005390	0.003994	0.001637	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002883	0.005500	0.003100	0.005548	0.003990	0.001944	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002956	0.004471	0.001937	0.004815	0.003345	0.001204	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002361	0.005133	0.003178	0.004815	0.003618	0.002238	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004151	0.006991	0.003900	0.006626	0.006578	0.001838	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002387	0.003760	0.001634	0.003949	0.002826	0.001005	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003865	0.005679	0.002732	0.005464	0.005285	0.001526	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002338	0.003676	0.001554	0.003856	0.002756	0.001045	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001805	0.002616	0.000856	0.002713	0.001992	0.000749	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

SUBSTRUCTURE ANNUAL FREQUENCY OF COLLAPSE (WATER ELEVATION 4.2 CD)

Pier ID	Description	Ultimate Lateral Capacity, H (MN)	Annual Frequency of Collapse, AF			Return Period
		Foundation	Inbound	Outbound	Total	
1	Pier 14	**25**	0.00000000	0.00000000	0.00000000	51,465,994,353
2	Pier 15	**100**	0.00000000	0.00000000	0.00000000	-
3	Pier 16	**90**	0.00000000	0.00000000	0.00000000	-
	Total for Bridge Piers:		0.00000000	0.00000000	0.00000000	**51,465,994,353**

VESSEL FLEET CHARACTERISTICS

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Vessel Size (m)		Vessel Drafts (m)				Vessel Displacement (tonnes)		Channel Width, C (m)	Centerline Transit Path to Edge of Channel, x_C (m)	Minimum Design Impact Speed, V_{min} (m/sec)		Standard Deviation, σ (m)	
				Length Overall, LOA	Beam/ Width, B	Operational Loaded, D_O	Ballasted			Loaded, W_L	Ballasted, W_E			Loaded	Ballasted	Loaded	Ballasted
							Stern, D_{ES}	Bow, D_{EB}	Average, D_{AVG}								
1	Ship	Tanker	120,000	250	44	11.9	8.2	4.7	6.5	101,270	54,890	125.4	62.7	0.514	0.514	80	80
2	Ship	Tanker	110,000	240	44	11.8	8.3	4.9	6.6	95,920	53,650	125.4	62.7	0.514	0.514	79	79
3	Ship	Tanker	105,000	244	42	13.0	8.4	5.0	6.7	102,480	52,820	119.7	59.9	0.514	0.514	80	80
4	Ship	Bulk Carrier	85,000	229	32	11.7	8.6	5.4	7.0	67,920	40,640	110.0	55.0	1.029	1.029	78	78
5	Ship	Bulk Carrier	80,000	225	32	11.9	8.4	5.2	6.8	67,900	38,800	110.0	55.0	1.029	1.029	78	78
6	Ship	Tanker	75,000	228	34	11.3	8.3	5.1	6.7	66,730	39,570	110.0	55.0	0.514	1.029	78	78
7	Ship	Bulk Carrier	75,000	225	32	12.1	7.8	4.6	6.2	68,640	35,180	110.0	55.0	1.029	1.029	78	78
8	Ship	Tanker	70,000	228	32	11.0	7.4	4.2	5.8	62,330	32,870	110.0	55.0	0.514	1.029	78	78
9	Ship	Bulk Carrier	70,000	225	32	12.0	6.8	3.6	5.2	67,680	29,330	110.0	55.0	1.029	1.029	78	78
10	Ship	Tanker	65,000	214	32	10.9	7.5	4.5	6.0	57,520	31,660	110.0	55.0	0.514	1.029	77	77
11	Ship	Bulk Carrier	65,000	212	32	11.7	7.8	4.8	6.3	61,920	33,350	110.0	55.0	1.029	1.029	77	77
12	Ship	Bulk Carrier	60,000	193	32	11.6	7.2	4.5	5.9	55,590	28,040	110.0	55.0	1.029	1.029	75	75
13	Ship	Tanker	55,000	184	32	11.4	8.3	5.7	7.0	51,250	31,470	110.0	55.0	0.514	1.029	74	74
14	Ship	Bulk Carrier	55,000	190	32	10.9	6.3	3.6	5.0	51,210	23,260	110.0	55.0	1.029	1.029	75	75
15	Ship	Tanker	50,000	183	32	10.6	8.2	5.6	6.9	47,500	30,920	110.0	55.0	0.514	1.029	74	74
16	Ship	Bulk Carrier	50,000	199	30	12.2	7.0	4.2	5.6	56,210	25,810	110.0	55.0	1.029	1.029	76	76
17	Ship	Tanker	45,000	181	32	10.3	8.6	6.1	7.4	45,340	32,350	110.0	55.0	0.514	1.029	74	74
18	Ship	Tanker	40,000	179	28	10.1	7.5	5.0	6.3	38,430	23,780	110.0	55.0	0.514	1.029	74	74
19	Ship	Bulk Carrier	40,000	181	30	9.1	7.2	4.7	6.0	37,700	24,650	110.0	55.0	1.029	1.029	74	74
20	Ship	Tanker	35,000	173	27	10.2	7.3	4.9	6.1	35,600	21,290	110.0	55.0	1.029	1.029	73	73
21	Ship	Bulk Carrier	35,000	177	29	9.7	6.5	4.0	5.3	37,830	20,480	110.0	55.0	1.029	1.029	73	73
22	Ship	Tanker	30,000	159	27	9.2	6.5	4.3	5.4	29,160	17,120	110.0	55.0	1.029	1.029	71	71
23	Ship	Bulk Carrier	30,000	170	27	9.5	6.6	4.2	5.4	32,770	18,630	110.0	55.0	1.029	1.029	72	72
24	Ship	Articulated Tug/Barge	30,000	210	23	9.3	5.0	5.0	5.0	32,470	17,460	110.0	55.0	1.029	1.029	77	77
25	Ship	Tanker	25,000	146	24	9.2	6.5	4.5	5.5	22,970	13,740	110.0	55.0	1.029	1.029	69	69
26	Ship	Articulated Tug/Barge	25,000	184	24	8.3	5.0	5.0	5.0	26,090	15,720	110.0	55.0	1.029	1.029	74	74
27	Ship	Tanker	20,000	145	24	8.7	6.1	4.1	5.1	20,880	12,240	110.0	55.0	1.029	1.029	69	69
28	Ship	Tanker	15,000	127	20	8.1	6.3	4.5	5.4	14,280	9,520	110.0	55.0	1.029	1.029	65	65

Notes:

Weight of Water (W_W) = **0.9854** m^3/tonne (used to determine ship loaded/ballasted displacement tonnage based on approximate salinity of water in Vancouver Harbor)

VESSEL FLEET ANNUAL TRIP FREQUENCY

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Annual Number of Trips (N)						Existing Total Trips	Growth Factor [1]	Future Total Trips
				Inbound			Outbound					
				Loaded	Ballasted	Total	Loaded	Ballasted	Total			
1	Ship	Tanker	120,000	0	0	0	5	0	5	5	10.20	51
2	Ship	Tanker	110,000	0	0	0	3	0	3	3	10.20	31
3	Ship	Tanker	105,000	0	0	0	0	0	0	0	10.20	0
4	Ship	Bulk Carrier	85,000	0	0	0	0	0	0	0	1.28	0
5	Ship	Bulk Carrier	80,000	0	0	0	0	0	0	0	1.28	0
6	Ship	Tanker	75,000	0	0	0	2	0	2	2	1.64	3
7	Ship	Bulk Carrier	75,000	0	0	0	1	0	1	1	1.28	1
8	Ship	Tanker	70,000	0	1	1	0	0	0	1	1.64	2
9	Ship	Bulk Carrier	70,000	0	0	0	0	0	0	0	1.28	0
10	Ship	Tanker	65,000	0	1	1	2	0	2	3	1.64	5
11	Ship	Bulk Carrier	65,000	4	0	4	2	0	2	6	1.28	8
12	Ship	Bulk Carrier	60,000	0	0	0	1	0	1	1	1.28	1
13	Ship	Tanker	55,000	1	2	3	3	0	3	6	1.64	10
14	Ship	Bulk Carrier	55,000	0	0	0	1	0	1	1	1.28	1
15	Ship	Tanker	50,000	3	8	11	8	4	12	23	1.64	38
16	Ship	Bulk Carrier	50,000	0	0	0	0	0	0	0	1.28	0
17	Ship	Tanker	45,000	0	1	1	1	0	1	2	1.64	3
18	Ship	Tanker	40,000	0	5	5	4	1	5	10	1.64	16
19	Ship	Bulk Carrier	40,000	0	1	1	1	0	1	2	1.28	3
20	Ship	Tanker	35,000	1	2	3	2	1	3	6	1.64	10
21	Ship	Bulk Carrier	35,000	0	1	1	1	0	1	2	1.28	3
22	Ship	Tanker	30,000	0	7	7	7	0	7	14	1.64	23
23	Ship	Bulk Carrier	30,000	0	0	0	0	1	1	1	1.28	1
24	Ship	Articulated Tug/Barge	30,000	3	5	8	5	3	8	16	1.28	20
25	Ship	Tanker	25,000	1	1	2	1	0	1	3	1.64	5
26	Ship	Articulated Tug/Barge	25,000	1	2	3	2	1	3	6	1.28	8
27	Ship	Tanker	20,000	10	4	14	4	10	14	28	1.64	46
28	Ship	Tanker	15,000	0	1	1	1	0	1	2	1.64	3
			Total Trips:	24	42	66	57	21	78	144		292

Notes:

[1] As part of the risk analysis, vessel trips will include future growth in the waterway that are projected to the mid-point of the remaining design life (assumed 50 years) of the structure. This equates to growth rates per year as follows for a 25-year projection. GF = $(1+PERCENT/100)^{25}$

- Aframax Tankers (DWT greater than 100,000 tonnes) = 9.735%
- All Other Tankers = 2.0%
- All Other Vessels = 1.0%

VESSEL FLEET TRANSIT SPEEDS IN MAIN CHANNEL

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Vessel Transit Speeds (knots)				Vessel Transit Speeds (m/sec) [1]			
				Inbound		Outbound		Inbound		Outbound	
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted
1	Ship	Tanker	120,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
2	Ship	Tanker	110,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
3	Ship	Tanker	105,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
4	Ship	Bulk Carrier	85,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
5	Ship	Bulk Carrier	80,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
6	Ship	Tanker	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
7	Ship	Bulk Carrier	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
8	Ship	Tanker	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
9	Ship	Bulk Carrier	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
10	Ship	Tanker	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
11	Ship	Bulk Carrier	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
12	Ship	Bulk Carrier	60,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
13	Ship	Tanker	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
14	Ship	Bulk Carrier	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
15	Ship	Tanker	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
16	Ship	Bulk Carrier	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
17	Ship	Tanker	45,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
18	Ship	Tanker	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
19	Ship	Bulk Carrier	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
20	Ship	Tanker	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
21	Ship	Bulk Carrier	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
22	Ship	Tanker	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
23	Ship	Bulk Carrier	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
24	Ship	Articulated Tug/Barge	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
25	Ship	Tanker	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
26	Ship	Articulated Tug/Barge	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
27	Ship	Tanker	20,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
28	Ship	Tanker	15,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866

Notes:

[1] Conversion (knot to m/sec) = 0.51 (convert vessel transit speeds from knots to meters/second for use in risk assessment equations)

ABERRANCY BASE RATE COMPUTATIONS

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Code Recommended Aberrancy Base Rate, BR	Vessel Traffic Service, VTS	Electronic Chart Display & Information System, ECDIS	Other Navigation Aids	Port Control State, PCS	Pilotage 1 Pilot	Pilotage 2 Pilots (MRA-2)		Daytime Only Transit Restrictions (MRA-2)		Visibility Restrictions (MRA-2)	Adjusted Aberrancy Base Rate, BR [1]	
										Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
2	Ship	Tanker	110,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
3	Ship	Tanker	105,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
4	Ship	Bulk Carrier	85,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
5	Ship	Bulk Carrier	80,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
6	Ship	Tanker	75,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
7	Ship	Bulk Carrier	75,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
8	Ship	Tanker	70,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
9	Ship	Bulk Carrier	70,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
10	Ship	Tanker	65,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
11	Ship	Bulk Carrier	65,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
12	Ship	Bulk Carrier	60,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
13	Ship	Tanker	55,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
14	Ship	Bulk Carrier	55,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
15	Ship	Tanker	50,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
16	Ship	Bulk Carrier	50,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
17	Ship	Tanker	45,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
18	Ship	Tanker	40,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
19	Ship	Bulk Carrier	40,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
20	Ship	Tanker	35,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
21	Ship	Bulk Carrier	35,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
22	Ship	Tanker	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
23	Ship	Bulk Carrier	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
24	Ship	Articulated Tug/Barge	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
25	Ship	Tanker	25,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
26	Ship	Articulated Tug/Barge	25,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
27	Ship	Tanker	20,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
28	Ship	Tanker	15,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05

Notes:

[1] Adjustments to the aberrancy Base Rate (BR) due to waterway current restrictions are accounted for elsewhere in the vessel collision risk analysis (refer to correction factors R_C and R_{XC} for the Probability of Aberrancy at each transit leg).

MISCELLANEOUS INFORMATION

CHANNEL CHARACTERISTICS

Waterway Current Speed (V_{min}) =	**1.03**	m/sec
Mean High Water (MHW) Elevation =	**4.20**	m (based on Chart Datum)
Sea Level Rise Adjustment =	**0.10**	m
Soft Soil Allowance =	**1.00**	m (assumed depth that vessels can "plow" through soft bottom material)

AVAILABLE WATER DEPTH AT PIERS

Pier ID	Description	Mudline Elevation (m) [1]		Water Elevation (m)	Soft Soil Allowance (m)	Design Water Depth (m)	
		Inbound	Outbound			Inbound	Outbound
1	**Pier 14**	**-5.00**	**N/A**	4.30	1.00	10.30	0.00
2	**Pier 15**	**-10.00**	**-9.00**	4.30	1.00	15.30	14.30
3	**Pier 16**	**-6.00**	**-5.00**	4.30	1.00	11.30	10.30

Notes:

[1] Mudline elevation is based on Chart Datum (CD) and was obtained from Nautical Chart 3494

PROBABILITY OF ABERRANCY VARIABLES FOR EACH VESSEL TRANSIT PATH

Leg ID	Waterway Region for Bridge Location	Angle of Channel Turn, θ (deg) [1]	Correction Factor, R_B	Current Angle to Vessel Path (deg) [2]	Parallel Current, V_C (m/sec)	Perpendicular Current, V_{XC} (m/sec)	Correction Factor, R_C	Correction Factor, R_{XC}	Vessel Traffic Density	Correction Factor, R_D	Summation (R_B*R_C*R_{XC}*R_D)	Aberrancy Distribution [3]	
												Inbound	Outbound
1	**Transition**	**7.7227**	1.0858	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.3095	**0.24**	**N/A**
2	**Turn/Bend**	**7.7227**	1.1716	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4130	**0.50**	**N/A**
3	**Turn/Bend**	**7.7227**	1.1716	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4130	**0.26**	**N/A**
4	**Transition**	**8.8764**	1.0986	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.3249	**N/A**	**0.24**
5	**Turn/Bend**	**8.8764**	1.1973	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4439	**N/A**	**0.50**
6	**Turn/Bend**	**8.8764**	1.1973	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4439	**N/A**	**0.26**

Notes:

[1] Angle of the turn region in accordance with information shown on Nautical Chart 3494, AIS transit data near the bridge, and CAN/CSA S6-14 Figure A3.3.1

[2] The angle between the water current direction and each channel transition leg

[3] Distribution of the Probability of Aberrancy for each channel transition leg is established as a ratio of the length of each leg to the overall length being considered (approximately 1 nautical mile or 2000m)

GEOMETRIC PROBABILITY DISTANCES FOR NORMAL DISTRIBUTION

Pier ID	Description	Leg 1 [1]			Leg 2 [1]			Leg 3 [1]			Leg 4 [1]			Leg 5 [1]			Leg 6 [1]		
		x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)
1	Pier 14	**363.89**	375.26	**386.63**	**363.89**	375.26	**386.63**	**299.02**	308.72	**318.42**	**299.02**	308.72	**318.42**	**299.02**	308.72	**318.42**	**520.46**	532.27	**544.09**
2	Pier 15	**222.26**	234.22	**246.17**	**222.26**	234.22	**246.17**	**156.11**	166.57	**177.02**	**156.11**	166.57	**177.02**	**156.11**	166.57	**177.02**	**379.70**	392.04	**404.39**
3	Pier 16	**86.36**	98.32	**110.27**	**86.36**	98.32	**110.27**	**158.26**	168.71	**179.16**	**158.26**	168.71	**179.16**	**158.26**	168.71	**179.16**	**48.82**	61.17	**73.51**

Notes:

[1] Perpendicular distances at each channel transition leg from the centerline of vessel transit path to the bridge element being considered. Distance "x" is from the centerline of vessel transit path to the centerline of bridge element. Distance "x_1" (scaled from CADD drawing) is from the centerline of vessel transit path to the closest edge of the bridge element. Distance "x_2" (scaled from CADD drawing) is from the centerline of vessel transit path to the farthest edge of the bridge element.

PROTECTION FACTOR

Pier ID	Description	Leg 1		Leg 2		Leg 3		Leg 4		Leg 5		Leg 6	
		Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
1	Pier 14	**0.09**	**N/A**	**0.09**	**N/A**	**0.13**	**N/A**	**N/A**	**0.00**	**N/A**	**0.00**	**N/A**	**0.00**
2	Pier 15	**0.65**	**N/A**	**0.65**	**N/A**	**0.73**	**N/A**	**N/A**	**0.02**	**N/A**	**0.02**	**N/A**	**0.02**
3	Pier 16	**0.74**	**N/A**	**0.74**	**N/A**	**0.66**	**N/A**	**N/A**	**0.03**	**N/A**	**0.03**	**N/A**	**0.04**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.5140	0.00	7.61	0.00	21.20	0	0	10.20	0.000002	0.000002	0.000010	0.000010	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.5140	0.00	7.44	0.00	20.29	0	0	10.20	0.000002	0.000002	0.000008	0.000008	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.5140	0.00	7.33	0.00	19.83	0	0	10.20	0.000002	0.000002	0.000008	0.000008	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.0290	0.00	22.90	0.00	35.71	0	0	1.28	0.000006	0.000006	0.000005	0.000005	0.000000	0.033334	0.0900	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.0290	0.00	21.57	0.00	34.65	0	0	1.28	0.000006	0.000006	0.000004	0.000004	0.000000	0.030940	0.0900	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.0290	0.00	22.00	0.00	33.55	0	0	1.64	0.000002	0.000006	0.000005	0.000005	0.000000	0.028311	0.0900	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.0290	0.00	19.56	0.00	33.55	0	0	1.28	0.000006	0.000006	0.000004	0.000004	0.000000	0.028311	0.0900	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.0290	0.00	18.27	0.00	32.41	0	1	1.64	0.000002	0.000006	0.000004	0.000004	0.000000	0.025405	0.0900	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.0290	0.00	16.30	0.00	32.41	0	0	1.28	0.000006	0.000006	0.000004	0.000004	0.000000	0.025405	0.0900	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.0290	0.00	17.60	0.00	31.23	0	1	1.64	0.000002	0.000006	0.000003	0.000003	0.000000	0.022170	0.0900	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.0290	0.00	18.54	0.00	31.23	0	0	1.28	0.000006	0.000006	0.000003	0.000003	0.000000	0.022170	0.0900	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.0290	0.00	15.59	0.00	30.01	0	0	1.28	0.000006	0.000006	0.000002	0.000002	0.000000	0.018538	0.0900	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.0290	0.00	17.73	0.00	28.73	0	2	1.64	0.000002	0.000006	0.000001	0.000001	0.000000	0.014421	0.0900	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.0290	0.00	12.93	0.00	28.73	0	0	1.28	0.000006	0.000006	0.000002	0.000002	0.000000	0.014421	0.0900	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	1.0290	0.00	17.25	0.00	27.39	0	8	1.64	0.000002	0.000006	0.000001	0.000001	0.000000	0.009702	0.0900	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.0290	0.00	14.35	0.00	27.39	0	0	1.28	0.000006	0.000006	0.000002	0.000002	0.000000	0.009702	0.0900	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.5140	1.0290	7.49	18.83	12.98	25.99	0	1	1.64	0.000002	0.000006	0.000001	0.000001	0.000000	0.004217	0.0900	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.5140	1.0290	6.35	13.22	12.24	24.50	0	5	1.64	0.000002	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	24.63	13.70	24.50	24.50	0	1	1.28	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.0290	1.0290	23.56	11.83	22.92	22.92	1	2	1.64	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	25.03	11.38	22.92	22.92	0	1	1.28	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	19.15	9.52	21.22	21.22	0	7	1.64	0.000006	0.000006	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	21.69	10.36	21.22	21.22	0	0	1.28	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	21.42	9.71	21.22	21.22	3	5	1.28	0.000006	0.000006	0.000002	0.000002	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	15.08	7.64	19.37	19.37	1	1	1.64	0.000006	0.000006	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	16.29	8.74	19.37	19.37	1	2	1.28	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	13.35	6.80	17.32	17.32	10	4	1.64	0.000006	0.000006	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	8.80	5.29	15.00	15.00	0	1	1.64	0.000006	0.000006	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.5140	0.00	7.61	0.00	21.20	0	0	10.20	0.000003	0.000003	0.000010	0.000010	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.5140	0.00	7.44	0.00	20.29	0	0	10.20	0.000003	0.000003	0.000008	0.000008	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.5140	0.00	7.33	0.00	19.83	0	0	10.20	0.000003	0.000003	0.000008	0.000008	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.0290	0.00	22.90	0.00	35.71	0	0	1.28	0.000013	0.000013	0.000005	0.000005	0.000000	0.033334	0.0900	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.0290	0.00	21.57	0.00	34.65	0	0	1.28	0.000013	0.000013	0.000004	0.000004	0.000000	0.030940	0.0900	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.0290	0.00	22.00	0.00	33.55	0	0	1.64	0.000003	0.000013	0.000005	0.000005	0.000000	0.028311	0.0900	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.0290	0.00	19.56	0.00	33.55	0	0	1.28	0.000013	0.000013	0.000004	0.000004	0.000000	0.028311	0.0900	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.0290	0.00	18.27	0.00	32.41	0	1	1.64	0.000003	0.000013	0.000004	0.000004	0.000000	0.025405	0.0900	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.0290	0.00	16.30	0.00	32.41	0	0	1.28	0.000013	0.000013	0.000004	0.000004	0.000000	0.025405	0.0900	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.0290	0.00	17.60	0.00	31.23	0	1	1.64	0.000003	0.000013	0.000003	0.000003	0.000000	0.022170	0.0900	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.0290	0.00	18.54	0.00	31.23	0	0	1.28	0.000013	0.000013	0.000003	0.000003	0.000000	0.022170	0.0900	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.0290	0.00	15.59	0.00	30.01	0	0	1.28	0.000013	0.000013	0.000002	0.000002	0.000000	0.018538	0.0900	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.0290	0.00	17.73	0.00	28.73	0	2	1.64	0.000003	0.000013	0.000001	0.000001	0.000000	0.014421	0.0900	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.0290	0.00	12.93	0.00	28.73	0	0	1.28	0.000013	0.000013	0.000002	0.000002	0.000000	0.014421	0.0900	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	1.0290	0.00	17.25	0.00	27.39	0	8	1.64	0.000003	0.000013	0.000001	0.000001	0.000000	0.009702	0.0900	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.0290	0.00	14.35	0.00	27.39	0	0	1.28	0.000013	0.000013	0.000002	0.000002	0.000000	0.009702	0.0900	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.5140	1.0290	7.49	18.83	12.98	25.99	0	1	1.64	0.000003	0.000013	0.000001	0.000001	0.000000	0.004217	0.0900	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.5140	1.0290	6.35	13.22	12.24	24.50	0	5	1.64	0.000003	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	24.63	13.70	24.50	24.50	0	1	1.28	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.0290	1.0290	23.56	11.83	22.92	22.92	1	2	1.64	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	25.03	11.38	22.92	22.92	0	1	1.28	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	19.15	9.52	21.22	21.22	0	7	1.64	0.000013	0.000013	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	21.69	10.36	21.22	21.22	0	0	1.28	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	21.42	9.71	21.22	21.22	3	5	1.28	0.000013	0.000013	0.000002	0.000002	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	15.08	7.64	19.37	19.37	1	1	1.64	0.000013	0.000013	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	16.29	8.74	19.37	19.37	1	2	1.28	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	13.35	6.80	17.32	17.32	10	4	1.64	0.000013	0.000013	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	8.80	5.29	15.00	15.00	0	1	1.64	0.000013	0.000013	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.5140	0.00	7.61	0.00	21.20	0	0	10.20	0.000002	0.000002	0.000261	0.000261	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.5140	0.00	7.44	0.00	20.29	0	0	10.20	0.000002	0.000002	0.000232	0.000232	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.5140	0.00	7.33	0.00	19.83	0	0	10.20	0.000002	0.000002	0.000231	0.000231	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.0290	0.00	22.90	0.00	35.71	0	0	1.28	0.000007	0.000007	0.000146	0.000146	0.000000	0.033334	0.1300	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.0290	0.00	21.57	0.00	34.65	0	0	1.28	0.000007	0.000007	0.000137	0.000137	0.000000	0.030940	0.1300	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.0290	0.00	22.00	0.00	33.55	0	0	1.64	0.000002	0.000007	0.000150	0.000150	0.000000	0.028311	0.1300	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.0290	0.00	19.56	0.00	33.55	0	0	1.28	0.000007	0.000007	0.000137	0.000137	0.000000	0.028311	0.1300	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.0290	0.00	18.27	0.00	32.41	0	1	1.64	0.000002	0.000007	0.000143	0.000143	0.000000	0.025405	0.1300	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.0290	0.00	16.30	0.00	32.41	0	0	1.28	0.000007	0.000007	0.000137	0.000137	0.000000	0.025405	0.1300	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.0290	0.00	17.60	0.00	31.23	0	1	1.64	0.000002	0.000007	0.000116	0.000116	0.000000	0.022170	0.1300	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.0290	0.00	18.54	0.00	31.23	0	0	1.28	0.000007	0.000007	0.000112	0.000112	0.000000	0.022170	0.1300	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.0290	0.00	15.59	0.00	30.01	0	0	1.28	0.000007	0.000007	0.000078	0.000078	0.000000	0.018538	0.1300	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.0290	0.00	17.73	0.00	28.73	0	2	1.64	0.000002	0.000007	0.000064	0.000064	0.000000	0.014421	0.1300	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.0290	0.00	12.93	0.00	28.73	0	0	1.28	0.000007	0.000007	0.000073	0.000073	0.000000	0.014421	0.1300	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	1.0290	0.00	17.25	0.00	27.39	0	8	1.64	0.000002	0.000007	0.000062	0.000062	0.000000	0.009702	0.1300	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.0290	0.00	14.35	0.00	27.39	0	0	1.28	0.000007	0.000007	0.000083	0.000083	0.000000	0.009702	0.1300	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.5140	1.0290	7.49	18.83	12.98	25.99	0	1	1.64	0.000002	0.000007	0.000059	0.000059	0.000000	0.004217	0.1300	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.5140	1.0290	6.35	13.22	12.24	24.50	0	5	1.64	0.000002	0.000007	0.000050	0.000050	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	24.63	13.70	24.50	24.50	0	1	1.28	0.000007	0.000007	0.000056	0.000056	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.0290	1.0290	23.56	11.83	22.92	22.92	1	2	1.64	0.000007	0.000007	0.000041	0.000041	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	25.03	11.38	22.92	22.92	0	1	1.28	0.000007	0.000007	0.000049	0.000049	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	19.15	9.52	21.22	21.22	0	7	1.64	0.000007	0.000007	0.000027	0.000027	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	21.69	10.36	21.22	21.22	0	0	1.28	0.000007	0.000007	0.000038	0.000038	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	21.42	9.71	21.22	21.22	3	5	1.28	0.000007	0.000007	0.000081	0.000081	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	15.08	7.64	19.37	19.37	1	1	1.64	0.000007	0.000007	0.000015	0.000015	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	16.29	8.74	19.37	19.37	1	2	1.28	0.000007	0.000007	0.000050	0.000050	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	13.35	6.80	17.32	17.32	10	4	1.64	0.000007	0.000007	0.000014	0.000014	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	8.80	5.29	15.00	15.00	0	1	1.64	0.000007	0.000007	0.000005	0.000005	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000261	0.000261	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000232	0.000232	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000231	0.000231	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000146	0.000146	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000150	0.000150	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000143	0.000143	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000116	0.000116	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000112	0.000112	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000078	0.000078	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000064	0.000064	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000073	0.000073	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000062	0.000062	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000083	0.000083	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000059	0.000059	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000050	0.000050	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000056	0.000056	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000041	0.000041	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000049	0.000049	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000027	0.000027	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000038	0.000038	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000081	0.000081	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000015	0.000015	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000050	0.000050	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000014	0.000014	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000005	0.000005	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004	0.000261	0.000261	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004	0.000232	0.000232	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004	0.000231	0.000231	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000146	0.000146	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000150	0.000150	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000143	0.000143	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000116	0.000116	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000112	0.000112	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000078	0.000078	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000064	0.000064	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000073	0.000073	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000062	0.000062	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000083	0.000083	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000059	0.000059	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000050	0.000050	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000056	0.000056	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000041	0.000041	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000049	0.000049	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000027	0.000027	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000038	0.000038	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000081	0.000081	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000015	0.000015	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000050	0.000050	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000014	0.000014	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000005	0.000005	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
																			Total for Pier:			**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.6023	0.6023	21.25	10.45	24.84	24.84	0	0	10.20	0.000002	0.000002	0.005802	0.005802	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.5710	0.5710	18.01	9.18	22.54	22.54	0	0	10.20	0.000002	0.000002	0.005450	0.005450	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.5827	0.5827	21.08	9.42	22.48	22.48	0	0	10.20	0.000002	0.000002	0.005365	0.005365	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.0435	1.0435	42.38	23.23	36.22	36.22	0	0	1.28	0.000006	0.000006	0.003880	0.003880	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.0321	1.0321	41.85	21.70	34.75	34.75	0	0	1.28	0.000006	0.000006	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.5286	1.0407	10.47	22.50	17.23	33.93	0	0	1.64	0.000002	0.000006	0.003985	0.003985	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.0321	1.0321	42.69	19.67	33.65	33.65	0	0	1.28	0.000006	0.000006	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.5286	1.0407	9.62	18.69	16.65	32.78	0	1	1.64	0.000002	0.000006	0.003850	0.003850	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.0321	1.0321	41.90	16.40	32.51	32.51	0	0	1.28	0.000006	0.000006	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.5140	1.0290	8.34	17.60	15.60	31.23	0	1	1.64	0.000002	0.000006	0.003428	0.003428	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.0290	1.0290	37.57	18.54	31.23	31.23	4	0	1.28	0.000006	0.000006	0.003367	0.003367	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.0290	1.0290	33.57	15.59	30.01	30.01	0	0	1.28	0.000006	0.000006	0.002772	0.002772	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.5140	1.0290	7.64	17.49	14.35	28.73	1	2	1.64	0.000002	0.000006	0.002486	0.002486	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	29.77	12.93	28.73	28.73	0	0	1.28	0.000006	0.000006	0.002677	0.002677	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.5140	1.0290	6.77	17.19	13.68	27.39	3	8	1.64	0.000002	0.000006	0.002454	0.002454	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	1.0290	1.0290	34.91	14.35	27.39	27.39	0	0	1.28	0.000006	0.000006	0.002822	0.002822	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.5140	1.0290	6.33	17.98	12.98	25.99	0	1	1.64	0.000002	0.000006	0.002390	0.002390	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.5140	1.0290	5.33	13.22	12.24	24.50	0	5	1.64	0.000002	0.000006	0.002103	0.002103	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	20.96	13.70	24.50	24.50	0	1	1.28	0.000006	0.000006	0.002274	0.002274	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.0290	1.0290	19.79	11.83	22.92	22.92	1	2	1.64	0.000006	0.000006	0.001878	0.001878	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	21.03	11.38	22.92	22.92	0	1	1.28	0.000006	0.000006	0.002098	0.002098	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	16.21	9.52	21.22	21.22	0	7	1.64	0.000006	0.000006	0.001485	0.001485	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	18.22	10.36	21.22	21.22	0	0	1.28	0.000006	0.000006	0.001793	0.001793	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	18.05	9.71	21.22	21.22	3	5	1.28	0.000006	0.000006	0.002613	0.002613	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	12.77	7.64	19.37	19.37	1	1	1.64	0.000006	0.000006	0.001042	0.001042	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	14.50	8.74	19.37	19.37	1	2	1.28	0.000006	0.000006	0.002026	0.002026	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	11.61	6.80	17.32	17.32	10	4	1.64	0.000006	0.000006	0.001018	0.001018	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	7.94	5.29	15.00	15.00	0	1	1.64	0.000006	0.000006	0.000544	0.000544	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.6023	0.6023	21.25	10.45	24.84	24.84	0	0	10.20	0.000003	0.000003	0.005802	0.005802	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.5710	0.5710	18.01	9.18	22.54	22.54	0	0	10.20	0.000003	0.000003	0.005450	0.005450	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.5827	0.5827	21.08	9.42	22.48	22.48	0	0	10.20	0.000003	0.000003	0.005365	0.005365	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.0435	1.0435	42.38	23.23	36.22	36.22	0	0	1.28	0.000013	0.000013	0.003880	0.003880	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.0321	1.0321	41.85	21.70	34.75	34.75	0	0	1.28	0.000013	0.000013	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.5286	1.0407	10.47	22.50	17.23	33.93	0	0	1.64	0.000003	0.000013	0.003985	0.003985	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.0321	1.0321	42.69	19.67	33.65	33.65	0	0	1.28	0.000013	0.000013	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.5286	1.0407	9.62	18.69	16.65	32.78	0	1	1.64	0.000003	0.000013	0.003850	0.003850	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.0321	1.0321	41.90	16.40	32.51	32.51	0	0	1.28	0.000013	0.000013	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.5140	1.0290	8.34	17.60	15.60	31.23	0	1	1.64	0.000003	0.000013	0.003428	0.003428	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.0290	1.0290	37.57	18.54	31.23	31.23	4	0	1.28	0.000013	0.000013	0.003367	0.003367	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.0290	1.0290	33.57	15.59	30.01	30.01	0	0	1.28	0.000013	0.000013	0.002772	0.002772	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.5140	1.0290	7.64	17.49	14.35	28.73	1	2	1.64	0.000003	0.000013	0.002486	0.002486	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	29.77	12.93	28.73	28.73	0	0	1.28	0.000013	0.000013	0.002677	0.002677	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.5140	1.0290	6.77	17.19	13.68	27.39	3	8	1.64	0.000003	0.000013	0.002454	0.002454	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	1.0290	1.0290	34.91	14.35	27.39	27.39	0	0	1.28	0.000013	0.000013	0.002822	0.002822	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.5140	1.0290	6.33	17.98	12.98	25.99	0	1	1.64	0.000003	0.000013	0.002390	0.002390	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.5140	1.0290	5.33	13.22	12.24	24.50	0	5	1.64	0.000003	0.000013	0.002103	0.002103	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	20.96	13.70	24.50	24.50	0	1	1.28	0.000013	0.000013	0.002274	0.002274	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.0290	1.0290	19.79	11.83	22.92	22.92	1	2	1.64	0.000013	0.000013	0.001878	0.001878	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	21.03	11.38	22.92	22.92	0	1	1.28	0.000013	0.000013	0.002098	0.002098	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	16.21	9.52	21.22	21.22	0	7	1.64	0.000013	0.000013	0.001485	0.001485	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	18.22	10.36	21.22	21.22	0	0	1.28	0.000013	0.000013	0.001793	0.001793	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	18.05	9.71	21.22	21.22	3	5	1.28	0.000013	0.000013	0.002613	0.002613	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	12.77	7.64	19.37	19.37	1	1	1.64	0.000013	0.000013	0.001042	0.001042	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	14.50	8.74	19.37	19.37	1	2	1.28	0.000013	0.000013	0.002026	0.002026	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	11.61	6.80	17.32	17.32	10	4	1.64	0.000013	0.000013	0.001018	0.001018	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	7.94	5.29	15.00	15.00	0	1	1.64	0.000013	0.000013	0.000544	0.000544	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	1.5822	1.5822	146.67	72.14	65.25	65.25	0	0	10.20	0.000002	0.000002	0.040552	0.040552	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	1.5632	1.5632	134.97	68.83	61.72	61.72	0	0	10.20	0.000002	0.000002	0.039452	0.039452	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	1.5542	1.5542	149.95	66.98	59.95	59.95	0	0	10.20	0.000002	0.000002	0.038476	0.038476	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.8147	1.8147	128.18	70.26	62.99	62.99	0	0	1.28	0.000007	0.000007	0.030162	0.030162	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.8076	1.8076	128.36	66.56	60.87	60.87	0	0	1.28	0.000007	0.000007	0.029749	0.029749	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	1.4942	1.8130	83.65	68.28	48.71	59.11	0	0	1.64	0.000002	0.000007	0.031022	0.031022	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.8076	1.8076	130.96	60.35	58.93	58.93	0	0	1.28	0.000007	0.000007	0.029749	0.029749	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	1.4942	1.8130	76.85	56.72	47.06	57.10	0	1	1.64	0.000002	0.000007	0.030060	0.030060	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.8076	1.8076	128.54	50.31	56.93	56.93	0	0	1.28	0.000007	0.000007	0.029749	0.029749	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	1.4612	1.7866	67.43	53.05	44.35	54.22	0	1	1.64	0.000002	0.000007	0.028549	0.028549	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.7825	1.7825	112.74	55.63	54.10	54.10	4	0	1.28	0.000007	0.000007	0.028320	0.028320	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.7387	1.7387	95.84	44.50	50.70	50.70	0	0	1.28	0.000007	0.000007	0.025962	0.025962	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	1.3709	1.7144	54.37	48.56	38.28	47.86	1	2	1.64	0.000002	0.000007	0.024719	0.024719	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.7309	1.7309	84.25	36.59	48.33	48.33	0	0	1.28	0.000007	0.000007	0.025557	0.025557	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	1.3674	1.7115	47.88	47.55	36.40	45.56	3	8	1.64	0.000002	0.000007	0.024575	0.024575	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	1.7536	1.7536	101.37	41.67	46.68	46.68	0	0	1.28	0.000007	0.000007	0.025596	0.025596	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	1.3600	1.7057	44.33	49.41	34.35	43.07	0	1	1.64	0.000002	0.000007	0.024285	0.024285	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	1.3525	1.6997	36.91	36.07	32.20	40.47	0	5	1.64	0.000002	0.000007	0.021912	0.021912	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.7057	1.7057	57.58	37.65	40.61	40.61	0	1	1.28	0.000007	0.000007	0.023227	0.023227	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.6807	1.6807	52.79	31.57	37.43	37.43	1	2	1.64	0.000007	0.000007	0.020575	0.020575	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6935	1.6935	56.96	30.84	37.72	37.72	0	1	1.28	0.000007	0.000007	0.022143	0.022143	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6298	1.6298	40.66	23.87	33.61	33.61	0	7	1.64	0.000007	0.000007	0.018487	0.018487	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6706	1.6706	48.01	27.30	34.45	34.45	0	0	1.28	0.000007	0.000007	0.020146	0.020146	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7783	1.7783	53.91	28.99	36.67	36.67	3	5	1.28	0.000007	0.000007	0.022591	0.022591	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5722	1.5722	29.81	17.83	29.59	29.59	1	1	1.64	0.000007	0.000007	0.015153	0.015153	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.7144	1.7144	40.26	24.26	32.27	32.27	1	2	1.28	0.000007	0.000007	0.020518	0.020518	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5672	1.5672	26.92	15.78	26.39	26.39	10	4	1.64	0.000007	0.000007	0.014991	0.014991	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4620	1.4620	16.02	10.68	21.32	21.32	0	1	1.64	0.000007	0.000007	0.010643	0.010643	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	1.5822	1.5822	152.00	72.14	65.25	65.25	5	0	10.20	0.000002	0.000002	0.040552	0.040552	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	1.5632	1.5632	139.94	68.83	61.72	61.72	3	0	10.20	0.000002	0.000002	0.039452	0.039452	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	1.5542	1.5542	154.71	66.98	59.95	59.95	0	0	10.20	0.000002	0.000002	0.038476	0.038476	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.8147	1.8147	132.96	70.26	62.99	62.99	0	0	1.28	0.000006	0.000006	0.030162	0.030162	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.8076	1.8076	133.03	66.56	60.87	60.87	0	0	1.28	0.000006	0.000006	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	1.4942	1.8130	86.95	68.28	48.71	59.11	2	0	1.64	0.000002	0.000006	0.031022	0.031022	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.8076	1.8076	135.59	60.35	58.93	58.93	1	0	1.28	0.000006	0.000006	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	1.4942	1.8130	80.02	56.72	47.06	57.10	0	0	1.64	0.000002	0.000006	0.030060	0.030060	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.8076	1.8076	133.15	50.31	56.93	56.93	0	0	1.28	0.000006	0.000006	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	1.4612	1.7866	70.25	53.05	44.35	54.22	2	0	1.64	0.000002	0.000006	0.028549	0.028549	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.7825	1.7825	116.95	55.63	54.10	54.10	2	0	1.28	0.000006	0.000006	0.028320	0.028320	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.7387	1.7387	99.46	44.50	50.70	50.70	1	0	1.28	0.000006	0.000006	0.025962	0.025962	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	1.3709	1.7144	56.48	48.56	38.28	47.86	3	0	1.64	0.000002	0.000006	0.024719	0.024719	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.7309	1.7309	87.76	36.59	48.33	48.33	1	0	1.28	0.000006	0.000006	0.025557	0.025557	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	1.3674	1.7115	49.98	47.55	36.40	45.56	8	4	1.64	0.000002	0.000006	0.024575	0.024575	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	1.7536	1.7536	104.91	41.67	46.68	46.68	0	0	1.28	0.000006	0.000006	0.025596	0.025596	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	1.3600	1.7057	46.37	49.41	34.35	43.07	1	0	1.64	0.000002	0.000006	0.024285	0.024285	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	1.3525	1.6997	38.39	36.07	32.20	40.47	4	1	1.64	0.000002	0.000006	0.021912	0.021912	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.7057	1.7057	57.58	37.65	40.61	40.61	1	0	1.28	0.000006	0.000006	0.023227	0.023227	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.6807	1.6807	55.26	31.57	37.43	37.43	2	1	1.64	0.000006	0.000006	0.020575	0.020575	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6935	1.6935	57.66	30.84	37.72	37.72	1	0	1.28	0.000006	0.000006	0.022143	0.022143	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6298	1.6298	40.66	23.87	33.61	33.61	7	0	1.64	0.000006	0.000006	0.018487	0.018487	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6706	1.6706	48.01	27.30	34.45	34.45	0	1	1.28	0.000006	0.000006	0.020146	0.020146	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7783	1.7783	53.91	28.99	36.67	36.67	5	3	1.28	0.000006	0.000006	0.022591	0.022591	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5722	1.5722	29.81	17.83	29.59	29.59	1	0	1.64	0.000006	0.000006	0.015153	0.015153	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.7144	1.7144	40.26	24.26	32.27	32.27	2	1	1.28	0.000006	0.000006	0.020518	0.020518	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5672	1.5672	26.92	15.78	26.39	26.39	4	10	1.64	0.000006	0.000006	0.014991	0.014991	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4620	1.4620	16.02	10.68	21.32	21.32	1	0	1.64	0.000006	0.000006	0.010643	0.010643	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	1.5822	1.5822	152.00	72.14	65.25	65.25	5	0	10.20	0.000004	0.000004	0.040552	0.040552	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	1.5632	1.5632	139.94	68.83	61.72	61.72	3	0	10.20	0.000004	0.000004	0.039452	0.039452	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	1.5542	1.5542	154.71	66.98	59.95	59.95	0	0	10.20	0.000004	0.000004	0.038476	0.038476	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.8147	1.8147	132.96	70.26	62.99	62.99	0	0	1.28	0.000013	0.000013	0.030162	0.030162	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.8076	1.8076	133.03	66.56	60.87	60.87	0	0	1.28	0.000013	0.000013	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	1.4942	1.8130	86.95	68.28	48.71	59.11	2	0	1.64	0.000004	0.000013	0.031022	0.031022	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.8076	1.8076	135.59	60.35	58.93	58.93	1	0	1.28	0.000013	0.000013	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	1.4942	1.8130	80.02	56.72	47.06	57.10	0	0	1.64	0.000004	0.000013	0.030060	0.030060	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.8076	1.8076	133.15	50.31	56.93	56.93	0	0	1.28	0.000013	0.000013	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	1.4612	1.7866	70.25	53.05	44.35	54.22	2	0	1.64	0.000004	0.000013	0.028549	0.028549	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.7825	1.7825	116.95	55.63	54.10	54.10	2	0	1.28	0.000013	0.000013	0.028320	0.028320	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.7387	1.7387	99.46	44.50	50.70	50.70	1	0	1.28	0.000013	0.000013	0.025962	0.025962	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	1.3709	1.7144	56.48	48.56	38.28	47.86	3	0	1.64	0.000004	0.000013	0.024719	0.024719	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.7309	1.7309	87.76	36.59	48.33	48.33	1	0	1.28	0.000013	0.000013	0.025557	0.025557	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	1.3674	1.7115	49.98	47.55	36.40	45.56	8	4	1.64	0.000004	0.000013	0.024575	0.024575	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	1.7536	1.7536	104.91	41.67	46.68	46.68	0	0	1.28	0.000013	0.000013	0.025596	0.025596	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	1.3600	1.7057	46.37	49.41	34.35	43.07	1	0	1.64	0.000004	0.000013	0.024285	0.024285	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	1.3525	1.6997	38.39	36.07	32.20	40.47	4	1	1.64	0.000004	0.000013	0.021912	0.021912	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.7057	1.7057	57.58	37.65	40.61	40.61	1	0	1.28	0.000013	0.000013	0.023227	0.023227	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.6807	1.6807	55.26	31.57	37.43	37.43	2	1	1.64	0.000013	0.000013	0.020575	0.020575	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6935	1.6935	57.66	30.84	37.72	37.72	1	0	1.28	0.000013	0.000013	0.022143	0.022143	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6298	1.6298	40.66	23.87	33.61	33.61	7	0	1.64	0.000013	0.000013	0.018487	0.018487	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6706	1.6706	48.01	27.30	34.45	34.45	0	1	1.28	0.000013	0.000013	0.020146	0.020146	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7783	1.7783	53.91	28.99	36.67	36.67	5	3	1.28	0.000013	0.000013	0.022591	0.022591	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5722	1.5722	29.81	17.83	29.59	29.59	1	0	1.64	0.000013	0.000013	0.015153	0.015153	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.7144	1.7144	40.26	24.26	32.27	32.27	2	1	1.28	0.000013	0.000013	0.020518	0.020518	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5672	1.5672	26.92	15.78	26.39	26.39	4	10	1.64	0.000013	0.000013	0.014991	0.014991	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4620	1.4620	16.02	10.68	21.32	21.32	1	0	1.64	0.000013	0.000013	0.010643	0.010643	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.5140	0.5140	16.04	7.61	21.20	21.20	5	0	10.20	0.000002	0.000002	0.000004	0.000004	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.5140	0.5140	15.13	7.44	20.29	20.29	3	0	10.20	0.000002	0.000002	0.000003	0.000003	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.5140	0.5140	16.92	7.33	19.83	19.83	0	0	10.20	0.000002	0.000002	0.000003	0.000003	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.0290	1.0290	42.75	22.59	35.71	35.71	0	0	1.28	0.000007	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.0290	1.0290	43.11	21.57	34.65	34.65	0	0	1.28	0.000007	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.5140	1.0290	10.29	22.00	16.76	33.55	2	0	1.64	0.000002	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.0290	1.0290	43.94	19.56	33.55	33.55	1	0	1.28	0.000007	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.5140	1.0290	9.47	18.27	16.19	32.41	0	0	1.64	0.000002	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.0290	1.0290	43.15	16.30	32.41	32.41	0	0	1.28	0.000007	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.5140	1.0290	8.69	17.60	15.60	31.23	2	0	1.64	0.000002	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.0290	1.0290	38.97	18.54	31.23	31.23	2	0	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.0290	1.0290	34.83	15.59	30.01	30.01	1	0	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.5140	1.0290	7.94	17.49	14.35	28.73	3	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	31.02	12.93	28.73	28.73	1	0	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.5140	1.0290	7.06	17.19	13.68	27.39	8	4	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	1.0290	1.0290	36.13	14.35	27.39	27.39	0	0	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.5140	1.0290	6.62	17.98	12.98	25.99	1	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.5140	1.0290	5.54	13.22	12.24	24.50	4	1	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	20.96	13.70	24.50	24.50	1	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.0290	1.0290	20.71	11.83	22.92	22.92	2	1	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	21.29	11.38	22.92	22.92	1	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	16.21	9.52	21.22	21.22	7	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	18.22	10.36	21.22	21.22	0	1	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	18.05	9.71	21.22	21.22	5	3	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	12.77	7.64	19.37	19.37	1	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	14.50	8.74	19.37	19.37	2	1	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	11.61	6.80	17.32	17.32	4	10	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	7.94	5.29	15.00	15.00	1	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	2.5708	0.00	190.45	0.00	106.02	0	0	10.20	0.000002	0.000002	0.161512	0.161512	0.000000	0.016786	0.7400	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	2.5643	0.00	185.20	0.00	101.25	0	0	10.20	0.000002	0.000002	0.160908	0.160908	0.000000	0.012342	0.7400	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	2.5343	0.00	178.10	0.00	97.76	0	0	10.20	0.000002	0.000002	0.156289	0.156289	0.000000	0.008821	0.7400	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	2.5928	0.00	143.44	0.00	89.99	0	0	1.28	0.000006	0.000006	0.131184	0.131184	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	2.5901	0.00	136.65	0.00	87.21	0	0	1.28	0.000006	0.000006	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	2.4684	2.5921	254.11	139.59	80.48	84.51	0	0	1.64	0.000002	0.000006	0.134715	0.134715	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	2.5901	0.00	123.90	0.00	84.44	0	0	1.28	0.000006	0.000006	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	2.4684	2.5921	237.35	115.95	77.75	81.64	0	1	1.64	0.000002	0.000006	0.131118	0.131118	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	2.5901	0.00	103.30	0.00	81.58	0	0	1.28	0.000006	0.000006	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	2.4555	2.5819	216.77	110.80	74.53	78.36	0	1	1.64	0.000002	0.000006	0.130079	0.130079	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	2.5803	0.00	116.57	0.00	78.32	0	0	1.28	0.000006	0.000006	0.129913	0.129913	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	2.5633	0.00	96.73	0.00	74.75	0	0	1.28	0.000006	0.000006	0.128069	0.128069	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	2.5539	0.00	107.76	0.00	71.30	0	2	1.64	0.000002	0.000006	0.126989	0.126989	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	2.5603	2.5603	209.80	80.05	71.48	71.48	0	0	1.28	0.000006	0.000006	0.127726	0.127726	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	2.4191	2.5527	173.74	105.78	64.40	67.95	3	8	1.64	0.000002	0.000006	0.126859	0.126859	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	2.5691	0.00	89.43	0.00	68.39	0	0	1.28	0.000006	0.000006	0.123982	0.123982	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	2.4163	2.5505	165.45	110.48	61.02	64.41	0	1	1.64	0.000002	0.000006	0.126593	0.126593	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	2.4134	2.5481	138.84	81.06	57.46	60.67	0	5	1.64	0.000002	0.000006	0.117002	0.117002	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	2.5505	2.5505	144.58	84.18	60.73	60.73	0	1	1.28	0.000006	0.000006	0.121920	0.121920	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	2.5408	2.5408	143.18	72.15	56.59	56.59	1	2	1.64	0.000006	0.000006	0.113859	0.113859	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	2.5457	2.5457	149.25	69.68	56.70	56.70	0	1	1.28	0.000006	0.000006	0.119052	0.119052	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	2.5210	2.5210	109.89	57.12	51.98	51.98	0	7	1.64	0.000006	0.000006	0.111576	0.111576	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	2.5368	2.5368	127.09	62.94	52.31	52.31	0	0	1.28	0.000006	0.000006	0.113415	0.113415	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	2.5787	2.5787	128.73	60.95	53.17	53.17	3	5	1.28	0.000006	0.000006	0.107501	0.107501	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	2.4986	2.4986	85.03	45.04	47.03	47.03	1	1	1.64	0.000006	0.000006	0.102204	0.102204	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	2.5539	2.5539	95.23	53.83	48.07	48.07	1	2	1.28	0.000006	0.000006	0.108342	0.108342	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	2.4967	2.4967	74.88	40.06	42.03	42.03	10	4	1.64	0.000006	0.000006	0.101978	0.101978	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	2.4559	2.4559	47.48	30.14	35.81	35.81	0	1	1.64	0.000006	0.000006	0.088583	0.088583	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	2.5708	0.00	190.45	0.00	106.02	0	0	10.20	0.000003	0.000003	0.161512	0.161512	0.000000	0.016786	0.7400	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	2.5643	0.00	185.20	0.00	101.25	0	0	10.20	0.000003	0.000003	0.160908	0.160908	0.000000	0.012342	0.7400	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	2.5343	0.00	178.10	0.00	97.76	0	0	10.20	0.000003	0.000003	0.156289	0.156289	0.000000	0.008821	0.7400	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	2.5928	0.00	143.44	0.00	89.99	0	0	1.28	0.000013	0.000013	0.131184	0.131184	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	2.5901	0.00	136.65	0.00	87.21	0	0	1.28	0.000013	0.000013	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	2.4684	2.5921	254.11	139.59	80.48	84.51	0	0	1.64	0.000003	0.000013	0.134715	0.134715	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	2.5901	0.00	123.90	0.00	84.44	0	0	1.28	0.000013	0.000013	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	2.4684	2.5921	237.35	115.95	77.75	81.64	0	1	1.64	0.000003	0.000013	0.131118	0.131118	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	2.5901	0.00	103.30	0.00	81.58	0	0	1.28	0.000013	0.000013	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	2.4555	2.5819	216.77	110.80	74.53	78.36	0	1	1.64	0.000003	0.000013	0.130079	0.130079	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	2.5803	0.00	116.57	0.00	78.32	0	0	1.28	0.000013	0.000013	0.129913	0.129913	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	2.5633	0.00	96.73	0.00	74.75	0	0	1.28	0.000013	0.000013	0.128069	0.128069	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	2.5539	0.00	107.76	0.00	71.30	0	2	1.64	0.000003	0.000013	0.126989	0.126989	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	2.5603	2.5603	209.80	80.05	71.48	71.48	0	0	1.28	0.000013	0.000013	0.127726	0.127726	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	2.4191	2.5527	173.74	105.78	64.40	67.95	3	8	1.64	0.000003	0.000013	0.126859	0.126859	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	2.5691	0.00	89.43	0.00	68.39	0	0	1.28	0.000013	0.000013	0.123982	0.123982	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	2.4163	2.5505	165.45	110.48	61.02	64.41	0	1	1.64	0.000003	0.000013	0.126593	0.126593	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	2.4134	2.5481	138.84	81.06	57.46	60.67	0	5	1.64	0.000003	0.000013	0.117002	0.117002	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	2.5505	2.5505	144.58	84.18	60.73	60.73	0	1	1.28	0.000013	0.000013	0.121920	0.121920	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	2.5408	2.5408	143.18	72.15	56.59	56.59	1	2	1.64	0.000013	0.000013	0.113859	0.113859	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	2.5457	2.5457	149.25	69.68	56.70	56.70	0	1	1.28	0.000013	0.000013	0.119052	0.119052	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	2.5210	2.5210	109.89	57.12	51.98	51.98	0	7	1.64	0.000013	0.000013	0.111576	0.111576	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	2.5368	2.5368	127.09	62.94	52.31	52.31	0	0	1.28	0.000013	0.000013	0.113415	0.113415	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	2.5787	2.5787	128.73	60.95	53.17	53.17	3	5	1.28	0.000013	0.000013	0.107501	0.107501	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	2.4986	2.4986	85.03	45.04	47.03	47.03	1	1	1.64	0.000013	0.000013	0.102204	0.102204	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	2.5539	2.5539	95.23	53.83	48.07	48.07	1	2	1.28	0.000013	0.000013	0.108342	0.108342	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	2.4967	2.4967	74.88	40.06	42.03	42.03	10	4	1.64	0.000013	0.000013	0.101978	0.101978	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	2.4559	2.4559	47.48	30.14	35.81	35.81	0	1	1.64	0.000013	0.000013	0.088583	0.088583	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	1.5512	0.00	69.34	0.00	63.97	0	0	10.20	0.000002	0.000002	0.038455	0.038455	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	1.5318	0.00	66.09	0.00	60.48	0	0	10.20	0.000002	0.000002	0.037377	0.037377	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	1.5234	0.00	64.36	0.00	58.77	0	0	10.20	0.000002	0.000002	0.036459	0.036459	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.7903	0.00	68.39	0.00	62.14	0	0	1.28	0.000007	0.000007	0.028514	0.028514	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.7831	0.00	64.76	0.00	60.04	0	0	1.28	0.000007	0.000007	0.028111	0.028111	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	1.4636	1.7885	89.34	66.45	47.72	58.31	0	0	1.64	0.000002	0.000007	0.029327	0.029327	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.7831	0.00	58.72	0.00	58.13	0	0	1.28	0.000007	0.000007	0.028111	0.028111	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	1.4636	1.7885	83.45	55.20	46.10	56.33	0	1	1.64	0.000002	0.000007	0.028414	0.028414	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.7831	0.00	48.96	0.00	56.16	0	0	1.28	0.000007	0.000007	0.028111	0.028111	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	1.4300	1.7616	73.51	51.58	43.40	53.47	0	1	1.64	0.000002	0.000007	0.026939	0.026939	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.7574	0.00	54.08	0.00	53.34	0	0	1.28	0.000007	0.000007	0.026716	0.026716	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.7129	0.00	43.19	0.00	49.95	0	0	1.28	0.000007	0.000007	0.024421	0.024421	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.6881	0.00	47.08	0.00	47.13	0	2	1.64	0.000002	0.000007	0.023214	0.023214	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.7049	1.7049	93.03	35.49	47.60	47.60	0	0	1.28	0.000007	0.000007	0.024028	0.024028	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	1.3343	1.6851	52.86	46.10	35.52	44.86	3	8	1.64	0.000002	0.000007	0.023075	0.023075	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.7280	0.00	40.46	0.00	46.00	0	0	1.28	0.000007	0.000007	0.024096	0.024096	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	1.3269	1.6791	49.89	47.89	33.51	42.40	0	1	1.64	0.000002	0.000007	0.022793	0.022793	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	1.3192	1.6730	41.49	34.94	31.41	39.83	0	5	1.64	0.000002	0.000007	0.020551	0.020551	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.6791	1.6791	62.67	36.49	39.98	39.98	0	1	1.28	0.000007	0.000007	0.021797	0.021797	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.6537	1.6537	60.65	30.57	36.83	36.83	1	2	1.64	0.000007	0.000007	0.019270	0.019270	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6667	1.6667	63.98	29.87	37.12	37.12	0	1	1.28	0.000007	0.000007	0.020760	0.020760	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6018	1.6018	44.36	23.06	33.03	33.03	0	7	1.64	0.000007	0.000007	0.017255	0.017255	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6434	1.6434	53.33	26.42	33.89	33.89	0	0	1.28	0.000007	0.000007	0.018856	0.018856	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7532	1.7532	59.50	28.17	36.15	36.15	3	5	1.28	0.000007	0.000007	0.021291	0.021291	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5431	1.5431	32.43	17.18	29.05	29.05	1	1	1.64	0.000007	0.000007	0.014084	0.014084	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.6881	1.6881	41.61	23.52	31.77	31.77	1	2	1.28	0.000007	0.000007	0.019256	0.019256	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5380	1.5380	28.42	15.20	25.89	25.89	10	4	1.64	0.000007	0.000007	0.013928	0.013928	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4308	1.4308	16.12	10.23	20.86	20.86	0	1	1.64	0.000007	0.000007	0.009812	0.009812	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	1.5512	0.00	69.34	0.00	63.97	0	0	10.20	0.000002	0.000002	0.038455	0.038455	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	1.5318	0.00	66.09	0.00	60.48	0	0	10.20	0.000002	0.000002	0.037377	0.037377	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	1.5234	0.00	64.36	0.00	58.77	0	0	10.20	0.000002	0.000002	0.036459	0.036459	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.7903	0.00	69.32	0.00	62.14	0	0	1.28	0.000006	0.000006	0.028514	0.028514	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.7831	0.00	64.76	0.00	60.04	0	0	1.28	0.000006	0.000006	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.7885	0.00	66.45	0.00	58.31	0	0	1.64	0.000002	0.000006	0.029327	0.029327	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.7831	0.00	58.72	0.00	58.13	0	0	1.28	0.000006	0.000006	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.7885	0.00	55.20	0.00	56.33	0	0	1.64	0.000002	0.000006	0.028414	0.028414	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.7831	0.00	48.96	0.00	56.16	0	0	1.28	0.000006	0.000006	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.7616	0.00	51.58	0.00	53.47	0	0	1.64	0.000002	0.000006	0.026939	0.026939	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.7574	0.00	54.08	0.00	53.34	0	0	1.28	0.000006	0.000006	0.026716	0.026716	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.7129	0.00	43.19	0.00	49.95	0	0	1.28	0.000006	0.000006	0.024421	0.024421	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.6881	0.00	47.72	0.00	47.13	0	0	1.64	0.000002	0.000006	0.023214	0.023214	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.7049	0.00	35.49	0.00	47.60	0	0	1.28	0.000006	0.000006	0.024028	0.024028	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	1.6851	0.00	46.25	0.00	44.86	0	4	1.64	0.000002	0.000006	0.023075	0.023075	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.7280	0.00	40.46	0.00	46.00	0	0	1.28	0.000006	0.000006	0.024096	0.024096	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	1.3269	1.6791	49.89	50.14	33.51	42.40	1	0	1.64	0.000002	0.000006	0.022793	0.022793	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	1.3192	1.6730	41.80	34.94	31.41	39.83	4	1	1.64	0.000002	0.000006	0.020551	0.020551	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.6791	1.6791	65.59	36.49	39.98	39.98	1	0	1.28	0.000006	0.000006	0.021797	0.021797	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.6537	1.6537	60.84	30.57	36.83	36.83	2	1	1.64	0.000006	0.000006	0.019270	0.019270	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6667	1.6667	65.68	29.87	37.12	37.12	1	0	1.28	0.000006	0.000006	0.020760	0.020760	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6018	1.6018	46.40	23.06	33.03	33.03	7	0	1.64	0.000006	0.000006	0.017255	0.017255	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6434	1.6434	55.31	26.42	33.89	33.89	0	1	1.28	0.000006	0.000006	0.018856	0.018856	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7532	1.7532	62.19	28.17	36.15	36.15	5	3	1.28	0.000006	0.000006	0.021291	0.021291	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5431	1.5431	33.92	17.18	29.05	29.05	1	0	1.64	0.000006	0.000006	0.014084	0.014084	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.6881	1.6881	43.84	23.52	31.77	31.77	2	1	1.28	0.000006	0.000006	0.019256	0.019256	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5380	1.5380	29.83	15.20	25.89	25.89	4	10	1.64	0.000006	0.000006	0.013928	0.013928	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4308	1.4308	17.02	10.23	20.86	20.86	1	0	1.64	0.000006	0.000006	0.009812	0.009812	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	1.5512	0.00	69.34	0.00	63.97	0	0	10.20	0.000004	0.000004	0.038455	0.038455	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	1.5318	0.00	66.09	0.00	60.48	0	0	10.20	0.000004	0.000004	0.037377	0.037377	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	1.5234	0.00	64.36	0.00	58.77	0	0	10.20	0.000004	0.000004	0.036459	0.036459	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.7903	0.00	69.32	0.00	62.14	0	0	1.28	0.000013	0.000013	0.028514	0.028514	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.7831	0.00	64.76	0.00	60.04	0	0	1.28	0.000013	0.000013	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.7885	0.00	66.45	0.00	58.31	0	0	1.64	0.000004	0.000013	0.029327	0.029327	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.7831	0.00	58.72	0.00	58.13	0	0	1.28	0.000013	0.000013	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.7885	0.00	55.20	0.00	56.33	0	0	1.64	0.000004	0.000013	0.028414	0.028414	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.7831	0.00	48.96	0.00	56.16	0	0	1.28	0.000013	0.000013	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.7616	0.00	51.58	0.00	53.47	0	0	1.64	0.000004	0.000013	0.026939	0.026939	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.7574	0.00	54.08	0.00	53.34	0	0	1.28	0.000013	0.000013	0.026716	0.026716	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.7129	0.00	43.19	0.00	49.95	0	0	1.28	0.000013	0.000013	0.024421	0.024421	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.6881	0.00	47.72	0.00	47.13	0	0	1.64	0.000004	0.000013	0.023214	0.023214	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.7049	0.00	35.49	0.00	47.60	0	0	1.28	0.000013	0.000013	0.024028	0.024028	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	1.6851	0.00	46.25	0.00	44.86	0	4	1.64	0.000004	0.000013	0.023075	0.023075	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.7280	0.00	40.46	0.00	46.00	0	0	1.28	0.000013	0.000013	0.024096	0.024096	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	1.3269	1.6791	49.89	50.14	33.51	42.40	1	0	1.64	0.000004	0.000013	0.022793	0.022793	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	1.3192	1.6730	41.80	34.94	31.41	39.83	4	1	1.64	0.000004	0.000013	0.020551	0.020551	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.6791	1.6791	65.59	36.49	39.98	39.98	1	0	1.28	0.000013	0.000013	0.021797	0.021797	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.6537	1.6537	60.84	30.57	36.83	36.83	2	1	1.64	0.000013	0.000013	0.019270	0.019270	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6667	1.6667	65.68	29.87	37.12	37.12	1	0	1.28	0.000013	0.000013	0.020760	0.020760	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6018	1.6018	46.40	23.06	33.03	33.03	7	0	1.64	0.000013	0.000013	0.017255	0.017255	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6434	1.6434	55.31	26.42	33.89	33.89	0	1	1.28	0.000013	0.000013	0.018856	0.018856	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7532	1.7532	62.19	28.17	36.15	36.15	5	3	1.28	0.000013	0.000013	0.021291	0.021291	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5431	1.5431	33.92	17.18	29.05	29.05	1	0	1.64	0.000013	0.000013	0.014084	0.014084	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.6881	1.6881	43.84	23.52	31.77	31.77	2	1	1.28	0.000013	0.000013	0.019256	0.019256	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5380	1.5380	29.83	15.20	25.89	25.89	4	10	1.64	0.000013	0.000013	0.013928	0.013928	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4308	1.4308	17.02	10.23	20.86	20.86	1	0	1.64	0.000013	0.000013	0.009812	0.009812	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	3.0866	0.00	274.55	0.00	127.29	0	0	10.20	0.000002	0.000002	0.252334	0.252334	0.000000	0.032551	0.0400	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	3.0866	0.00	268.35	0.00	121.87	0	0	10.20	0.000002	0.000002	0.253318	0.253318	0.000000	0.029058	0.0400	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	3.0678	0.00	260.97	0.00	118.34	0	0	10.20	0.000002	0.000002	0.245736	0.245736	0.000000	0.026610	0.0400	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	3.0164	0.00	196.76	0.00	104.69	0	0	1.28	0.000007	0.000007	0.210874	0.210874	0.000000	0.015593	0.0400	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	3.0160	0.00	185.29	0.00	101.55	0	0	1.28	0.000007	0.000007	0.211233	0.211233	0.000000	0.012640	0.0400	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	3.0163	0.00	189.00	0.00	98.34	0	0	1.64	0.000002	0.000007	0.216444	0.216444	0.000000	0.009421	0.0400	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	3.0160	0.00	168.00	0.00	98.33	0	0	1.28	0.000007	0.000007	0.211233	0.211233	0.000000	0.009411	0.0400	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	3.0163	0.00	157.00	0.00	95.00	0	0	1.64	0.000002	0.000007	0.210963	0.210963	0.000000	0.005851	0.0400	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	3.0160	0.00	140.06	0.00	94.99	0	0	1.28	0.000007	0.000007	0.211233	0.211233	0.000000	0.005841	0.0400	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	3.0148	0.00	151.07	0.00	91.50	0	0	1.64	0.000002	0.000007	0.212262	0.212262	0.000000	0.001825	0.0400	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	3.0146	0.00	159.11	0.00	91.50	0	0	1.28	0.000007	0.000007	0.212456	0.212456	0.000000	0.001817	0.0400	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	3.0122	0.00	133.56	0.00	87.84	0	0	1.28	0.000007	0.000007	0.214409	0.214409	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	3.0108	0.00	151.81	0.00	84.06	0	0	1.64	0.000002	0.000007	0.215404	0.215404	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	3.0117	0.00	110.76	0.00	84.08	0	0	1.28	0.000007	0.000007	0.214736	0.214736	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	3.0106	0.00	147.64	0.00	80.14	0	4	1.64	0.000002	0.000007	0.215518	0.215518	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	3.0130	0.00	123.01	0.00	80.20	0	0	1.28	0.000007	0.000007	0.206349	0.206349	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	2.9912	3.0103	253.55	161.14	75.54	76.02	1	0	1.64	0.000002	0.000007	0.215746	0.215746	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	2.9908	3.0100	214.85	113.11	71.21	71.67	4	1	1.64	0.000002	0.000007	0.200954	0.200954	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	3.0103	3.0103	210.80	117.27	71.67	71.67	1	0	1.28	0.000007	0.000007	0.208250	0.208250	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	3.0089	3.0089	201.45	101.20	67.01	67.01	2	1	1.64	0.000007	0.000007	0.197827	0.197827	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	3.0097	3.0097	214.17	97.39	67.03	67.03	1	0	1.28	0.000007	0.000007	0.204934	0.204934	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	3.0061	3.0061	163.41	81.22	61.99	61.99	7	0	1.64	0.000007	0.000007	0.199365	0.199365	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	3.0084	3.0084	185.36	88.52	62.03	62.03	0	1	1.28	0.000007	0.000007	0.198151	0.198151	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	3.0143	3.0143	183.84	83.29	62.15	62.15	5	3	1.28	0.000007	0.000007	0.177852	0.177852	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	3.0029	3.0029	128.45	65.05	56.52	56.52	1	0	1.64	0.000007	0.000007	0.189289	0.189289	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	3.0108	3.0108	139.48	74.81	56.67	56.67	2	1	1.28	0.000007	0.000007	0.185399	0.185399	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	3.0027	3.0027	113.71	57.94	50.55	50.55	4	10	1.64	0.000007	0.000007	0.189394	0.189394	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	2.9969	2.9969	74.65	44.89	43.70	43.70	1	0	1.64	0.000007	0.000007	0.175586	0.175586	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

SUPERSTRUCTURE ANNUAL FREQUENCY OF COLLAPSE (WATER ELEVATION 4.2 CD)

Pier ID	Description	Ultimate Lateral Capacity, H (MN)	Annual Frequency of Collapse, AF			Return Period
		Superstructure	Inbound	Outbound	Total	
1	Main Span South	**0**	0.00021788	0.00001565	0.00023353	4,282
2	Main Span North	**0**	0.00003669	0.00002390	0.00006059	16,504
3	Anchor Span North	**0**	0.00000493	0.00000000	0.00000493	202,814
Total for Bridge Superstructure:			0.00025950	0.00003955	0.00029905	**3,344**

VESSEL FLEET CHARACTERISTICS (SUPERSTRUCTURE ONLY)

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Vessel Size (m)		Vessel Drafts (m)				Vessel Heights (m)									Vessel Displacement (tonnes) [3]		Channel Width, C (m)	Centerline Transit Path to Edge of Channel, x_C (m)	Minimum Design Impact Speed, V_{min} (m/sec)		Standard Deviation, σ (m)	
							Ballasted			Baseline [1]			Loaded [2]			Ballasted [2]										
				Length Overall, LOA	Beam/ Width, B	Operational Loaded, D_O	Stern, D_{ES}	Bow, D_{EB}	Average, D_{AVG}	Bow, H_{BH}	Deckhouse, H_{DH}	Mast, H_{MT}	Bow, H_{BH}	Deckhouse, H_{DH}	Mast, H_{MT}	Bow, H_{BH}	Deckhouse, H_{DH}	Mast, H_{MT}	Loaded, W_L	Ballasted, W_E			Loaded	Ballasted	Loaded	Ballasted
1	Ship	Tanker	120,000	250	44	11.9	8.2	4.7	6.5	26.53	40.24	51.50	14.63	28.34	39.60	21.83	32.04	43.30	101,270	54,890	125.4	62.7	0.514	0.514	80	80
2	Ship	Tanker	110,000	240	44	11.8	8.3	4.9	6.6	26.31	39.96	52.09	14.51	28.16	40.29	21.41	31.66	43.79	95,920	53,650	125.4	62.7	0.514	0.514	79	79
3	Ship	Tanker	105,000	244	42	13.0	8.4	5.0	6.7	26.19	39.80	52.29	13.19	26.80	39.29	21.19	31.40	43.89	102,480	52,820	119.7	59.9	0.514	0.514	80	80
4	Ship	Bulk Carrier	85,000	229	32	11.7	8.6	5.4	7.0	27.69	42.80	55.70	15.99	31.10	44.00	22.29	34.20	47.10	67,920	40,640	110.0	55.0	1.029	1.029	78	78
5	Ship	Bulk Carrier	80,000	225	32	11.9	8.4	5.2	6.8	27.34	42.25	55.19	15.44	30.35	43.29	22.14	33.85	46.79	67,900	38,800	110.0	55.0	1.029	1.029	78	78
6	Ship	Tanker	75,000	228	34	11.3	8.3	5.1	6.7	25.36	38.69	51.41	14.06	27.39	40.11	20.26	30.39	43.11	66,730	39,570	110.0	55.0	0.514	1.029	78	78
7	Ship	Bulk Carrier	75,000	225	32	12.1	7.8	4.6	6.2	26.96	41.67	54.64	14.86	29.57	42.54	22.36	33.87	46.84	68,640	35,180	110.0	55.0	1.029	1.029	78	78
8	Ship	Tanker	70,000	228	32	11.0	7.4	4.2	5.8	25.18	38.46	49.61	14.18	27.46	38.61	20.98	31.06	42.21	62,330	32,870	110.0	55.0	0.514	1.029	78	78
9	Ship	Bulk Carrier	70,000	225	32	12.0	6.8	3.6	5.2	26.56	41.04	54.06	14.56	29.04	42.06	22.96	34.24	47.26	67,680	29,330	110.0	55.0	1.029	1.029	78	78
10	Ship	Tanker	65,000	214	32	10.9	7.5	4.5	6.0	25.00	38.22	49.43	14.10	27.32	38.53	20.50	30.72	41.93	57,520	31,660	110.0	55.0	0.514	1.029	77	77
11	Ship	Bulk Carrier	65,000	212	32	11.7	7.8	4.8	6.3	26.12	40.36	53.43	14.42	28.66	41.73	21.32	32.56	45.63	61,920	33,350	110.0	55.0	1.029	1.029	77	77
12	Ship	Bulk Carrier	60,000	193	32	11.6	7.2	4.5	5.9	25.66	39.63	52.75	14.06	28.03	41.15	21.16	32.43	45.55	55,590	28,040	110.0	55.0	1.029	1.029	75	75
13	Ship	Tanker	55,000	184	32	11.4	8.3	5.7	7.0	24.58	37.66	49.38	13.18	26.26	37.98	18.88	29.36	41.08	51,250	31,470	110.0	55.0	0.514	1.029	74	74
14	Ship	Bulk Carrier	55,000	190	32	10.9	6.3	3.6	5.0	25.15	38.84	52.01	14.25	27.94	41.11	21.55	32.54	45.71	51,210	23,260	110.0	55.0	1.029	1.029	75	75
15	Ship	Tanker	50,000	183	32	10.6	8.2	5.6	6.9	24.35	37.35	49.65	13.75	26.75	39.05	18.75	29.15	41.45	47,500	30,920	110.0	55.0	0.514	1.029	74	74
16	Ship	Bulk Carrier	50,000	199	30	12.2	7.0	4.2	5.6	24.59	37.98	51.21	12.39	25.78	39.01	20.39	30.98	44.21	56,210	25,810	110.0	55.0	1.029	1.029	76	76
17	Ship	Tanker	45,000	181	32	10.3	8.6	6.1	7.4	24.08	37.00	49.13	13.78	26.70	38.83	17.98	28.40	40.53	45,340	32,350	110.0	55.0	0.514	1.029	74	74
18	Ship	Tanker	40,000	179	28	10.1	7.5	5.0	6.3	23.79	36.61	47.60	13.69	26.51	37.50	18.79	29.11	40.10	38,430	23,780	110.0	55.0	0.514	1.029	74	74
19	Ship	Bulk Carrier	40,000	181	30	9.1	7.2	4.7	6.0	23.29	35.95	49.32	14.19	26.85	40.22	18.59	28.75	42.12	37,700	24,650	110.0	55.0	1.029	1.029	74	74
20	Ship	Tanker	35,000	173	27	10.2	7.3	4.9	6.1	23.46	36.17	46.68	13.26	25.97	36.48	18.56	28.87	39.38	35,600	21,290	110.0	55.0	1.029	1.029	73	73
21	Ship	Bulk Carrier	35,000	177	29	9.7	6.5	4.0	5.3	22.51	34.73	48.19	12.81	25.03	38.49	18.51	28.23	41.69	37,830	20,480	110.0	55.0	1.029	1.029	73	73
22	Ship	Tanker	30,000	159	27	9.2	6.5	4.3	5.4	23.08	35.66	44.78	13.88	26.46	35.58	18.78	29.16	38.28	29,160	17,120	110.0	55.0	1.029	1.029	71	71
23	Ship	Bulk Carrier	30,000	170	27	9.5	6.6	4.2	5.4	21.61	33.33	46.89	12.11	23.83	37.39	17.41	26.73	40.29	32,770	18,630	110.0	55.0	1.029	1.029	72	72
24	Ship	Articulated Tug/Barge	30,000	210	23	9.3	5.0	5.0	5.0	23.08	35.66	44.78	13.78	26.36	35.48	18.08	30.66	39.78	32,470	17,460	110.0	55.0	1.029	1.029	77	77
25	Ship	Tanker	25,000	146	24	9.2	6.5	4.5	5.5	22.62	35.06	43.64	13.42	25.86	34.44	18.12	28.56	37.14	22,970	13,740	110.0	55.0	1.029	1.029	69	69
26	Ship	Articulated Tug/Barge	25,000	184	24	8.3	5.0	5.0	5.0	22.62	35.06	43.64	14.32	26.76	35.34	17.62	30.06	38.64	26,090	15,720	110.0	55.0	1.029	1.029	74	74
27	Ship	Tanker	20,000	145	24	8.7	6.1	4.1	5.1	22.07	34.32	42.76	13.37	25.62	34.06	17.97	28.22	36.66	20,880	12,240	110.0	55.0	1.029	1.029	69	69
28	Ship	Tanker	15,000	127	20	8.1	6.3	4.5	5.4	21.52	33.58	40.63	13.42	25.48	32.53	17.02	27.28	34.33	14,280	9,520	110.0	55.0	1.029	1.029	65	65

Notes:

[1] Vessel heights as measured from the baseline/keel of the vessel.

[2] Vessel heights as measured from the waterline. Use Operational Loaded Draft (D_O) for all loaded vessel heights. Use Ballasted Bow (D_{EB}) for ballasted vessel heights at the bow and Ballasted Stern (D_{ES}) for ballasted vessel heights at the deckhouse and mast.

[3] Weight of Water (W_W) = 0.9854 m^3/tonne (used to determine ship loaded/ballasted displacement tonnage based on approximate salinity of water in Vancouver Harbor)

VESSEL FLEET ANNUAL TRIP FREQUENCY (SUPERSTRUCTURE ONLY)

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Annual Number of Trips (N)						Existing Total Trips	Growth Factor [1]	Future Total Trips
				Inbound			Outbound					
				Loaded	Ballasted	Total	Loaded	Ballasted	Total			
1	Ship	Tanker	120,000	0	0	0	5	0	5	5	10.20	51
2	Ship	Tanker	110,000	0	0	0	3	0	3	3	10.20	31
3	Ship	Tanker	105,000	0	0	0	0	0	0	0	10.20	0
4	Ship	Bulk Carrier	85,000	0	0	0	0	0	0	0	1.28	0
5	Ship	Bulk Carrier	80,000	0	0	0	0	0	0	0	1.28	0
6	Ship	Tanker	75,000	0	0	0	2	0	2	2	1.64	3
7	Ship	Bulk Carrier	75,000	0	0	0	1	0	1	1	1.28	1
8	Ship	Tanker	70,000	0	1	1	0	0	0	1	1.64	2
9	Ship	Bulk Carrier	70,000	0	0	0	0	0	0	0	1.28	0
10	Ship	Tanker	65,000	0	1	1	2	0	2	3	1.64	5
11	Ship	Bulk Carrier	65,000	4	0	4	2	0	2	6	1.28	8
12	Ship	Bulk Carrier	60,000	0	0	0	1	0	1	1	1.28	1
13	Ship	Tanker	55,000	1	2	3	3	0	3	6	1.64	10
14	Ship	Bulk Carrier	55,000	0	0	0	1	0	1	1	1.28	1
15	Ship	Tanker	50,000	3	8	11	8	4	12	23	1.64	38
16	Ship	Bulk Carrier	50,000	0	0	0	0	0	0	0	1.28	0
17	Ship	Tanker	45,000	0	1	1	1	0	1	2	1.64	3
18	Ship	Tanker	40,000	0	5	5	4	1	5	10	1.64	16
19	Ship	Bulk Carrier	40,000	0	1	1	1	0	1	2	1.28	3
20	Ship	Tanker	35,000	1	2	3	2	1	3	6	1.64	10
21	Ship	Bulk Carrier	35,000	0	1	1	1	0	1	2	1.28	3
22	Ship	Tanker	30,000	0	7	7	7	0	7	14	1.64	23
23	Ship	Bulk Carrier	30,000	0	0	0	0	1	1	1	1.28	1
24	Ship	Articulated Tug/Barge	30,000	3	5	8	5	3	8	16	1.28	20
25	Ship	Tanker	25,000	1	1	2	1	0	1	3	1.64	5
26	Ship	Articulated Tug/Barge	25,000	1	2	3	2	1	3	6	1.28	8
27	Ship	Tanker	20,000	10	4	14	4	10	14	28	1.64	46
28	Ship	Tanker	15,000	0	1	1	1	0	1	2	1.64	3
			Total Trips:	24	42	66	57	21	78	144		292

Notes:

[1] As part of the risk analysis, vessel trips will include future growth in the waterway that are projected to the mid-point of the remaining design life (assumed 50 years) of the structure. This equates to growth rates per year as follows for a 25-year projection. GF = $(1+\text{PERCENT}/100)^{25}$

- Aframax Tankers (DWT greater than 100,000 tonnes) = 9.735%
- All Other Tankers = 2.0%
- All Other Vessels = 1.0%

VESSEL FLEET TRANSIT SPEEDS IN MAIN CHANNEL (SUPERSTRUCTURE ONLY)

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Vessel Transit Speeds (knots)				Vessel Transit Speeds (m/sec) [1]			
				Inbound		Outbound		Inbound		Outbound	
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted
1	Ship	Tanker	120,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
2	Ship	Tanker	110,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
3	Ship	Tanker	105,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
4	Ship	Bulk Carrier	85,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
5	Ship	Bulk Carrier	80,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
6	Ship	Tanker	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
7	Ship	Bulk Carrier	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
8	Ship	Tanker	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
9	Ship	Bulk Carrier	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
10	Ship	Tanker	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
11	Ship	Bulk Carrier	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
12	Ship	Bulk Carrier	60,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
13	Ship	Tanker	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
14	Ship	Bulk Carrier	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
15	Ship	Tanker	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
16	Ship	Bulk Carrier	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
17	Ship	Tanker	45,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
18	Ship	Tanker	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
19	Ship	Bulk Carrier	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
20	Ship	Tanker	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
21	Ship	Bulk Carrier	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
22	Ship	Tanker	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
23	Ship	Bulk Carrier	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
24	Ship	Articulated Tug/Barge	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
25	Ship	Tanker	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
26	Ship	Articulated Tug/Barge	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
27	Ship	Tanker	20,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
28	Ship	Tanker	15,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866

Notes:

[1] Conversion (knot to m/sec) = 0.51 (convert vessel transit speeds from knots to meters/second for use in risk assessment equations)

ABERRANCY BASE RATE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Code Recommended Aberrancy Base Rate, BR	Vessel Traffic Service, VTS	Electronic Chart Display & Information System, ECDIS	Other Navigation Aids	Port Control State, PCS	Pilotage 1 Pilot	Pilotage 2 Pilots (MRA-2)		Daytime Only Transit Restrictions (MRA-2)		Visibility Restrictions (MRA-2)	Adjusted Aberrancy Base Rate, BR [1]	
										Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
2	Ship	Tanker	110,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
3	Ship	Tanker	105,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
4	Ship	Bulk Carrier	85,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
5	Ship	Bulk Carrier	80,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
6	Ship	Tanker	75,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
7	Ship	Bulk Carrier	75,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
8	Ship	Tanker	70,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
9	Ship	Bulk Carrier	70,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
10	Ship	Tanker	65,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
11	Ship	Bulk Carrier	65,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
12	Ship	Bulk Carrier	60,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
13	Ship	Tanker	55,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
14	Ship	Bulk Carrier	55,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
15	Ship	Tanker	50,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
16	Ship	Bulk Carrier	50,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
17	Ship	Tanker	45,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
18	Ship	Tanker	40,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
19	Ship	Bulk Carrier	40,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
20	Ship	Tanker	35,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
21	Ship	Bulk Carrier	35,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
22	Ship	Tanker	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
23	Ship	Bulk Carrier	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
24	Ship	Articulated Tug/Barge	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
25	Ship	Tanker	25,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
26	Ship	Articulated Tug/Barge	25,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
27	Ship	Tanker	20,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
28	Ship	Tanker	15,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05

Notes:

[1] Adjustments to the aberrancy Base Rate (BR) due to waterway current restrictions are accounted for elsewhere in the vessel collision risk analysis (refer to correction factors R_C and R_{XC} for the Probability of Aberrancy at each transit leg).

MISCELLANEOUS INFORMATION (SUPERSTRUCTURE ONLY)

CHANNEL CHARACTERISTICS

Waterway Current Speed (V_{min}) =	**1.03**	m/sec
Mean High Water (MHW) Elevation =	**4.20**	m (based on Chart Datum)
Sea Level Rise Adjustment =	**0.10**	m
Soft Soil Allowance =	**1.00**	m (assumed depth that vessels can "plow" through soft bottom material)

AVAILABLE WATER DEPTH AT PIERS

Pier ID	Description	Mudline Elevation (m) [1]		Water Elevation (m)	Soft Soil Allowance (m)	Design Water Depth (m)	
		Inbound	Outbound			Inbound	Outbound
1	**Main Span South**	**-6.00**	**-5.00**	4.30	1.00	11.30	10.30
2	**Main Span North**	**-10.00**	**-9.00**	4.30	1.00	15.30	14.30
3	**Anchor Span North**	**-5.00**	**N/A**	4.30	1.00	10.30	0.00

Notes:
[1] Mudline elevation is based on Chart Datum (CD) and was obtained from Nautical Chart 3494

PROBABILITY OF ABERRANCY VARIABLES FOR EACH VESSEL TRANSIT PATH

Leg ID	Waterway Region for Bridge Location	Angle of Channel Turn, θ (deg) [1]	Correction Factor, R_B	Current Angle to Vessel Path (deg) [2]	Parallel Current, V_C (m/sec)	Perpendicular Current, V_{XC} (m/sec)	Correction Factor, R_C	Correction Factor, R_{XC}	Vessel Traffic Density	Correction Factor, R_D	Summation (R_B*R_C*R_{XC}*R_D)	Aberrancy Distribution [3]	
												Inbound	Outbound
1	**Transition**	**7.7227**	1.0858	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.3095	**0.24**	**N/A**
2	**Turn/Bend**	**7.7227**	1.1716	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4130	**0.50**	**N/A**
3	**Turn/Bend**	**7.7227**	1.1716	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4130	**0.26**	**N/A**
4	**Transition**	**8.8764**	1.0986	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.3249	**N/A**	**0.24**
5	**Turn/Bend**	**8.8764**	1.1973	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4439	**N/A**	**0.50**
6	**Turn/Bend**	**8.8764**	1.1973	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4439	**N/A**	**0.26**

Notes:
[1] Angle of the turn region in accordance with information shown on Nautical Chart 3494, AIS transit data near the bridge, and CAN/CSA S6-14 Figure A3.3.1
[2] The angle between the water current direction and each channel transition leg
[3] Distribution of the Probability of Aberrancy for each channel transition leg is established as a ratio of the length of each leg to the overall length being considered (approximately 1 nautical mile or 2000m)

PROTECTION FACTOR

Pier ID	Description	Leg 1		Leg 2		Leg 3		Leg 4		Leg 5		Leg 6	
		Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
1	Main Span South	**0.63**	**N/A**	**0.63**	**N/A**	**0.66**	**N/A**	**N/A**	**0.29**	**N/A**	**0.29**	**N/A**	**0.36**
2	Main Span North	**0.72**	**N/A**	**0.72**	**N/A**	**0.80**	**N/A**	**N/A**	**0.23**	**N/A**	**0.23**	**N/A**	**0.18**
3	Anchor Span North	**0.58**	**N/A**	**0.58**	**N/A**	**0.67**	**N/A**	**N/A**	**0.00**	**N/A**	**0.00**	**N/A**	**0.00**

SUPERSTRUCTURE CONTACT GEOMETRY - MAIN SPAN SOUTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Main Span South (Pier 16)																				
				Leg 1 [1]							Leg 2 [1]							Leg 3 [1]						
				Centerline of Pier 16	Loaded			Ballasted			Centerline of Pier 16	Loaded			Ballasted			Centerline of Pier 16	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	98.319	90.571	69.730	40.537	81.256	62.850	20.586	98.319	90.571	69.730	40.537	81.256	62.850	20.586	168.710	160.899	139.886	110.453	151.507	132.949	90.337
2	Ship	Tanker	110,000	98.319	90.725	70.065	37.737	81.799	63.556	16.064	98.319	90.725	70.065	37.737	81.799	63.556	16.064	168.710	161.055	140.224	107.630	152.055	133.661	85.777
3	Ship	Tanker	105,000	98.319	92.433	72.594	41.795	82.084	64.040	15.141	98.319	92.433	72.594	41.795	82.084	64.040	15.141	168.710	162.777	142.774	111.721	152.342	134.149	84.847
4	Ship	Bulk Carrier	85,000	98.319	88.811	64.597	14.126	80.661	57.553	-68.079	98.319	88.811	64.597	14.126	80.661	57.553	-68.079	168.710	159.125	134.711	83.823	150.907	127.608	0.941
5	Ship	Bulk Carrier	80,000	98.319	88.531	65.992	20.678	80.855	58.485	-68.079	98.319	88.531	65.992	20.678	80.855	58.485	-68.079	168.710	158.842	136.117	90.430	151.103	128.548	0.941
6	Ship	Tanker	75,000	98.319	91.308	71.496	38.468	83.287	65.917	21.895	98.319	91.308	71.496	38.468	83.287	65.917	21.895	168.710	161.642	141.667	108.367	153.555	136.042	91.657
7	Ship	Bulk Carrier	75,000	98.319	90.273	67.443	25.436	80.570	58.431	-68.079	98.319	90.273	67.443	25.436	80.570	58.431	-68.079	168.710	160.599	137.580	95.227	150.816	128.494	0.941
8	Ship	Tanker	70,000	98.319	91.153	71.366	44.554	82.356	64.672	27.485	98.319	91.153	71.366	44.554	82.356	64.672	27.485	168.710	161.486	141.536	114.503	152.616	134.786	97.293
9	Ship	Bulk Carrier	70,000	98.319	90.661	68.429	28.417	79.735	57.446	-68.079	98.319	90.661	68.429	28.417	79.735	57.446	-68.079	168.710	160.990	138.574	98.233	149.974	127.500	0.941
10	Ship	Tanker	65,000	98.319	91.256	71.627	44.878	82.976	65.305	29.225	98.319	91.256	71.627	44.878	82.976	65.305	29.225	168.710	161.590	141.799	114.830	153.242	135.424	99.047
11	Ship	Bulk Carrier	65,000	98.319	90.842	69.135	30.468	81.916	61.883	-5.985	98.319	90.842	69.135	30.468	81.916	61.883	-5.985	168.710	161.173	139.286	100.300	152.173	131.974	63.547
12	Ship	Bulk Carrier	60,000	98.319	91.308	70.306	34.070	82.123	62.124	-4.384	98.319	91.308	70.306	34.070	82.123	62.124	-4.384	168.710	161.642	140.467	103.932	152.381	132.217	65.161
13	Ship	Tanker	55,000	98.319	92.446	73.598	48.400	85.072	67.834	34.505	98.319	92.446	73.598	48.400	85.072	67.834	34.505	168.710	162.790	143.786	118.381	155.355	137.974	104.371
14	Ship	Bulk Carrier	55,000	98.319	91.063	70.474	34.319	81.619	61.920	-7.651	98.319	91.063	70.474	34.319	81.619	61.920	-7.651	168.710	161.395	140.636	104.183	151.873	132.011	61.867
15	Ship	Tanker	50,000	98.319	91.709	72.687	42.769	85.241	68.223	32.206	98.319	91.709	72.687	42.769	85.241	68.223	32.206	168.710	162.047	142.867	112.703	155.525	138.367	102.053
16	Ship	Bulk Carrier	50,000	98.319	93.469	74.491	42.932	83.119	64.821	12.188	98.319	93.469	74.491	42.932	83.119	64.821	12.188	168.710	163.821	144.686	112.867	153.386	134.936	81.869
17	Ship	Tanker	45,000	98.319	91.671	72.780	43.661	86.237	69.619	36.763	98.319	91.671	72.780	43.661	86.237	69.619	36.763	168.710	162.008	142.961	113.603	156.529	139.774	106.648
18	Ship	Tanker	40,000	98.319	91.787	73.133	48.759	85.189	68.298	38.509	98.319	91.787	73.133	48.759	85.189	68.298	38.509	168.710	162.125	143.317	118.743	155.473	138.442	108.408
19	Ship	Bulk Carrier	40,000	98.319	91.140	72.501	38.022	85.349	68.967	28.045	98.319	91.140	72.501	38.022	85.349	68.967	28.045	168.710	161.473	142.680	107.917	155.634	139.117	97.857
20	Ship	Tanker	35,000	98.319	92.343	74.138	51.477	85.487	68.744	41.430	98.319	92.343	74.138	51.477	85.487	68.744	41.430	168.710	162.686	144.330	121.482	155.773	138.892	111.353
21	Ship	Bulk Carrier	35,000	98.319	92.925	75.885	45.041	85.551	69.934	30.715	98.319	92.925	75.885	45.041	85.551	69.934	30.715	168.710	163.273	146.092	114.994	155.838	140.092	100.550
22	Ship	Tanker	30,000	98.319	91.541	73.226	53.875	85.202	68.206	45.893	98.319	91.541	73.226	53.875	85.202	68.206	45.893	168.710	161.877	143.411	123.900	155.486	138.349	115.853
23	Ship	Bulk Carrier	30,000	98.319	93.831	78.117	49.052	86.974	72.724	37.737	98.319	93.831	78.117	49.052	86.974	72.724	37.737	168.710	164.186	148.342	119.038	157.273	142.905	107.630
24	Ship	Articulated Tug/Barge	30,000	98.319	91.671	73.413	54.142	86.108	65.416	39.807	98.319	91.671	73.413	54.142	86.108	65.416	39.807	168.710	162.008	143.599	124.169	156.399	135.536	109.717
25	Ship	Tanker	25,000	98.319	92.136	74.342	56.913	86.056	69.321	49.718	98.319	92.136	74.342	56.913	86.056	69.321	49.718	168.710	162.477	144.536	126.963	156.347	139.474	119.709
26	Ship	Articulated Tug/Barge	25,000	98.319	90.971	72.669	54.515	86.703	66.531	44.432	98.319	90.971	72.669	54.515	86.703	66.531	44.432	168.710	161.303	142.849	124.545	156.999	136.661	114.380
27	Ship	Tanker	20,000	98.319	92.200	74.488	57.926	86.249	69.953	50.998	98.319	92.200	74.488	57.926	86.249	69.953	50.998	168.710	162.542	144.986	127.984	156.542	140.111	120.999
28	Ship	Tanker	15,000	98.319	92.136	75.049	61.938	87.478	71.702	57.206	98.319	92.136	75.049	61.938	87.478	71.702	57.206	168.710	162.477	145.249	132.030	157.781	141.874	127.258

Notes:

[1] Perpendicular distances at each channel transition leg (as measured in CADD drawing) from the centerline of vessel transit path to where the loaded/ballasted vessel bow, deckhouse, or mast makes first contact with the bottom chord of the truss superstructure adjacent to Pier 16. The absolute boundaries for "Main Span South" are the centerline of main span (between Piers 15-16) and the centerline of Pier 16. Note that the values for Leg 6 are shown as "N/A" since the extension of this particular vessel transit path occurs well south of the centerline of pier boundary.

SUPERSTRUCTURE CONTACT GEOMETRY - MAIN SPAN SOUTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Main Span South (Pier 16)																				
				Leg 4 [1]							Leg 5 [1]							Leg 6 [1]						
				Centerline of Pier 16	Loaded			Ballasted			Centerline of Pier 16	Loaded			Ballasted			Centerline of Pier 16	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	168.710	160.899	139.886	110.453	151.507	132.949	90.337	168.710	160.899	139.886	110.453	151.507	132.949	90.337	61.162	N/A	N/A	N/A	N/A	N/A	N/A
2	Ship	Tanker	110,000	168.710	161.055	140.224	107.630	152.055	133.661	85.777	168.710	161.055	140.224	107.630	152.055	133.661	85.777	61.162	N/A	N/A	N/A	N/A	N/A	N/A
3	Ship	Tanker	105,000	168.710	162.777	142.774	111.721	152.342	134.149	84.847	168.710	162.777	142.774	111.721	152.342	134.149	84.847	61.162	N/A	N/A	N/A	N/A	N/A	N/A
4	Ship	Bulk Carrier	85,000	168.710	159.125	134.711	83.823	150.907	127.608	0.941	168.710	159.125	134.711	83.823	150.907	127.608	0.941	61.162	N/A	N/A	N/A	N/A	N/A	N/A
5	Ship	Bulk Carrier	80,000	168.710	158.842	136.117	90.430	151.103	128.548	0.941	168.710	158.842	136.117	90.430	151.103	128.548	0.941	61.162	N/A	N/A	N/A	N/A	N/A	N/A
6	Ship	Tanker	75,000	168.710	161.642	141.667	108.367	153.555	136.042	91.657	168.710	161.642	141.667	108.367	153.555	136.042	91.657	61.162	N/A	N/A	N/A	N/A	N/A	N/A
7	Ship	Bulk Carrier	75,000	168.710	160.599	137.580	95.227	150.816	128.494	0.941	168.710	160.599	137.580	95.227	150.816	128.494	0.941	61.162	N/A	N/A	N/A	N/A	N/A	N/A
8	Ship	Tanker	70,000	168.710	161.486	141.536	114.503	152.616	134.786	97.293	168.710	161.486	141.536	114.503	152.616	134.786	97.293	61.162	N/A	N/A	N/A	N/A	N/A	N/A
9	Ship	Bulk Carrier	70,000	168.710	160.990	138.574	98.233	149.974	127.500	0.941	168.710	160.990	138.574	98.233	149.974	127.500	0.941	61.162	N/A	N/A	N/A	N/A	N/A	N/A
10	Ship	Tanker	65,000	168.710	161.590	141.799	114.830	153.242	135.424	99.047	168.710	161.590	141.799	114.830	153.242	135.424	99.047	61.162	N/A	N/A	N/A	N/A	N/A	N/A
11	Ship	Bulk Carrier	65,000	168.710	161.173	139.286	100.300	152.173	131.974	63.547	168.710	161.173	139.286	100.300	152.173	131.974	63.547	61.162	N/A	N/A	N/A	N/A	N/A	N/A
12	Ship	Bulk Carrier	60,000	168.710	161.642	140.467	103.932	152.381	132.217	65.161	168.710	161.642	140.467	103.932	152.381	132.217	65.161	61.162	N/A	N/A	N/A	N/A	N/A	N/A
13	Ship	Tanker	55,000	168.710	162.790	143.786	118.381	155.355	137.974	104.371	168.710	162.790	143.786	118.381	155.355	137.974	104.371	61.162	N/A	N/A	N/A	N/A	N/A	N/A
14	Ship	Bulk Carrier	55,000	168.710	161.395	140.636	104.183	151.873	132.011	61.867	168.710	161.395	140.636	104.183	151.873	132.011	61.867	61.162	N/A	N/A	N/A	N/A	N/A	N/A
15	Ship	Tanker	50,000	168.710	162.047	142.867	112.703	155.525	138.367	102.053	168.710	162.047	142.867	112.703	155.525	138.367	102.053	61.162	N/A	N/A	N/A	N/A	N/A	N/A
16	Ship	Bulk Carrier	50,000	168.710	163.821	144.686	112.867	153.386	134.936	81.869	168.710	163.821	144.686	112.867	153.386	134.936	81.869	61.162	N/A	N/A	N/A	N/A	N/A	N/A
17	Ship	Tanker	45,000	168.710	162.008	142.961	113.603	156.529	139.774	106.648	168.710	162.008	142.961	113.603	156.529	139.774	106.648	61.162	N/A	N/A	N/A	N/A	N/A	N/A
18	Ship	Tanker	40,000	168.710	162.125	143.317	118.743	155.473	138.442	108.408	168.710	162.125	143.317	118.743	155.473	138.442	108.408	61.162	N/A	N/A	N/A	N/A	N/A	N/A
19	Ship	Bulk Carrier	40,000	168.710	161.473	142.680	107.917	155.634	139.117	97.857	168.710	161.473	142.680	107.917	155.634	139.117	97.857	61.162	N/A	N/A	N/A	N/A	N/A	N/A
20	Ship	Tanker	35,000	168.710	162.686	144.330	121.482	155.773	138.892	111.353	168.710	162.686	144.330	121.482	155.773	138.892	111.353	61.162	N/A	N/A	N/A	N/A	N/A	N/A
21	Ship	Bulk Carrier	35,000	168.710	163.273	146.092	114.994	155.838	140.092	100.550	168.710	163.273	146.092	114.994	155.838	140.092	100.550	61.162	N/A	N/A	N/A	N/A	N/A	N/A
22	Ship	Tanker	30,000	168.710	161.877	143.411	123.900	155.486	138.349	115.853	168.710	161.877	143.411	123.900	155.486	138.349	115.853	61.162	N/A	N/A	N/A	N/A	N/A	N/A
23	Ship	Bulk Carrier	30,000	168.710	164.186	148.342	119.038	157.273	142.905	107.630	168.710	164.186	148.342	119.038	157.273	142.905	107.630	61.162	N/A	N/A	N/A	N/A	N/A	N/A
24	Ship	Articulated Tug/Barge	30,000	168.710	162.008	143.599	124.169	156.399	135.536	109.717	168.710	162.008	143.599	124.169	156.399	135.536	109.717	61.162	N/A	N/A	N/A	N/A	N/A	N/A
25	Ship	Tanker	25,000	168.710	162.477	144.536	126.963	156.347	139.474	119.709	168.710	162.477	144.536	126.963	156.347	139.474	119.709	61.162	N/A	N/A	N/A	N/A	N/A	N/A
26	Ship	Articulated Tug/Barge	25,000	168.710	161.303	142.849	124.545	156.999	136.661	114.380	168.710	161.303	142.849	124.545	156.999	136.661	114.380	61.162	N/A	N/A	N/A	N/A	N/A	N/A
27	Ship	Tanker	20,000	168.710	162.542	144.986	127.984	156.542	140.111	120.999	168.710	162.542	144.986	127.984	156.542	140.111	120.999	61.162	N/A	N/A	N/A	N/A	N/A	N/A
28	Ship	Tanker	15,000	168.710	162.477	145.249	132.030	157.781	141.874	127.258	168.710	162.477	145.249	132.030	157.781	141.874	127.258	61.162	N/A	N/A	N/A	N/A	N/A	N/A

SUPERSTRUCTURE CONTACT GEOMETRY - MAIN SPAN NORTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Main Span North (Pier 15)																				
				Leg 1 [1]							Leg 2 [1]							Leg 3 [1]						
				Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	234.213	226.465	205.624	176.431	217.150	198.744	156.480	234.213	226.465	205.624	176.431	217.150	198.744	156.480	166.562	158.750	137.738	108.304	149.359	130.801	88.189
2	Ship	Tanker	110,000	234.213	226.619	205.959	173.631	217.693	199.450	151.957	234.213	226.619	205.959	173.631	217.693	199.450	151.957	166.562	158.906	138.076	105.482	149.907	131.513	83.629
3	Ship	Tanker	105,000	234.213	228.327	208.488	177.689	217.978	199.934	151.035	234.213	228.327	208.488	177.689	217.978	199.934	151.035	166.562	160.628	140.626	109.572	150.194	132.001	82.699
4	Ship	Bulk Carrier	85,000	234.213	224.705	200.491	150.019	216.554	193.447	68.079	234.213	224.705	200.491	150.019	216.554	193.447	68.079	166.562	156.976	132.563	81.675	148.565	125.460	-0.941
5	Ship	Bulk Carrier	80,000	234.213	224.424	201.886	156.572	216.749	194.379	68.079	234.213	224.424	201.886	156.572	216.749	194.379	68.079	166.562	156.693	133.969	88.282	148.955	126.400	-0.941
6	Ship	Tanker	75,000	234.213	227.201	207.390	174.362	219.181	201.811	157.789	234.213	227.201	207.390	174.362	219.181	201.811	157.789	166.562	159.493	139.519	106.219	151.407	133.894	89.509
7	Ship	Bulk Carrier	75,000	234.213	226.167	203.337	161.330	216.464	194.000	68.079	234.213	226.167	203.337	161.330	216.464	194.000	68.079	166.562	158.450	135.432	93.079	148.668	126.346	-0.941
8	Ship	Tanker	70,000	234.213	227.047	207.260	180.448	218.249	200.566	163.379	234.213	227.047	207.260	180.448	218.249	200.566	163.379	166.562	159.337	139.388	112.354	150.468	132.638	95.145
9	Ship	Bulk Carrier	70,000	234.213	226.555	204.323	164.311	215.629	193.339	68.079	234.213	226.555	204.323	164.311	215.629	193.339	68.079	166.562	158.841	136.426	96.085	147.826	125.352	-0.941
10	Ship	Tanker	65,000	234.213	227.150	207.521	180.772	218.870	201.198	165.119	234.213	227.150	207.521	180.772	218.870	201.198	165.119	166.562	159.441	139.651	112.681	151.094	133.276	96.899
11	Ship	Bulk Carrier	65,000	234.213	226.736	205.029	166.361	217.810	197.777	129.909	234.213	226.736	205.029	166.361	217.810	197.777	129.909	166.562	159.024	137.138	98.152	150.025	129.826	61.399
12	Ship	Bulk Carrier	60,000	234.213	227.201	206.200	169.964	218.016	198.018	131.510	234.213	227.201	206.200	169.964	218.016	198.018	131.510	166.562	159.493	138.319	101.784	150.233	130.069	63.012
13	Ship	Tanker	55,000	234.213	228.340	209.492	184.294	220.966	203.728	170.399	234.213	228.340	209.492	184.294	220.966	203.728	170.399	166.562	160.641	141.638	116.232	153.206	135.826	102.223
14	Ship	Bulk Carrier	55,000	234.213	226.957	206.368	170.213	217.513	197.813	128.243	234.213	226.957	206.368	170.213	217.513	197.813	128.243	166.562	159.246	138.488	102.035	149.725	129.863	59.719
15	Ship	Tanker	50,000	234.213	227.603	208.580	178.663	221.135	204.117	168.100	234.213	227.603	208.580	178.663	221.135	204.117	168.100	166.562	159.898	140.719	110.554	153.376	136.219	99.905
16	Ship	Bulk Carrier	50,000	234.213	229.363	210.384	178.825	219.013	200.714	148.082	234.213	229.363	210.384	178.825	219.013	200.714	148.082	166.562	161.672	142.538	110.718	151.238	132.788	79.721
17	Ship	Tanker	45,000	234.213	227.564	208.674	179.555	222.130	205.513	172.657	234.213	227.564	208.674	179.555	222.130	205.513	172.657	166.562	159.859	140.813	111.454	154.380	137.626	104.500
18	Ship	Tanker	40,000	234.213	227.681	209.027	184.653	221.083	204.192	174.403	234.213	227.681	209.027	184.653	221.083	204.192	174.403	166.562	159.976	141.169	116.594	153.324	136.294	106.260
19	Ship	Bulk Carrier	40,000	234.213	227.034	208.395	173.916	221.243	204.861	163.938	234.213	227.034	208.395	173.916	221.243	204.861	163.938	166.562	159.324	140.532	105.769	153.485	136.969	95.709
20	Ship	Tanker	35,000	234.213	228.237	210.031	187.371	221.381	204.638	177.324	234.213	228.237	210.031	187.371	221.381	204.638	177.324	166.562	160.537	142.182	119.334	153.624	136.744	109.204
21	Ship	Bulk Carrier	35,000	234.213	228.819	211.779	180.935	221.445	205.828	166.609	234.213	228.819	211.779	180.935	221.445	205.828	166.609	166.562	161.124	143.944	112.845	153.689	137.944	98.402
22	Ship	Tanker	30,000	234.213	227.435	209.120	189.769	221.096	204.099	181.787	234.213	227.435	209.120	189.769	221.096	204.099	181.787	166.562	159.728	141.263	121.752	153.337	136.201	113.704
23	Ship	Bulk Carrier	30,000	234.213	229.725	214.011	184.946	222.868	208.618	173.631	234.213	229.725	214.011	184.946	222.868	208.618	173.631	166.562	162.037	146.194	116.889	155.124	140.757	105.482
24	Ship	Articulated Tug/Barge	30,000	234.213	227.564	209.306	190.036	222.001	201.310	175.701	234.213	227.564	209.306	190.036	222.001	201.310	175.701	166.562	159.859	141.451	122.021	154.250	133.388	107.568
25	Ship	Tanker	25,000	234.213	228.030	210.236	192.807	221.950	205.215	185.612	234.213	228.030	210.236	192.807	221.950	205.215	185.612	166.562	160.328	142.388	124.815	154.198	137.326	117.561
26	Ship	Articulated Tug/Barge	25,000	234.213	226.865	208.563	190.409	226.865	208.563	190.409	234.213	226.865	208.563	190.409	226.865	208.563	190.409	166.562	159.154	140.701	122.397	154.850	134.513	112.231
27	Ship	Tanker	20,000	234.213	228.094	210.682	193.819	222.143	205.847	186.892	234.213	228.094	210.682	193.819	222.143	205.847	186.892	166.562	160.393	142.838	125.836	154.393	137.963	118.851
28	Ship	Tanker	15,000	234.213	228.030	210.943	197.832	223.372	207.596	193.099	234.213	228.030	210.943	197.832	223.372	207.596	193.099	166.562	160.328	143.101	129.882	155.632	139.726	125.110

Notes:

[1] Perpendicular distances at each channel transition leg (as measured in CADD drawing) from the centerline of vessel transit path to where the loaded/ballasted vessel bow, deckhouse, or mast makes first contact with the bottom chord of the truss superstructure adjacent to Pier 15. The absolute boundaries for "Main Span North" are the centerline of main span (between Piers 15-16) and the centerline of Pier 15.

SUPERSTRUCTURE CONTACT GEOMETRY - MAIN SPAN NORTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Main Span North (Pier 15)																				
				Leg 4 [1]							Leg 5 [1]							Leg 6 [1]						
				Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	166.562	158.750	137.738	108.304	149.359	130.801	88.189	166.562	158.750	137.738	108.304	149.359	130.801	88.189	392.040	384.331	363.594	334.546	375.062	356.748	314.694
2	Ship	Tanker	110,000	166.562	158.906	138.076	105.482	149.907	131.513	83.629	166.562	158.906	138.076	105.482	149.907	131.513	83.629	392.040	384.485	363.927	331.760	375.603	357.450	310.194
3	Ship	Tanker	105,000	166.562	160.628	140.626	109.572	150.194	132.001	82.699	166.562	160.628	140.626	109.572	150.194	132.001	82.699	392.040	386.184	366.444	335.797	375.886	357.932	309.276
4	Ship	Bulk Carrier	85,000	166.562	156.976	132.563	81.675	148.565	125.460	-0.941	166.562	156.976	132.563	81.675	148.565	125.460	-0.941	392.040	382.580	358.487	308.266	374.470	351.477	226.732
5	Ship	Bulk Carrier	80,000	166.562	156.693	133.969	88.282	148.955	126.400	-0.941	166.562	156.693	133.969	88.282	148.955	126.400	-0.941	392.040	382.301	359.874	314.786	374.663	352.404	226.732
6	Ship	Tanker	75,000	166.562	159.493	139.519	106.219	151.407	133.894	89.509	166.562	159.493	139.519	106.219	151.407	133.894	89.509	392.040	385.064	365.351	332.487	377.083	359.800	315.997
7	Ship	Bulk Carrier	75,000	166.562	158.450	135.432	93.079	148.668	126.346	-0.941	166.562	158.450	135.432	93.079	148.668	126.346	-0.941	392.040	384.035	361.318	319.520	352.351	374.380	226.732
8	Ship	Tanker	70,000	166.562	159.337	139.388	112.354	150.468	132.638	95.145	166.562	159.337	139.388	112.354	150.468	132.638	95.145	392.040	384.910	365.222	338.543	376.156	358.561	321.559
9	Ship	Bulk Carrier	70,000	166.562	158.841	136.426	96.085	147.826	125.352	-0.941	166.562	158.841	136.426	96.085	147.826	125.352	-0.941	392.040	384.420	362.299	322.487	373.549	351.370	226.732
10	Ship	Tanker	65,000	166.562	159.441	139.651	112.681	151.094	133.276	96.899	166.562	159.441	139.651	112.681	151.094	133.276	96.899	392.040	385.013	365.481	338.866	376.774	359.190	323.290
11	Ship	Bulk Carrier	65,000	166.562	159.024	137.138	98.152	150.025	129.826	61.399	166.562	159.024	137.138	98.152	150.025	129.826	61.399	392.040	384.601	363.001	324.526	375.719	355.785	288.255
12	Ship	Bulk Carrier	60,000	166.562	159.493	138.319	101.784	150.233	130.069	63.012	166.562	159.493	138.319	101.784	150.233	130.069	63.012	392.040	385.064	364.167	328.111	375.925	356.025	289.848
13	Ship	Tanker	55,000	166.562	160.641	141.638	116.232	153.206	135.826	102.223	166.562	160.641	141.638	116.232	153.206	135.826	102.223	392.040	386.197	367.442	342.370	378.859	361.707	328.544
14	Ship	Bulk Carrier	55,000	166.562	159.246	138.488	102.035	149.725	129.863	59.719	166.562	159.246	138.488	102.035	149.725	129.863	59.719	392.040	384.820	364.334	328.358	375.423	355.822	286.597
15	Ship	Tanker	50,000	166.562	159.898	140.719	110.554	153.376	136.219	99.905	166.562	159.898	140.719	110.554	153.376	136.219	99.905	392.040	385.464	366.535	336.767	379.027	362.095	326.256
16	Ship	Bulk Carrier	50,000	166.562	161.672	142.538	110.718	151.238	132.788	79.721	166.562	161.672	142.538	110.718	151.238	132.788	79.721	392.040	387.214	368.331	336.928	376.916	358.709	306.337
17	Ship	Tanker	45,000	166.562	159.859	140.813	111.454	154.380	137.626	104.500	166.562	159.859	140.813	111.454	154.380	137.626	104.500	392.040	385.425	366.628	337.655	380.018	363.483	330.791
18	Ship	Tanker	40,000	166.562	159.976	141.169	116.594	153.324	136.294	106.260	166.562	159.976	141.169	116.594	153.324	136.294	106.260	392.040	385.541	366.980	342.727	378.976	362.169	332.528
19	Ship	Bulk Carrier	40,000	166.562	159.324	140.532	105.769	153.485	136.969	95.709	166.562	159.324	140.532	105.769	153.485	136.969	95.709	392.040	384.897	366.351	332.043	379.135	362.835	322.115
20	Ship	Tanker	35,000	166.562	160.537	142.182	119.334	153.624	136.744	109.204	166.562	160.537	142.182	119.334	153.624	136.744	109.204	392.040	386.094	367.979	345.431	379.272	362.613	335.434
21	Ship	Bulk Carrier	35,000	166.562	161.124	143.944	112.845	153.689	137.944	98.402	166.562	161.124	143.944	112.845	153.689	137.944	98.402	392.040	386.673	369.718	339.027	379.336	363.797	324.773
22	Ship	Tanker	30,000	166.562	159.728	141.263	121.752	153.337	136.201	113.704	166.562	159.728	141.263	121.752	153.337	136.201	113.704	392.040	385.296	367.072	347.817	378.989	362.077	339.875
23	Ship	Bulk Carrier	30,000	166.562	162.037	146.194	116.889	155.124	140.757	105.482	166.562	162.037	146.194	116.889	155.124	140.757	105.482	392.040	387.575	371.939	343.018	380.752	366.573	331.760
24	Ship	Articulated Tug/Barge	30,000	166.562	159.859	141.451	122.021	154.250	133.388	107.568	166.562	159.859	141.451	122.021	154.250	133.388	107.568	392.040	385.425	367.258	348.083	379.890	359.301	333.820
25	Ship	Tanker	25,000	166.562	160.328	142.388	124.815	154.198	137.326	117.561	166.562	160.328	142.388	124.815	154.198	137.326	117.561	392.040	385.888	368.183	350.840	379.838	363.187	343.682
26	Ship	Articulated Tug/Barge	25,000	166.562	159.154	140.701	122.397	154.850	134.513	112.231	166.562	159.154	140.701	122.397	154.850	134.513	112.231	392.040	384.729	366.518	348.454	380.482	360.411	338.421
27	Ship	Tanker	20,000	166.562	160.393	142.838	125.836	154.393	137.963	118.851	166.562	160.393	142.838	125.836	154.393	137.963	118.851	392.040	385.952	368.627	351.848	380.031	363.816	344.955
28	Ship	Tanker	15,000	166.562	160.328	143.101	129.882	155.632	139.726	125.110	166.562	160.328	143.101	129.882	155.632	139.726	125.110	392.040	385.888	368.886	355.841	381.254	365.555	351.131

SUPERSTRUCTURE CONTACT GEOMETRY - ANCHOR SPAN NORTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Anchor Span North (Pier 15)																				
				Leg 1 [1]							Leg 2 [1]							Leg 3 [1]						
				Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	234.213	243.815	276.020	375.210	257.870	293.290	375.210	234.213	243.815	276.020	375.210	257.870	293.290	375.210	166.562	176.244	208.714	308.722	190.415	226.127	308.722
2	Ship	Tanker	110,000	234.213	243.611	275.336	375.210	256.829	291.102	375.210	234.213	243.611	275.336	375.210	256.829	291.102	375.210	166.562	176.038	208.024	308.722	189.365	223.921	308.722
3	Ship	Tanker	105,000	234.213	241.366	270.193	375.210	256.283	289.605	375.210	234.213	241.366	270.193	375.210	256.283	289.605	375.210	166.562	173.775	202.839	308.722	188.815	222.411	308.722
4	Ship	Bulk Carrier	85,000	234.213	246.127	287.877	375.210	259.011	310.962	375.210	234.213	246.127	287.877	375.210	259.011	310.962	375.210	166.562	178.575	220.669	308.722	191.565	243.944	308.722
5	Ship	Bulk Carrier	80,000	234.213	245.192	283.654	375.210	258.639	307.673	375.210	234.213	245.192	283.654	375.210	258.639	307.673	375.210	166.562	177.632	216.411	308.722	191.190	240.629	308.722
6	Ship	Tanker	75,000	234.213	242.845	272.411	375.210	253.977	283.807	375.210	234.213	242.845	272.411	375.210	253.977	283.807	375.210	166.562	175.266	205.075	308.722	186.490	216.565	308.722
7	Ship	Bulk Carrier	75,000	234.213	243.214	280.691	375.210	259.184	307.861	375.210	234.213	243.214	280.691	375.210	259.184	307.861	375.210	166.562	175.638	213.424	308.722	191.740	240.818	308.722
8	Ship	Tanker	70,000	234.213	243.049	272.677	375.210	255.762	287.647	375.210	234.213	243.049	272.677	375.210	255.762	287.647	375.210	166.562	175.472	205.343	308.722	188.290	220.437	308.722
9	Ship	Bulk Carrier	70,000	234.213	243.696	278.678	375.210	260.672	311.644	375.210	234.213	243.696	278.678	375.210	260.672	311.644	375.210	166.562	176.124	211.394	308.722	193.240	244.632	308.722
10	Ship	Tanker	65,000	234.213	242.914	272.145	375.210	254.572	285.689	375.210	234.213	242.914	272.145	375.210	254.572	285.689	375.210	166.562	175.335	204.807	308.722	187.090	218.463	308.722
11	Ship	Bulk Carrier	65,000	234.213	243.458	277.235	375.210	256.605	296.284	375.210	234.213	243.458	277.235	375.210	256.605	296.284	375.210	166.562	175.884	209.939	308.722	189.140	229.146	308.722
12	Ship	Bulk Carrier	60,000	234.213	242.845	274.842	375.210	256.209	295.537	375.210	234.213	242.845	274.842	375.210	256.209	295.537	375.210	166.562	175.266	207.526	308.722	188.740	228.392	308.722
13	Ship	Tanker	55,000	234.213	241.350	268.854	375.210	251.040	279.894	375.210	234.213	241.350	268.854	375.210	251.040	279.894	375.210	166.562	173.758	201.489	308.722	183.529	212.620	308.722
14	Ship	Bulk Carrier	55,000	234.213	243.168	247.500	375.210	257.176	296.169	375.210	234.213	243.168	247.500	375.210	257.176	296.169	375.210	166.562	175.592	207.182	308.722	189.715	229.030	308.722
15	Ship	Tanker	50,000	234.213	242.319	270.069	375.210	250.820	279.097	375.210	234.213	242.319	270.069	375.210	250.820	279.097	375.210	166.562	174.735	202.714	308.722	183.307	211.816	308.722
16	Ship	Bulk Carrier	50,000	234.213	240.006	267.664	375.210	254.299	287.186	375.210	234.213	240.006	267.664	375.210	254.299	287.186	375.210	166.562	172.403	200.289	308.722	186.815	219.972	308.722
17	Ship	Tanker	45,000	234.213	242.369	269.945	375.210	249.511	276.247	375.210	234.213	242.369	269.945	375.210	249.511	276.247	375.210	166.562	174.786	202.589	308.722	181.987	208.943	308.722
18	Ship	Tanker	40,000	234.213	242.216	269.474	375.210	250.888	278.944	375.210	234.213	242.216	269.474	375.210	250.888	278.944	375.210	166.562	174.632	202.114	308.722	183.375	211.662	308.722
19	Ship	Bulk Carrier	40,000	234.213	243.066	270.360	375.210	250.547	277.577	375.210	234.213	243.066	270.360	375.210	250.547	277.577	375.210	166.562	175.489	203.007	308.722	183.032	210.284	308.722
20	Ship	Tanker	35,000	234.213	241.485	268.135	375.210	250.497	278.032	375.210	234.213	241.485	268.135	375.210	250.497	278.032	375.210	166.562	173.895	200.764	308.722	182.981	210.743	308.722
21	Ship	Bulk Carrier	35,000	234.213	240.720	265.804	375.210	250.412	275.601	375.210	234.213	240.720	265.804	375.210	250.412	275.601	375.210	166.562	173.123	198.414	308.722	182.895	208.292	308.722
22	Ship	Tanker	30,000	234.213	242.540	269.350	375.210	250.871	279.134	375.210	234.213	242.540	269.350	375.210	250.871	279.134	375.210	166.562	174.958	201.989	308.722	183.358	211.854	308.722
23	Ship	Bulk Carrier	30,000	234.213	239.530	262.829	375.210	248.541	270.020	375.210	234.213	239.530	262.829	375.210	248.541	270.020	375.210	166.562	171.923	195.415	308.722	181.009	202.664	308.722
24	Ship	Articulated Tug/Barge	30,000	234.213	242.369	269.102	375.210	249.681	285.343	375.210	234.213	242.369	269.102	375.210	249.681	285.343	375.210	166.562	174.786	201.739	308.722	182.158	218.114	308.722
25	Ship	Tanker	25,000	234.213	241.757	267.862	315.519	249.749	276.855	375.210	234.213	241.757	267.862	315.519	249.749	276.855	375.210	166.562	174.169	200.489	248.539	182.227	209.556	308.722
26	Ship	Articulated Tug/Barge	25,000	234.213	243.288	270.094	375.210	248.898	282.553	375.210	234.213	243.288	270.094	375.210	248.898	282.553	375.210	166.562	175.712	202.739	308.722	181.369	215.301	308.722
27	Ship	Tanker	20,000	234.213	241.672	267.267	309.646	249.493	275.564	375.210	234.213	241.672	267.267	309.646	249.493	275.564	375.210	166.562	174.083	199.889	242.618	181.969	208.254	308.722
28	Ship	Tanker	15,000	234.213	241.757	266.920	296.112	247.879	271.993	313.389	234.213	241.757	266.920	296.112	247.879	271.993	313.389	166.562	174.169	199.539	228.972	180.341	204.654	246.391

Notes:

[1] Perpendicular distances at each channel transition leg (as measured in CADD drawing) from the centerline of vessel transit path to where the loaded/ballasted vessel bow, deckhouse, or mast makes first contact with the bottom chord of the truss superstructure adjacent to Pier 15. The absolute boundaries for "Anchor Span North" are the centerline of Pier 15 and the centerline of Pier 14.

SUPERSTRUCTURE CONTACT GEOMETRY - ANCHOR SPAN NORTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Anchor Span North (Pier 15)																				
				Leg 4 [1]							Leg 5 [1]							Leg 6 [1]						
				Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	166.562	176.244	208.714	308.722	190.415	226.127	308.722	166.562	176.244	208.714	308.722	190.415	226.127	308.722	392.040	401.595	433.640	532.337	415.580	450.824	532.337
2	Ship	Tanker	110,000	166.562	176.038	208.024	308.722	189.365	223.921	308.722	166.562	176.038	208.024	308.722	189.365	223.921	308.722	392.040	401.392	432.959	532.337	414.544	448.647	532.337
3	Ship	Tanker	105,000	166.562	173.775	202.839	308.722	188.815	222.411	308.722	166.562	173.775	202.839	308.722	188.815	222.411	308.722	392.040	399.158	427.842	532.337	414.001	447.157	532.337
4	Ship	Bulk Carrier	85,000	166.562	178.575	220.669	308.722	191.565	243.944	308.722	166.562	178.575	220.669	308.722	191.565	243.944	308.722	392.040	403.895	445.438	532.337	416.715	468.408	532.337
5	Ship	Bulk Carrier	80,000	166.562	177.632	216.411	308.722	191.190	240.629	308.722	166.562	177.632	216.411	308.722	191.190	240.629	308.722	392.040	402.965	441.236	532.337	416.345	465.136	532.337
6	Ship	Tanker	75,000	166.562	175.266	205.075	308.722	186.490	216.565	308.722	166.562	175.266	205.075	308.722	186.490	216.565	308.722	392.040	400.630	430.048	532.337	411.706	441.388	532.337
7	Ship	Bulk Carrier	75,000	166.562	175.638	213.424	308.722	191.740	240.818	308.722	166.562	175.638	213.424	308.722	191.740	240.818	308.722	392.040	400.997	438.288	532.337	416.887	465.322	532.337
8	Ship	Tanker	70,000	166.562	175.472	205.343	308.722	188.290	220.437	308.722	166.562	175.472	205.343	308.722	188.290	220.437	308.722	392.040	400.833	430.313	532.337	413.483	445.209	532.337
9	Ship	Bulk Carrier	70,000	166.562	176.124	211.394	308.722	193.240	244.632	308.722	166.562	176.124	211.394	308.722	193.240	244.632	308.722	392.040	401.477	436.284	532.337	418.368	469.087	532.337
10	Ship	Tanker	65,000	166.562	175.335	204.807	308.722	187.090	218.463	308.722	166.562	175.335	204.807	308.722	187.090	218.463	308.722	392.040	400.698	429.784	532.337	412.299	443.261	532.337
11	Ship	Bulk Carrier	65,000	166.562	175.884	209.939	308.722	189.140	229.146	308.722	166.562	175.884	209.939	308.722	189.140	229.146	308.722	392.040	401.240	434.849	532.337	414.322	453.803	532.337
12	Ship	Bulk Carrier	60,000	166.562	175.266	207.526	308.722	188.740	228.392	308.722	166.562	175.266	207.526	308.722	188.740	228.392	308.722	392.040	400.630	432.467	532.337	413.927	453.059	532.337
13	Ship	Tanker	55,000	166.562	173.758	201.489	308.722	183.529	212.620	308.722	166.562	173.758	201.489	308.722	183.529	212.620	308.722	392.040	399.142	426.509	532.337	408.784	437.494	532.337
14	Ship	Bulk Carrier	55,000	166.562	175.592	207.182	308.722	189.715	229.030	308.722	166.562	175.592	207.182	308.722	189.715	229.030	308.722	392.040	400.952	432.128	532.337	414.889	453.689	532.337
15	Ship	Tanker	50,000	166.562	174.735	202.714	308.722	183.307	211.816	308.722	166.562	174.735	202.714	308.722	183.307	211.816	308.722	392.040	400.106	427.716	532.337	408.565	436.701	532.337
16	Ship	Bulk Carrier	50,000	166.562	172.403	200.289	308.722	186.815	219.972	308.722	166.562	172.403	200.289	308.722	186.815	219.972	308.722	392.040	397.214	425.325	532.337	412.027	444.750	532.337
17	Ship	Tanker	45,000	166.562	174.786	202.589	308.722	181.987	208.943	308.722	166.562	174.786	202.589	308.722	181.987	208.943	308.722	392.040	400.156	427.595	532.337	407.263	433.866	532.337
18	Ship	Tanker	40,000	166.562	174.632	202.114	308.722	183.375	211.662	308.722	166.562	174.632	202.114	308.722	183.375	211.662	308.722	392.040	400.004	427.126	532.337	408.632	436.549	532.337
19	Ship	Bulk Carrier	40,000	166.562	175.489	203.007	308.722	183.032	210.284	308.722	166.562	175.489	203.007	308.722	183.032	210.284	308.722	392.040	400.850	428.008	532.337	408.294	435.189	532.337
20	Ship	Tanker	35,000	166.562	173.895	200.764	308.722	182.981	210.743	308.722	166.562	173.895	200.764	308.722	182.981	210.743	308.722	392.040	399.277	425.794	532.337	408.244	435.642	532.337
21	Ship	Bulk Carrier	35,000	166.562	173.123	198.414	308.722	182.895	208.292	308.722	166.562	173.123	198.414	308.722	182.895	208.292	308.722	392.040	398.515	423.475	532.337	408.159	433.223	532.337
22	Ship	Tanker	30,000	166.562	174.958	201.989	308.722	183.358	211.854	308.722	166.562	174.958	201.989	308.722	183.358	211.854	308.722	392.040	400.326	427.003	532.337	408.616	436.738	532.337
23	Ship	Bulk Carrier	30,000	166.562	171.923	195.415	308.722	181.009	202.664	308.722	166.562	171.923	195.415	308.722	181.009	202.664	308.722	392.040	397.331	420.514	532.337	406.297	427.669	532.337
24	Ship	Articulated Tug/Barge	30,000	166.562	174.786	201.739	308.722	182.158	218.114	308.722	166.562	174.786	201.739	308.722	182.158	218.114	308.722	392.040	400.156	426.756	532.337	407.431	442.916	532.337
25	Ship	Tanker	25,000	166.562	174.169	200.489	248.539	182.227	209.556	308.722	166.562	174.169	200.489	248.539	182.227	209.556	308.722	392.040	399.547	425.523	472.943	407.499	434.471	532.337
26	Ship	Articulated Tug/Barge	25,000	166.562	175.712	202.739	308.722	181.369	215.301	308.722	166.562	175.712	202.739	308.722	181.369	215.301	308.722	392.040	401.070	427.743	532.337	406.653	440.140	532.337
27	Ship	Tanker	20,000	166.562	174.083	199.889	242.618	181.969	208.254	308.722	166.562	174.083	199.889	242.618	181.969	208.254	308.722	392.040	399.462	424.930	467.098	407.245	433.186	532.337
28	Ship	Tanker	15,000	166.562	174.169	199.539	228.972	180.341	204.654	246.391	166.562	174.169	199.539	228.972	180.341	204.654	246.391	392.040	399.547	424.585	453.632	405.638	429.633	470.823

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	2.8179	3.0845	3.0866	0.00	0.00	0.00	58.10	12.72	1.27	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	2.8065	3.0741	3.0866	0.00	0.00	0.00	55.41	12.14	1.22	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	2.7674	3.0265	3.0866	0.00	0.00	0.00	53.38	11.67	1.19	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	2.7941	3.0575	2.9375	0.00	0.00	0.00	48.49	12.20	1.17	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	2.7902	3.0467	2.9367	0.00	0.00	0.00	46.98	12.31	1.19	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	2.5684	2.8512	3.0866	2.7637	2.9620	3.0866	41.87	11.62	1.26	45.05	12.07	1.26	0	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	2.7935	3.0473	2.9367	0.00	0.00	0.00	45.54	12.42	1.20	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	2.5706	2.8530	3.0866	2.7743	2.9762	3.0866	40.48	11.68	1.26	43.69	12.19	1.26	0	1	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	2.8031	3.0586	2.9367	0.00	0.00	0.00	44.14	12.52	1.20	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	2.5584	2.8444	3.0866	2.7606	2.9666	3.0866	38.83	11.65	1.26	41.89	12.16	1.26	0	1	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	2.7720	3.0062	3.0866	0.00	0.00	0.00	42.07	12.32	1.26	0	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	2.7589	3.0006	3.0866	0.00	0.00	0.00	40.23	12.25	1.26	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	2.7168	2.9288	3.0866	0.00	0.00	0.00	37.92	11.86	1.25	0	2	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	2.6484	2.8986	3.0866	2.7632	3.0025	3.0866	36.97	11.73	1.25	38.57	12.16	1.25	0	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	2.5209	2.8141	3.0866	2.7139	2.9237	3.0866	33.55	11.24	1.23	36.12	11.67	1.23	3	8	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	2.7507	2.9693	3.0866	0.00	0.00	0.00	36.61	11.86	1.23	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	2.5191	2.8115	3.0866	2.7000	2.9057	3.0866	31.81	11.01	1.21	34.09	11.37	1.21	0	1	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	2.5148	2.8048	3.0866	2.7113	2.9213	3.0866	29.94	10.68	1.18	32.28	11.13	1.18	0	5	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	2.6393	2.8700	3.0866	2.7110	2.9138	3.0866	31.42	10.93	1.18	32.27	11.10	1.18	0	1	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	2.6160	2.8455	3.0866	2.7024	2.9134	3.0866	29.13	10.46	1.13	30.09	10.71	1.13	1	2	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	2.6131	2.8258	3.0866	2.7051	2.9002	3.0866	29.10	10.38	1.13	30.12	10.66	1.13	0	1	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	2.6095	2.8486	3.0866	2.6923	2.9142	3.0866	26.90	9.99	1.08	27.76	10.22	1.08	0	7	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	2.5938	2.7932	3.0866	2.6808	2.8617	3.0866	26.74	9.79	1.08	27.64	10.03	1.08	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	2.6566	2.8707	3.0866	2.7218	2.9645	3.0866	27.39	10.06	1.08	28.06	10.39	1.08	3	5	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	2.5825	2.8241	3.0607	2.6651	2.8922	3.0866	24.31	9.30	1.01	25.08	9.53	1.02	1	1	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	2.6442	2.8693	3.0866	2.6967	2.9448	3.0866	24.89	9.45	1.02	25.38	9.70	1.02	1	2	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	2.5800	2.8212	3.0468	2.6611	2.8830	3.0866	21.72	8.55	0.92	22.40	8.74	0.94	10	4	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	2.5459	2.7947	2.9856	2.6137	2.8434	3.0545	18.56	7.54	0.81	19.05	7.67	0.82	0	1	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.019260	0.062918	0.114394	0.045363	0.061142	0.182251	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.018785	0.062176	0.128552	0.043642	0.060274	0.208175	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.014397	0.058115	0.118833	0.042847	0.059317	0.213891	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.023754	0.076331	0.223322	0.046886	0.079646	0.575396	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.024462	0.070573	0.196427	0.046246	0.076692	0.580974	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.017175	0.058819	0.130921	0.039136	0.056193	0.189761	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.019840	0.070051	0.178324	0.047099	0.076047	0.580766	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.017575	0.058855	0.103574	0.041847	0.057960	0.158223	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.018826	0.067615	0.167435	0.049618	0.077347	0.576946	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.017178	0.058164	0.103764	0.039817	0.057571	0.153718	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.018223	0.065585	0.161528	0.042877	0.067092	0.320161	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.016790	0.062568	0.150438	0.041847	0.066973	0.319206	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.013811	0.054208	0.096524	0.033188	0.054511	0.140754	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.017367	0.061329	0.150156	0.043243	0.066291	0.336934	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.015628	0.055368	0.118672	0.032691	0.053601	0.153443	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000001	0.000002	0.000003	0.000007	0.000012
0.011462	0.054091	0.122738	0.039102	0.059817	0.240045	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.015691	0.054923	0.115066	0.029894	0.051449	0.136490	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.015368	0.053999	0.093673	0.032721	0.053165	0.123774	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000004	0.000006
0.017023	0.054520	0.140301	0.032336	0.051276	0.177024	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.013891	0.051921	0.085515	0.031710	0.052365	0.112162	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000001	0.000000	0.000001	0.000001	0.000003
0.012534	0.047818	0.119200	0.031660	0.048441	0.167624	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.015560	0.052507	0.072827	0.031961	0.053283	0.090717	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000004	0.000007
0.010251	0.042809	0.108748	0.027578	0.042753	0.143553	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.016075	0.053253	0.070846	0.030867	0.066068	0.104933	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000001	0.000001	0.000001	0.000002	0.000002	0.000007
0.013772	0.049712	0.064102	0.029027	0.051340	0.078102	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000002
0.017503	0.053589	0.067586	0.028703	0.063647	0.089749	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002
0.013590	0.049338	0.060439	0.028461	0.049622	0.074663	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000001	0.000003	0.000004	0.000001	0.000001	0.000002	0.000011
0.013079	0.046148	0.046226	0.024154	0.045955	0.054405	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
																		Total for Pier:	**0.000062**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	2.8179	3.0845	3.0866	0.00	0.00	0.00	58.10	12.72	1.27	0	0	10.20	0.000003	0.000003
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	2.8065	3.0741	3.0866	0.00	0.00	0.00	55.41	12.14	1.22	0	0	10.20	0.000003	0.000003
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	2.7674	3.0265	3.0866	0.00	0.00	0.00	53.38	11.67	1.19	0	0	10.20	0.000003	0.000003
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	2.7941	3.0575	2.9375	0.00	0.00	0.00	48.49	12.20	1.17	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	2.7902	3.0467	2.9367	0.00	0.00	0.00	46.98	12.31	1.19	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	2.5684	2.8512	3.0866	2.7637	2.9620	3.0866	41.87	11.62	1.26	45.05	12.07	1.26	0	0	1.64	0.000003	0.000013
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	2.7935	3.0473	2.9367	0.00	0.00	0.00	45.54	12.42	1.20	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	2.5706	2.8530	3.0866	2.7743	2.9762	3.0866	40.48	11.68	1.26	43.69	12.19	1.26	0	1	1.64	0.000003	0.000013
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	2.8031	3.0586	2.9367	0.00	0.00	0.00	44.14	12.52	1.20	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	2.5584	2.8444	3.0866	2.7606	2.9666	3.0866	38.83	11.65	1.26	41.89	12.16	1.26	0	1	1.64	0.000003	0.000013
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	2.7720	3.0062	3.0866	0.00	0.00	0.00	42.07	12.32	1.26	0	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	2.7589	3.0006	3.0866	0.00	0.00	0.00	40.23	12.25	1.26	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	2.7168	2.9288	3.0866	0.00	0.00	0.00	37.92	11.86	1.25	0	2	1.64	0.000003	0.000013
14	Ship	Bulk Carrier	55,000	2.6484	2.8986	3.0866	2.7632	3.0025	3.0866	36.97	11.73	1.25	38.57	12.16	1.25	0	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	2.5209	2.8141	3.0866	2.7139	2.9237	3.0866	33.55	11.24	1.23	36.12	11.67	1.23	3	8	1.64	0.000003	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	2.7507	2.9693	3.0866	0.00	0.00	0.00	36.61	11.86	1.23	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	2.5191	2.8115	3.0866	2.7000	2.9057	3.0866	31.81	11.01	1.21	34.09	11.37	1.21	0	1	1.64	0.000003	0.000013
18	Ship	Tanker	40,000	2.5148	2.8048	3.0866	2.7113	2.9213	3.0866	29.94	10.68	1.18	32.28	11.13	1.18	0	5	1.64	0.000003	0.000013
19	Ship	Bulk Carrier	40,000	2.6393	2.8700	3.0866	2.7110	2.9138	3.0866	31.42	10.93	1.18	32.27	11.10	1.18	0	1	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	2.6160	2.8455	3.0866	2.7024	2.9134	3.0866	29.13	10.46	1.13	30.09	10.71	1.13	1	2	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	2.6131	2.8258	3.0866	2.7051	2.9002	3.0866	29.10	10.38	1.13	30.12	10.66	1.13	0	1	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	2.6095	2.8486	3.0866	2.6923	2.9142	3.0866	26.90	9.99	1.08	27.76	10.22	1.08	0	7	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	2.5938	2.7932	3.0866	2.6808	2.8617	3.0866	26.74	9.79	1.08	27.64	10.03	1.08	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	2.6566	2.8707	3.0866	2.7218	2.9645	3.0866	27.39	10.06	1.08	28.06	10.39	1.08	3	5	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	2.5825	2.8241	3.0607	2.6651	2.8922	3.0866	24.31	9.30	1.01	25.08	9.53	1.02	1	1	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	2.6442	2.8693	3.0866	2.6967	2.9448	3.0866	24.89	9.45	1.02	25.38	9.70	1.02	1	2	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	2.5800	2.8212	3.0468	2.6611	2.8830	3.0866	21.72	8.55	0.92	22.40	8.74	0.94	10	4	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	2.5459	2.7947	2.9856	2.6137	2.8434	3.0545	18.56	7.54	0.81	19.05	7.67	0.82	0	1	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.019260	0.062918	0.114394	0.045363	0.061142	0.182251	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.018785	0.062176	0.128552	0.043642	0.060274	0.208175	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.014397	0.058115	0.118833	0.042847	0.059317	0.213891	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.023754	0.076331	0.223322	0.046886	0.079646	0.575396	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.024462	0.070573	0.196427	0.046246	0.076692	0.580974	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.017175	0.058819	0.130921	0.039136	0.056193	0.189761	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.019840	0.070051	0.178324	0.047099	0.076047	0.580766	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.017575	0.058855	0.103574	0.041847	0.057960	0.158223	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002	0.000003
0.018826	0.067615	0.167435	0.049618	0.077347	0.576946	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.017178	0.058164	0.103764	0.039817	0.057571	0.153718	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002	0.000003
0.018223	0.065585	0.161528	0.042877	0.067092	0.320161	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.016790	0.062568	0.150438	0.041847	0.066973	0.319206	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.013811	0.054208	0.096524	0.033188	0.054511	0.140754	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000001	0.000004	0.000006
0.017367	0.061329	0.150156	0.043243	0.066291	0.336934	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.015628	0.055368	0.118672	0.032691	0.053601	0.153443	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000001	0.000001	0.000003	0.000006	0.000016	0.000028
0.011462	0.054091	0.122738	0.039102	0.059817	0.240045	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.015691	0.054923	0.115066	0.029894	0.051449	0.136490	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.015368	0.053999	0.093673	0.032721	0.053165	0.123774	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000002	0.000004	0.000008	0.000014
0.017023	0.054520	0.140301	0.032336	0.051276	0.177024	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.013891	0.051921	0.085515	0.031710	0.052365	0.112162	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000001	0.000001	0.000001	0.000001	0.000003	0.000007
0.012534	0.047818	0.119200	0.031660	0.048441	0.167624	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.015560	0.052507	0.072827	0.031961	0.053283	0.090717	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000003	0.000005	0.000008	0.000016
0.010251	0.042809	0.108748	0.027578	0.042753	0.143553	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.016075	0.053253	0.070846	0.030867	0.066068	0.104933	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000001	0.000002	0.000002	0.000002	0.000003	0.000005	0.000015
0.013772	0.049712	0.064102	0.029027	0.051340	0.078102	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000001	0.000001	0.000000	0.000001	0.000001	0.000004
0.017503	0.053589	0.067586	0.028703	0.063647	0.089749	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000001	0.000001	0.000001	0.000001	0.000002	0.000005
0.013590	0.049338	0.060439	0.028461	0.049622	0.074663	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000002	0.000007	0.000008	0.000002	0.000003	0.000004	0.000025
0.013079	0.046148	0.046226	0.024154	0.045955	0.054405	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002
																		Total for Pier:	**0.000137**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	1.8003	2.0691	2.6863	0.00	0.00	0.00	37.12	8.53	1.11	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	1.7760	2.0458	2.7482	0.00	0.00	0.00	35.06	8.08	1.09	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.7584	2.0197	2.7277	0.00	0.00	0.00	33.92	7.79	1.05	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.9932	2.2589	3.0866	0.00	0.00	0.00	34.59	9.02	1.23	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.9849	2.2435	3.0866	0.00	0.00	0.00	33.42	9.06	1.25	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	1.5645	1.8496	2.3249	1.9615	2.1614	2.6682	25.50	7.54	0.95	31.98	8.81	1.09	0	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.9882	2.2441	3.0866	0.00	0.00	0.00	32.41	9.15	1.26	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	1.5667	1.8515	2.2373	1.9722	2.1758	2.6038	24.67	7.58	0.92	31.06	8.91	1.07	0	1	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.9978	2.2555	3.0866	0.00	0.00	0.00	31.46	9.24	1.26	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	1.5337	1.8220	2.2149	1.9418	2.1495	2.5734	23.27	7.47	0.91	29.47	8.81	1.05	0	1	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.9507	2.1868	2.9867	0.00	0.00	0.00	29.60	8.96	1.22	0	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.9101	2.1537	2.9639	0.00	0.00	0.00	27.85	8.79	1.21	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.8523	2.0661	2.4794	0.00	0.00	0.00	25.86	8.36	1.00	0	2	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	1.7937	2.0460	2.4890	1.9095	2.1508	3.0032	25.04	8.28	1.01	26.66	8.71	1.22	0	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	1.4370	1.7326	2.1974	1.8476	2.0591	2.5067	19.13	6.92	0.88	24.59	8.22	1.00	3	8	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.9111	2.1315	2.7656	0.00	0.00	0.00	25.44	8.51	1.10	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	1.4306	1.7253	2.1797	1.8299	2.0373	2.4473	18.06	6.75	0.85	23.11	7.97	0.96	0	1	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	1.4215	1.7139	2.0958	1.8376	2.0493	2.4227	16.92	6.53	0.80	21.88	7.81	0.92	0	5	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	1.7687	2.0013	2.4316	1.8410	2.0454	2.5561	21.06	7.62	0.93	21.92	7.79	0.97	0	1	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	1.7295	1.9609	2.2488	1.8167	2.0294	2.3765	19.26	7.21	0.83	20.23	7.46	0.87	1	2	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	1.7346	1.9491	2.3375	1.8274	2.0241	2.5178	19.32	7.16	0.86	20.35	7.44	0.93	0	1	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	1.6910	1.9321	2.1869	1.7745	1.9982	2.2920	17.43	6.77	0.77	18.29	7.00	0.80	0	7	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	1.7008	1.9019	2.2738	1.7885	1.9709	2.4186	17.53	6.67	0.80	18.44	6.91	0.85	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	1.8317	2.0476	2.2755	1.8975	2.1422	2.4450	18.88	7.18	0.80	19.56	7.51	0.86	3	5	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	1.6277	1.8712	2.1098	1.7109	1.9399	2.2082	15.32	6.16	0.69	16.10	6.39	0.73	1	1	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	1.7791	2.0061	2.2312	1.8321	2.0822	2.3563	16.74	6.61	0.73	17.24	6.86	0.78	1	2	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	1.6220	1.8611	2.0927	1.7037	1.9275	2.1878	13.65	5.64	0.63	14.34	5.84	0.66	10	4	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	1.5215	1.7724	1.9649	1.5899	1.8216	2.0344	11.09	4.78	0.53	11.59	4.91	0.55	0	1	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.004692	0.018090	0.043588	0.011690	0.019200	0.081226	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004452	0.017415	0.048900	0.010928	0.018390	0.093818	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003415	0.016040	0.043850	0.010822	0.018180	0.097330	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005516	0.021744	0.099723	0.011466	0.024737	0.443209	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005620	0.019734	0.082844	0.011159	0.023416	0.445177	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003915	0.015774	0.048078	0.009382	0.016277	0.079846	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004508	0.019233	0.072361	0.011386	0.023261	0.445105	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004010	0.015810	0.036573	0.010092	0.017005	0.064529	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.004268	0.018408	0.066292	0.012061	0.023913	0.443778	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003736	0.014949	0.035322	0.009138	0.016122	0.060041	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.003944	0.017069	0.061131	0.009840	0.019211	0.161343	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003348	0.015032	0.052482	0.008892	0.017933	0.153638	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002614	0.012148	0.028901	0.006616	0.013284	0.048184	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.003420	0.014553	0.051767	0.009097	0.017621	0.165269	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002957	0.012485	0.037094	0.006476	0.012954	0.053156	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000001	0.000003	0.000004
0.002315	0.012772	0.040035	0.008466	0.015982	0.102450	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002939	0.012260	0.035444	0.005818	0.012126	0.045041	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002844	0.011897	0.027504	0.006348	0.012611	0.040306	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.003200	0.012232	0.045171	0.006334	0.012205	0.062642	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002473	0.010969	0.023848	0.005935	0.011996	0.034818	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002275	0.010149	0.035178	0.006060	0.011219	0.057030	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002536	0.010319	0.018694	0.005472	0.011335	0.025584	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002
0.001772	0.008550	0.029807	0.005013	0.009271	0.044325	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003435	0.013316	0.022217	0.006840	0.017958	0.037774	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002
0.002007	0.008760	0.014697	0.004446	0.009820	0.019656	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003347	0.012192	0.019461	0.005656	0.015513	0.028770	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.001961	0.008417	0.013821	0.004313	0.009355	0.018391	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000001	0.000001	0.000000	0.000000	0.000001	0.000003
0.001549	0.006704	0.008591	0.002984	0.007124	0.010826	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000020**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	1.8003	2.0691	2.6863	0.00	0.00	0.00	37.12	8.53	1.11	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	1.7760	2.0458	2.7482	0.00	0.00	0.00	35.06	8.08	1.09	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.7584	2.0197	2.7277	0.00	0.00	0.00	33.92	7.79	1.05	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.9932	2.2589	3.0866	0.00	0.00	0.00	34.59	9.02	1.23	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.9849	2.2435	3.0866	0.00	0.00	0.00	33.42	9.06	1.25	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.9615	2.1614	2.6682	0.00	0.00	0.00	31.98	8.81	1.09	0	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.9882	2.2441	3.0866	0.00	0.00	0.00	32.41	9.15	1.26	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.9722	2.1758	2.6038	0.00	0.00	0.00	31.06	8.91	1.07	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.9978	2.2555	3.0866	0.00	0.00	0.00	31.46	9.24	1.26	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.9418	2.1495	2.5734	0.00	0.00	0.00	29.47	8.81	1.05	0	0	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.9507	2.1868	2.9867	0.00	0.00	0.00	29.60	8.96	1.22	0	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.9101	2.1537	2.9639	0.00	0.00	0.00	27.85	8.79	1.21	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.8523	2.0661	2.4794	0.00	0.00	0.00	25.86	8.36	1.00	0	0	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.9095	2.1508	3.0032	0.00	0.00	0.00	26.66	8.71	1.22	0	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	1.8476	2.0591	2.5067	0.00	0.00	0.00	24.59	8.22	1.00	0	4	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.9111	2.1315	2.7656	0.00	0.00	0.00	25.44	8.51	1.10	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	1.4306	1.7253	2.1797	1.8299	2.0373	2.4473	18.06	6.75	0.85	23.11	7.97	0.96	1	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	1.4215	1.7139	2.0958	1.8376	2.0493	2.4227	16.92	6.53	0.80	21.88	7.81	0.92	4	1	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	1.7687	2.0013	2.4316	1.8410	2.0454	2.5561	21.06	7.62	0.93	21.92	7.79	0.97	1	0	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	1.7295	1.9609	2.2488	1.8167	2.0294	2.3765	19.26	7.21	0.83	20.23	7.46	0.87	2	1	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	1.7346	1.9491	2.3375	1.8274	2.0241	2.5178	19.32	7.16	0.86	20.35	7.44	0.93	1	0	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	1.6910	1.9321	2.1869	1.7745	1.9982	2.2920	17.43	6.77	0.77	18.29	7.00	0.80	7	0	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	1.7008	1.9019	2.2738	1.7885	1.9709	2.4186	17.53	6.67	0.80	18.44	6.91	0.85	0	1	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	1.8317	2.0476	2.2755	1.8975	2.1422	2.4450	18.88	7.18	0.80	19.56	7.51	0.86	5	3	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	1.6277	1.8712	2.1098	1.7109	1.9399	2.2082	15.32	6.16	0.69	16.10	6.39	0.73	1	0	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	1.7791	2.0061	2.2312	1.8321	2.0822	2.3563	16.74	6.61	0.73	17.24	6.86	0.78	2	1	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	1.6220	1.8611	2.0927	1.7037	1.9275	2.1878	13.65	5.64	0.63	14.34	5.84	0.66	4	10	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	1.5215	1.7724	1.9649	1.5899	1.8216	2.0344	11.09	4.78	0.53	11.59	4.91	0.55	1	0	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.004692	0.018090	0.043588	0.011690	0.019200	0.081226	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004452	0.017415	0.048900	0.010928	0.018390	0.093818	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003415	0.016040	0.043850	0.010822	0.018180	0.097330	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005516	0.021744	0.099723	0.011466	0.024737	0.443209	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005620	0.019734	0.082844	0.011159	0.023416	0.445177	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003915	0.015774	0.048078	0.009382	0.016277	0.079846	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004508	0.019233	0.072361	0.011386	0.023261	0.445105	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004010	0.015810	0.036573	0.010092	0.017005	0.064529	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004268	0.018408	0.066292	0.012061	0.023913	0.443778	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003736	0.014949	0.035322	0.009138	0.016122	0.060041	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003944	0.017069	0.061131	0.009840	0.019211	0.161343	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003348	0.015032	0.052482	0.008892	0.017933	0.153638	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002614	0.012148	0.028901	0.006616	0.013284	0.048184	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003420	0.014553	0.051767	0.009097	0.017621	0.165269	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002957	0.012485	0.037094	0.006476	0.012954	0.053156	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.002315	0.012772	0.040035	0.008466	0.015982	0.102450	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002939	0.012260	0.035444	0.005818	0.012126	0.045041	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002844	0.011897	0.027504	0.006348	0.012611	0.040306	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003200	0.012232	0.045171	0.006334	0.012205	0.062642	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002473	0.010969	0.023848	0.005935	0.011996	0.034818	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002275	0.010149	0.035178	0.006060	0.011219	0.057030	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002536	0.010319	0.018694	0.005472	0.011335	0.025584	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.001772	0.008550	0.029807	0.005013	0.009271	0.044325	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003435	0.013316	0.022217	0.006840	0.017958	0.037774	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002007	0.008760	0.014697	0.004446	0.009820	0.019656	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003347	0.012192	0.019461	0.005656	0.015513	0.028770	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001961	0.008417	0.013821	0.004313	0.009355	0.018391	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.001549	0.006704	0.008591	0.002984	0.007124	0.010826	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000005**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	1.8003	2.0691	2.6863	0.00	0.00	0.00	37.12	8.53	1.11	0	0	10.20	0.000004	0.000004
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	1.7760	2.0458	2.7482	0.00	0.00	0.00	35.06	8.08	1.09	0	0	10.20	0.000004	0.000004
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.7584	2.0197	2.7277	0.00	0.00	0.00	33.92	7.79	1.05	0	0	10.20	0.000004	0.000004
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.9932	2.2589	3.0866	0.00	0.00	0.00	34.59	9.02	1.23	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.9849	2.2435	3.0866	0.00	0.00	0.00	33.42	9.06	1.25	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.9615	2.1614	2.6682	0.00	0.00	0.00	31.98	8.81	1.09	0	0	1.64	0.000004	0.000013
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.9882	2.2441	3.0866	0.00	0.00	0.00	32.41	9.15	1.26	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.9722	2.1758	2.6038	0.00	0.00	0.00	31.06	8.91	1.07	0	0	1.64	0.000004	0.000013
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.9978	2.2555	3.0866	0.00	0.00	0.00	31.46	9.24	1.26	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.9418	2.1495	2.5734	0.00	0.00	0.00	29.47	8.81	1.05	0	0	1.64	0.000004	0.000013
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.9507	2.1868	2.9867	0.00	0.00	0.00	29.60	8.96	1.22	0	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.9101	2.1537	2.9639	0.00	0.00	0.00	27.85	8.79	1.21	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.8523	2.0661	2.4794	0.00	0.00	0.00	25.86	8.36	1.00	0	0	1.64	0.000004	0.000013
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.9095	2.1508	3.0032	0.00	0.00	0.00	26.66	8.71	1.22	0	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	1.8476	2.0591	2.5067	0.00	0.00	0.00	24.59	8.22	1.00	0	4	1.64	0.000004	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.9111	2.1315	2.7656	0.00	0.00	0.00	25.44	8.51	1.10	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	1.4306	1.7253	2.1797	1.8299	2.0373	2.4473	18.06	6.75	0.85	23.11	7.97	0.96	1	0	1.64	0.000004	0.000013
18	Ship	Tanker	40,000	1.4215	1.7139	2.0958	1.8376	2.0493	2.4227	16.92	6.53	0.80	21.88	7.81	0.92	4	1	1.64	0.000004	0.000013
19	Ship	Bulk Carrier	40,000	1.7687	2.0013	2.4316	1.8410	2.0454	2.5561	21.06	7.62	0.93	21.92	7.79	0.97	1	0	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	1.7295	1.9609	2.2488	1.8167	2.0294	2.3765	19.26	7.21	0.83	20.23	7.46	0.87	2	1	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	1.7346	1.9491	2.3375	1.8274	2.0241	2.5178	19.32	7.16	0.86	20.35	7.44	0.93	1	0	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	1.6910	1.9321	2.1869	1.7745	1.9982	2.2920	17.43	6.77	0.77	18.29	7.00	0.80	7	0	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	1.7008	1.9019	2.2738	1.7885	1.9709	2.4186	17.53	6.67	0.80	18.44	6.91	0.85	0	1	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	1.8317	2.0476	2.2755	1.8975	2.1422	2.4450	18.88	7.18	0.80	19.56	7.51	0.86	5	3	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	1.6277	1.8712	2.1098	1.7109	1.9399	2.2082	15.32	6.16	0.69	16.10	6.39	0.73	1	0	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	1.7791	2.0061	2.2312	1.8321	2.0822	2.3563	16.74	6.61	0.73	17.24	6.86	0.78	2	1	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	1.6220	1.8611	2.0927	1.7037	1.9275	2.1878	13.65	5.64	0.63	14.34	5.84	0.66	4	10	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	1.5215	1.7724	1.9649	1.5899	1.8216	2.0344	11.09	4.78	0.53	11.59	4.91	0.55	1	0	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.004692	0.018090	0.043588	0.011690	0.019200	0.081226	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004452	0.017415	0.048900	0.010928	0.018390	0.093818	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003415	0.016040	0.043850	0.010822	0.018180	0.097330	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005516	0.021744	0.099723	0.011466	0.024737	0.443209	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005620	0.019734	0.082844	0.011159	0.023416	0.445177	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003915	0.015774	0.048078	0.009382	0.016277	0.079846	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004508	0.019233	0.072361	0.011386	0.023261	0.445105	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004010	0.015810	0.036573	0.010092	0.017005	0.064529	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004268	0.018408	0.066292	0.012061	0.023913	0.443778	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003736	0.014949	0.035322	0.009138	0.016122	0.060041	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003944	0.017069	0.061131	0.009840	0.019211	0.161343	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003348	0.015032	0.052482	0.008892	0.017933	0.153638	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002614	0.012148	0.028901	0.006616	0.013284	0.048184	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003420	0.014553	0.051767	0.009097	0.017621	0.165269	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002957	0.012485	0.037094	0.006476	0.012954	0.053156	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.002315	0.012772	0.040035	0.008466	0.015982	0.102450	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002939	0.012260	0.035444	0.005818	0.012126	0.045041	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002844	0.011897	0.027504	0.006348	0.012611	0.040306	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.003200	0.012232	0.045171	0.006334	0.012205	0.062642	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002473	0.010969	0.023848	0.005935	0.011996	0.034818	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002275	0.010149	0.035178	0.006060	0.011219	0.057030	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002536	0.010319	0.018694	0.005472	0.011335	0.025584	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000001
0.001772	0.008550	0.029807	0.005013	0.009271	0.044325	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003435	0.013316	0.022217	0.006840	0.017958	0.037774	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000001	0.000000	0.000000	0.000001	0.000002
0.002007	0.008760	0.014697	0.004446	0.009820	0.019656	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003347	0.012192	0.019461	0.005656	0.015513	0.028770	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.001961	0.008417	0.013821	0.004313	0.009355	0.018391	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000003
0.001549	0.006704	0.008591	0.002984	0.007124	0.010826	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000011**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	4	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	1	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	4	1	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	1	0	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	2	1	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	1	0	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	7	0	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	1	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	5	3	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	1	0	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	2	1	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	4	10	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	1	0	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.277428	0.000000	0.000000	0.277428	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.279537	0.000000	0.000000	0.279537	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.278673	0.000000	0.000000	0.278673	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.282064	0.000000	0.000000	0.282064	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.283043	0.000000	0.000000	0.283043	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.282306	0.000000	0.000000	0.282306	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.283043	0.000000	0.000000	0.283043	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.282306	0.000000	0.000000	0.282306	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.283043	0.000000	0.000000	0.283043	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.285918	0.000000	0.000000	0.285918	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.286471	0.000000	0.000000	0.286471	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.292284	0.000000	0.000000	0.292284	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.295439	0.000000	0.000000	0.295439	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.293303	0.000000	0.000000	0.293303	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.295807	0.000000	0.000000	0.295807	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.290333	0.000000	0.000000	0.290333	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.296557	0.000000	0.000000	0.296557	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.297322	0.000000	0.000000	0.297322	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.296557	0.000000	0.000000	0.296557	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.299719	0.000000	0.000000	0.299719	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.298104	0.000000	0.000000	0.298104	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.305977	0.000000	0.000000	0.305977	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.300978	0.000000	0.000000	0.300978	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.287035	0.000000	0.000000	0.287035	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.312789	0.000000	0.000000	0.312789	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.295439	0.000000	0.000000	0.295439	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.313360	0.000000	0.000000	0.313360	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.325034	0.000000	0.000000	0.325034	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.7146	1.0164	1.4393	0.8495	1.1161	1.7283	14.73	4.19	0.59	17.52	4.60	0.71	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.6824	0.9854	1.4596	0.8133	1.0809	1.7775	13.47	3.89	0.58	16.06	4.27	0.70	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.6673	0.9522	1.3945	0.8159	1.0750	1.7772	12.87	3.67	0.54	15.74	4.15	0.69	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	1.1519	1.4279	2.0034	1.2448	1.5083	2.9375	19.99	5.70	0.80	21.60	6.02	1.17	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	1.1443	1.4027	1.9222	1.2323	1.4888	2.9367	19.27	5.67	0.78	20.75	6.02	1.19	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.6287	0.9115	1.3829	1.2123	1.4106	1.9132	10.25	3.71	0.56	19.76	5.75	0.78	0	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	1.1243	1.3861	1.8676	1.2356	1.4931	2.9367	18.33	5.65	0.76	20.14	6.08	1.20	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.6309	0.9133	1.2960	1.2229	1.4248	1.8494	9.94	3.74	0.53	19.26	5.83	0.76	0	1	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	1.1199	1.3748	1.8335	1.2451	1.5007	2.9367	17.64	5.63	0.75	19.61	6.14	1.20	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.5785	0.8645	1.2542	1.1771	1.3830	1.8034	8.78	3.54	0.51	17.86	5.67	0.74	0	1	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	1.0791	1.3328	1.7849	1.1834	1.4176	2.2110	16.38	5.46	0.73	17.96	5.81	0.91	4	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	1.0290	1.2599	1.6977	1.1171	1.3587	2.1623	15.00	5.14	0.69	16.29	5.55	0.88	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.5140	0.7108	1.0983	1.0453	1.2573	1.6672	7.18	2.88	0.44	14.59	5.09	0.67	1	2	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	1.0290	1.2472	1.6866	1.1118	1.3512	2.1966	14.36	5.05	0.68	15.52	5.47	0.89	0	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.5140	0.7199	1.1809	1.0389	1.2487	1.6926	6.84	2.87	0.47	13.83	4.99	0.68	3	8	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	1.0290	1.2300	1.6071	1.1269	1.3455	1.9744	13.70	4.91	0.64	15.00	5.37	0.79	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	0.5140	0.7083	1.1590	1.0290	1.2236	1.6303	6.49	2.77	0.45	12.99	4.79	0.64	0	1	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	0.5140	0.6925	1.0714	1.0290	1.2319	1.6022	6.12	2.64	0.41	12.25	4.69	0.61	0	5	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	1.0290	1.1879	1.6147	1.0290	1.2316	1.7382	12.25	4.53	0.62	12.25	4.69	0.66	0	1	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	1.0290	1.1329	1.4185	1.0290	1.2009	1.5451	11.46	4.16	0.52	11.46	4.41	0.57	1	2	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	1.0290	1.1289	1.5140	1.0290	1.2032	1.6929	11.46	4.15	0.56	11.46	4.42	0.62	0	1	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	1.0290	1.0741	1.3268	1.0290	1.1397	1.4310	10.61	3.77	0.47	10.61	3.99	0.50	0	7	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	1.0290	1.0684	1.4373	1.0290	1.1368	1.5809	10.61	3.74	0.50	10.61	3.98	0.55	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	1.0629	1.2771	1.5030	1.1282	1.3708	1.6712	10.96	4.48	0.53	11.63	4.81	0.59	3	5	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	1.0290	1.0290	1.2159	1.0290	1.0475	1.3136	9.68	3.39	0.40	9.68	3.45	0.43	1	1	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.1978	1.4211	1.0290	1.1978	1.4211	9.68	3.95	0.47	9.68	3.95	0.47	1	2	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	1.0290	1.0290	1.1960	1.0290	1.0322	1.2904	8.66	3.12	0.36	8.66	3.13	0.39	10	4	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0756	7.50	2.78	0.28	7.50	2.78	0.29	0	1	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000620	0.002781	0.008684	0.001627	0.003194	0.018833	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000566	0.002579	0.009616	0.001461	0.002940	0.021785	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000437	0.002357	0.008425	0.001467	0.002935	0.022948	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000677	0.003221	0.022668	0.001477	0.003961	0.186026	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000679	0.002854	0.017680	0.001411	0.003667	0.185432	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000472	0.002206	0.009000	0.001184	0.002438	0.017064	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000539	0.002736	0.014865	0.001442	0.003724	0.185343	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000484	0.002214	0.006582	0.001281	0.002576	0.013333	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000509	0.002598	0.013295	0.001536	0.003787	0.185187	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000421	0.001963	0.006004	0.001082	0.002286	0.011641	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000441	0.002260	0.011495	0.001162	0.002771	0.040694	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000334	0.001778	0.008795	0.000940	0.002338	0.035781	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000243	0.001318	0.004090	0.000645	0.001553	0.007748	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000335	0.001690	0.008522	0.000946	0.002266	0.039090	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000274	0.001359	0.005462	0.000626	0.001499	0.008638	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000237	0.001507	0.006373	0.000923	0.002107	0.021254	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000268	0.001315	0.005120	0.000550	0.001364	0.006947	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000255	0.001254	0.003771	0.000596	0.001419	0.006094	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000293	0.001318	0.006820	0.000603	0.001385	0.010371	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000211	0.001093	0.003062	0.000529	0.001285	0.004944	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000200	0.001027	0.004838	0.000558	0.001228	0.008996	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000190	0.000918	0.002119	0.000429	0.001082	0.003165	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000146	0.000801	0.003749	0.000431	0.000935	0.006244	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000378	0.001692	0.003466	0.000778	0.002463	0.006703	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000129	0.000668	0.001423	0.000298	0.000806	0.002074	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000314	0.001341	0.002648	0.000314	0.001341	0.002648	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000124	0.000632	0.001309	0.000285	0.000754	0.001893	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000074	0.000386	0.000617	0.000148	0.000435	0.000828	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000003**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.7146	1.0164	1.4393	0.8495	1.1161	1.7283	14.73	4.19	0.59	17.52	4.60	0.71	0	0	10.20	0.000003	0.000003
2	Ship	Tanker	110,000	0.6824	0.9854	1.4596	0.8133	1.0809	1.7775	13.47	3.89	0.58	16.06	4.27	0.70	0	0	10.20	0.000003	0.000003
3	Ship	Tanker	105,000	0.6673	0.9522	1.3945	0.8159	1.0750	1.7772	12.87	3.67	0.54	15.74	4.15	0.69	0	0	10.20	0.000003	0.000003
4	Ship	Bulk Carrier	85,000	1.1519	1.4279	2.0034	1.2448	1.5083	2.9375	19.99	5.70	0.80	21.60	6.02	1.17	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	1.1443	1.4027	1.9222	1.2323	1.4888	2.9367	19.27	5.67	0.78	20.75	6.02	1.19	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.6287	0.9115	1.3829	1.2123	1.4106	1.9132	10.25	3.71	0.56	19.76	5.75	0.78	0	0	1.64	0.000003	0.000013
7	Ship	Bulk Carrier	75,000	1.1243	1.3861	1.8676	1.2356	1.4931	2.9367	18.33	5.65	0.76	20.14	6.08	1.20	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.6309	0.9133	1.2960	1.2229	1.4248	1.8494	9.94	3.74	0.53	19.26	5.83	0.76	0	1	1.64	0.000003	0.000013
9	Ship	Bulk Carrier	70,000	1.1199	1.3748	1.8335	1.2451	1.5007	2.9367	17.64	5.63	0.75	19.61	6.14	1.20	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.5785	0.8645	1.2542	1.1771	1.3830	1.8034	8.78	3.54	0.51	17.86	5.67	0.74	0	1	1.64	0.000003	0.000013
11	Ship	Bulk Carrier	65,000	1.0791	1.3328	1.7849	1.1834	1.4176	2.2110	16.38	5.46	0.73	17.96	5.81	0.91	4	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	1.0290	1.2599	1.6977	1.1171	1.3587	2.1623	15.00	5.14	0.69	16.29	5.55	0.88	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.5140	0.7108	1.0983	1.0453	1.2573	1.6672	7.18	2.88	0.44	14.59	5.09	0.67	1	2	1.64	0.000003	0.000013
14	Ship	Bulk Carrier	55,000	1.0290	1.2472	1.6866	1.1118	1.3512	2.1966	14.36	5.05	0.68	15.52	5.47	0.89	0	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.5140	0.7199	1.1809	1.0389	1.2487	1.6926	6.84	2.87	0.47	13.83	4.99	0.68	3	8	1.64	0.000003	0.000013
16	Ship	Bulk Carrier	50,000	1.0290	1.2300	1.6071	1.1269	1.3455	1.9744	13.70	4.91	0.64	15.00	5.37	0.79	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	0.5140	0.7083	1.1590	1.0290	1.2236	1.6303	6.49	2.77	0.45	12.99	4.79	0.64	0	1	1.64	0.000003	0.000013
18	Ship	Tanker	40,000	0.5140	0.6925	1.0714	1.0290	1.2319	1.6022	6.12	2.64	0.41	12.25	4.69	0.61	0	5	1.64	0.000003	0.000013
19	Ship	Bulk Carrier	40,000	1.0290	1.1879	1.6147	1.0290	1.2316	1.7382	12.25	4.53	0.62	12.25	4.69	0.66	0	1	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	1.0290	1.1329	1.4185	1.0290	1.2009	1.5451	11.46	4.16	0.52	11.46	4.41	0.57	1	2	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	1.0290	1.1289	1.5140	1.0290	1.2032	1.6929	11.46	4.15	0.56	11.46	4.42	0.62	0	1	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	1.0290	1.0741	1.3268	1.0290	1.1397	1.4310	10.61	3.77	0.47	10.61	3.99	0.50	0	7	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	1.0290	1.0684	1.4373	1.0290	1.1368	1.5809	10.61	3.74	0.50	10.61	3.98	0.55	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	1.0629	1.2771	1.5030	1.1282	1.3708	1.6712	10.96	4.48	0.53	11.63	4.81	0.59	3	5	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	1.0290	1.0290	1.2159	1.0290	1.0475	1.3136	9.68	3.39	0.40	9.68	3.45	0.43	1	1	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.1978	1.4211	1.0290	1.1978	1.4211	9.68	3.95	0.47	9.68	3.95	0.47	1	2	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	1.0290	1.0290	1.1960	1.0290	1.0322	1.2904	8.66	3.12	0.36	8.66	3.13	0.39	10	4	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0756	7.50	2.78	0.28	7.50	2.78	0.29	0	1	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000620	0.002781	0.008684	0.001627	0.003194	0.018833	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000566	0.002579	0.009616	0.001461	0.002940	0.021785	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000437	0.002357	0.008425	0.001467	0.002935	0.022948	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000677	0.003221	0.022668	0.001477	0.003961	0.186026	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000679	0.002854	0.017680	0.001411	0.003667	0.185432	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000472	0.002206	0.009000	0.001184	0.002438	0.017064	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000539	0.002736	0.014865	0.001442	0.003724	0.185343	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000484	0.002214	0.006582	0.001281	0.002576	0.013333	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000509	0.002598	0.013295	0.001536	0.003787	0.185187	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000421	0.001963	0.006004	0.001082	0.002286	0.011641	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000441	0.002260	0.011495	0.001162	0.002771	0.040694	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000001
0.000334	0.001778	0.008795	0.000940	0.002338	0.035781	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000243	0.001318	0.004090	0.000645	0.001553	0.007748	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000335	0.001690	0.008522	0.000946	0.002266	0.039090	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000274	0.001359	0.005462	0.000626	0.001499	0.008638	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000237	0.001507	0.006373	0.000923	0.002107	0.021254	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000268	0.001315	0.005120	0.000550	0.001364	0.006947	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000255	0.001254	0.003771	0.000596	0.001419	0.006094	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000293	0.001318	0.006820	0.000603	0.001385	0.010371	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000211	0.001093	0.003062	0.000529	0.001285	0.004944	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000200	0.001027	0.004838	0.000558	0.001228	0.008996	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000190	0.000918	0.002119	0.000429	0.001082	0.003165	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000146	0.000801	0.003749	0.000431	0.000935	0.006244	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000378	0.001692	0.003466	0.000778	0.002463	0.006703	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000129	0.000668	0.001423	0.000298	0.000806	0.002074	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000314	0.001341	0.002648	0.000314	0.001341	0.002648	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000124	0.000632	0.001309	0.000285	0.000754	0.001893	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000074	0.000386	0.000617	0.000148	0.000435	0.000828	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000006**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	1.6954	1.9997	2.4261	1.8314	2.1002	2.7174	34.96	8.25	1.00	37.76	8.66	1.12	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	1.6755	1.9811	2.4591	1.8075	2.0773	2.7797	33.08	7.82	0.97	35.68	8.20	1.10	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	1.6395	1.9267	2.3726	1.7893	2.0505	2.7585	31.62	7.43	0.92	34.51	7.91	1.06	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	1.9240	2.2024	2.7825	2.0199	2.2834	3.0866	33.39	8.79	1.11	35.05	9.11	1.23	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	1.9208	2.1813	2.7051	2.0095	2.2681	3.0866	32.34	8.81	1.09	33.83	9.16	1.25	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	1.5951	1.8802	2.3556	1.9860	2.1860	2.6927	26.00	7.66	0.96	32.37	8.91	1.10	0	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	1.9007	2.1645	2.6501	2.0128	2.2687	3.0866	30.98	8.82	1.08	32.81	9.25	1.26	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	1.5974	1.8821	2.2680	1.9967	2.2003	2.6283	25.16	7.71	0.93	31.45	9.01	1.08	0	1	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	1.8962	2.1532	2.6156	2.0225	2.2801	3.0866	29.86	8.82	1.07	31.85	9.34	1.26	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	1.5650	1.8533	2.2463	1.9669	2.1745	2.5984	23.75	7.59	0.92	29.85	8.91	1.06	0	1	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	1.8706	2.1265	2.5822	1.9758	2.2119	3.0118	28.39	8.71	1.06	29.98	9.06	1.23	4	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	1.8242	2.0800	2.5214	1.9361	2.1797	2.9898	26.60	8.49	1.03	28.23	8.90	1.22	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	1.4621	1.7543	2.1450	1.8787	2.0925	2.5058	20.41	7.10	0.87	26.23	8.47	1.01	1	2	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	1.8199	2.0721	2.5151	1.9356	2.1769	3.0293	25.40	8.39	1.02	27.02	8.81	1.23	0	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	1.4701	1.7657	2.2305	1.8741	2.0856	2.5332	19.57	7.05	0.89	24.94	8.33	1.01	3	8	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	1.8120	2.0407	2.4209	1.9367	2.1572	2.7913	24.12	8.15	0.97	25.78	8.61	1.11	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	1.4638	1.7586	2.2129	1.8565	2.0639	2.4739	18.48	6.88	0.87	23.44	8.08	0.97	0	1	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	1.4549	1.7473	2.1292	1.8643	2.0760	2.4494	17.32	6.66	0.81	22.19	7.91	0.93	0	5	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	1.7953	2.0279	2.4582	1.8676	2.0720	2.5827	21.37	7.73	0.94	22.23	7.89	0.98	0	1	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	1.7566	1.9879	2.2759	1.8437	2.0565	2.4035	19.56	7.31	0.84	20.53	7.56	0.88	1	2	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	1.7614	1.9760	2.3643	1.8543	2.0509	2.5447	19.62	7.26	0.87	20.65	7.54	0.94	0	1	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	1.7191	1.9602	2.2150	1.8025	2.0263	2.3201	17.72	6.87	0.78	18.58	7.10	0.81	0	7	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	1.7281	1.9291	2.3011	1.8158	1.9982	2.4459	17.82	6.76	0.81	18.72	7.00	0.86	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	1.8569	2.0728	2.3007	1.9227	2.1674	2.4702	19.14	7.27	0.81	19.82	7.60	0.87	3	5	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	1.6568	1.9004	2.1389	1.7400	1.9691	2.2374	15.59	6.26	0.70	16.38	6.49	0.74	1	1	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	1.8056	2.0325	2.2577	1.8585	2.1086	2.3827	16.99	6.70	0.74	17.49	6.95	0.78	1	2	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	1.6513	1.8904	2.1219	1.7330	1.9568	2.2170	13.90	5.73	0.64	14.59	5.93	0.67	10	4	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	1.5528	1.8037	1.9962	1.6212	1.8528	2.0657	11.32	4.87	0.54	11.82	5.00	0.56	0	1	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.004957	0.019011	0.045418	0.012327	0.020125	0.084217	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004708	0.018321	0.050962	0.011535	0.019296	0.097252	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003611	0.016880	0.045740	0.011420	0.019072	0.100853	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005839	0.022868	0.103423	0.012280	0.025785	0.449797	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005951	0.020768	0.086083	0.011798	0.024579	0.451882	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004147	0.016621	0.050174	0.009920	0.017112	0.082969	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004776	0.020252	0.075282	0.012037	0.024414	0.451808	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004247	0.016658	0.038216	0.010669	0.017870	0.067123	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.004521	0.019388	0.069022	0.012748	0.025091	0.450420	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003964	0.015777	0.036965	0.009678	0.016973	0.062561	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.004186	0.018010	0.063760	0.010423	0.020212	0.166726	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000002	0.000000	0.000000	0.000000	0.000002
0.003565	0.015909	0.054910	0.009446	0.018917	0.159085	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002788	0.012888	0.030396	0.007045	0.014058	0.050462	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.003643	0.015409	0.054188	0.009668	0.018595	0.171029	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003155	0.013244	0.038961	0.006898	0.013713	0.055649	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000004	0.000006
0.002463	0.013521	0.041969	0.008987	0.016857	0.106482	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003136	0.013011	0.037248	0.006202	0.012848	0.047230	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.003037	0.012632	0.028950	0.006768	0.013360	0.042287	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.003414	0.012979	0.047401	0.006750	0.012928	0.065538	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002644	0.011664	0.025147	0.006335	0.012725	0.036596	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.002431	0.010790	0.037022	0.006463	0.011895	0.059750	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002721	0.011006	0.019778	0.005862	0.012060	0.026990	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.001897	0.009110	0.031452	0.005357	0.009853	0.046595	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003648	0.014067	0.023311	0.007253	0.018924	0.039468	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000003
0.002163	0.009382	0.015617	0.004783	0.010492	0.020827	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.003569	0.012930	0.020492	0.006025	0.016417	0.030196	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002114	0.009019	0.014695	0.004642	0.010000	0.019500	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000001	0.000001	0.000000	0.000000	0.000001	0.000003
0.001682	0.007234	0.009203	0.003236	0.007672	0.011572	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000028**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	1.6954	1.9997	2.4261	1.8314	2.1002	2.7174	34.96	8.25	1.00	37.76	8.66	1.12	5	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	1.6755	1.9811	2.4591	1.8075	2.0773	2.7797	33.08	7.82	0.97	35.68	8.20	1.10	3	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	1.6395	1.9267	2.3726	1.7893	2.0505	2.7585	31.62	7.43	0.92	34.51	7.91	1.06	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	1.9240	2.2024	2.7825	2.0199	2.2834	3.0866	33.39	8.79	1.11	35.05	9.11	1.23	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	1.9208	2.1813	2.7051	2.0095	2.2681	3.0866	32.34	8.81	1.09	33.83	9.16	1.25	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	1.5951	1.8802	2.3556	1.9860	2.1860	2.6927	26.00	7.66	0.96	32.37	8.91	1.10	2	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	1.9007	2.1645	2.6501	2.0128	2.2687	3.0866	30.98	8.82	1.08	32.81	9.25	1.26	1	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	1.5974	1.8821	2.2680	1.9967	2.2003	2.6283	25.16	7.71	0.93	31.45	9.01	1.08	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	1.8962	2.1532	2.6156	2.0225	2.2801	3.0866	29.86	8.82	1.07	31.85	9.34	1.26	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	1.5650	1.8533	2.2463	1.9669	2.1745	2.5984	23.75	7.59	0.92	29.85	8.91	1.06	2	0	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	1.8706	2.1265	2.5822	1.9758	2.2119	3.0118	28.39	8.71	1.06	29.98	9.06	1.23	2	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	1.8242	2.0800	2.5214	1.9361	2.1797	2.9898	26.60	8.49	1.03	28.23	8.90	1.22	1	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	1.4621	1.7543	2.1450	1.8787	2.0925	2.5058	20.41	7.10	0.87	26.23	8.47	1.01	3	0	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	1.8199	2.0721	2.5151	1.9356	2.1769	3.0293	25.40	8.39	1.02	27.02	8.81	1.23	1	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	1.4701	1.7657	2.2305	1.8741	2.0856	2.5332	19.57	7.05	0.89	24.94	8.33	1.01	8	4	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	1.8120	2.0407	2.4209	1.9367	2.1572	2.7913	24.12	8.15	0.97	25.78	8.61	1.11	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	1.4638	1.7586	2.2129	1.8565	2.0639	2.4739	18.48	6.88	0.87	23.44	8.08	0.97	1	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	1.4549	1.7473	2.1292	1.8643	2.0760	2.4494	17.32	6.66	0.81	22.19	7.91	0.93	4	1	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	1.7953	2.0279	2.4582	1.8676	2.0720	2.5827	21.37	7.73	0.94	22.23	7.89	0.98	1	0	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	1.7566	1.9879	2.2759	1.8437	2.0565	2.4035	19.56	7.31	0.84	20.53	7.56	0.88	2	1	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	1.7614	1.9760	2.3643	1.8543	2.0509	2.5447	19.62	7.26	0.87	20.65	7.54	0.94	1	0	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	1.7191	1.9602	2.2150	1.8025	2.0263	2.3201	17.72	6.87	0.78	18.58	7.10	0.81	7	0	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	1.7281	1.9291	2.3011	1.8158	1.9982	2.4459	17.82	6.76	0.81	18.72	7.00	0.86	0	1	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	1.8569	2.0728	2.3007	1.9227	2.1674	2.4702	19.14	7.27	0.81	19.82	7.60	0.87	5	3	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	1.6568	1.9004	2.1389	1.7400	1.9691	2.2374	15.59	6.26	0.70	16.38	6.49	0.74	1	0	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	1.8056	2.0325	2.2577	1.8585	2.1086	2.3827	16.99	6.70	0.74	17.49	6.95	0.78	2	1	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	1.6513	1.8904	2.1219	1.7330	1.9568	2.2170	13.90	5.73	0.64	14.59	5.93	0.67	4	10	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	1.5528	1.8037	1.9962	1.6212	1.8528	2.0657	11.32	4.87	0.54	11.82	5.00	0.56	1	0	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			Total
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.004957	0.019011	0.045418	0.012327	0.020125	0.084217	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000001
0.004708	0.018321	0.050962	0.011535	0.019296	0.097252	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000001
0.003611	0.016880	0.045740	0.011420	0.019072	0.100853	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005839	0.022868	0.103423	0.012280	0.025785	0.449797	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005951	0.020768	0.086083	0.011798	0.024579	0.451882	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004147	0.016621	0.050174	0.009920	0.017112	0.082969	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004776	0.020252	0.075282	0.012037	0.024414	0.451808	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004247	0.016658	0.038216	0.010669	0.017870	0.067123	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004521	0.019388	0.069022	0.012748	0.025091	0.450420	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003964	0.015777	0.036965	0.009678	0.016973	0.062561	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004186	0.018010	0.063760	0.010423	0.020212	0.166726	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003565	0.015909	0.054910	0.009446	0.018917	0.159085	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002788	0.012888	0.030396	0.007045	0.014058	0.050462	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003643	0.015409	0.054188	0.009668	0.018595	0.171029	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003155	0.013244	0.038961	0.006898	0.013713	0.055649	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002463	0.013521	0.041969	0.008987	0.016857	0.106482	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003136	0.013011	0.037248	0.006202	0.012848	0.047230	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003037	0.012632	0.028950	0.006768	0.013360	0.042287	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003414	0.012979	0.047401	0.006750	0.012928	0.065538	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002644	0.011664	0.025147	0.006335	0.012725	0.036596	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002431	0.010790	0.037022	0.006463	0.011895	0.059750	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002721	0.011006	0.019778	0.005862	0.012060	0.026990	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.001897	0.009110	0.031452	0.005357	0.009853	0.046595	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003648	0.014067	0.023311	0.007253	0.018924	0.039468	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002163	0.009382	0.015617	0.004783	0.010492	0.020827	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003569	0.012930	0.020492	0.006025	0.016417	0.030196	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002114	0.009019	0.014695	0.004642	0.010000	0.019500	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.001682	0.007234	0.009203	0.003236	0.007672	0.011572	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000007**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	1.6954	1.9997	2.4261	1.8314	2.1002	2.7174	34.96	8.25	1.00	37.76	8.66	1.12	5	0	10.20	0.000004	0.000004
2	Ship	Tanker	110,000	1.6755	1.9811	2.4591	1.8075	2.0773	2.7797	33.08	7.82	0.97	35.68	8.20	1.10	3	0	10.20	0.000004	0.000004
3	Ship	Tanker	105,000	1.6395	1.9267	2.3726	1.7893	2.0505	2.7585	31.62	7.43	0.92	34.51	7.91	1.06	0	0	10.20	0.000004	0.000004
4	Ship	Bulk Carrier	85,000	1.9240	2.2024	2.7825	2.0199	2.2834	3.0866	33.39	8.79	1.11	35.05	9.11	1.23	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	1.9208	2.1813	2.7051	2.0095	2.2681	3.0866	32.34	8.81	1.09	33.83	9.16	1.25	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	1.5951	1.8802	2.3556	1.9860	2.1860	2.6927	26.00	7.66	0.96	32.37	8.91	1.10	2	0	1.64	0.000004	0.000013
7	Ship	Bulk Carrier	75,000	1.9007	2.1645	2.6501	2.0128	2.2687	3.0866	30.98	8.82	1.08	32.81	9.25	1.26	1	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	1.5974	1.8821	2.2680	1.9967	2.2003	2.6283	25.16	7.71	0.93	31.45	9.01	1.08	0	0	1.64	0.000004	0.000013
9	Ship	Bulk Carrier	70,000	1.8962	2.1532	2.6156	2.0225	2.2801	3.0866	29.86	8.82	1.07	31.85	9.34	1.26	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	1.5650	1.8533	2.2463	1.9669	2.1745	2.5984	23.75	7.59	0.92	29.85	8.91	1.06	2	0	1.64	0.000004	0.000013
11	Ship	Bulk Carrier	65,000	1.8706	2.1265	2.5822	1.9758	2.2119	3.0118	28.39	8.71	1.06	29.98	9.06	1.23	2	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	1.8242	2.0800	2.5214	1.9361	2.1797	2.9898	26.60	8.49	1.03	28.23	8.90	1.22	1	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	1.4621	1.7543	2.1450	1.8787	2.0925	2.5058	20.41	7.10	0.87	26.23	8.47	1.01	3	0	1.64	0.000004	0.000013
14	Ship	Bulk Carrier	55,000	1.8199	2.0721	2.5151	1.9356	2.1769	3.0293	25.40	8.39	1.02	27.02	8.81	1.23	1	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	1.4701	1.7657	2.2305	1.8741	2.0856	2.5332	19.57	7.05	0.89	24.94	8.33	1.01	8	4	1.64	0.000004	0.000013
16	Ship	Bulk Carrier	50,000	1.8120	2.0407	2.4209	1.9367	2.1572	2.7913	24.12	8.15	0.97	25.78	8.61	1.11	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	1.4638	1.7586	2.2129	1.8565	2.0639	2.4739	18.48	6.88	0.87	23.44	8.08	0.97	1	0	1.64	0.000004	0.000013
18	Ship	Tanker	40,000	1.4549	1.7473	2.1292	1.8643	2.0760	2.4494	17.32	6.66	0.81	22.19	7.91	0.93	4	1	1.64	0.000004	0.000013
19	Ship	Bulk Carrier	40,000	1.7953	2.0279	2.4582	1.8676	2.0720	2.5827	21.37	7.73	0.94	22.23	7.89	0.98	1	0	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	1.7566	1.9879	2.2759	1.8437	2.0565	2.4035	19.56	7.31	0.84	20.53	7.56	0.88	2	1	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	1.7614	1.9760	2.3643	1.8543	2.0509	2.5447	19.62	7.26	0.87	20.65	7.54	0.94	1	0	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	1.7191	1.9602	2.2150	1.8025	2.0263	2.3201	17.72	6.87	0.78	18.58	7.10	0.81	7	0	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	1.7281	1.9291	2.3011	1.8158	1.9982	2.4459	17.82	6.76	0.81	18.72	7.00	0.86	0	1	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	1.8569	2.0728	2.3007	1.9227	2.1674	2.4702	19.14	7.27	0.81	19.82	7.60	0.87	5	3	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	1.6568	1.9004	2.1389	1.7400	1.9691	2.2374	15.59	6.26	0.70	16.38	6.49	0.74	1	0	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	1.8056	2.0325	2.2577	1.8585	2.1086	2.3827	16.99	6.70	0.74	17.49	6.95	0.78	2	1	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	1.6513	1.8904	2.1219	1.7330	1.9568	2.2170	13.90	5.73	0.64	14.59	5.93	0.67	4	10	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	1.5528	1.8037	1.9962	1.6212	1.8528	2.0657	11.32	4.87	0.54	11.82	5.00	0.56	1	0	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			Total
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.004957	0.019011	0.045418	0.012327	0.020125	0.084217	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000001	0.000002	0.000000	0.000000	0.000000	0.000003
0.004708	0.018321	0.050962	0.011535	0.019296	0.097252	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000002
0.003611	0.016880	0.045740	0.011420	0.019072	0.100853	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005839	0.022868	0.103423	0.012280	0.025785	0.449797	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005951	0.020768	0.086083	0.011798	0.024579	0.451882	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004147	0.016621	0.050174	0.009920	0.017112	0.082969	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004776	0.020252	0.075282	0.012037	0.024414	0.451808	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004247	0.016658	0.038216	0.010669	0.017870	0.067123	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004521	0.019388	0.069022	0.012748	0.025091	0.450420	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003964	0.015777	0.036965	0.009678	0.016973	0.062561	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004186	0.018010	0.063760	0.010423	0.020212	0.166726	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.003565	0.015909	0.054910	0.009446	0.018917	0.159085	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002788	0.012888	0.030396	0.007045	0.014058	0.050462	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003643	0.015409	0.054188	0.009668	0.018595	0.171029	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003155	0.013244	0.038961	0.006898	0.013713	0.055649	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.002463	0.013521	0.041969	0.008987	0.016857	0.106482	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003136	0.013011	0.037248	0.006202	0.012848	0.047230	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003037	0.012632	0.028950	0.006768	0.013360	0.042287	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.003414	0.012979	0.047401	0.006750	0.012928	0.065538	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002644	0.011664	0.025147	0.006335	0.012725	0.036596	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002431	0.010790	0.037022	0.006463	0.011895	0.059750	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002721	0.011006	0.019778	0.005862	0.012060	0.026990	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000001
0.001897	0.009110	0.031452	0.005357	0.009853	0.046595	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003648	0.014067	0.023311	0.007253	0.018924	0.039468	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000002
0.002163	0.009382	0.015617	0.004783	0.010492	0.020827	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003569	0.012930	0.020492	0.006025	0.016417	0.030196	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002114	0.009019	0.014695	0.004642	0.010000	0.019500	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.001682	0.007234	0.009203	0.003236	0.007672	0.011572	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000017**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.5140	0.5140	0.5140	0.5140	0.5140	0.5140	10.60	2.12	0.21	10.60	2.12	0.21	5	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.5140	0.5140	0.5140	0.5140	0.5140	0.5140	10.15	2.03	0.20	10.15	2.03	0.20	3	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.5140	0.5140	0.5140	0.5140	0.5140	0.5140	9.91	1.98	0.20	9.91	1.98	0.20	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.1288	17.86	4.11	0.41	17.86	4.11	0.45	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.1179	17.32	4.16	0.42	17.32	4.16	0.45	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	8.38	2.09	0.21	16.77	4.19	0.42	2	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.1179	16.77	4.19	0.42	16.77	4.19	0.46	1	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	8.09	2.10	0.21	16.21	4.21	0.42	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.1179	16.21	4.21	0.42	16.21	4.21	0.46	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	7.80	2.11	0.21	15.62	4.22	0.42	2	0	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	15.62	4.22	0.42	15.62	4.22	0.42	2	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	15.00	4.20	0.42	15.00	4.20	0.42	1	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	7.18	2.08	0.21	14.36	4.17	0.42	3	0	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	14.36	4.17	0.42	14.36	4.17	0.42	1	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.84	2.05	0.21	13.70	4.11	0.41	8	4	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	13.70	4.11	0.41	13.70	4.11	0.41	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.49	2.01	0.20	12.99	4.03	0.40	1	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.12	1.96	0.20	12.25	3.92	0.39	4	1	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	12.25	3.92	0.39	12.25	3.92	0.39	1	0	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	11.46	3.78	0.38	11.46	3.78	0.38	2	1	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	11.46	3.78	0.38	11.46	3.78	0.38	1	0	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	7	0	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	0	1	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	5	3	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	9.68	3.39	0.34	9.68	3.39	0.34	1	0	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	9.68	3.39	0.34	9.68	3.39	0.34	2	1	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	8.66	3.12	0.31	8.66	3.12	0.31	4	10	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	7.50	2.78	0.28	7.50	2.78	0.28	1	0	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000000	0.000002	0.000012	0.000001	0.000003	0.000039	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000002	0.000012	0.000001	0.000002	0.000043	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000010	0.000001	0.000002	0.000048	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000002	0.000040	0.000001	0.000003	0.001932	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000002	0.000026	0.000001	0.000002	0.001858	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000010	0.000000	0.000001	0.000026	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000020	0.000003	0.000002	0.001860	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000006	0.000001	0.000002	0.000018	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000017	0.000001	0.000003	0.001857	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000005	0.000000	0.000001	0.000012	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000011	0.000000	0.000001	0.000089	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000006	0.000000	0.000001	0.000056	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000002	0.000000	0.000000	0.000004	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000005	0.000000	0.000001	0.000062	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000002	0.000000	0.000000	0.000005	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000004	0.000000	0.000001	0.000025	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000002	0.000000	0.000000	0.000003	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000003	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000003	0.000000	0.000000	0.000006	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000002	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000002	0.000000	0.000000	0.000004	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000002	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000002	0.000000	0.000001	0.000005	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000002	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	10.60	2.12	0.21	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	10.15	2.03	0.20	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	9.91	1.98	0.20	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	17.86	4.11	0.41	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	17.32	4.16	0.42	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.77	4.19	0.42	0	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.77	4.19	0.42	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.21	4.21	0.42	0	1	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.21	4.21	0.42	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.62	4.22	0.42	0	1	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.62	4.22	0.42	0	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.00	4.20	0.42	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	14.36	4.17	0.42	0	2	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	14.36	4.17	0.42	0	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	13.70	4.11	0.41	0	8	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	13.70	4.11	0.41	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.49	2.01	0.20	12.99	4.03	0.40	0	1	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.12	1.96	0.20	12.25	3.92	0.39	0	5	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	12.25	3.92	0.39	12.25	3.92	0.39	0	1	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	11.46	3.78	0.38	11.46	3.78	0.38	1	2	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	11.46	3.78	0.38	11.46	3.78	0.38	0	1	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	0	7	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	3	5	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	9.68	3.39	0.34	9.68	3.39	0.34	1	1	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	9.68	3.39	0.34	9.68	3.39	0.34	1	2	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	8.66	3.12	0.31	8.66	3.12	0.31	10	4	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	7.50	2.78	0.28	7.50	2.78	0.28	0	1	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000560	0.000884	0.000283	0.001086	0.000517	0.000124	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000511	0.000811	0.000260	0.000977	0.000484	0.000121	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000418	0.000877	0.000346	0.000994	0.000509	0.000138	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000566	0.000735	0.000122	0.000940	0.000447	0.000036	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000512	0.000711	0.000141	0.000897	0.000427	0.000041	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000432	0.000721	0.000255	0.000809	0.000452	0.000147	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000435	0.000765	0.000164	0.000909	0.000416	0.000040	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000440	0.000716	0.000252	0.000855	0.000432	0.000121	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000454	0.000729	0.000181	0.000939	0.000393	0.000033	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000381	0.000614	0.000211	0.000719	0.000380	0.000107	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000392	0.000626	0.000158	0.000746	0.000371	0.000059	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000297	0.000485	0.000126	0.000586	0.000282	0.000041	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000224	0.000420	0.000142	0.000434	0.000273	0.000079	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000294	0.000106	0.000466	0.000576	0.000254	0.000037	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000246	0.000397	0.000131	0.000424	0.000268	0.000081	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000228	0.000560	0.000204	0.000599	0.000318	0.000074	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000240	0.000381	0.000126	0.000389	0.000268	0.000090	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000229	0.000368	0.000123	0.000399	0.000247	0.000074	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000256	0.000367	0.000123	0.000407	0.000256	0.000083	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000191	0.000337	0.000114	0.000355	0.000221	0.000066	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000186	0.000366	0.000143	0.000379	0.000231	0.000084	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000164	0.000238	0.000072	0.000275	0.000159	0.000041	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000139	0.000326	0.000141	0.000308	0.000202	0.000095	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000346	0.000572	0.000229	0.000572	0.000475	0.000101	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000112	0.000173	0.000048	0.000192	0.000114	0.000029	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000274	0.000379	0.000133	0.000395	0.000322	0.000068	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000108	0.000167	0.000047	0.000185	0.000110	0.000030	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000062	0.000087	0.000020	0.000096	0.000060	0.000015	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	10.60	2.12	0.21	0	0	10.20	0.000003	0.000003
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	10.15	2.03	0.20	0	0	10.20	0.000003	0.000003
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	9.91	1.98	0.20	0	0	10.20	0.000003	0.000003
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	17.86	4.11	0.41	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	17.32	4.16	0.42	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.77	4.19	0.42	0	0	1.64	0.000003	0.000013
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.77	4.19	0.42	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.21	4.21	0.42	0	1	1.64	0.000003	0.000013
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.21	4.21	0.42	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.62	4.22	0.42	0	1	1.64	0.000003	0.000013
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.62	4.22	0.42	0	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.00	4.20	0.42	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	14.36	4.17	0.42	0	2	1.64	0.000003	0.000013
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	14.36	4.17	0.42	0	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	13.70	4.11	0.41	0	8	1.64	0.000003	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	13.70	4.11	0.41	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.49	2.01	0.20	12.99	4.03	0.40	0	1	1.64	0.000003	0.000013
18	Ship	Tanker	40,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.12	1.96	0.20	12.25	3.92	0.39	0	5	1.64	0.000003	0.000013
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	12.25	3.92	0.39	12.25	3.92	0.39	0	1	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	11.46	3.78	0.38	11.46	3.78	0.38	1	2	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	11.46	3.78	0.38	11.46	3.78	0.38	0	1	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	0	7	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	3	5	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	9.68	3.39	0.34	9.68	3.39	0.34	1	1	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	9.68	3.39	0.34	9.68	3.39	0.34	1	2	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	8.66	3.12	0.31	8.66	3.12	0.31	10	4	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	7.50	2.78	0.28	7.50	2.78	0.28	0	1	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000560	0.000884	0.000283	0.001086	0.000517	0.000124	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000511	0.000811	0.000260	0.000977	0.000484	0.000121	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000418	0.000877	0.000346	0.000994	0.000509	0.000138	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000566	0.000735	0.000122	0.000940	0.000447	0.000036	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000512	0.000711	0.000141	0.000897	0.000427	0.000041	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000432	0.000721	0.000255	0.000809	0.000452	0.000147	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000435	0.000765	0.000164	0.000909	0.000416	0.000040	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000440	0.000716	0.000252	0.000855	0.000432	0.000121	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000454	0.000729	0.000181	0.000939	0.000393	0.000033	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000381	0.000614	0.000211	0.000719	0.000380	0.000107	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000392	0.000626	0.000158	0.000746	0.000371	0.000059	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000297	0.000485	0.000126	0.000586	0.000282	0.000041	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000224	0.000420	0.000142	0.000434	0.000273	0.000079	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000294	0.000106	0.000466	0.000576	0.000254	0.000037	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000246	0.000397	0.000131	0.000424	0.000268	0.000081	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000228	0.000560	0.000204	0.000599	0.000318	0.000074	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000240	0.000381	0.000126	0.000389	0.000268	0.000090	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000229	0.000368	0.000123	0.000399	0.000247	0.000074	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000256	0.000367	0.000123	0.000407	0.000256	0.000083	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000191	0.000337	0.000114	0.000355	0.000221	0.000066	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000186	0.000366	0.000143	0.000379	0.000231	0.000084	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000164	0.000238	0.000072	0.000275	0.000159	0.000041	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000139	0.000326	0.000141	0.000308	0.000202	0.000095	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000346	0.000572	0.000229	0.000572	0.000475	0.000101	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000112	0.000173	0.000048	0.000192	0.000114	0.000029	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000274	0.000379	0.000133	0.000395	0.000322	0.000068	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000108	0.000167	0.000047	0.000185	0.000110	0.000030	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000062	0.000087	0.000020	0.000096	0.000060	0.000015	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	1.2367	0.7194	0.5140	0.00	0.00	0.00	25.50	2.97	0.21	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	1.2288	0.7219	0.5140	0.00	0.00	0.00	24.26	2.85	0.20	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.2347	0.7522	0.5140	0.00	0.00	0.00	23.81	2.90	0.20	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.5297	1.0290	1.0290	0.00	0.00	0.00	26.55	4.11	0.41	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.5253	1.0290	1.0290	0.00	0.00	0.00	25.68	4.16	0.42	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.5855	1.2422	1.0290	0.00	0.00	0.00	25.85	5.06	0.42	0	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.5190	1.0290	1.0290	0.00	0.00	0.00	24.76	4.19	0.42	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.5650	1.1980	1.0290	0.00	0.00	0.00	24.65	4.91	0.42	0	1	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.5018	1.0290	1.0290	0.00	0.00	0.00	23.65	4.21	0.42	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.5474	1.1818	1.0290	0.00	0.00	0.00	23.48	4.84	0.42	0	1	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.5186	1.0509	1.0290	0.00	0.00	0.00	23.05	4.31	0.42	0	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.4708	1.0290	1.0290	0.00	0.00	0.00	21.45	4.20	0.42	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.5057	1.1479	1.0290	0.00	0.00	0.00	21.02	4.65	0.42	0	2	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.4496	1.0290	1.0290	0.00	0.00	0.00	20.24	4.17	0.42	0	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	1.5052	1.1538	1.0290	0.00	0.00	0.00	20.03	4.61	0.41	0	8	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.5116	1.1154	1.0290	0.00	0.00	0.00	20.12	4.45	0.41	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	1.2328	0.8025	0.5140	1.5148	1.1811	1.0290	15.57	3.14	0.20	19.13	4.62	0.40	0	1	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	1.2271	0.8000	0.5140	1.4907	1.1390	1.0290	14.61	3.05	0.20	17.75	4.34	0.39	0	5	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	1.5952	1.2546	1.0290	1.5018	1.1645	1.0290	18.99	4.78	0.39	17.88	4.44	0.39	0	1	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	1.5883	1.2497	1.0290	1.4738	1.1239	1.0290	17.69	4.59	0.38	16.41	4.13	0.38	1	2	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	1.6116	1.2958	1.0290	1.4896	1.1724	1.0290	17.95	4.76	0.38	16.59	4.31	0.38	0	1	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	1.5202	1.1672	1.0290	1.4105	1.0384	1.0290	15.67	4.09	0.36	14.54	3.64	0.36	0	7	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	1.6026	1.3044	1.0290	1.4872	1.2124	1.0290	16.52	4.57	0.36	15.33	4.25	0.36	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	1.6819	1.3658	1.0290	1.5954	1.1738	1.0290	17.34	4.79	0.36	16.45	4.11	0.36	3	5	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	1.4689	1.1116	1.0290	1.3595	1.0290	1.0290	13.82	3.66	0.34	12.80	3.39	0.34	1	1	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	1.6019	1.2695	1.0290	1.5323	1.1150	1.0290	15.08	4.18	0.34	14.42	3.67	0.34	1	2	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	1.4648	1.1134	1.0290	1.3574	1.0290	1.0290	12.33	3.37	0.31	11.43	3.12	0.31	10	4	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	1.3513	1.0290	1.0290	1.2614	1.0290	1.0290	9.85	2.78	0.28	9.20	2.78	0.28	0	1	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.004897	0.009310	0.004528	0.010069	0.006345	0.002321	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004648	0.008893	0.004333	0.009407	0.006126	0.002341	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003694	0.009135	0.005394	0.009383	0.006272	0.002568	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005468	0.008986	0.002426	0.009587	0.006391	0.000901	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005020	0.008711	0.002774	0.009324	0.006181	0.001001	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004125	0.008246	0.004416	0.008132	0.005822	0.002832	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004228	0.009155	0.003122	0.009463	0.006049	0.000992	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004211	0.008204	0.004371	0.008659	0.005701	0.002426	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004426	0.008699	0.003380	0.009832	0.005837	0.000835	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003912	0.007574	0.003955	0.007791	0.005355	0.002295	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004087	0.007983	0.003173	0.008251	0.005560	0.001431	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003479	0.006945	0.002842	0.007301	0.004805	0.001159	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002778	0.006242	0.003256	0.005664	0.004571	0.002040	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003526	0.006634	0.002779	0.007369	0.004492	0.001078	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003088	0.006019	0.003056	0.005569	0.004513	0.002082	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002518	0.007322	0.004067	0.007111	0.004979	0.001816	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003063	0.005884	0.002991	0.005156	0.004494	0.002289	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002970	0.005772	0.002969	0.005423	0.004311	0.001977	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003289	0.005709	0.002940	0.005420	0.004357	0.002161	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002609	0.005527	0.002885	0.005079	0.004066	0.001876	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002435	0.005679	0.003368	0.005225	0.004038	0.002221	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002598	0.004590	0.002175	0.004539	0.003436	0.001389	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001921	0.005296	0.003455	0.004492	0.003638	0.002542	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003626	0.007127	0.004289	0.006207	0.006604	0.002231	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002070	0.003916	0.001645	0.003716	0.002898	0.001166	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003430	0.005752	0.003093	0.005103	0.005355	0.001817	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002025	0.003828	0.001602	0.003624	0.002821	0.001213	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.001569	0.002740	0.000913	0.002531	0.002044	0.000798	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000004**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.004897	0.009310	0.004528	0.010069	0.006345	0.002321	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004648	0.008893	0.004333	0.009407	0.006126	0.002341	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003694	0.009135	0.005394	0.009383	0.006272	0.002568	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005468	0.008986	0.002426	0.009587	0.006391	0.000901	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005020	0.008711	0.002774	0.009324	0.006181	0.001001	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004125	0.008246	0.004416	0.008132	0.005822	0.002832	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004228	0.009155	0.003122	0.009463	0.006049	0.000992	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004211	0.008204	0.004371	0.008659	0.005701	0.002426	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004426	0.008699	0.003380	0.009832	0.005837	0.000835	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003912	0.007574	0.003955	0.007791	0.005355	0.002295	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004087	0.007983	0.003173	0.008251	0.005560	0.001431	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003479	0.006945	0.002842	0.007301	0.004805	0.001159	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002778	0.006242	0.003256	0.005664	0.004571	0.002040	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003526	0.006634	0.002779	0.007369	0.004492	0.001078	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003088	0.006019	0.003056	0.005569	0.004513	0.002082	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002518	0.007322	0.004067	0.007111	0.004979	0.001816	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003063	0.005884	0.002991	0.005156	0.004494	0.002289	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002970	0.005772	0.002969	0.005423	0.004311	0.001977	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003289	0.005709	0.002940	0.005420	0.004357	0.002161	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002609	0.005527	0.002885	0.005079	0.004066	0.001876	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002435	0.005679	0.003368	0.005225	0.004038	0.002221	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002598	0.004590	0.002175	0.004539	0.003436	0.001389	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001921	0.005296	0.003455	0.004492	0.003638	0.002542	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003626	0.007127	0.004289	0.006207	0.006604	0.002231	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002070	0.003916	0.001645	0.003716	0.002898	0.001166	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003430	0.005752	0.003093	0.005103	0.005355	0.001817	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002025	0.003828	0.001602	0.003624	0.002821	0.001213	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001569	0.002740	0.000913	0.002531	0.002044	0.000798	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.004897	0.009310	0.004528	0.010069	0.006345	0.002321	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004648	0.008893	0.004333	0.009407	0.006126	0.002341	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003694	0.009135	0.005394	0.009383	0.006272	0.002568	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005468	0.008986	0.002426	0.009587	0.006391	0.000901	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005020	0.008711	0.002774	0.009324	0.006181	0.001001	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004125	0.008246	0.004416	0.008132	0.005822	0.002832	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004228	0.009155	0.003122	0.009463	0.006049	0.000992	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004211	0.008204	0.004371	0.008659	0.005701	0.002426	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004426	0.008699	0.003380	0.009832	0.005837	0.000835	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003912	0.007574	0.003955	0.007791	0.005355	0.002295	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004087	0.007983	0.003173	0.008251	0.005560	0.001431	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003479	0.006945	0.002842	0.007301	0.004805	0.001159	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002778	0.006242	0.003256	0.005664	0.004571	0.002040	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003526	0.006634	0.002779	0.007369	0.004492	0.001078	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003088	0.006019	0.003056	0.005569	0.004513	0.002082	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002518	0.007322	0.004067	0.007111	0.004979	0.001816	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003063	0.005884	0.002991	0.005156	0.004494	0.002289	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002970	0.005772	0.002969	0.005423	0.004311	0.001977	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003289	0.005709	0.002940	0.005420	0.004357	0.002161	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002609	0.005527	0.002885	0.005079	0.004066	0.001876	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002435	0.005679	0.003368	0.005225	0.004038	0.002221	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002598	0.004590	0.002175	0.004539	0.003436	0.001389	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001921	0.005296	0.003455	0.004492	0.003638	0.002542	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003626	0.007127	0.004289	0.006207	0.006604	0.002231	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002070	0.003916	0.001645	0.003716	0.002898	0.001166	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003430	0.005752	0.003093	0.005103	0.005355	0.001817	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002025	0.003828	0.001602	0.003624	0.002821	0.001213	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001569	0.002740	0.000913	0.002531	0.002044	0.000798	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

SUBSTRUCTURE ANNUAL FREQUENCY OF COLLAPSE (WATER ELEVATION 2.0 CD)

Pier ID	Description	Ultimate Lateral Capacity, H (MN)	Annual Frequency of Collapse, AF			Return Period
		Foundation	Inbound	Outbound	Total	
1	Pier 14	**25**	0.00000000	0.00000000	0.00000000	25,040,528,385
2	Pier 15	**100**	0.00000000	0.00000000	0.00000000	-
3	Pier 16	**90**	0.00000090	0.00000000	0.00000090	1,115,513
	Total for Bridge Piers:		0.00000090	0.00000000	0.00000090	**1,115,463**

VESSEL FLEET CHARACTERISTICS

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Vessel Size (m)		Vessel Drafts (m)				Vessel Displacement (tonnes)		Channel Width, C (m)	Centerline Transit Path to Edge of Channel, x_C (m)	Minimum Design Impact Speed, V_{min} (m/sec)		Standard Deviation, σ (m)	
				Length Overall, LOA	Beam/ Width, B	Operational Loaded, D_O	Ballasted			Loaded, W_L	Ballasted, W_E			Loaded	Ballasted	Loaded	Ballasted
							Stern, D_{ES}	Bow, D_{EB}	Average, D_{AVG}								
1	Ship	Tanker	120,000	250	44	11.9	8.2	4.7	6.5	101,270	54,890	125.4	62.7	0.514	0.514	80	80
2	Ship	Tanker	110,000	240	44	11.8	8.3	4.9	6.6	95,920	53,650	125.4	62.7	0.514	0.514	79	79
3	Ship	Tanker	105,000	244	42	13.0	8.4	5.0	6.7	102,480	52,820	119.7	59.9	0.514	0.514	80	80
4	Ship	Bulk Carrier	85,000	229	32	11.7	8.6	5.4	7.0	67,920	40,640	110.0	55.0	1.029	1.029	78	78
5	Ship	Bulk Carrier	80,000	225	32	11.9	8.4	5.2	6.8	67,900	38,800	110.0	55.0	1.029	1.029	78	78
6	Ship	Tanker	75,000	228	34	11.3	8.3	5.1	6.7	66,730	39,570	110.0	55.0	0.514	1.029	78	78
7	Ship	Bulk Carrier	75,000	225	32	12.1	7.8	4.6	6.2	68,640	35,180	110.0	55.0	1.029	1.029	78	78
8	Ship	Tanker	70,000	228	32	11.0	7.4	4.2	5.8	62,330	32,870	110.0	55.0	0.514	1.029	78	78
9	Ship	Bulk Carrier	70,000	225	32	12.0	6.8	3.6	5.2	67,680	29,330	110.0	55.0	1.029	1.029	78	78
10	Ship	Tanker	65,000	214	32	10.9	7.5	4.5	6.0	57,520	31,660	110.0	55.0	0.514	1.029	77	77
11	Ship	Bulk Carrier	65,000	212	32	11.7	7.8	4.8	6.3	61,920	33,350	110.0	55.0	1.029	1.029	77	77
12	Ship	Bulk Carrier	60,000	193	32	11.6	7.2	4.5	5.9	55,590	28,040	110.0	55.0	1.029	1.029	75	75
13	Ship	Tanker	55,000	184	32	11.4	8.3	5.7	7.0	51,250	31,470	110.0	55.0	0.514	1.029	74	74
14	Ship	Bulk Carrier	55,000	190	32	10.9	6.3	3.6	5.0	51,210	23,260	110.0	55.0	1.029	1.029	75	75
15	Ship	Tanker	50,000	183	32	10.6	8.2	5.6	6.9	47,500	30,920	110.0	55.0	0.514	1.029	74	74
16	Ship	Bulk Carrier	50,000	199	30	12.2	7.0	4.2	5.6	56,210	25,810	110.0	55.0	1.029	1.029	76	76
17	Ship	Tanker	45,000	181	32	10.3	8.6	6.1	7.4	45,340	32,350	110.0	55.0	0.514	1.029	74	74
18	Ship	Tanker	40,000	179	28	10.1	7.5	5.0	6.3	38,430	23,780	110.0	55.0	0.514	1.029	74	74
19	Ship	Bulk Carrier	40,000	181	30	9.1	7.2	4.7	6.0	37,700	24,650	110.0	55.0	1.029	1.029	74	74
20	Ship	Tanker	35,000	173	27	10.2	7.3	4.9	6.1	35,600	21,290	110.0	55.0	1.029	1.029	73	73
21	Ship	Bulk Carrier	35,000	177	29	9.7	6.5	4.0	5.3	37,830	20,480	110.0	55.0	1.029	1.029	73	73
22	Ship	Tanker	30,000	159	27	9.2	6.5	4.3	5.4	29,160	17,120	110.0	55.0	1.029	1.029	71	71
23	Ship	Bulk Carrier	30,000	170	27	9.5	6.6	4.2	5.4	32,770	18,630	110.0	55.0	1.029	1.029	72	72
24	Ship	Articulated Tug/Barge	30,000	210	23	9.3	5.0	5.0	5.0	32,470	17,460	110.0	55.0	1.029	1.029	77	77
25	Ship	Tanker	25,000	146	24	9.2	6.5	4.5	5.5	22,970	13,740	110.0	55.0	1.029	1.029	69	69
26	Ship	Articulated Tug/Barge	25,000	184	24	8.3	5.0	5.0	5.0	26,090	15,720	110.0	55.0	1.029	1.029	74	74
27	Ship	Tanker	20,000	145	24	8.7	6.1	4.1	5.1	20,880	12,240	110.0	55.0	1.029	1.029	69	69
28	Ship	Tanker	15,000	127	20	8.1	6.3	4.5	5.4	14,280	9,520	110.0	55.0	1.029	1.029	65	65

Notes:

Weight of Water (W_W) = **0.9854** m^3/tonne (used to determine ship loaded/ballasted displacement tonnage based on approximate salinity of water in Vancouver Harbor)

VESSEL FLEET ANNUAL TRIP FREQUENCY

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Annual Number of Trips (N)						Existing Total Trips	Growth Factor [1]	Future Total Trips
				Inbound			Outbound					
				Loaded	Ballasted	Total	Loaded	Ballasted	Total			
1	Ship	Tanker	120,000	0	5	5	0	0	0	5	10.20	51
2	Ship	Tanker	110,000	0	5	5	3	0	3	8	10.20	82
3	Ship	Tanker	105,000	0	0	0	0	0	0	0	10.20	0
4	Ship	Bulk Carrier	85,000	0	0	0	2	0	2	2	1.28	3
5	Ship	Bulk Carrier	80,000	0	0	0	2	0	2	2	1.28	3
6	Ship	Tanker	75,000	0	4	4	3	0	3	7	1.64	11
7	Ship	Bulk Carrier	75,000	0	0	0	1	0	1	1	1.28	1
8	Ship	Tanker	70,000	0	0	0	0	0	0	0	1.64	0
9	Ship	Bulk Carrier	70,000	0	0	0	0	0	0	0	1.28	0
10	Ship	Tanker	65,000	0	1	1	0	0	0	1	1.64	2
11	Ship	Bulk Carrier	65,000	0	0	0	2	0	2	2	1.28	3
12	Ship	Bulk Carrier	60,000	0	0	0	0	0	0	0	1.28	0
13	Ship	Tanker	55,000	0	2	2	2	0	2	4	1.64	7
14	Ship	Bulk Carrier	55,000	0	0	0	1	0	1	1	1.28	1
15	Ship	Tanker	50,000	4	8	12	8	3	11	23	1.64	38
16	Ship	Bulk Carrier	50,000	0	1	1	0	0	0	1	1.28	1
17	Ship	Tanker	45,000	0	0	0	0	0	0	0	1.64	0
18	Ship	Tanker	40,000	1	5	6	5	1	6	12	1.64	20
19	Ship	Bulk Carrier	40,000	0	1	1	1	0	1	2	1.28	3
20	Ship	Tanker	35,000	1	2	3	2	1	3	6	1.64	10
21	Ship	Bulk Carrier	35,000	0	1	1	1	0	1	2	1.28	3
22	Ship	Tanker	30,000	1	7	8	7	0	7	15	1.64	25
23	Ship	Bulk Carrier	30,000	0	0	0	0	0	0	0	1.28	0
24	Ship	Articulated Tug/Barge	30,000	2	4	6	4	3	7	13	1.28	17
25	Ship	Tanker	25,000	0	1	1	1	1	2	3	1.64	5
26	Ship	Articulated Tug/Barge	25,000	1	2	3	2	2	4	7	1.28	9
27	Ship	Tanker	20,000	10	4	14	5	9	14	28	1.64	46
28	Ship	Tanker	15,000	0	1	1	1	0	1	2	1.64	3
			Total Trips:	20	54	74	53	20	73	147		344

Notes:

[1] As part of the risk analysis, vessel trips will include future growth in the waterway that are projected to the mid-point of the remaining design life (assumed 50 years) of the structure. This equates to growth rates per year as follows for a 25-year projection. GF = $(1+PERCENT/100)^{25}$

- Aframax Tankers (DWT greater than 100,000 tonnes) = 9.735%
- All Other Tankers = 2.0%
- All Other Vessels = 1.0%

VESSEL FLEET TRANSIT SPEEDS IN MAIN CHANNEL

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Vessel Transit Speeds (knots)				Vessel Transit Speeds (m/sec) [1]			
				Inbound		Outbound		Inbound		Outbound	
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted
1	Ship	Tanker	120,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
2	Ship	Tanker	110,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
3	Ship	Tanker	105,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
4	Ship	Bulk Carrier	85,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
5	Ship	Bulk Carrier	80,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
6	Ship	Tanker	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
7	Ship	Bulk Carrier	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
8	Ship	Tanker	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
9	Ship	Bulk Carrier	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
10	Ship	Tanker	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
11	Ship	Bulk Carrier	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
12	Ship	Bulk Carrier	60,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
13	Ship	Tanker	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
14	Ship	Bulk Carrier	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
15	Ship	Tanker	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
16	Ship	Bulk Carrier	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
17	Ship	Tanker	45,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
18	Ship	Tanker	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
19	Ship	Bulk Carrier	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
20	Ship	Tanker	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
21	Ship	Bulk Carrier	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
22	Ship	Tanker	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
23	Ship	Bulk Carrier	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
24	Ship	Articulated Tug/Barge	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
25	Ship	Tanker	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
26	Ship	Articulated Tug/Barge	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
27	Ship	Tanker	20,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
28	Ship	Tanker	15,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866

Notes:

[1] Conversion (knot to m/sec) = 0.51 (convert vessel transit speeds from knots to meters/second for use in risk assessment equations)

ABERRANCY BASE RATE COMPUTATIONS

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Code Recommended Aberrancy Base Rate, BR	Vessel Traffic Service, VTS	Electronic Chart Display & Information System, ECDIS	Other Navigation Aids	Port Control State, PCS	Pilotage 1 Pilot	Pilotage 2 Pilots (MRA-2)		Daytime Only Transit Restrictions (MRA-2)		Visibility Restrictions (MRA-2)	Adjusted Aberrancy Base Rate, BR [1]	
										Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
2	Ship	Tanker	110,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
3	Ship	Tanker	105,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
4	Ship	Bulk Carrier	85,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
5	Ship	Bulk Carrier	80,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
6	Ship	Tanker	75,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
7	Ship	Bulk Carrier	75,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
8	Ship	Tanker	70,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
9	Ship	Bulk Carrier	70,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
10	Ship	Tanker	65,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
11	Ship	Bulk Carrier	65,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
12	Ship	Bulk Carrier	60,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
13	Ship	Tanker	55,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
14	Ship	Bulk Carrier	55,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
15	Ship	Tanker	50,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
16	Ship	Bulk Carrier	50,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
17	Ship	Tanker	45,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
18	Ship	Tanker	40,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
19	Ship	Bulk Carrier	40,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
20	Ship	Tanker	35,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
21	Ship	Bulk Carrier	35,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
22	Ship	Tanker	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
23	Ship	Bulk Carrier	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
24	Ship	Articulated Tug/Barge	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
25	Ship	Tanker	25,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
26	Ship	Articulated Tug/Barge	25,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
27	Ship	Tanker	20,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
28	Ship	Tanker	15,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05

Notes:

[1] Adjustments to the aberrancy Base Rate (BR) due to waterway current restrictions are accounted for elsewhere in the vessel collision risk analysis (refer to correction factors R_C and R_{XC} for the Probability of Aberrancy at each transit leg).

MISCELLANEOUS INFORMATION

CHANNEL CHARACTERISTICS

Waterway Current Speed (V_{min}) =	**1.03**	m/sec
Mean High Water (MHW) Elevation =	**2.00**	m (based on Chart Datum)
Sea Level Rise Adjustment =	**0.10**	m
Soft Soil Allowance =	**1.00**	m (assumed depth that vessels can "plow" through soft bottom material)

AVAILABLE WATER DEPTH AT PIERS

Pier ID	Description	Mudline Elevation (m) [1]		Water Elevation (m)	Soft Soil Allowance (m)	Design Water Depth (m)	
		Inbound	Outbound			Inbound	Outbound
1	**Pier 14**	**-5.00**	**N/A**	2.10	1.00	8.10	0.00
2	**Pier 15**	**-10.00**	**-9.00**	2.10	1.00	13.10	12.10
3	**Pier 16**	**-6.00**	**-5.00**	2.10	1.00	9.10	8.10

Notes:

[1] Mudline elevation is based on Chart Datum (CD) and was obtained from Nautical Chart 3494

PROBABILITY OF ABERRANCY VARIABLES FOR EACH VESSEL TRANSIT PATH

Leg ID	Waterway Region for Bridge Location	Angle of Channel Turn, θ (deg) [1]	Correction Factor, R_B	Current Angle to Vessel Path (deg) [2]	Parallel Current, V_C (m/sec)	Perpendicular Current, V_{XC} (m/sec)	Correction Factor, R_C	Correction Factor, R_{XC}	Vessel Traffic Density	Correction Factor, R_D	Summation (R_B*R_C*R_{XC}*R_D)	Aberrancy Distribution [3]	
												Inbound	Outbound
1	**Transition**	**7.7227**	1.0858	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.3095	**0.24**	**N/A**
2	**Turn/Bend**	**7.7227**	1.1716	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4130	**0.50**	**N/A**
3	**Turn/Bend**	**7.7227**	1.1716	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4130	**0.26**	**N/A**
4	**Transition**	**8.8764**	1.0986	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.3249	**N/A**	**0.24**
5	**Turn/Bend**	**8.8764**	1.1973	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4439	**N/A**	**0.50**
6	**Turn/Bend**	**8.8764**	1.1973	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4439	**N/A**	**0.26**

Notes:

[1] Angle of the turn region in accordance with information shown on Nautical Chart 3494, AIS transit data near the bridge, and CAN/CSA S6-14 Figure A3.3.1

[2] The angle between the water current direction and each channel transition leg

[3] Distribution of the Probability of Aberrancy for each channel transition leg is established as a ratio of the length of each leg to the overall length being considered (approximately 1 nautical mile or 2000m)

GEOMETRIC PROBABILITY DISTANCES FOR NORMAL DISTRIBUTION

Pier ID	Description	Leg 1 [1]			Leg 2 [1]			Leg 3 [1]			Leg 4 [1]			Leg 5 [1]			Leg 6 [1]		
		x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)
1	Pier 14	**363.89**	375.26	**386.63**	**363.89**	375.26	**386.63**	**299.02**	308.72	**318.42**	**299.02**	308.72	**318.42**	**299.02**	308.72	**318.42**	**520.46**	532.27	**544.09**
2	Pier 15	**222.26**	234.22	**246.17**	**222.26**	234.22	**246.17**	**156.11**	166.57	**177.02**	**156.11**	166.57	**177.02**	**156.11**	166.57	**177.02**	**379.70**	392.04	**404.39**
3	Pier 16	**86.36**	98.32	**110.27**	**86.36**	98.32	**110.27**	**158.26**	168.71	**179.16**	**158.26**	168.71	**179.16**	**158.26**	168.71	**179.16**	**48.82**	61.17	**73.51**

Notes:

[1] Perpendicular distances at each channel transition leg from the centerline of vessel transit path to the bridge element being considered. Distance "x" is from the centerline of vessel transit path to the centerline of bridge element. Distance "x_1" (scaled from CADD drawing) is from the centerline of vessel transit path to the closest edge of the bridge element. Distance "x_2" (scaled from CADD drawing) is from the centerline of vessel transit path to the farthest edge of the bridge element.

PROTECTION FACTOR

Pier ID	Description	Leg 1		Leg 2		Leg 3		Leg 4		Leg 5		Leg 6	
		Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
1	Pier 14	**0.09**	**N/A**	**0.09**	**N/A**	**0.13**	**N/A**	**N/A**	**0.00**	**N/A**	**0.00**	**N/A**	**0.00**
2	Pier 15	**0.65**	**N/A**	**0.65**	**N/A**	**0.73**	**N/A**	**N/A**	**0.02**	**N/A**	**0.02**	**N/A**	**0.02**
3	Pier 16	**0.74**	**N/A**	**0.74**	**N/A**	**0.66**	**N/A**	**N/A**	**0.03**	**N/A**	**0.03**	**N/A**	**0.04**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.5140	0.00	8.50	0.00	21.20	0	5	10.20	0.000002	0.000002	0.000010	0.000010	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.5140	0.00	8.41	0.00	20.29	0	5	10.20	0.000002	0.000002	0.000008	0.000008	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.5140	0.00	8.34	0.00	19.83	0	0	10.20	0.000002	0.000002	0.000008	0.000008	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.0290	0.00	26.28	0.00	35.71	0	0	1.28	0.000006	0.000006	0.000005	0.000005	0.000000	0.033334	0.0900	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.0290	0.00	24.74	0.00	34.65	0	0	1.28	0.000006	0.000006	0.000004	0.000004	0.000000	0.030940	0.0900	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.0290	0.00	25.05	0.00	33.55	0	4	1.64	0.000002	0.000006	0.000005	0.000005	0.000000	0.028311	0.0900	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.0290	0.00	21.36	0.00	33.55	0	0	1.28	0.000006	0.000006	0.000004	0.000004	0.000000	0.028311	0.0900	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.0290	0.00	19.17	0.00	32.41	0	0	1.64	0.000002	0.000006	0.000004	0.000004	0.000000	0.025405	0.0900	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.0290	0.00	16.30	0.00	32.41	0	0	1.28	0.000006	0.000006	0.000004	0.000004	0.000000	0.025405	0.0900	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.0290	0.00	18.86	0.00	31.23	0	1	1.64	0.000002	0.000006	0.000003	0.000003	0.000000	0.022170	0.0900	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.0290	0.00	20.43	0.00	31.23	0	0	1.28	0.000006	0.000006	0.000003	0.000003	0.000000	0.022170	0.0900	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.0290	0.00	16.44	0.00	30.01	0	0	1.28	0.000006	0.000006	0.000002	0.000002	0.000000	0.018538	0.0900	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.0290	0.00	20.35	0.00	28.73	0	2	1.64	0.000002	0.000006	0.000001	0.000001	0.000000	0.014421	0.0900	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.0290	0.00	12.93	0.00	28.73	0	0	1.28	0.000006	0.000006	0.000002	0.000002	0.000000	0.014421	0.0900	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	1.0290	0.00	19.86	0.00	27.39	0	8	1.64	0.000002	0.000006	0.000001	0.000001	0.000000	0.009702	0.0900	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.0290	0.00	14.71	0.00	27.39	0	1	1.28	0.000006	0.000006	0.000002	0.000002	0.000000	0.009702	0.0900	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	1.0290	0.00	21.39	0.00	25.99	0	0	1.64	0.000002	0.000006	0.000001	0.000001	0.000000	0.004217	0.0900	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	1.0290	0.00	14.50	0.00	24.50	0	5	1.64	0.000002	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	1.0290	0.00	14.61	0.00	24.50	0	1	1.28	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	1.0290	0.00	12.81	0.00	22.92	0	2	1.64	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	1.0290	0.00	11.38	0.00	22.92	0	1	1.28	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	1.0290	0.00	9.52	0.00	21.22	0	7	1.64	0.000006	0.000006	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	1.0290	0.00	10.36	0.00	21.22	0	0	1.28	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	1.0290	0.00	9.71	0.00	21.22	0	4	1.28	0.000006	0.000006	0.000002	0.000002	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	1.0290	0.00	7.74	0.00	19.37	0	1	1.64	0.000006	0.000006	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	1.0290	0.00	8.74	0.00	19.37	0	2	1.28	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	1.0290	0.00	6.80	0.00	17.32	0	4	1.64	0.000006	0.000006	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	9.45	5.29	15.00	15.00	0	1	1.64	0.000006	0.000006	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.5140	0.00	8.50	0.00	21.20	0	5	10.20	0.000003	0.000003	0.000010	0.000010	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.5140	0.00	8.41	0.00	20.29	0	5	10.20	0.000003	0.000003	0.000008	0.000008	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.5140	0.00	8.34	0.00	19.83	0	0	10.20	0.000003	0.000003	0.000008	0.000008	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.0290	0.00	26.28	0.00	35.71	0	0	1.28	0.000013	0.000013	0.000005	0.000005	0.000000	0.033334	0.0900	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.0290	0.00	24.74	0.00	34.65	0	0	1.28	0.000013	0.000013	0.000004	0.000004	0.000000	0.030940	0.0900	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.0290	0.00	25.05	0.00	33.55	0	4	1.64	0.000003	0.000013	0.000005	0.000005	0.000000	0.028311	0.0900	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.0290	0.00	21.36	0.00	33.55	0	0	1.28	0.000013	0.000013	0.000004	0.000004	0.000000	0.028311	0.0900	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.0290	0.00	19.17	0.00	32.41	0	0	1.64	0.000003	0.000013	0.000004	0.000004	0.000000	0.025405	0.0900	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.0290	0.00	16.30	0.00	32.41	0	0	1.28	0.000013	0.000013	0.000004	0.000004	0.000000	0.025405	0.0900	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.0290	0.00	18.86	0.00	31.23	0	1	1.64	0.000003	0.000013	0.000003	0.000003	0.000000	0.022170	0.0900	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.0290	0.00	20.43	0.00	31.23	0	0	1.28	0.000013	0.000013	0.000003	0.000003	0.000000	0.022170	0.0900	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.0290	0.00	16.44	0.00	30.01	0	0	1.28	0.000013	0.000013	0.000002	0.000002	0.000000	0.018538	0.0900	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.0290	0.00	20.35	0.00	28.73	0	2	1.64	0.000003	0.000013	0.000001	0.000001	0.000000	0.014421	0.0900	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.0290	0.00	12.93	0.00	28.73	0	0	1.28	0.000013	0.000013	0.000002	0.000002	0.000000	0.014421	0.0900	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	1.0290	0.00	19.86	0.00	27.39	0	8	1.64	0.000003	0.000013	0.000001	0.000001	0.000000	0.009702	0.0900	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.0290	0.00	14.71	0.00	27.39	0	1	1.28	0.000013	0.000013	0.000002	0.000002	0.000000	0.009702	0.0900	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	1.0290	0.00	21.39	0.00	25.99	0	0	1.64	0.000003	0.000013	0.000001	0.000001	0.000000	0.004217	0.0900	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	1.0290	0.00	14.50	0.00	24.50	0	5	1.64	0.000003	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	1.0290	0.00	14.61	0.00	24.50	0	1	1.28	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	1.0290	0.00	12.81	0.00	22.92	0	2	1.64	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	1.0290	0.00	11.38	0.00	22.92	0	1	1.28	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	1.0290	0.00	9.52	0.00	21.22	0	7	1.64	0.000013	0.000013	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	1.0290	0.00	10.36	0.00	21.22	0	0	1.28	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	1.0290	0.00	9.71	0.00	21.22	0	4	1.28	0.000013	0.000013	0.000002	0.000002	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	1.0290	0.00	7.74	0.00	19.37	0	1	1.64	0.000013	0.000013	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	1.0290	0.00	8.74	0.00	19.37	0	2	1.28	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	1.0290	0.00	6.80	0.00	17.32	0	4	1.64	0.000013	0.000013	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	9.45	5.29	15.00	15.00	0	1	1.64	0.000013	0.000013	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.5140	0.00	8.50	0.00	21.20	0	5	10.20	0.000002	0.000002	0.000261	0.000261	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.5140	0.00	8.41	0.00	20.29	0	5	10.20	0.000002	0.000002	0.000232	0.000232	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.5140	0.00	8.34	0.00	19.83	0	0	10.20	0.000002	0.000002	0.000231	0.000231	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.0290	0.00	26.28	0.00	35.71	0	0	1.28	0.000007	0.000007	0.000146	0.000146	0.000000	0.033334	0.1300	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.0290	0.00	24.74	0.00	34.65	0	0	1.28	0.000007	0.000007	0.000137	0.000137	0.000000	0.030940	0.1300	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.0290	0.00	25.05	0.00	33.55	0	4	1.64	0.000002	0.000007	0.000150	0.000150	0.000000	0.028311	0.1300	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.0290	0.00	21.36	0.00	33.55	0	0	1.28	0.000007	0.000007	0.000137	0.000137	0.000000	0.028311	0.1300	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.0290	0.00	19.17	0.00	32.41	0	0	1.64	0.000002	0.000007	0.000143	0.000143	0.000000	0.025405	0.1300	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.0290	0.00	16.30	0.00	32.41	0	0	1.28	0.000007	0.000007	0.000137	0.000137	0.000000	0.025405	0.1300	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.0290	0.00	18.86	0.00	31.23	0	1	1.64	0.000002	0.000007	0.000116	0.000116	0.000000	0.022170	0.1300	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.0290	0.00	20.43	0.00	31.23	0	0	1.28	0.000007	0.000007	0.000112	0.000112	0.000000	0.022170	0.1300	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.0290	0.00	16.44	0.00	30.01	0	0	1.28	0.000007	0.000007	0.000078	0.000078	0.000000	0.018538	0.1300	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.0290	0.00	20.35	0.00	28.73	0	2	1.64	0.000002	0.000007	0.000064	0.000064	0.000000	0.014421	0.1300	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.0290	0.00	12.93	0.00	28.73	0	0	1.28	0.000007	0.000007	0.000073	0.000073	0.000000	0.014421	0.1300	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	1.0290	0.00	19.86	0.00	27.39	0	8	1.64	0.000002	0.000007	0.000062	0.000062	0.000000	0.009702	0.1300	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.0290	0.00	14.71	0.00	27.39	0	1	1.28	0.000007	0.000007	0.000083	0.000083	0.000000	0.009702	0.1300	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	1.0290	0.00	21.39	0.00	25.99	0	0	1.64	0.000002	0.000007	0.000059	0.000059	0.000000	0.004217	0.1300	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	1.0290	0.00	14.50	0.00	24.50	0	5	1.64	0.000002	0.000007	0.000050	0.000050	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	1.0290	0.00	14.61	0.00	24.50	0	1	1.28	0.000007	0.000007	0.000056	0.000056	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	1.0290	0.00	12.81	0.00	22.92	0	2	1.64	0.000007	0.000007	0.000041	0.000041	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	1.0290	0.00	11.38	0.00	22.92	0	1	1.28	0.000007	0.000007	0.000049	0.000049	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	1.0290	0.00	9.52	0.00	21.22	0	7	1.64	0.000007	0.000007	0.000027	0.000027	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	1.0290	0.00	10.36	0.00	21.22	0	0	1.28	0.000007	0.000007	0.000038	0.000038	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	1.0290	0.00	9.71	0.00	21.22	0	4	1.28	0.000007	0.000007	0.000081	0.000081	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	1.0290	0.00	7.74	0.00	19.37	0	1	1.64	0.000007	0.000007	0.000015	0.000015	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	1.0290	0.00	8.74	0.00	19.37	0	2	1.28	0.000007	0.000007	0.000050	0.000050	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	1.0290	0.00	6.80	0.00	17.32	0	4	1.64	0.000007	0.000007	0.000014	0.000014	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	9.45	5.29	15.00	15.00	0	1	1.64	0.000007	0.000007	0.000005	0.000005	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000261	0.000261	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000232	0.000232	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000231	0.000231	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000146	0.000146	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000150	0.000150	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000143	0.000143	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000116	0.000116	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000112	0.000112	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000078	0.000078	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000064	0.000064	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000073	0.000073	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000062	0.000062	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000083	0.000083	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000059	0.000059	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000050	0.000050	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000056	0.000056	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000041	0.000041	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000049	0.000049	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000027	0.000027	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000038	0.000038	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000081	0.000081	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000015	0.000015	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000050	0.000050	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000014	0.000014	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000005	0.000005	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004	0.000261	0.000261	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004	0.000232	0.000232	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004	0.000231	0.000231	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000146	0.000146	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000150	0.000150	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000143	0.000143	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000116	0.000116	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000112	0.000112	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000078	0.000078	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000064	0.000064	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000073	0.000073	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000062	0.000062	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000083	0.000083	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000059	0.000059	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000050	0.000050	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000056	0.000056	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000041	0.000041	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000049	0.000049	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000027	0.000027	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000038	0.000038	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000081	0.000081	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000015	0.000015	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000050	0.000050	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000014	0.000014	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000005	0.000005	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
																			Total for Pier:			**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.6023	0.6023	22.95	10.45	24.84	24.84	0	5	10.20	0.000002	0.000002	0.005802	0.005802	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.5710	0.5710	19.46	9.18	22.54	22.54	0	5	10.20	0.000002	0.000002	0.005450	0.005450	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.5827	0.5827	21.75	9.42	22.48	22.48	0	0	10.20	0.000002	0.000002	0.005365	0.005365	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.0435	1.0435	45.86	23.23	36.22	36.22	0	0	1.28	0.000006	0.000006	0.003880	0.003880	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.0321	1.0321	45.19	21.70	34.75	34.75	0	0	1.28	0.000006	0.000006	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.5286	1.0407	11.38	22.50	17.23	33.93	0	4	1.64	0.000002	0.000006	0.003985	0.003985	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.0321	1.0321	45.70	19.67	33.65	33.65	0	0	1.28	0.000006	0.000006	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.5286	1.0407	10.49	18.69	16.65	32.78	0	0	1.64	0.000002	0.000006	0.003850	0.003850	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.0321	1.0321	45.06	16.40	32.51	32.51	0	0	1.28	0.000006	0.000006	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.5140	1.0290	9.11	17.60	15.60	31.23	0	1	1.64	0.000002	0.000006	0.003428	0.003428	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.0290	1.0290	40.65	18.54	31.23	31.23	0	0	1.28	0.000006	0.000006	0.003367	0.003367	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.0290	1.0290	36.36	15.59	30.01	30.01	0	0	1.28	0.000006	0.000006	0.002772	0.002772	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.5140	1.0290	8.30	17.49	14.35	28.73	0	2	1.64	0.000002	0.000006	0.002486	0.002486	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	32.51	12.93	28.73	28.73	0	0	1.28	0.000006	0.000006	0.002677	0.002677	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.5140	1.0290	7.42	17.19	13.68	27.39	4	8	1.64	0.000002	0.000006	0.002454	0.002454	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	1.0290	1.0290	37.20	14.35	27.39	27.39	0	1	1.28	0.000006	0.000006	0.002822	0.002822	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.5140	1.0290	6.97	17.98	12.98	25.99	0	0	1.64	0.000002	0.000006	0.002390	0.002390	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.5140	1.0290	5.85	13.22	12.24	24.50	1	5	1.64	0.000002	0.000006	0.002103	0.002103	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	21.56	13.70	24.50	24.50	0	1	1.28	0.000006	0.000006	0.002274	0.002274	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.0290	1.0290	21.82	11.83	22.92	22.92	1	2	1.64	0.000006	0.000006	0.001878	0.001878	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	22.53	11.38	22.92	22.92	0	1	1.28	0.000006	0.000006	0.002098	0.002098	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	16.80	9.52	21.22	21.22	1	7	1.64	0.000006	0.000006	0.001485	0.001485	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	19.27	10.36	21.22	21.22	0	0	1.28	0.000006	0.000006	0.001793	0.001793	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	18.84	9.71	21.22	21.22	2	4	1.28	0.000006	0.000006	0.002613	0.002613	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	13.23	7.64	19.37	19.37	0	1	1.64	0.000006	0.000006	0.001042	0.001042	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	14.50	8.74	19.37	19.37	1	2	1.28	0.000006	0.000006	0.002026	0.002026	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	11.61	6.80	17.32	17.32	10	4	1.64	0.000006	0.000006	0.001018	0.001018	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	7.94	5.29	15.00	15.00	0	1	1.64	0.000006	0.000006	0.000544	0.000544	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.6023	0.6023	22.95	10.45	24.84	24.84	0	5	10.20	0.000003	0.000003	0.005802	0.005802	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.5710	0.5710	19.46	9.18	22.54	22.54	0	5	10.20	0.000003	0.000003	0.005450	0.005450	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.5827	0.5827	21.75	9.42	22.48	22.48	0	0	10.20	0.000003	0.000003	0.005365	0.005365	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.0435	1.0435	45.86	23.23	36.22	36.22	0	0	1.28	0.000013	0.000013	0.003880	0.003880	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.0321	1.0321	45.19	21.70	34.75	34.75	0	0	1.28	0.000013	0.000013	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.5286	1.0407	11.38	22.50	17.23	33.93	0	4	1.64	0.000003	0.000013	0.003985	0.003985	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.0321	1.0321	45.70	19.67	33.65	33.65	0	0	1.28	0.000013	0.000013	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.5286	1.0407	10.49	18.69	16.65	32.78	0	0	1.64	0.000003	0.000013	0.003850	0.003850	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.0321	1.0321	45.06	16.40	32.51	32.51	0	0	1.28	0.000013	0.000013	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.5140	1.0290	9.11	17.60	15.60	31.23	0	1	1.64	0.000003	0.000013	0.003428	0.003428	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.0290	1.0290	40.65	18.54	31.23	31.23	0	0	1.28	0.000013	0.000013	0.003367	0.003367	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.0290	1.0290	36.36	15.59	30.01	30.01	0	0	1.28	0.000013	0.000013	0.002772	0.002772	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.5140	1.0290	8.30	17.49	14.35	28.73	0	2	1.64	0.000003	0.000013	0.002486	0.002486	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	32.51	12.93	28.73	28.73	0	0	1.28	0.000013	0.000013	0.002677	0.002677	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.5140	1.0290	7.42	17.19	13.68	27.39	4	8	1.64	0.000003	0.000013	0.002454	0.002454	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	1.0290	1.0290	37.20	14.35	27.39	27.39	0	1	1.28	0.000013	0.000013	0.002822	0.002822	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.5140	1.0290	6.97	17.98	12.98	25.99	0	0	1.64	0.000003	0.000013	0.002390	0.002390	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.5140	1.0290	5.85	13.22	12.24	24.50	1	5	1.64	0.000003	0.000013	0.002103	0.002103	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	21.56	13.70	24.50	24.50	0	1	1.28	0.000013	0.000013	0.002274	0.002274	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.0290	1.0290	21.82	11.83	22.92	22.92	1	2	1.64	0.000013	0.000013	0.001878	0.001878	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	22.53	11.38	22.92	22.92	0	1	1.28	0.000013	0.000013	0.002098	0.002098	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	16.80	9.52	21.22	21.22	1	7	1.64	0.000013	0.000013	0.001485	0.001485	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	19.27	10.36	21.22	21.22	0	0	1.28	0.000013	0.000013	0.001793	0.001793	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	18.84	9.71	21.22	21.22	2	4	1.28	0.000013	0.000013	0.002613	0.002613	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	13.23	7.64	19.37	19.37	0	1	1.64	0.000013	0.000013	0.001042	0.001042	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	14.50	8.74	19.37	19.37	1	2	1.28	0.000013	0.000013	0.002026	0.002026	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	11.61	6.80	17.32	17.32	10	4	1.64	0.000013	0.000013	0.001018	0.001018	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	7.94	5.29	15.00	15.00	0	1	1.64	0.000013	0.000013	0.000544	0.000544	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	1.5822	1.5822	158.39	72.14	65.25	65.25	0	5	10.20	0.000002	0.000002	0.040552	0.040552	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	1.5632	1.5632	145.90	68.83	61.72	61.72	0	5	10.20	0.000002	0.000002	0.039452	0.039452	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	1.5542	1.5542	154.71	66.98	59.95	59.95	0	0	10.20	0.000002	0.000002	0.038476	0.038476	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.8147	1.8147	138.70	70.26	62.99	62.99	0	0	1.28	0.000007	0.000007	0.030162	0.030162	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.8076	1.8076	138.62	66.56	60.87	60.87	0	0	1.28	0.000007	0.000007	0.029749	0.029749	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	1.4942	1.8130	90.91	68.28	48.71	59.11	0	4	1.64	0.000002	0.000007	0.031022	0.031022	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.8076	1.8076	140.18	60.35	58.93	58.93	0	0	1.28	0.000007	0.000007	0.029749	0.029749	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	1.4942	1.8130	83.81	56.72	47.06	57.10	0	0	1.64	0.000002	0.000007	0.030060	0.030060	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.8076	1.8076	138.22	50.31	56.93	56.93	0	0	1.28	0.000007	0.000007	0.029749	0.029749	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	1.4612	1.7866	73.63	53.05	44.35	54.22	0	1	1.64	0.000002	0.000007	0.028549	0.028549	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.7825	1.7825	121.99	55.63	54.10	54.10	0	0	1.28	0.000007	0.000007	0.028320	0.028320	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.7387	1.7387	103.81	44.50	50.70	50.70	0	0	1.28	0.000007	0.000007	0.025962	0.025962	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	1.3709	1.7144	59.02	48.56	38.28	47.86	0	2	1.64	0.000002	0.000007	0.024719	0.024719	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.7309	1.7309	91.99	36.59	48.33	48.33	0	0	1.28	0.000007	0.000007	0.025557	0.025557	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	1.3674	1.7115	52.49	47.55	36.40	45.56	4	8	1.64	0.000002	0.000007	0.024575	0.024575	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	1.7536	1.7536	108.03	41.67	46.68	46.68	0	1	1.28	0.000007	0.000007	0.025596	0.025596	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	1.3600	1.7057	48.81	49.41	34.35	43.07	0	0	1.64	0.000002	0.000007	0.024285	0.024285	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	1.3525	1.6997	40.47	36.07	32.20	40.47	1	5	1.64	0.000002	0.000007	0.021912	0.021912	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.7057	1.7057	59.24	37.65	40.61	40.61	0	1	1.28	0.000007	0.000007	0.023227	0.023227	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.6807	1.6807	58.21	31.57	37.43	37.43	1	2	1.64	0.000007	0.000007	0.020575	0.020575	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6935	1.6935	61.01	30.84	37.72	37.72	0	1	1.28	0.000007	0.000007	0.022143	0.022143	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6298	1.6298	42.14	23.87	33.61	33.61	1	7	1.64	0.000007	0.000007	0.018487	0.018487	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6706	1.6706	50.78	27.30	34.45	34.45	0	0	1.28	0.000007	0.000007	0.020146	0.020146	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7783	1.7783	56.25	28.99	36.67	36.67	2	4	1.28	0.000007	0.000007	0.022591	0.022591	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5722	1.5722	30.89	17.83	29.59	29.59	0	1	1.64	0.000007	0.000007	0.015153	0.015153	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.7144	1.7144	40.26	24.26	32.27	32.27	1	2	1.28	0.000007	0.000007	0.020518	0.020518	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5672	1.5672	26.92	15.78	26.39	26.39	10	4	1.64	0.000007	0.000007	0.014991	0.014991	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4620	1.4620	16.02	10.68	21.32	21.32	0	1	1.64	0.000007	0.000007	0.010643	0.010643	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	1.5822	1.5822	158.44	72.14	65.25	65.25	0	0	10.20	0.000002	0.000002	0.040552	0.040552	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	1.5632	1.5632	146.49	68.83	61.72	61.72	3	0	10.20	0.000002	0.000002	0.039452	0.039452	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	1.5542	0.00	66.98	0.00	59.95	0	0	10.20	0.000002	0.000002	0.038476	0.038476	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.8147	1.8147	139.80	70.26	62.99	62.99	2	0	1.28	0.000006	0.000006	0.030162	0.030162	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.8076	1.8076	138.67	66.56	60.87	60.87	2	0	1.28	0.000006	0.000006	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	1.4942	1.8130	93.11	68.28	48.71	59.11	3	0	1.64	0.000002	0.000006	0.031022	0.031022	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.8076	1.8076	140.18	60.35	58.93	58.93	1	0	1.28	0.000006	0.000006	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	1.4942	1.8130	86.97	56.72	47.06	57.10	0	0	1.64	0.000002	0.000006	0.030060	0.030060	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.8076	1.8076	138.22	50.31	56.93	56.93	0	0	1.28	0.000006	0.000006	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	1.4612	1.7866	76.45	53.05	44.35	54.22	0	0	1.64	0.000002	0.000006	0.028549	0.028549	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.7825	1.7825	122.96	55.63	54.10	54.10	2	0	1.28	0.000006	0.000006	0.028320	0.028320	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.7387	1.7387	105.04	44.50	50.70	50.70	0	0	1.28	0.000006	0.000006	0.025962	0.025962	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	1.3709	1.7144	60.20	48.56	38.28	47.86	2	0	1.64	0.000002	0.000006	0.024719	0.024719	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.7309	1.7309	95.51	36.59	48.33	48.33	1	0	1.28	0.000006	0.000006	0.025557	0.025557	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	1.3674	1.7115	54.58	47.55	36.40	45.56	8	3	1.64	0.000002	0.000006	0.024575	0.024575	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.7536	0.00	41.67	0.00	46.68	0	0	1.28	0.000006	0.000006	0.025596	0.025596	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	1.3600	1.7057	50.85	49.41	34.35	43.07	0	0	1.64	0.000002	0.000006	0.024285	0.024285	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	1.3525	1.6997	42.21	36.07	32.20	40.47	5	1	1.64	0.000002	0.000006	0.021912	0.021912	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.7057	1.7057	62.25	37.65	40.61	40.61	1	0	1.28	0.000006	0.000006	0.023227	0.023227	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.6807	1.6807	60.68	31.57	37.43	37.43	2	1	1.64	0.000006	0.000006	0.020575	0.020575	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6935	1.6935	63.81	30.84	37.72	37.72	1	0	1.28	0.000006	0.000006	0.022143	0.022143	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6298	1.6298	44.24	23.87	33.61	33.61	7	0	1.64	0.000006	0.000006	0.018487	0.018487	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6706	1.6706	53.19	27.30	34.45	34.45	0	0	1.28	0.000006	0.000006	0.020146	0.020146	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7783	1.7783	59.01	28.99	36.67	36.67	4	3	1.28	0.000006	0.000006	0.022591	0.022591	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5722	1.5722	32.43	17.83	29.59	29.59	1	1	1.64	0.000006	0.000006	0.015153	0.015153	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.7144	1.7144	41.07	24.26	32.27	32.27	2	2	1.28	0.000006	0.000006	0.020518	0.020518	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5672	1.5672	28.32	15.78	26.39	26.39	5	9	1.64	0.000006	0.000006	0.014991	0.014991	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4620	1.4620	16.07	10.68	21.32	21.32	1	0	1.64	0.000006	0.000006	0.010643	0.010643	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	1.5822	1.5822	158.44	72.14	65.25	65.25	0	0	10.20	0.000004	0.000004	0.040552	0.040552	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	1.5632	1.5632	146.49	68.83	61.72	61.72	3	0	10.20	0.000004	0.000004	0.039452	0.039452	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	1.5542	0.00	66.98	0.00	59.95	0	0	10.20	0.000004	0.000004	0.038476	0.038476	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.8147	1.8147	139.80	70.26	62.99	62.99	2	0	1.28	0.000013	0.000013	0.030162	0.030162	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.8076	1.8076	138.67	66.56	60.87	60.87	2	0	1.28	0.000013	0.000013	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	1.4942	1.8130	93.11	68.28	48.71	59.11	3	0	1.64	0.000004	0.000013	0.031022	0.031022	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.8076	1.8076	140.18	60.35	58.93	58.93	1	0	1.28	0.000013	0.000013	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	1.4942	1.8130	86.97	56.72	47.06	57.10	0	0	1.64	0.000004	0.000013	0.030060	0.030060	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.8076	1.8076	138.22	50.31	56.93	56.93	0	0	1.28	0.000013	0.000013	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	1.4612	1.7866	76.45	53.05	44.35	54.22	0	0	1.64	0.000004	0.000013	0.028549	0.028549	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.7825	1.7825	122.96	55.63	54.10	54.10	2	0	1.28	0.000013	0.000013	0.028320	0.028320	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.7387	1.7387	105.04	44.50	50.70	50.70	0	0	1.28	0.000013	0.000013	0.025962	0.025962	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	1.3709	1.7144	60.20	48.56	38.28	47.86	2	0	1.64	0.000004	0.000013	0.024719	0.024719	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.7309	1.7309	95.51	36.59	48.33	48.33	1	0	1.28	0.000013	0.000013	0.025557	0.025557	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	1.3674	1.7115	54.58	47.55	36.40	45.56	8	3	1.64	0.000004	0.000013	0.024575	0.024575	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.7536	0.00	41.67	0.00	46.68	0	0	1.28	0.000013	0.000013	0.025596	0.025596	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	1.3600	1.7057	50.85	49.41	34.35	43.07	0	0	1.64	0.000004	0.000013	0.024285	0.024285	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	1.3525	1.6997	42.21	36.07	32.20	40.47	5	1	1.64	0.000004	0.000013	0.021912	0.021912	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.7057	1.7057	62.25	37.65	40.61	40.61	1	0	1.28	0.000013	0.000013	0.023227	0.023227	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.6807	1.6807	60.68	31.57	37.43	37.43	2	1	1.64	0.000013	0.000013	0.020575	0.020575	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6935	1.6935	63.81	30.84	37.72	37.72	1	0	1.28	0.000013	0.000013	0.022143	0.022143	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6298	1.6298	44.24	23.87	33.61	33.61	7	0	1.64	0.000013	0.000013	0.018487	0.018487	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6706	1.6706	53.19	27.30	34.45	34.45	0	0	1.28	0.000013	0.000013	0.020146	0.020146	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7783	1.7783	59.01	28.99	36.67	36.67	4	3	1.28	0.000013	0.000013	0.022591	0.022591	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5722	1.5722	32.43	17.83	29.59	29.59	1	1	1.64	0.000013	0.000013	0.015153	0.015153	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.7144	1.7144	41.07	24.26	32.27	32.27	2	2	1.28	0.000013	0.000013	0.020518	0.020518	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5672	1.5672	28.32	15.78	26.39	26.39	5	9	1.64	0.000013	0.000013	0.014991	0.014991	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4620	1.4620	16.07	10.68	21.32	21.32	1	0	1.64	0.000013	0.000013	0.010643	0.010643	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.5140	0.5140	16.72	7.61	21.20	21.20	0	0	10.20	0.000002	0.000002	0.000004	0.000004	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.5140	0.5140	15.84	7.44	20.29	20.29	3	0	10.20	0.000002	0.000002	0.000003	0.000003	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.5140	0.00	7.33	0.00	19.83	0	0	10.20	0.000002	0.000002	0.000003	0.000003	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	1.0290	1.0290	44.95	22.59	35.71	35.71	2	0	1.28	0.000007	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	1.0290	1.0290	44.93	21.57	34.65	34.65	2	0	1.28	0.000007	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.5140	1.0290	11.02	22.00	16.76	33.55	3	0	1.64	0.000002	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	1.0290	1.0290	45.42	19.56	33.55	33.55	1	0	1.28	0.000007	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.5140	1.0290	10.29	18.27	16.19	32.41	0	0	1.64	0.000002	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	1.0290	1.0290	44.79	16.30	32.41	32.41	0	0	1.28	0.000007	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.5140	1.0290	9.46	17.60	15.60	31.23	0	0	1.64	0.000002	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	1.0290	1.0290	40.98	18.54	31.23	31.23	2	0	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	1.0290	1.0290	36.79	15.59	30.01	30.01	0	0	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.5140	1.0290	8.46	17.49	14.35	28.73	2	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	33.75	12.93	28.73	28.73	1	0	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.5140	1.0290	7.71	17.19	13.68	27.39	8	3	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.0290	0.00	14.35	0.00	27.39	0	0	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.5140	1.0290	7.26	17.98	12.98	25.99	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.5140	1.0290	6.10	13.22	12.24	24.50	5	1	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	22.66	13.70	24.50	24.50	1	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.0290	1.0290	22.75	11.83	22.92	22.92	2	1	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	23.56	11.38	22.92	22.92	1	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	17.64	9.52	21.22	21.22	7	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	20.18	10.36	21.22	21.22	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	19.76	9.71	21.22	21.22	4	3	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	13.89	7.64	19.37	19.37	1	1	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	14.79	8.74	19.37	19.37	2	2	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	12.21	6.80	17.32	17.32	5	9	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	7.96	5.29	15.00	15.00	1	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	2.5708	0.00	198.53	0.00	106.02	0	5	10.20	0.000002	0.000002	0.161512	0.161512	0.000000	0.016786	0.7400	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	2.5643	0.00	195.89	0.00	101.25	0	5	10.20	0.000002	0.000002	0.160908	0.160908	0.000000	0.012342	0.7400	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	2.5343	0.00	190.12	0.00	97.76	0	0	10.20	0.000002	0.000002	0.156289	0.156289	0.000000	0.008821	0.7400	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	2.5928	0.00	157.10	0.00	89.99	0	0	1.28	0.000006	0.000006	0.131184	0.131184	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	2.5901	0.00	147.18	0.00	87.21	0	0	1.28	0.000006	0.000006	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	2.5921	0.00	149.01	0.00	84.51	0	4	1.64	0.000002	0.000006	0.134715	0.134715	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	2.5901	0.00	125.80	0.00	84.44	0	0	1.28	0.000006	0.000006	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	2.5921	0.00	115.95	0.00	81.64	0	0	1.64	0.000002	0.000006	0.131118	0.131118	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	2.5901	0.00	103.30	0.00	81.58	0	0	1.28	0.000006	0.000006	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	2.5819	0.00	110.80	0.00	78.36	0	1	1.64	0.000002	0.000006	0.130079	0.130079	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	2.5803	0.00	119.66	0.00	78.32	0	0	1.28	0.000006	0.000006	0.129913	0.129913	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	2.5633	0.00	96.73	0.00	74.75	0	0	1.28	0.000006	0.000006	0.128069	0.128069	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	2.5539	0.00	118.02	0.00	71.30	0	2	1.64	0.000002	0.000006	0.126989	0.126989	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	2.5603	0.00	80.05	0.00	71.48	0	0	1.28	0.000006	0.000006	0.127726	0.127726	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	2.5527	0.00	114.91	0.00	67.95	0	8	1.64	0.000002	0.000006	0.126859	0.126859	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	2.5691	0.00	89.43	0.00	68.39	0	1	1.28	0.000006	0.000006	0.123982	0.123982	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	2.5505	0.00	124.26	0.00	64.41	0	0	1.64	0.000002	0.000006	0.126593	0.126593	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	2.5481	0.00	82.76	0.00	60.67	0	5	1.64	0.000002	0.000006	0.117002	0.117002	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	2.5505	2.5505	153.27	84.18	60.73	60.73	0	1	1.28	0.000006	0.000006	0.121920	0.121920	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	2.5408	0.00	72.44	0.00	56.59	0	2	1.64	0.000006	0.000006	0.113859	0.113859	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	2.5457	0.00	69.68	0.00	56.70	0	1	1.28	0.000006	0.000006	0.119052	0.119052	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	2.5210	0.00	57.12	0.00	51.98	0	7	1.64	0.000006	0.000006	0.111576	0.111576	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	2.5368	0.00	62.94	0.00	52.31	0	0	1.28	0.000006	0.000006	0.113415	0.113415	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	2.5787	0.00	60.95	0.00	53.17	0	4	1.28	0.000006	0.000006	0.107501	0.107501	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	2.4986	0.00	45.04	0.00	47.03	0	1	1.64	0.000006	0.000006	0.102204	0.102204	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	2.5539	2.5539	106.35	53.83	48.07	48.07	1	2	1.28	0.000006	0.000006	0.108342	0.108342	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	2.4967	2.4967	81.35	40.06	42.03	42.03	10	4	1.64	0.000006	0.000006	0.101978	0.101978	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	2.4559	2.4559	53.32	30.14	35.81	35.81	0	1	1.64	0.000006	0.000006	0.088583	0.088583	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	2.5708	0.00	198.53	0.00	106.02	0	5	10.20	0.000003	0.000003	0.161512	0.161512	0.000000	0.016786	0.7400	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	2.5643	0.00	195.89	0.00	101.25	0	5	10.20	0.000003	0.000003	0.160908	0.160908	0.000000	0.012342	0.7400	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	2.5343	0.00	190.12	0.00	97.76	0	0	10.20	0.000003	0.000003	0.156289	0.156289	0.000000	0.008821	0.7400	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	2.5928	0.00	157.10	0.00	89.99	0	0	1.28	0.000013	0.000013	0.131184	0.131184	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	2.5901	0.00	147.18	0.00	87.21	0	0	1.28	0.000013	0.000013	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	2.5921	0.00	149.01	0.00	84.51	0	4	1.64	0.000003	0.000013	0.134715	0.134715	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	2.5901	0.00	125.80	0.00	84.44	0	0	1.28	0.000013	0.000013	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	2.5921	0.00	115.95	0.00	81.64	0	0	1.64	0.000003	0.000013	0.131118	0.131118	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	2.5901	0.00	103.30	0.00	81.58	0	0	1.28	0.000013	0.000013	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	2.5819	0.00	110.80	0.00	78.36	0	1	1.64	0.000003	0.000013	0.130079	0.130079	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	2.5803	0.00	119.66	0.00	78.32	0	0	1.28	0.000013	0.000013	0.129913	0.129913	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	2.5633	0.00	96.73	0.00	74.75	0	0	1.28	0.000013	0.000013	0.128069	0.128069	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	2.5539	0.00	118.02	0.00	71.30	0	2	1.64	0.000003	0.000013	0.126989	0.126989	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	2.5603	0.00	80.05	0.00	71.48	0	0	1.28	0.000013	0.000013	0.127726	0.127726	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	2.5527	0.00	114.91	0.00	67.95	0	8	1.64	0.000003	0.000013	0.126859	0.126859	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	2.5691	0.00	89.43	0.00	68.39	0	1	1.28	0.000013	0.000013	0.123982	0.123982	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	2.5505	0.00	124.26	0.00	64.41	0	0	1.64	0.000003	0.000013	0.126593	0.126593	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	2.5481	0.00	82.76	0.00	60.67	0	5	1.64	0.000003	0.000013	0.117002	0.117002	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	2.5505	2.5505	153.27	84.18	60.73	60.73	0	1	1.28	0.000013	0.000013	0.121920	0.121920	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	2.5408	0.00	72.44	0.00	56.59	0	2	1.64	0.000013	0.000013	0.113859	0.113859	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	2.5457	0.00	69.68	0.00	56.70	0	1	1.28	0.000013	0.000013	0.119052	0.119052	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	2.5210	0.00	57.12	0.00	51.98	0	7	1.64	0.000013	0.000013	0.111576	0.111576	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	2.5368	0.00	62.94	0.00	52.31	0	0	1.28	0.000013	0.000013	0.113415	0.113415	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	2.5787	0.00	60.95	0.00	53.17	0	4	1.28	0.000013	0.000013	0.107501	0.107501	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	2.4986	0.00	45.04	0.00	47.03	0	1	1.64	0.000013	0.000013	0.102204	0.102204	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	2.5539	2.5539	106.35	53.83	48.07	48.07	1	2	1.28	0.000013	0.000013	0.108342	0.108342	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	2.4967	2.4967	81.35	40.06	42.03	42.03	10	4	1.64	0.000013	0.000013	0.101978	0.101978	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	2.4559	2.4559	53.32	30.14	35.81	35.81	0	1	1.64	0.000013	0.000013	0.088583	0.088583	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000001**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	1.5512	0.00	72.28	0.00	63.97	0	5	10.20	0.000002	0.000002	0.038455	0.038455	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	1.5318	0.00	69.90	0.00	60.48	0	5	10.20	0.000002	0.000002	0.037377	0.037377	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	1.5234	0.00	68.70	0.00	58.77	0	0	10.20	0.000002	0.000002	0.036459	0.036459	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.7903	0.00	74.90	0.00	62.14	0	0	1.28	0.000007	0.000007	0.028514	0.028514	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.7831	0.00	69.75	0.00	60.04	0	0	1.28	0.000007	0.000007	0.028111	0.028111	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.7885	0.00	70.94	0.00	58.31	0	4	1.64	0.000002	0.000007	0.029327	0.029327	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.7831	0.00	59.62	0.00	58.13	0	0	1.28	0.000007	0.000007	0.028111	0.028111	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.7885	0.00	55.20	0.00	56.33	0	0	1.64	0.000002	0.000007	0.028414	0.028414	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.7831	0.00	48.96	0.00	56.16	0	0	1.28	0.000007	0.000007	0.028111	0.028111	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.7616	0.00	51.58	0.00	53.47	0	1	1.64	0.000002	0.000007	0.026939	0.026939	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.7574	0.00	55.51	0.00	53.34	0	0	1.28	0.000007	0.000007	0.026716	0.026716	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.7129	0.00	43.19	0.00	49.95	0	0	1.28	0.000007	0.000007	0.024421	0.024421	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.6881	0.00	51.56	0.00	47.13	0	2	1.64	0.000002	0.000007	0.023214	0.023214	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.7049	0.00	35.49	0.00	47.60	0	0	1.28	0.000007	0.000007	0.024028	0.024028	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	1.6851	0.00	50.07	0.00	44.86	0	8	1.64	0.000002	0.000007	0.023075	0.023075	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.7280	0.00	40.46	0.00	46.00	0	1	1.28	0.000007	0.000007	0.024096	0.024096	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	1.6791	0.00	53.86	0.00	42.40	0	0	1.64	0.000002	0.000007	0.022793	0.022793	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	1.6730	0.00	35.68	0.00	39.83	0	5	1.64	0.000002	0.000007	0.020551	0.020551	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.6791	1.6791	66.44	36.49	39.98	39.98	0	1	1.28	0.000007	0.000007	0.021797	0.021797	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	1.6537	0.00	30.68	0.00	36.83	0	2	1.64	0.000007	0.000007	0.019270	0.019270	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	1.6667	0.00	29.87	0.00	37.12	0	1	1.28	0.000007	0.000007	0.020760	0.020760	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	1.6018	0.00	23.06	0.00	33.03	0	7	1.64	0.000007	0.000007	0.017255	0.017255	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	1.6434	0.00	26.42	0.00	33.89	0	0	1.28	0.000007	0.000007	0.018856	0.018856	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	1.7532	0.00	28.17	0.00	36.15	0	4	1.28	0.000007	0.000007	0.021291	0.021291	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	1.5431	0.00	17.18	0.00	29.05	0	1	1.64	0.000007	0.000007	0.014084	0.014084	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.6881	1.6881	46.46	23.52	31.77	31.77	1	2	1.28	0.000007	0.000007	0.019256	0.019256	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5380	1.5380	30.87	15.20	25.89	25.89	10	4	1.64	0.000007	0.000007	0.013928	0.013928	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4308	1.4308	18.10	10.23	20.86	20.86	0	1	1.64	0.000007	0.000007	0.009812	0.009812	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	1.5512	0.00	77.40	0.00	63.97	0	0	10.20	0.000002	0.000002	0.038455	0.038455	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	1.5318	0.00	74.67	0.00	60.48	0	0	10.20	0.000002	0.000002	0.037377	0.037377	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	1.5234	0.00	73.28	0.00	58.77	0	0	10.20	0.000002	0.000002	0.036459	0.036459	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.7903	0.00	79.55	0.00	62.14	0	0	1.28	0.000006	0.000006	0.028514	0.028514	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.7831	0.00	74.29	0.00	60.04	0	0	1.28	0.000006	0.000006	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.7885	0.00	75.66	0.00	58.31	0	0	1.64	0.000002	0.000006	0.029327	0.029327	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.7831	0.00	64.13	0.00	58.13	0	0	1.28	0.000006	0.000006	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.7885	0.00	57.92	0.00	56.33	0	0	1.64	0.000002	0.000006	0.028414	0.028414	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.7831	0.00	48.96	0.00	56.16	0	0	1.28	0.000006	0.000006	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.7616	0.00	55.27	0.00	53.47	0	0	1.64	0.000002	0.000006	0.026939	0.026939	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.7574	0.00	59.60	0.00	53.34	0	0	1.28	0.000006	0.000006	0.026716	0.026716	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.7129	0.00	45.56	0.00	49.95	0	0	1.28	0.000006	0.000006	0.024421	0.024421	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.6881	0.00	54.77	0.00	47.13	0	0	1.64	0.000002	0.000006	0.023214	0.023214	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.7049	0.00	35.49	0.00	47.60	0	0	1.28	0.000006	0.000006	0.024028	0.024028	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	1.6851	0.00	53.25	0.00	44.86	0	3	1.64	0.000002	0.000006	0.023075	0.023075	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.7280	0.00	41.49	0.00	46.00	0	0	1.28	0.000006	0.000006	0.024096	0.024096	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	1.6791	0.00	56.96	0.00	42.40	0	0	1.64	0.000002	0.000006	0.022793	0.022793	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	1.6730	0.00	38.34	0.00	39.83	0	1	1.64	0.000002	0.000006	0.020551	0.020551	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	1.6791	0.00	38.90	0.00	39.98	0	0	1.28	0.000006	0.000006	0.021797	0.021797	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	1.6537	0.00	33.07	0.00	36.83	0	1	1.64	0.000006	0.000006	0.019270	0.019270	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	1.6667	0.00	29.87	0.00	37.12	0	0	1.28	0.000006	0.000006	0.020760	0.020760	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	1.6018	0.00	23.06	0.00	33.03	0	0	1.64	0.000006	0.000006	0.017255	0.017255	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	1.6434	0.00	26.42	0.00	33.89	0	0	1.28	0.000006	0.000006	0.018856	0.018856	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	1.7532	0.00	28.17	0.00	36.15	0	3	1.28	0.000006	0.000006	0.021291	0.021291	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	1.5431	0.00	17.40	0.00	29.05	0	1	1.64	0.000006	0.000006	0.014084	0.014084	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	1.6881	0.00	23.52	0.00	31.77	0	2	1.28	0.000006	0.000006	0.019256	0.019256	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	1.5380	0.00	15.20	0.00	25.89	0	9	1.64	0.000006	0.000006	0.013928	0.013928	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4308	1.4308	18.27	10.23	20.86	20.86	1	0	1.64	0.000006	0.000006	0.009812	0.009812	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	1.5512	0.00	77.40	0.00	63.97	0	0	10.20	0.000004	0.000004	0.038455	0.038455	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	1.5318	0.00	74.67	0.00	60.48	0	0	10.20	0.000004	0.000004	0.037377	0.037377	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	1.5234	0.00	73.28	0.00	58.77	0	0	10.20	0.000004	0.000004	0.036459	0.036459	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.7903	0.00	79.55	0.00	62.14	0	0	1.28	0.000013	0.000013	0.028514	0.028514	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.7831	0.00	74.29	0.00	60.04	0	0	1.28	0.000013	0.000013	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.7885	0.00	75.66	0.00	58.31	0	0	1.64	0.000004	0.000013	0.029327	0.029327	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.7831	0.00	64.13	0.00	58.13	0	0	1.28	0.000013	0.000013	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.7885	0.00	57.92	0.00	56.33	0	0	1.64	0.000004	0.000013	0.028414	0.028414	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.7831	0.00	48.96	0.00	56.16	0	0	1.28	0.000013	0.000013	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.7616	0.00	55.27	0.00	53.47	0	0	1.64	0.000004	0.000013	0.026939	0.026939	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.7574	0.00	59.60	0.00	53.34	0	0	1.28	0.000013	0.000013	0.026716	0.026716	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.7129	0.00	45.56	0.00	49.95	0	0	1.28	0.000013	0.000013	0.024421	0.024421	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.6881	0.00	54.77	0.00	47.13	0	0	1.64	0.000004	0.000013	0.023214	0.023214	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.7049	0.00	35.49	0.00	47.60	0	0	1.28	0.000013	0.000013	0.024028	0.024028	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	1.6851	0.00	53.25	0.00	44.86	0	3	1.64	0.000004	0.000013	0.023075	0.023075	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.7280	0.00	41.49	0.00	46.00	0	0	1.28	0.000013	0.000013	0.024096	0.024096	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	1.6791	0.00	56.96	0.00	42.40	0	0	1.64	0.000004	0.000013	0.022793	0.022793	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	1.6730	0.00	38.34	0.00	39.83	0	1	1.64	0.000004	0.000013	0.020551	0.020551	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	1.6791	0.00	38.90	0.00	39.98	0	0	1.28	0.000013	0.000013	0.021797	0.021797	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	1.6537	0.00	33.07	0.00	36.83	0	1	1.64	0.000013	0.000013	0.019270	0.019270	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	1.6667	0.00	29.87	0.00	37.12	0	0	1.28	0.000013	0.000013	0.020760	0.020760	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	1.6018	0.00	23.06	0.00	33.03	0	0	1.64	0.000013	0.000013	0.017255	0.017255	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	1.6434	0.00	26.42	0.00	33.89	0	0	1.28	0.000013	0.000013	0.018856	0.018856	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	1.7532	0.00	28.17	0.00	36.15	0	3	1.28	0.000013	0.000013	0.021291	0.021291	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	1.5431	0.00	17.40	0.00	29.05	0	1	1.64	0.000013	0.000013	0.014084	0.014084	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	1.6881	0.00	23.52	0.00	31.77	0	2	1.28	0.000013	0.000013	0.019256	0.019256	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	1.5380	0.00	15.20	0.00	25.89	0	9	1.64	0.000013	0.000013	0.013928	0.013928	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4308	1.4308	18.27	10.23	20.86	20.86	1	0	1.64	0.000013	0.000013	0.009812	0.009812	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	3.0866	0.00	306.48	0.00	127.29	0	0	10.20	0.000002	0.000002	0.252334	0.252334	0.000000	0.032551	0.0400	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	3.0866	0.00	303.20	0.00	121.87	0	0	10.20	0.000002	0.000002	0.253318	0.253318	0.000000	0.029058	0.0400	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	3.0678	0.00	297.14	0.00	118.34	0	0	10.20	0.000002	0.000002	0.245736	0.245736	0.000000	0.026610	0.0400	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	3.0164	0.00	225.82	0.00	104.69	0	0	1.28	0.000007	0.000007	0.210874	0.210874	0.000000	0.015593	0.0400	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	3.0160	0.00	212.53	0.00	101.55	0	0	1.28	0.000007	0.000007	0.211233	0.211233	0.000000	0.012640	0.0400	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	3.0163	0.00	215.19	0.00	98.34	0	0	1.64	0.000002	0.000007	0.216444	0.216444	0.000000	0.009421	0.0400	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	3.0160	0.00	183.48	0.00	98.33	0	0	1.28	0.000007	0.000007	0.211233	0.211233	0.000000	0.009411	0.0400	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	3.0163	0.00	164.73	0.00	95.00	0	0	1.64	0.000002	0.000007	0.210963	0.210963	0.000000	0.005851	0.0400	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	3.0160	0.00	140.06	0.00	94.99	0	0	1.28	0.000007	0.000007	0.211233	0.211233	0.000000	0.005841	0.0400	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	3.0148	0.00	161.86	0.00	91.50	0	0	1.64	0.000002	0.000007	0.212262	0.212262	0.000000	0.001825	0.0400	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	3.0146	0.00	175.35	0.00	91.50	0	0	1.28	0.000007	0.000007	0.212456	0.212456	0.000000	0.001817	0.0400	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	3.0122	0.00	140.90	0.00	87.84	0	0	1.28	0.000007	0.000007	0.214409	0.214409	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	3.0108	0.00	174.22	0.00	84.06	0	0	1.64	0.000002	0.000007	0.215404	0.215404	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	3.0117	0.00	110.76	0.00	84.08	0	0	1.28	0.000007	0.000007	0.214736	0.214736	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	3.0106	0.00	169.98	0.00	80.14	0	3	1.64	0.000002	0.000007	0.215518	0.215518	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	3.0130	0.00	126.15	0.00	80.20	0	0	1.28	0.000007	0.000007	0.206349	0.206349	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	3.0103	0.00	183.07	0.00	76.02	0	0	1.64	0.000002	0.000007	0.215746	0.215746	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	3.0100	0.00	124.10	0.00	71.67	0	1	1.64	0.000002	0.000007	0.200954	0.200954	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	3.0103	0.00	125.02	0.00	71.67	0	0	1.28	0.000007	0.000007	0.208250	0.208250	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	3.0089	0.00	109.49	0.00	67.01	0	1	1.64	0.000007	0.000007	0.197827	0.197827	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	3.0097	0.00	97.39	0.00	67.03	0	0	1.28	0.000007	0.000007	0.204934	0.204934	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	3.0061	0.00	81.22	0.00	61.99	0	0	1.64	0.000007	0.000007	0.199365	0.199365	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	3.0084	0.00	88.52	0.00	62.03	0	0	1.28	0.000007	0.000007	0.198151	0.198151	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	3.0143	0.00	83.29	0.00	62.15	0	3	1.28	0.000007	0.000007	0.177852	0.177852	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	3.0029	0.00	65.89	0.00	56.52	0	1	1.64	0.000007	0.000007	0.189289	0.189289	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	3.0108	0.00	74.81	0.00	56.67	0	2	1.28	0.000007	0.000007	0.185399	0.185399	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	3.0027	0.00	57.94	0.00	50.55	0	9	1.64	0.000007	0.000007	0.189394	0.189394	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	2.9969	2.9969	80.16	44.89	43.70	43.70	1	0	1.64	0.000007	0.000007	0.175586	0.175586	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

SUPERSTRUCTURE ANNUAL FREQUENCY OF COLLAPSE (WATER ELEVATION 2.0 CD)

Pier ID	Description	Ultimate Lateral Capacity, H (MN)	Annual Frequency of Collapse, AF			Return Period
		Superstructure	Inbound	Outbound	Total	
1	Main Span South	0	0.00026147	0.00000618	0.00026765	3,736
2	Main Span North	0	0.00004598	0.00001620	0.00006218	16,082
3	Anchor Span North	0	0.00000685	0.00000000	0.00000685	145,909
Total for Bridge Superstructure:			0.00031430	0.00002238	0.00033668	**2,970**

VESSEL FLEET CHARACTERISTICS (SUPERSTRUCTURE ONLY)

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Vessel Size (m)		Vessel Drafts (m)				Vessel Heights (m)									Vessel Displacement (tonnes) [3]		Channel Width, C (m)	Centerline Transit Path to Edge of Channel, x_C (m)	Minimum Design Impact Speed, V_{min} (m/sec)		Standard Deviation, σ (m)	
				Length Overall, LOA	Beam/ Width, B	Operational Loaded, D_O	Ballasted			Baseline [1]			Loaded [2]			Ballasted [2]			Loaded, W_L	Ballasted, W_E						
							Stern, D_{ES}	Bow, D_{EB}	Average, D_{AVG}	Bow, H_{BH}	Deckhouse, H_{DH}	Mast, H_{MT}	Bow, H_{BH}	Deckhouse, H_{DH}	Mast, H_{MT}	Bow, H_{BH}	Deckhouse, H_{DH}	Mast, H_{MT}					Loaded	Ballasted	Loaded	Ballasted
1	Ship	Tanker	120,000	250	44	11.9	8.2	4.7	6.5	26.53	40.24	51.50	14.63	28.34	39.60	21.83	32.04	43.30	101,270	54,890	125.4	62.7	0.514	0.514	80	80
2	Ship	Tanker	110,000	240	44	11.8	8.3	4.9	6.6	26.31	39.96	52.09	14.51	28.16	40.29	21.41	31.66	43.79	95,920	53,650	125.4	62.7	0.514	0.514	79	79
3	Ship	Tanker	105,000	244	42	13.0	8.4	5.0	6.7	26.19	39.80	52.29	13.19	26.80	39.29	21.19	31.40	43.89	102,480	52,820	119.7	59.9	0.514	0.514	80	80
4	Ship	Bulk Carrier	85,000	229	32	11.7	8.6	5.4	7.0	27.69	42.80	55.70	15.99	31.10	44.00	22.29	34.20	47.10	67,920	40,640	110.0	55.0	1.029	1.029	78	78
5	Ship	Bulk Carrier	80,000	225	32	11.9	8.4	5.2	6.8	27.34	42.25	55.19	15.44	30.35	43.29	22.14	33.85	46.79	67,900	38,800	110.0	55.0	1.029	1.029	78	78
6	Ship	Tanker	75,000	228	34	11.3	8.3	5.1	6.7	25.36	38.69	51.41	14.06	27.39	40.11	20.26	30.39	43.11	66,730	39,570	110.0	55.0	0.514	1.029	78	78
7	Ship	Bulk Carrier	75,000	225	32	12.1	7.8	4.6	6.2	26.96	41.67	54.64	14.86	29.57	42.54	22.36	33.87	46.84	68,640	35,180	110.0	55.0	1.029	1.029	78	78
8	Ship	Tanker	70,000	228	32	11.0	7.4	4.2	5.8	25.18	38.46	49.61	14.18	27.46	38.61	20.98	31.06	42.21	62,330	32,870	110.0	55.0	0.514	1.029	78	78
9	Ship	Bulk Carrier	70,000	225	32	12.0	6.8	3.6	5.2	26.56	41.04	54.06	14.56	29.04	42.06	22.96	34.24	47.26	67,680	29,330	110.0	55.0	1.029	1.029	78	78
10	Ship	Tanker	65,000	214	32	10.9	7.5	4.5	6.0	25.00	38.22	49.43	14.10	27.32	38.53	20.50	30.72	41.93	57,520	31,660	110.0	55.0	0.514	1.029	77	77
11	Ship	Bulk Carrier	65,000	212	32	11.7	7.8	4.8	6.3	26.12	40.36	53.43	14.42	28.66	41.73	21.32	32.56	45.63	61,920	33,350	110.0	55.0	1.029	1.029	77	77
12	Ship	Bulk Carrier	60,000	193	32	11.6	7.2	4.5	5.9	25.66	39.63	52.75	14.06	28.03	41.15	21.16	32.43	45.55	55,590	28,040	110.0	55.0	1.029	1.029	75	75
13	Ship	Tanker	55,000	184	32	11.4	8.3	5.7	7.0	24.58	37.66	49.38	13.18	26.26	37.98	18.88	29.36	41.08	51,250	31,470	110.0	55.0	0.514	1.029	74	74
14	Ship	Bulk Carrier	55,000	190	32	10.9	6.3	3.6	5.0	25.15	38.84	52.01	14.25	27.94	41.11	21.55	32.54	45.71	51,210	23,260	110.0	55.0	1.029	1.029	75	75
15	Ship	Tanker	50,000	183	32	10.6	8.2	5.6	6.9	24.35	37.35	49.65	13.75	26.75	39.05	18.75	29.15	41.45	47,500	30,920	110.0	55.0	0.514	1.029	74	74
16	Ship	Bulk Carrier	50,000	199	30	12.2	7.0	4.2	5.6	24.59	37.98	51.21	12.39	25.78	39.01	20.39	30.98	44.21	56,210	25,810	110.0	55.0	1.029	1.029	76	76
17	Ship	Tanker	45,000	181	32	10.3	8.6	6.1	7.4	24.08	37.00	49.13	13.78	26.70	38.83	17.98	28.40	40.53	45,340	32,350	110.0	55.0	0.514	1.029	74	74
18	Ship	Tanker	40,000	179	28	10.1	7.5	5.0	6.3	23.79	36.61	47.60	13.69	26.51	37.50	18.79	29.11	40.10	38,430	23,780	110.0	55.0	0.514	1.029	74	74
19	Ship	Bulk Carrier	40,000	181	30	9.1	7.2	4.7	6.0	23.29	35.95	49.32	14.19	26.85	40.22	18.59	28.75	42.12	37,700	24,650	110.0	55.0	1.029	1.029	74	74
20	Ship	Tanker	35,000	173	27	10.2	7.3	4.9	6.1	23.46	36.17	46.68	13.26	25.97	36.48	18.56	28.87	39.38	35,600	21,290	110.0	55.0	1.029	1.029	73	73
21	Ship	Bulk Carrier	35,000	177	29	9.7	6.5	4.0	5.3	22.51	34.73	48.19	12.81	25.03	38.49	18.51	28.23	41.69	37,830	20,480	110.0	55.0	1.029	1.029	73	73
22	Ship	Tanker	30,000	159	27	9.2	6.5	4.3	5.4	23.08	35.66	44.78	13.88	26.46	35.58	18.78	29.16	38.28	29,160	17,120	110.0	55.0	1.029	1.029	71	71
23	Ship	Bulk Carrier	30,000	170	27	9.5	6.6	4.2	5.4	21.61	33.33	46.89	12.11	23.83	37.39	17.41	26.73	40.29	32,770	18,630	110.0	55.0	1.029	1.029	72	72
24	Ship	Articulated Tug/Barge	30,000	210	23	9.3	5.0	5.0	5.0	23.08	35.66	44.78	13.78	26.36	35.48	18.08	30.66	39.78	32,470	17,460	110.0	55.0	1.029	1.029	77	77
25	Ship	Tanker	25,000	146	24	9.2	6.5	4.5	5.5	22.62	35.06	43.64	13.42	25.86	34.44	18.12	28.56	37.14	22,970	13,740	110.0	55.0	1.029	1.029	69	69
26	Ship	Articulated Tug/Barge	25,000	184	24	8.3	5.0	5.0	5.0	22.62	35.06	43.64	14.32	26.76	35.34	17.62	30.06	38.64	26,090	15,720	110.0	55.0	1.029	1.029	74	74
27	Ship	Tanker	20,000	145	24	8.7	6.1	4.1	5.1	22.07	34.32	42.76	13.37	25.62	34.06	17.97	28.22	36.66	20,880	12,240	110.0	55.0	1.029	1.029	69	69
28	Ship	Tanker	15,000	127	20	8.1	6.3	4.5	5.4	21.52	33.58	40.63	13.42	25.48	32.53	17.02	27.28	34.33	14,280	9,520	110.0	55.0	1.029	1.029	65	65

Notes:

[1] Vessel heights as measured from the baseline/keel of the vessel.

[2] Vessel heights as measured from the waterline. Use Operational Loaded Draft (D_O) for all loaded vessel heights. Use Ballasted Bow (D_{EB}) for ballasted vessel heights at the bow and Ballasted Stern (D_{ES}) for ballasted vessel heights at the deckhouse and mast.

[3] Weight of Water (W_W) = 0.9854 m^3/tonne (used to determine ship loaded/ballasted displacement tonnage based on approximate salinity of water in Vancouver Harbor)

VESSEL FLEET ANNUAL TRIP FREQUENCY (SUPERSTRUCTURE ONLY)

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Annual Number of Trips (N)						Existing Total Trips	Growth Factor [1]	Future Total Trips
				Inbound			Outbound					
				Loaded	Ballasted	Total	Loaded	Ballasted	Total			
1	Ship	Tanker	120,000	0	5	5	0	0	0	5	10.20	51
2	Ship	Tanker	110,000	0	5	5	3	0	3	8	10.20	82
3	Ship	Tanker	105,000	0	0	0	0	0	0	0	10.20	0
4	Ship	Bulk Carrier	85,000	0	0	0	2	0	2	2	1.28	3
5	Ship	Bulk Carrier	80,000	0	0	0	2	0	2	2	1.28	3
6	Ship	Tanker	75,000	0	4	4	3	0	3	7	1.64	11
7	Ship	Bulk Carrier	75,000	0	0	0	1	0	1	1	1.28	1
8	Ship	Tanker	70,000	0	0	0	0	0	0	0	1.64	0
9	Ship	Bulk Carrier	70,000	0	0	0	0	0	0	0	1.28	0
10	Ship	Tanker	65,000	0	1	1	0	0	0	1	1.64	2
11	Ship	Bulk Carrier	65,000	0	0	0	2	0	2	2	1.28	3
12	Ship	Bulk Carrier	60,000	0	0	0	0	0	0	0	1.28	0
13	Ship	Tanker	55,000	0	2	2	2	0	2	4	1.64	7
14	Ship	Bulk Carrier	55,000	0	0	0	1	0	1	1	1.28	1
15	Ship	Tanker	50,000	4	8	12	8	3	11	23	1.64	38
16	Ship	Bulk Carrier	50,000	0	1	1	0	0	0	1	1.28	1
17	Ship	Tanker	45,000	0	0	0	0	0	0	0	1.64	0
18	Ship	Tanker	40,000	1	5	6	5	1	6	12	1.64	20
19	Ship	Bulk Carrier	40,000	0	1	1	1	0	1	2	1.28	3
20	Ship	Tanker	35,000	1	2	3	2	1	3	6	1.64	10
21	Ship	Bulk Carrier	35,000	0	1	1	1	0	1	2	1.28	3
22	Ship	Tanker	30,000	1	7	8	7	0	7	15	1.64	25
23	Ship	Bulk Carrier	30,000	0	0	0	0	0	0	0	1.28	0
24	Ship	Articulated Tug/Barge	30,000	2	4	6	4	3	7	13	1.28	17
25	Ship	Tanker	25,000	0	1	1	1	1	2	3	1.64	5
26	Ship	Articulated Tug/Barge	25,000	1	2	3	2	2	4	7	1.28	9
27	Ship	Tanker	20,000	10	4	14	5	9	14	28	1.64	46
28	Ship	Tanker	15,000	0	1	1	1	0	1	2	1.64	3
			Total Trips:	20	54	74	53	20	73	147		344

Notes:

[1] As part of the risk analysis, vessel trips will include future growth in the waterway that are projected to the mid-point of the remaining design life (assumed 50 years) of the structure. This equates to growth rates per year as follows for a 25-year projection. GF = $(1+PERCENT/100)^{25}$

- Aframax Tankers (DWT greater than 100,000 tonnes) = 9.735%
- All Other Tankers = 2.0%
- All Other Vessels = 1.0%

VESSEL FLEET TRANSIT SPEEDS IN MAIN CHANNEL (SUPERSTRUCTURE ONLY)

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Vessel Transit Speeds (knots)				Vessel Transit Speeds (m/sec) [1]			
				Inbound		Outbound		Inbound		Outbound	
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted
1	Ship	Tanker	120,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
2	Ship	Tanker	110,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
3	Ship	Tanker	105,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
4	Ship	Bulk Carrier	85,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
5	Ship	Bulk Carrier	80,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
6	Ship	Tanker	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
7	Ship	Bulk Carrier	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
8	Ship	Tanker	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
9	Ship	Bulk Carrier	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
10	Ship	Tanker	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
11	Ship	Bulk Carrier	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
12	Ship	Bulk Carrier	60,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
13	Ship	Tanker	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
14	Ship	Bulk Carrier	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
15	Ship	Tanker	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
16	Ship	Bulk Carrier	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
17	Ship	Tanker	45,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
18	Ship	Tanker	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
19	Ship	Bulk Carrier	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
20	Ship	Tanker	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
21	Ship	Bulk Carrier	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
22	Ship	Tanker	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
23	Ship	Bulk Carrier	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
24	Ship	Articulated Tug/Barge	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
25	Ship	Tanker	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
26	Ship	Articulated Tug/Barge	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
27	Ship	Tanker	20,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
28	Ship	Tanker	15,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866

Notes:

[1] Conversion (knot to m/sec) = 0.51 (convert vessel transit speeds from knots to meters/second for use in risk assessment equations)

ABERRANCY BASE RATE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Code Recommended Aberrancy Base Rate, BR	Vessel Traffic Service, VTS	Electronic Chart Display & Information System, ECDIS	Other Navigation Aids	Port Control State, PCS	Pilotage 1 Pilot	Pilotage 2 Pilots (MRA-2)		Daytime Only Transit Restrictions (MRA-2)		Visibility Restrictions (MRA-2)	Adjusted Aberrancy Base Rate, BR [1]	
										Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
2	Ship	Tanker	110,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
3	Ship	Tanker	105,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
4	Ship	Bulk Carrier	85,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
5	Ship	Bulk Carrier	80,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
6	Ship	Tanker	75,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
7	Ship	Bulk Carrier	75,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
8	Ship	Tanker	70,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
9	Ship	Bulk Carrier	70,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
10	Ship	Tanker	65,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
11	Ship	Bulk Carrier	65,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
12	Ship	Bulk Carrier	60,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
13	Ship	Tanker	55,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
14	Ship	Bulk Carrier	55,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
15	Ship	Tanker	50,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
16	Ship	Bulk Carrier	50,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
17	Ship	Tanker	45,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
18	Ship	Tanker	40,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
19	Ship	Bulk Carrier	40,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
20	Ship	Tanker	35,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
21	Ship	Bulk Carrier	35,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
22	Ship	Tanker	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
23	Ship	Bulk Carrier	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
24	Ship	Articulated Tug/Barge	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
25	Ship	Tanker	25,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
26	Ship	Articulated Tug/Barge	25,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
27	Ship	Tanker	20,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
28	Ship	Tanker	15,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05

Notes:

[1] Adjustments to the aberrancy Base Rate (BR) due to waterway current restrictions are accounted for elsewhere in the vessel collision risk analysis (refer to correction factors R_C and R_{XC} for the Probability of Aberrancy at each transit leg).

MISCELLANEOUS INFORMATION (SUPERSTRUCTURE ONLY)

CHANNEL CHARACTERISTICS

Waterway Current Speed (V_{min}) =	1.03	m/sec
Mean High Water (MHW) Elevation =	2.00	m (based on Chart Datum)
Sea Level Rise Adjustment =	0.10	m
Soft Soil Allowance =	1.00	m (assumed depth that vessels can "plow" through soft bottom material)

AVAILABLE WATER DEPTH AT PIERS

Pier ID	Description	Mudline Elevation (m) [1]		Water Elevation (m)	Soft Soil Allowance (m)	Design Water Depth (m)	
		Inbound	Outbound			Inbound	Outbound
1	Main Span South	-6.00	-5.00	2.10	1.00	9.10	8.10
2	Main Span North	-10.00	-9.00	2.10	1.00	13.10	12.10
3	Anchor Span North	-5.00	N/A	2.10	1.00	8.10	0.00

Notes:
[1] Mudline elevation is based on Chart Datum (CD) and was obtained from Nautical Chart 3494

PROBABILITY OF ABERRANCY VARIABLES FOR EACH VESSEL TRANSIT PATH

Leg ID	Waterway Region for Bridge Location	Angle of Channel Turn, θ (deg) [1]	Correction Factor, R_B	Current Angle to Vessel Path (deg) [2]	Parallel Current, V_C (m/sec)	Perpendicular Current, V_{XC} (m/sec)	Correction Factor, R_C	Correction Factor, R_{XC}	Vessel Traffic Density	Correction Factor, R_D	Summation (R_B*R_C*R_{XC}*R_D)	Aberrancy Distribution [3]	
												Inbound	Outbound
1	Transition	7.7227	1.0858	0.0000	1.0300	0.0000	1.2060	1.0000	Low	1.0	1.3095	0.24	N/A
2	Turn/Bend	7.7227	1.1716	0.0000	1.0300	0.0000	1.2060	1.0000	Low	1.0	1.4130	0.50	N/A
3	Turn/Bend	7.7227	1.1716	0.0000	1.0300	0.0000	1.2060	1.0000	Low	1.0	1.4130	0.26	N/A
4	Transition	8.8764	1.0986	0.0000	1.0300	0.0000	1.2060	1.0000	Low	1.0	1.3249	N/A	0.24
5	Turn/Bend	8.8764	1.1973	0.0000	1.0300	0.0000	1.2060	1.0000	Low	1.0	1.4439	N/A	0.50
6	Turn/Bend	8.8764	1.1973	0.0000	1.0300	0.0000	1.2060	1.0000	Low	1.0	1.4439	N/A	0.26

Notes:
[1] Angle of the turn region in accordance with information shown on Nautical Chart 3494, AIS transit data near the bridge, and CAN/CSA S6-14 Figure A3.3.1
[2] The angle between the water current direction and each channel transition leg
[3] Distribution of the Probability of Aberrancy for each channel transition leg is established as a ratio of the length of each leg to the overall length being considered (approximately 1 nautical mile or 2000m)

PROTECTION FACTOR

Pier ID	Description	Leg 1		Leg 2		Leg 3		Leg 4		Leg 5		Leg 6	
		Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
1	Main Span South	0.63	N/A	0.63	N/A	0.66	N/A	N/A	0.29	N/A	0.29	N/A	0.36
2	Main Span North	0.72	N/A	0.72	N/A	0.80	N/A	N/A	0.23	N/A	0.23	N/A	0.18
3	Anchor Span North	0.58	N/A	0.58	N/A	0.67	N/A	N/A	0.00	N/A	0.00	N/A	0.00

SUPERSTRUCTURE CONTACT GEOMETRY - MAIN SPAN SOUTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Main Span South (Pier 16)																				
				Leg 1 [1]							Leg 2 [1]							Leg 3 [1]						
				Centerline of Pier 16	Loaded			Ballasted			Centerline of Pier 16	Loaded			Ballasted			Centerline of Pier 16	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	98.319	93.417	73.821	49.026	84.102	66.941	34.381	98.319	93.417	73.821	49.026	84.102	66.941	34.381	168.710	163.768	144.011	119.011	154.377	137.074	104.245
2	Ship	Tanker	110,000	98.319	93.572	74.156	46.664	84.645	67.647	31.337	98.319	93.572	74.156	46.664	84.645	67.647	31.337	168.710	163.925	144.349	116.630	154.925	137.786	101.176
3	Ship	Tanker	105,000	98.319	95.280	76.685	49.852	84.930	68.131	30.716	98.319	95.280	76.685	49.852	84.930	68.131	30.716	168.710	165.646	146.899	119.844	155.211	138.274	100.550
4	Ship	Bulk Carrier	85,000	98.319	91.657	68.689	30.032	83.507	62.924	4.603	98.319	91.657	68.689	30.032	83.507	62.924	4.603	168.710	161.994	138.836	99.861	153.777	133.024	74.222
5	Ship	Bulk Carrier	80,000	98.319	92.369	70.084	34.443	83.701	63.575	8.681	98.319	92.369	70.084	34.443	83.701	63.575	8.681	168.710	162.711	140.242	104.308	153.972	133.680	78.333
6	Ship	Tanker	75,000	98.319	94.154	75.588	47.394	86.133	70.009	35.222	98.319	94.154	75.588	47.394	86.133	70.009	35.222	168.710	164.511	145.792	117.366	156.425	140.167	105.094
7	Ship	Bulk Carrier	75,000	98.319	93.119	71.534	37.535	83.416	63.538	8.213	98.319	93.119	71.534	37.535	83.416	63.538	8.213	168.710	163.468	141.705	107.426	153.685	133.643	77.861
8	Ship	Tanker	70,000	98.319	93.999	75.458	51.664	85.202	68.763	38.874	98.319	93.999	75.458	51.664	85.202	68.763	38.874	168.710	164.355	145.661	121.671	155.485	138.911	108.775
9	Ship	Bulk Carrier	70,000	98.319	93.507	72.520	39.482	82.640	62.850	2.399	98.319	93.507	72.520	39.482	82.640	62.850	2.399	168.710	163.859	142.699	109.389	152.903	132.949	72.000
10	Ship	Tanker	65,000	98.319	94.102	75.718	51.877	85.823	69.395	40.010	98.319	94.102	75.718	51.877	85.823	69.395	40.010	168.710	164.459	145.924	121.886	156.111	139.549	109.921
11	Ship	Bulk Carrier	65,000	98.319	93.688	73.226	40.821	84.762	65.974	19.386	98.319	93.688	73.226	40.821	84.762	65.974	19.386	168.710	164.042	143.411	110.739	155.042	136.099	89.127
12	Ship	Bulk Carrier	60,000	98.319	94.154	74.398	43.175	84.969	66.215	20.124	98.319	94.154	74.398	43.175	84.969	66.215	20.124	168.710	164.511	144.592	113.112	155.251	136.343	89.871
13	Ship	Tanker	55,000	98.319	95.293	77.689	53.342	87.919	71.925	43.459	98.319	95.293	77.689	53.342	87.919	71.925	43.459	168.710	165.659	147.911	123.363	158.225	142.099	113.398
14	Ship	Bulk Carrier	55,000	98.319	93.908	74.565	43.337	84.464	66.011	18.648	98.319	93.908	74.565	43.337	84.464	66.011	18.648	168.710	164.264	144.761	113.275	154.742	136.136	88.383
15	Ship	Tanker	50,000	98.319	94.555	76.778	50.491	88.087	72.315	41.957	98.319	94.555	76.778	50.491	88.087	72.315	41.957	168.710	164.916	146.992	120.489	158.394	142.492	111.884
16	Ship	Bulk Carrier	50,000	98.319	96.315	78.582	50.598	85.965	68.912	28.728	98.319	96.315	78.582	50.598	85.965	68.912	28.728	168.710	166.690	148.811	120.596	156.255	139.061	98.546
17	Ship	Tanker	45,000	98.319	94.516	76.871	51.077	89.083	73.710	45.690	98.319	94.516	76.871	51.077	89.083	73.710	45.690	168.710	164.877	147.086	121.080	159.398	143.899	115.648
18	Ship	Tanker	40,000	98.319	94.633	77.224	54.621	88.035	72.389	47.435	98.319	94.633	77.224	54.621	88.035	72.389	47.435	168.710	164.994	147.442	124.653	158.342	142.567	117.407
19	Ship	Bulk Carrier	40,000	98.319	93.986	76.592	46.948	88.294	73.059	39.239	98.319	93.986	76.592	46.948	88.294	73.059	39.239	168.710	164.342	146.805	116.916	158.603	143.242	109.144
20	Ship	Tanker	35,000	98.319	95.189	78.229	57.339	88.332	72.836	49.612	98.319	95.189	78.229	57.339	88.332	72.836	49.612	168.710	165.555	148.455	127.393	158.642	143.017	119.602
21	Ship	Bulk Carrier	35,000	98.319	95.771	79.977	51.983	88.397	74.026	40.984	98.319	95.771	79.977	51.983	88.397	74.026	40.984	168.710	166.142	150.217	121.993	158.707	144.217	110.903
22	Ship	Tanker	30,000	98.319	94.387	77.317	59.737	88.048	72.296	52.543	98.319	94.387	77.317	59.737	88.048	72.296	52.543	168.710	164.746	147.536	129.811	158.355	142.474	122.557
23	Ship	Bulk Carrier	30,000	98.319	96.677	81.515	54.914	46.664	76.815	89.820	98.319	96.677	81.515	54.914	46.664	76.815	89.820	168.710	167.055	151.768	124.948	160.142	147.030	116.630
24	Ship	Articulated Tug/Barge	30,000	98.319	94.516	77.503	60.004	88.953	69.507	48.546	98.319	94.516	77.503	60.004	88.953	69.507	48.546	168.710	164.877	147.724	130.079	159.268	139.661	118.527
25	Ship	Tanker	25,000	98.319	94.982	78.433	62.478	88.902	73.412	55.580	98.319	94.982	78.433	62.478	88.902	73.412	55.580	168.710	165.346	148.661	132.574	159.216	143.599	125.620
26	Ship	Articulated Tug/Barge	25,000	98.319	93.818	76.760	60.377	89.549	70.623	51.584	98.319	93.818	76.760	60.377	89.549	70.623	51.584	168.710	164.172	146.974	130.456	159.868	140.786	121.590
27	Ship	Tanker	20,000	98.319	95.047	78.880	63.184	89.096	74.045	56.859	98.319	95.047	78.880	63.184	89.096	74.045	56.859	168.710	165.411	149.111	133.286	159.411	144.236	126.909
28	Ship	Tanker	15,000	98.319	94.982	79.140	66.030	90.325	75.793	62.682	98.319	94.982	79.140	66.030	90.325	75.793	62.682	168.710	165.346	149.374	136.155	160.651	145.999	132.780

Notes:

[1] Perpendicular distances at each channel transition leg (as measured in CADD drawing) from the centerline of vessel transit path to where the loaded/ballasted vessel bow, deckhouse, or mast makes first contact with the bottom chord of the truss superstructure adjacent to Pier 16. The absolute boundaries for "Main Span South" are the centerline of main span (between Piers 15-16) and the centerline of Pier 16. Note that the values for Leg 6 are shown as "N/A" since the extension of this particular vessel transit path occurs well south of the centerline of pier boundary.

SUPERSTRUCTURE CONTACT GEOMETRY - MAIN SPAN SOUTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Main Span South (Pier 16)																				
				Leg 4 [1]							Leg 5 [1]							Leg 6 [1]						
				Centerline of Pier 16	Loaded			Ballasted			Centerline of Pier 16	Loaded			Ballasted			Centerline of Pier 16	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	168.710	163.768	144.011	119.011	154.377	137.074	104.245	168.710	163.768	144.011	119.011	154.377	137.074	104.245	61.162	N/A	N/A	N/A	N/A	N/A	N/A
2	Ship	Tanker	110,000	168.710	163.925	144.349	116.630	154.925	137.786	101.176	168.710	163.925	144.349	116.630	154.925	137.786	101.176	61.162	N/A	N/A	N/A	N/A	N/A	N/A
3	Ship	Tanker	105,000	168.710	165.646	146.899	119.844	155.211	138.274	100.550	168.710	165.646	146.899	119.844	155.211	138.274	100.550	61.162	N/A	N/A	N/A	N/A	N/A	N/A
4	Ship	Bulk Carrier	85,000	168.710	161.994	138.836	99.861	153.777	133.024	74.222	168.710	161.994	138.836	99.861	153.777	133.024	74.222	61.162	N/A	N/A	N/A	N/A	N/A	N/A
5	Ship	Bulk Carrier	80,000	168.710	162.711	140.242	104.308	153.972	133.680	78.333	168.710	162.711	140.242	104.308	153.972	133.680	78.333	61.162	N/A	N/A	N/A	N/A	N/A	N/A
6	Ship	Tanker	75,000	168.710	164.511	145.792	117.366	156.425	140.167	105.094	168.710	164.511	145.792	117.366	156.425	140.167	105.094	61.162	N/A	N/A	N/A	N/A	N/A	N/A
7	Ship	Bulk Carrier	75,000	168.710	163.468	141.705	107.426	153.685	133.643	77.861	168.710	163.468	141.705	107.426	153.685	133.643	77.861	61.162	N/A	N/A	N/A	N/A	N/A	N/A
8	Ship	Tanker	70,000	168.710	164.355	145.661	121.671	155.485	138.911	108.775	168.710	164.355	145.661	121.671	155.485	138.911	108.775	61.162	N/A	N/A	N/A	N/A	N/A	N/A
9	Ship	Bulk Carrier	70,000	168.710	163.859	142.699	109.389	152.903	132.949	72.000	168.710	163.859	142.699	109.389	152.903	132.949	72.000	61.162	N/A	N/A	N/A	N/A	N/A	N/A
10	Ship	Tanker	65,000	168.710	164.459	145.924	121.886	156.111	139.549	109.921	168.710	164.459	145.924	121.886	156.111	139.549	109.921	61.162	N/A	N/A	N/A	N/A	N/A	N/A
11	Ship	Bulk Carrier	65,000	168.710	164.042	143.411	110.739	155.042	136.099	89.127	168.710	164.042	143.411	110.739	155.042	136.099	89.127	61.162	N/A	N/A	N/A	N/A	N/A	N/A
12	Ship	Bulk Carrier	60,000	168.710	164.511	144.592	113.112	155.251	136.343	89.871	168.710	164.511	144.592	113.112	155.251	136.343	89.871	61.162	N/A	N/A	N/A	N/A	N/A	N/A
13	Ship	Tanker	55,000	168.710	165.659	147.911	123.363	158.225	142.099	113.398	168.710	165.659	147.911	123.363	158.225	142.099	113.398	61.162	N/A	N/A	N/A	N/A	N/A	N/A
14	Ship	Bulk Carrier	55,000	168.710	164.264	144.761	113.275	154.742	136.136	88.383	168.710	164.264	144.761	113.275	154.742	136.136	88.383	61.162	N/A	N/A	N/A	N/A	N/A	N/A
15	Ship	Tanker	50,000	168.710	164.916	146.992	120.489	158.394	142.492	111.884	168.710	164.916	146.992	120.489	158.394	142.492	111.884	61.162	N/A	N/A	N/A	N/A	N/A	N/A
16	Ship	Bulk Carrier	50,000	168.710	166.690	148.811	120.596	156.255	139.061	98.546	168.710	166.690	148.811	120.596	156.255	139.061	98.546	61.162	N/A	N/A	N/A	N/A	N/A	N/A
17	Ship	Tanker	45,000	168.710	164.877	147.086	121.080	159.398	143.899	115.648	168.710	164.877	147.086	121.080	159.398	143.899	115.648	61.162	N/A	N/A	N/A	N/A	N/A	N/A
18	Ship	Tanker	40,000	168.710	164.994	147.442	124.653	158.342	142.567	117.407	168.710	164.994	147.442	124.653	158.342	142.567	117.407	61.162	N/A	N/A	N/A	N/A	N/A	N/A
19	Ship	Bulk Carrier	40,000	168.710	164.342	146.805	116.916	158.603	143.242	109.144	168.710	164.342	146.805	116.916	158.603	143.242	109.144	61.162	N/A	N/A	N/A	N/A	N/A	N/A
20	Ship	Tanker	35,000	168.710	165.555	148.455	127.393	158.642	143.017	119.602	168.710	165.555	148.455	127.393	158.642	143.017	119.602	61.162	N/A	N/A	N/A	N/A	N/A	N/A
21	Ship	Bulk Carrier	35,000	168.710	166.142	150.217	121.993	158.707	144.217	110.903	168.710	166.142	150.217	121.993	158.707	144.217	110.903	61.162	N/A	N/A	N/A	N/A	N/A	N/A
22	Ship	Tanker	30,000	168.710	164.746	147.536	129.811	158.355	142.474	122.557	168.710	164.746	147.536	129.811	158.355	142.474	122.557	61.162	N/A	N/A	N/A	N/A	N/A	N/A
23	Ship	Bulk Carrier	30,000	168.710	167.055	151.768	124.948	160.142	147.030	116.630	168.710	167.055	151.768	124.948	160.142	147.030	116.630	61.162	N/A	N/A	N/A	N/A	N/A	N/A
24	Ship	Articulated Tug/Barge	30,000	168.710	164.877	147.724	130.079	159.268	139.661	118.527	168.710	164.877	147.724	130.079	159.268	139.661	118.527	61.162	N/A	N/A	N/A	N/A	N/A	N/A
25	Ship	Tanker	25,000	168.710	165.346	148.661	132.574	159.216	143.599	125.620	168.710	165.346	148.661	132.574	159.216	143.599	125.620	61.162	N/A	N/A	N/A	N/A	N/A	N/A
26	Ship	Articulated Tug/Barge	25,000	168.710	164.172	146.974	130.456	159.868	140.786	121.590	168.710	164.172	146.974	130.456	159.868	140.786	121.590	61.162	N/A	N/A	N/A	N/A	N/A	N/A
27	Ship	Tanker	20,000	168.710	165.411	149.111	133.286	159.411	144.236	126.909	168.710	165.411	149.111	133.286	159.411	144.236	126.909	61.162	N/A	N/A	N/A	N/A	N/A	N/A
28	Ship	Tanker	15,000	168.710	165.346	149.374	136.155	160.651	145.999	132.780	168.710	165.346	149.374	136.155	160.651	145.999	132.780	61.162	N/A	N/A	N/A	N/A	N/A	N/A

SUPERSTRUCTURE CONTACT GEOMETRY - MAIN SPAN NORTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Main Span North (Pier 15)																				
				Leg 1 [1]							Leg 2 [1]							Leg 3 [1]						
				Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	234.213	229.311	209.715	184.919	219.996	202.835	170.274	234.213	229.311	209.715	184.919	219.996	202.835	170.274	166.562	161.620	141.863	116.863	152.228	134.926	102.097
2	Ship	Tanker	110,000	234.213	229.466	210.050	182.558	220.539	203.541	167.231	234.213	229.466	210.050	182.558	220.539	203.541	167.231	166.562	161.776	142.200	114.482	152.776	135.638	99.028
3	Ship	Tanker	105,000	234.213	231.173	212.579	185.745	220.824	204.025	166.610	234.213	231.173	212.579	185.745	220.824	204.025	166.610	166.562	163.498	144.750	117.696	153.063	136.126	98.402
4	Ship	Bulk Carrier	85,000	234.213	227.551	204.583	165.926	219.401	198.818	140.497	234.213	227.551	204.583	165.926	219.401	198.818	140.497	166.562	159.846	136.688	97.713	151.628	130.876	72.074
5	Ship	Bulk Carrier	80,000	234.213	228.263	205.977	170.337	219.595	199.469	144.575	234.213	228.263	205.977	170.337	219.595	199.469	144.575	166.562	160.563	138.094	102.160	151.824	131.532	76.185
6	Ship	Tanker	75,000	234.213	230.048	211.482	183.288	222.027	205.903	171.116	234.213	230.048	211.482	183.288	222.027	205.903	171.116	166.562	162.363	143.644	115.218	154.276	138.019	102.946
7	Ship	Bulk Carrier	75,000	234.213	229.013	207.428	173.429	219.310	199.431	144.106	234.213	229.013	207.428	173.429	219.310	199.431	144.106	166.562	161.320	139.557	105.277	151.537	131.494	75.713
8	Ship	Tanker	70,000	234.213	229.893	211.352	187.557	221.096	204.657	174.768	234.213	229.893	211.352	187.557	221.096	204.657	174.768	166.562	162.207	143.513	119.522	153.337	136.763	106.627
9	Ship	Bulk Carrier	70,000	234.213	229.401	208.413	175.376	218.534	198.743	138.292	234.213	229.401	208.413	175.376	218.534	198.743	138.292	166.562	161.711	140.550	107.241	150.755	130.801	69.851
10	Ship	Tanker	65,000	234.213	229.996	211.612	187.771	221.717	205.289	175.904	234.213	229.996	211.612	187.771	221.717	205.289	175.904	166.562	162.311	143.775	119.737	153.963	137.401	107.773
11	Ship	Bulk Carrier	65,000	234.213	229.582	209.120	176.715	220.656	201.868	155.280	234.213	229.582	209.120	176.715	220.656	201.868	155.280	166.562	161.894	141.263	108.591	152.894	133.951	86.979
12	Ship	Bulk Carrier	60,000	234.213	230.048	210.292	179.068	220.863	202.109	156.018	234.213	230.048	210.292	179.068	220.863	202.109	156.018	166.562	162.363	142.444	110.964	153.102	134.194	87.723
13	Ship	Tanker	55,000	234.213	231.186	213.583	189.236	223.812	207.818	179.352	234.213	231.186	213.583	189.236	223.812	207.818	179.352	166.562	163.511	145.763	121.215	156.076	139.950	111.250
14	Ship	Bulk Carrier	55,000	234.213	229.802	210.459	179.231	220.358	201.905	154.542	234.213	229.802	210.459	179.231	220.358	201.905	154.542	166.562	162.115	142.613	111.127	152.594	133.988	86.234
15	Ship	Tanker	50,000	234.213	230.449	212.672	186.385	223.981	208.209	177.851	234.213	230.449	212.672	186.385	223.981	208.209	177.851	166.562	162.768	144.844	118.340	156.246	140.344	109.736
16	Ship	Bulk Carrier	50,000	234.213	232.208	214.476	186.492	221.859	204.806	164.622	234.213	232.208	214.476	186.492	221.859	204.806	164.622	166.562	164.542	146.663	118.448	154.107	136.913	96.398
17	Ship	Tanker	45,000	234.213	230.410	212.765	186.971	224.977	209.604	181.584	234.213	230.410	212.765	186.971	224.977	209.604	181.584	166.562	162.728	144.938	118.931	157.250	141.750	113.500
18	Ship	Tanker	40,000	234.213	230.527	213.118	190.515	223.929	208.283	183.329	234.213	230.527	213.118	190.515	223.929	208.283	183.329	166.562	162.846	145.294	122.504	156.194	140.419	115.259
19	Ship	Bulk Carrier	40,000	234.213	229.880	212.486	182.842	224.188	208.953	175.133	234.213	229.880	212.486	182.842	224.188	208.953	175.133	166.562	162.194	144.657	114.768	156.455	141.094	106.995
20	Ship	Tanker	35,000	234.213	231.083	214.123	193.233	224.226	208.730	185.506	234.213	231.083	214.123	193.233	224.226	208.730	185.506	166.562	163.407	146.307	125.245	156.494	140.869	117.454
21	Ship	Bulk Carrier	35,000	234.213	231.665	215.871	187.877	224.291	209.920	176.878	234.213	231.665	215.871	187.877	224.291	209.920	176.878	166.562	163.994	148.069	119.845	156.559	142.069	108.754
22	Ship	Tanker	30,000	234.213	230.281	213.211	195.631	223.942	208.190	188.437	234.213	230.281	213.211	195.631	223.942	208.190	188.437	166.562	162.598	145.388	127.663	156.207	140.325	120.409
23	Ship	Bulk Carrier	30,000	234.213	232.571	217.409	190.808	225.714	212.709	182.558	234.213	232.571	217.409	190.808	225.714	212.709	182.558	166.562	164.907	149.620	122.800	157.994	144.882	114.482
24	Ship	Articulated Tug/Barge	30,000	234.213	230.410	213.397	195.897	224.847	205.401	184.440	234.213	230.410	213.397	195.897	224.847	205.401	184.440	166.562	162.728	145.575	127.931	157.386	157.513	116.379
25	Ship	Tanker	25,000	234.213	230.876	214.327	198.372	224.796	209.306	191.474	234.213	230.876	214.327	198.372	224.796	209.306	191.474	166.562	163.198	146.513	130.426	157.068	141.450	123.472
26	Ship	Articulated Tug/Barge	25,000	234.213	229.712	212.653	196.270	225.442	206.517	187.477	234.213	229.712	212.653	196.270	225.442	206.517	187.477	166.562	162.024	144.825	128.307	157.720	138.638	119.442
27	Ship	Tanker	20,000	234.213	230.941	214.773	199.078	224.990	209.938	192.753	234.213	230.941	214.773	199.078	224.990	209.938	192.753	166.562	163.263	146.963	131.138	157.263	142.088	124.761
28	Ship	Tanker	15,000	234.213	230.876	215.034	201.923	226.219	211.686	198.576	234.213	230.876	215.034	201.923	226.219	211.686	198.576	166.562	163.198	147.225	134.007	158.502	143.850	130.632

Notes:

[1] Perpendicular distances at each channel transition leg (as measured in CADD drawing) from the centerline of vessel transit path to where the loaded/ballasted vessel bow, deckhouse, or mast makes first contact with the bottom chord of the truss superstructure adjacent to Pier 15. The absolute boundaries for "Main Span North" are the centerline of main span (between Piers 15-16) and the centerline of Pier 15.

SUPERSTRUCTURE CONTACT GEOMETRY - MAIN SPAN NORTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Main Span North (Pier 15)																				
				Leg 4 [1]							Leg 5 [1]							Leg 6 [1]						
				Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	166.562	161.620	141.863	116.863	152.228	134.926	102.097	166.562	161.620	141.863	116.863	152.228	134.926	102.097	392.040	387.162	367.665	342.992	377.894	360.818	328.420
2	Ship	Tanker	110,000	166.562	161.776	142.200	114.482	152.776	135.638	99.028	166.562	161.776	142.200	114.482	152.776	135.638	99.028	392.040	387.317	367.998	340.642	378.435	361.521	325.391
3	Ship	Tanker	105,000	166.562	163.498	144.750	117.696	153.063	136.126	98.402	166.562	163.498	144.750	117.696	153.063	136.126	98.402	392.040	389.016	370.514	343.814	378.718	362.002	324.773
4	Ship	Bulk Carrier	85,000	166.562	159.846	136.688	97.713	151.628	130.876	72.074	166.562	159.846	136.688	97.713	151.628	130.876	72.074	392.040	385.412	362.558	324.093	377.302	356.821	298.791
5	Ship	Bulk Carrier	80,000	166.562	160.563	138.094	102.160	151.824	131.532	76.185	166.562	160.563	138.094	102.160	151.824	131.532	76.185	392.040	386.120	363.945	328.482	377.495	357.469	302.848
6	Ship	Tanker	75,000	166.562	162.363	143.644	115.218	154.276	138.019	102.946	166.562	162.363	143.644	115.218	154.276	138.019	102.946	392.040	387.896	369.422	341.369	379.915	363.871	329.257
7	Ship	Bulk Carrier	75,000	166.562	161.320	139.557	105.277	151.537	131.494	75.713	166.562	161.320	139.557	105.277	151.537	131.494	75.713	392.040	386.866	365.389	331.559	377.212	357.432	302.382
8	Ship	Tanker	70,000	166.562	162.207	143.513	119.522	153.337	136.763	106.627	166.562	162.207	143.513	119.522	153.337	136.763	106.627	392.040	387.742	369.293	345.617	378.988	362.632	332.891
9	Ship	Bulk Carrier	70,000	166.562	161.711	140.550	107.241	150.755	130.801	69.851	166.562	161.711	140.550	107.241	150.755	130.801	69.851	392.040	387.253	366.369	333.496	376.440	356.747	296.597
10	Ship	Tanker	65,000	166.562	162.311	143.775	119.737	153.963	137.401	107.773	166.562	162.311	143.775	119.737	153.963	137.401	107.773	392.040	392.043	369.552	345.829	379.606	363.261	334.021
11	Ship	Bulk Carrier	65,000	166.562	161.894	141.263	108.591	152.894	133.951	86.979	166.562	161.894	141.263	108.591	152.894	133.951	86.979	392.040	387.433	367.072	334.829	378.551	359.856	313.500
12	Ship	Bulk Carrier	60,000	166.562	162.363	142.444	110.964	153.102	134.194	87.723	166.562	162.363	142.444	110.964	153.102	134.194	87.723	392.040	387.896	368.238	337.170	378.757	360.097	314.235
13	Ship	Tanker	55,000	166.562	163.511	145.763	121.215	156.076	139.950	111.250	166.562	163.511	145.763	121.215	156.076	139.950	111.250	392.040	389.029	371.513	347.287	381.692	365.777	337.453
14	Ship	Bulk Carrier	55,000	166.562	162.115	142.613	111.127	152.594	133.988	86.234	166.562	162.115	142.613	111.127	152.594	133.988	86.234	392.040	387.652	368.405	337.332	378.255	359.893	312.765
15	Ship	Tanker	50,000	166.562	162.768	144.844	118.340	156.246	140.344	109.736	166.562	162.768	144.844	118.340	156.246	140.344	109.736	392.040	388.295	370.607	344.450	381.859	366.166	335.959
16	Ship	Bulk Carrier	50,000	166.562	164.542	146.663	118.448	154.107	136.913	96.398	166.562	164.542	146.663	118.448	154.107	136.913	96.398	392.040	390.046	372.402	344.556	379.748	362.780	322.795
17	Ship	Tanker	45,000	166.562	162.728	144.938	118.931	157.250	141.750	113.500	166.562	162.728	144.938	118.931	157.250	141.750	113.500	392.040	388.257	370.699	345.034	382.850	367.554	339.673
18	Ship	Tanker	40,000	166.562	162.846	145.294	122.504	156.194	140.419	115.259	166.562	162.846	145.294	122.504	156.194	140.419	115.259	392.040	388.373	371.051	348.560	381.808	366.240	341.409
19	Ship	Bulk Carrier	40,000	166.562	162.194	144.657	114.768	156.455	141.094	106.995	166.562	162.194	144.657	114.768	156.455	141.094	106.995	392.040	387.729	370.422	340.925	382.065	366.906	333.254
20	Ship	Tanker	35,000	166.562	163.407	146.307	125.245	156.494	140.869	117.454	166.562	163.407	146.307	125.245	156.494	140.869	117.454	392.040	388.926	372.050	351.264	382.104	366.684	343.575
21	Ship	Bulk Carrier	35,000	166.562	163.994	148.069	119.845	156.559	142.069	108.754	166.562	163.994	148.069	119.845	156.559	142.069	108.754	392.040	389.505	373.789	345.935	382.168	367.868	334.990
22	Ship	Tanker	30,000	166.562	162.598	145.388	127.663	156.207	140.325	120.409	166.562	162.598	145.388	127.663	156.207	140.325	120.409	392.040	388.128	371.143	353.650	381.820	366.147	346.492
23	Ship	Bulk Carrier	30,000	166.562	164.907	149.620	122.800	157.994	144.882	114.482	166.562	164.907	149.620	122.800	157.994	144.882	114.482	392.040	390.406	375.320	348.852	383.584	370.644	340.642
24	Ship	Articulated Tug/Barge	30,000	166.562	162.728	145.575	127.931	157.386	157.513	116.379	166.562	162.728	145.575	127.931	157.386	157.513	116.379	392.040	388.257	371.328	353.915	382.721	363.372	342.515
25	Ship	Tanker	25,000	166.562	163.198	146.513	130.426	157.068	141.450	123.472	166.562	163.198	146.513	130.426	157.068	141.450	123.472	392.040	388.720	372.254	356.377	382.670	367.258	349.514
26	Ship	Articulated Tug/Barge	25,000	166.562	162.024	144.825	128.307	157.720	138.638	119.442	166.562	162.024	144.825	128.307	157.720	138.638	119.442	392.040	392.043	370.588	354.287	383.314	364.482	345.537
27	Ship	Tanker	20,000	166.562	163.263	146.963	131.138	157.263	142.088	124.761	166.562	163.263	146.963	131.138	157.263	142.088	124.761	392.040	388.784	372.698	357.080	382.863	367.887	350.787
28	Ship	Tanker	15,000	166.562	163.198	147.225	134.007	158.502	143.850	130.632	166.562	163.198	147.225	134.007	158.502	143.850	130.632	392.040	388.720	372.957	359.912	384.086	369.626	356.581

SUPERSTRUCTURE CONTACT GEOMETRY - ANCHOR SPAN NORTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Anchor Span North (Pier 15)																				
				Leg 1 [1]							Leg 2 [1]							Leg 3 [1]						
				Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	234.213	240.074	268.557	375.210	252.415	281.717	375.210	234.213	240.074	268.557	375.210	252.415	281.717	375.210	166.562	172.472	201.190	308.722	184.915	214.458	308.722
2	Ship	Tanker	110,000	234.213	239.870	268.111	375.210	251.602	280.274	375.210	234.213	239.870	268.111	375.210	251.602	280.274	375.210	166.562	172.266	200.740	308.722	184.095	213.003	308.722
3	Ship	Tanker	105,000	234.213	237.626	264.738	375.210	251.228	279.286	375.210	234.213	237.626	264.738	375.210	251.228	279.286	375.210	166.562	170.003	197.340	308.722	183.718	212.007	308.722
4	Ship	Bulk Carrier	85,000	234.213	242.386	278.147	375.210	253.556	293.060	375.210	234.213	242.386	278.147	375.210	253.556	293.060	375.210	166.562	174.803	210.858	308.722	186.065	225.895	308.722
5	Ship	Bulk Carrier	80,000	234.213	241.451	275.298	375.210	253.184	291.044	375.210	234.213	241.451	275.298	375.210	253.184	291.044	375.210	166.562	173.861	207.986	308.722	185.690	223.862	308.722
6	Ship	Tanker	75,000	234.213	239.105	266.201	375.210	249.647	275.450	375.210	234.213	239.105	266.201	375.210	249.647	275.450	375.210	166.562	171.495	198.815	308.722	182.124	208.139	308.722
7	Ship	Bulk Carrier	75,000	234.213	240.465	272.335	375.210	253.730	291.159	375.210	234.213	240.465	272.335	375.210	253.730	291.159	375.210	166.562	172.866	204.999	308.722	186.240	223.979	308.722
8	Ship	Tanker	70,000	234.213	239.309	266.375	375.210	250.871	277.995	375.210	234.213	239.309	266.375	375.210	250.871	277.995	375.210	166.562	171.701	198.990	308.722	183.358	210.705	308.722
9	Ship	Bulk Carrier	70,000	234.213	239.955	270.322	375.210	255.217	293.290	375.210	234.213	239.955	270.322	375.210	255.217	293.290	375.210	166.562	172.352	202.969	308.722	187.740	226.127	308.722
10	Ship	Tanker	65,000	234.213	239.173	266.028	375.210	250.055	276.703	375.210	234.213	239.173	266.028	375.210	250.055	276.703	375.210	166.562	171.563	198.640	308.722	182.535	209.403	308.722
11	Ship	Bulk Carrier	65,000	234.213	239.717	269.350	375.210	251.449	283.692	375.210	234.213	239.717	269.350	375.210	251.449	283.692	375.210	166.562	172.112	201.990	308.722	183.941	216.450	308.722
12	Ship	Bulk Carrier	60,000	234.213	239.105	267.788	375.210	251.177	283.198	375.210	234.213	239.105	267.788	375.210	251.177	283.198	375.210	166.562	171.495	200.415	308.722	183.666	215.952	308.722
13	Ship	Tanker	55,000	234.213	237.609	263.400	375.210	247.300	271.537	375.210	234.213	237.609	263.400	375.210	247.300	271.537	375.210	166.562	169.98/6	195.990	308.722	179.758	204.195	308.722
14	Ship	Bulk Carrier	55,000	234.213	239.428	267.565	375.210	251.721	283.616	375.210	234.213	239.428	267.565	375.210	251.721	283.616	375.210	166.562	171.821	200.190	308.722	184.215	216.373	308.722
15	Ship	Tanker	50,000	234.213	238.578	264.615	375.210	247.079	270.740	375.210	234.213	238.578	264.615	375.210	247.079	270.740	375.210	166.562	170.963	197.215	308.722	179.535	203.390	308.722
16	Ship	Bulk Carrier	50,000	234.213	236.265	262.209	375.210	249.868	277.691	375.210	234.213	236.265	262.209	375.210	249.868	277.691	375.210	166.562	168.632	194.790	308.722	182.346	210.399	308.722
17	Ship	Tanker	45,000	234.213	238.629	264.491	375.210	245.770	268.706	375.210	234.213	238.629	264.491	375.210	245.770	268.706	375.210	166.562	171.015	197.090	308.722	178.215	201.340	308.722
18	Ship	Tanker	40,000	234.213	238.476	264.019	375.210	247.147	270.588	375.210	234.213	238.476	264.019	375.210	247.147	270.588	375.210	166.562	170.861	196.615	308.722	179.604	203.237	308.722
19	Ship	Bulk Carrier	40,000	234.213	239.326	264.862	375.210	246.807	269.574	375.210	234.213	239.326	264.862	375.210	246.807	269.574	375.210	166.562	171.718	197.465	308.722	179.261	202.215	308.722
20	Ship	Tanker	35,000	234.213	237.745	262.681	312.420	246.756	269.871	375.210	234.213	237.745	262.681	312.420	246.756	269.871	375.210	166.562	170.123	195.265	245.414	179.209	202.515	308.722
21	Ship	Bulk Carrier	35,000	234.213	236.980	260.350	375.210	246.671	268.284	375.210	234.213	236.980	260.350	375.210	246.671	268.284	375.210	166.562	169.352	200.915	308.722	179.124	200.915	308.722
22	Ship	Tanker	30,000	234.213	238.799	263.895	375.210	247.130	270.778	375.210	234.213	238.799	263.895	375.210	247.130	270.778	375.210	166.562	171.186	196.490	308.722	179.586	203.429	308.722
23	Ship	Bulk Carrier	30,000	234.213	235.789	257.374	375.210	244.801	264.565	375.210	234.213	235.789	257.374	375.210	244.801	264.565	375.210	166.562	168.152	189.915	308.722	177.238	197.165	308.722
24	Ship	Articulated Tug/Barge	30,000	234.213	238.629	263.648	302.317	245.940	276.475	375.210	234.213	238.629	263.648	302.317	245.940	276.475	375.210	166.562	171.015	196.240	235.229	178.386	209.173	308.722
25	Ship	Tanker	25,000	234.213	238.017	262.408	294.442	246.008	269.102	331.605	234.213	238.017	262.408	294.442	246.008	269.102	331.605	166.562	170.398	194.990	227.288	201.740	264.757	308.722
26	Ship	Articulated Tug/Barge	25,000	234.213	239.547	264.639	301.002	245.158	274.196	375.210	234.213	239.547	264.639	301.002	245.158	274.196	375.210	166.562	171.941	197.240	233.902	177.598	206.876	308.722
27	Ship	Tanker	20,000	234.213	237.932	261.813	292.254	245.753	268.259	315.907	234.213	237.932	261.813	292.254	245.753	268.259	315.907	166.562	170.312	194.390	225.082	178.198	200.890	248.930
28	Ship	Tanker	15,000	234.213	268.017	261.466	283.578	244.138	265.929	293.808	234.213	268.017	261.466	283.578	244.138	265.929	293.808	166.562	170.398	194.040	216.335	176.569	198.540	226.649

Notes:

[1] Perpendicular distances at each channel transition leg (as measured in CADD drawing) from the centerline of vessel transit path to where the loaded/ballasted vessel bow, deckhouse, or mast makes first contact with the bottom chord of the truss superstructure adjacent to Pier 15. The absolute boundaries for "Anchor Span North" are the centerline of Pier 15 and the centerline of Pier 14.

SUPERSTRUCTURE CONTACT GEOMETRY - ANCHOR SPAN NORTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Anchor Span North (Pier 15)																				
				Leg 4 [1]							Leg 5 [1]							Leg 6 [1]						
				Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	166.562	172.472	201.190	308.722	184.915	214.458	308.722	166.562	172.472	201.190	308.722	184.915	214.458	308.722	392.040	397.872	426.214	532.337	410.152	439.308	532.337
2	Ship	Tanker	110,000	166.562	172.266	200.740	308.722	184.095	213.003	308.722	166.562	172.266	200.740	308.722	184.095	213.003	308.722	392.040	397.669	425.770	532.337	409.343	437.872	532.337
3	Ship	Tanker	105,000	166.562	170.003	197.340	308.722	183.718	212.007	308.722	166.562	170.003	197.340	308.722	183.718	212.007	308.722	392.040	395.436	422.414	532.337	408.971	436.889	532.337
4	Ship	Bulk Carrier	85,000	166.562	174.803	210.858	308.722	186.065	225.895	308.722	166.562	174.803	210.858	308.722	186.065	225.895	308.722	392.040	400.173	435.756	532.337	411.287	450.595	532.337
5	Ship	Bulk Carrier	80,000	166.562	173.861	207.986	308.722	185.690	223.862	308.722	166.562	173.861	207.986	308.722	185.690	223.862	308.722	392.040	399.243	432.921	532.337	410.917	448.589	532.337
6	Ship	Tanker	75,000	166.562	171.495	198.815	308.722	182.124	208.139	308.722	166.562	171.495	198.815	308.722	182.124	208.139	308.722	392.040	396.908	423.870	532.337	407.397	433.072	532.337
7	Ship	Bulk Carrier	75,000	166.562	172.866	204.999	308.722	186.240	223.979	308.722	166.562	172.866	204.999	308.722	186.240	223.979	308.722	392.040	398.262	429.973	532.337	411.460	448.704	532.337
8	Ship	Tanker	70,000	166.562	171.701	198.990	308.722	183.358	210.705	308.722	166.562	171.701	198.990	308.722	183.358	210.705	308.722	392.040	397.111	424.043	532.337	408.616	435.604	532.337
9	Ship	Bulk Carrier	70,000	166.562	172.352	202.969	308.722	187.740	226.127	308.722	166.562	172.352	202.969	308.722	187.740	226.127	308.722	392.040	397.754	427.970	532.337	412.940	450.824	532.337
10	Ship	Tanker	65,000	166.562	171.563	198.640	308.722	182.535	209.403	308.722	166.562	171.563	198.640	308.722	182.535	209.403	308.722	392.040	396.976	423.697	532.337	407.804	434.319	532.337
11	Ship	Bulk Carrier	65,000	166.562	172.112	201.990	308.722	183.941	216.450	308.722	166.562	172.112	201.990	308.722	183.941	216.450	308.722	392.040	397.517	427.003	532.337	409.191	441.274	532.337
12	Ship	Bulk Carrier	60,000	166.562	171.495	200.415	308.722	183.666	215.952	308.722	166.562	171.495	200.415	308.722	183.666	215.952	308.722	392.040	396.908	425.449	532.337	408.920	440.782	532.337
13	Ship	Tanker	55,000	166.562	169.98/6	195.990	308.722	179.758	204.195	308.722	166.562	169.98/6	195.990	308.722	179.758	204.195	308.722	392.040	395.419	421.082	532.337	405.063	429.179	532.337
14	Ship	Bulk Carrier	55,000	166.562	171.821	200.190	308.722	184.215	216.373	308.722	166.562	171.821	200.190	308.722	184.215	216.373	308.722	392.040	397.230	425.227	532.337	409.462	441.198	532.337
15	Ship	Tanker	50,000	166.562	170.963	197.215	308.722	179.535	203.390	308.722	166.562	170.963	197.215	308.722	179.535	203.390	308.722	392.040	396.384	422.291	532.337	404.843	428.386	532.337
16	Ship	Bulk Carrier	50,000	166.562	168.632	194.790	308.722	182.346	210.399	308.722	166.562	168.632	194.790	308.722	182.346	210.399	308.722	392.040	394.083	419.898	532.337	407.617	435.302	532.337
17	Ship	Tanker	45,000	166.562	171.015	197.090	308.722	178.215	201.340	308.722	166.562	171.015	197.090	308.722	178.215	201.340	308.722	392.040	396.434	422.168	532.337	403.540	426.362	532.337
18	Ship	Tanker	40,000	166.562	170.861	196.615	308.722	179.604	203.237	308.722	166.562	170.861	196.615	308.722	179.604	203.237	308.722	392.040	396.282	421.699	532.337	404.910	428.234	532.337
19	Ship	Bulk Carrier	40,000	166.562	171.718	197.465	308.722	179.261	202.215	308.722	166.562	171.718	197.465	308.722	179.261	202.215	308.722	392.040	397.128	422.538	532.337	404.572	427.225	532.337
20	Ship	Tanker	35,000	166.562	170.123	195.265	245.414	179.209	202.515	308.722	166.562	170.123	195.265	245.414	179.209	202.515	308.722	392.040	395.555	420.367	469.859	404.521	427.521	532.337
21	Ship	Bulk Carrier	35,000	166.562	169.352	200.915	308.722	179.124	200.915	308.722	166.562	169.352	200.915	308.722	179.124	200.915	308.722	392.040	394.793	418.047	532.337	404.437	425.942	532.337
22	Ship	Tanker	30,000	166.562	171.186	196.490	308.722	179.586	203.429	308.722	166.562	171.186	196.490	308.722	179.586	203.429	308.722	392.040	396.604	421.575	532.337	404.894	428.423	532.337
23	Ship	Bulk Carrier	30,000	166.562	168.152	189.915	308.722	177.238	197.165	308.722	166.562	168.152	189.915	308.722	177.238	197.165	308.722	392.040	393.609	415.087	532.337	402.576	422.242	532.337
24	Ship	Articulated Tug/Barge	30,000	166.562	171.015	196.240	235.229	178.386	209.173	308.722	166.562	171.015	196.240	235.229	178.386	209.173	308.722	392.040	396.434	421.329	459.806	403.709	434.093	532.337
25	Ship	Tanker	25,000	166.562	170.398	194.990	227.288	201.740	264.757	308.722	166.562	170.398	194.990	227.288	201.740	264.757	308.722	392.040	395.825	420.095	451.970	403.777	426.757	488.948
26	Ship	Articulated Tug/Barge	25,000	166.562	171.941	197.240	233.902	177.598	206.876	308.722	166.562	171.941	197.240	233.902	177.598	206.876	308.722	392.040	397.348	422.316	458.497	402.931	431.825	532.337
27	Ship	Tanker	20,000	166.562	170.312	194.390	225.082	178.198	200.890	248.930	166.562	170.312	194.390	225.082	178.198	200.890	248.930	392.040	395.741	419.503	449.793	403.523	425.918	473.329
28	Ship	Tanker	15,000	166.562	170.398	194.040	216.335	176.569	198.540	226.649	166.562	170.398	194.040	216.335	176.569	198.540	226.649	392.040	395.825	419.158	441.160	401.916	423.599	451.340

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	2.7766	3.0252	3.0866	0.00	0.00	0.00	57.25	12.48	1.27	0	5	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	2.7648	3.0141	3.0866	0.00	0.00	0.00	54.58	11.90	1.22	0	5	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	2.7265	2.9677	3.0866	0.00	0.00	0.00	52.59	11.45	1.19	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	2.7616	2.9963	3.0866	0.00	0.00	0.00	47.93	11.96	1.23	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	2.7576	2.9883	3.0866	0.00	0.00	0.00	46.43	12.07	1.25	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	2.7312	2.9153	3.0866	0.00	0.00	0.00	44.52	11.88	1.26	0	4	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	2.7609	2.9888	3.0866	0.00	0.00	0.00	45.01	12.18	1.26	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	2.7418	2.9295	3.0866	0.00	0.00	0.00	43.18	12.00	1.26	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	2.7698	2.9966	3.0866	0.00	0.00	0.00	43.62	12.27	1.26	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	2.7275	2.9189	3.0866	0.00	0.00	0.00	41.39	11.96	1.26	0	1	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	2.7387	2.9584	3.0866	0.00	0.00	0.00	41.56	12.12	1.26	0	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	2.7246	2.9511	3.0866	0.00	0.00	0.00	39.72	12.05	1.26	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	2.6817	2.8785	3.0866	0.00	0.00	0.00	37.44	11.65	1.25	0	2	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	2.7286	2.9528	3.0866	0.00	0.00	0.00	38.09	11.95	1.25	0	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	2.6788	2.8732	3.0866	0.00	0.00	0.00	35.65	11.47	1.23	0	8	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	2.7166	2.9204	3.0866	0.00	0.00	0.00	36.16	11.66	1.23	0	1	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	2.6648	2.8550	3.0866	0.00	0.00	0.00	33.65	11.18	1.21	0	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	2.6759	2.8705	3.0866	0.00	0.00	0.00	31.86	10.94	1.18	0	5	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	2.6041	2.8194	3.0866	2.6745	2.8631	3.0866	31.00	10.74	1.18	31.84	10.91	1.18	0	1	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	2.6666	2.8619	3.0866	0.00	0.00	0.00	29.69	10.52	1.13	0	2	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	2.6696	2.8491	3.0866	0.00	0.00	0.00	29.73	10.47	1.13	0	1	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	2.6551	2.8608	3.0866	0.00	0.00	0.00	27.37	10.03	1.08	0	7	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	3.0866	2.8097	2.6447	0.00	0.00	0.00	31.82	9.85	0.93	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	2.6885	2.9165	3.0866	0.00	0.00	0.00	27.72	10.22	1.08	0	4	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	2.6264	2.8367	3.0788	0.00	0.00	0.00	24.72	9.34	1.01	0	1	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	2.6092	2.8190	3.0205	2.6617	2.8945	3.0866	24.56	9.29	0.99	25.05	9.53	1.02	1	2	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	2.5412	2.7614	2.9752	2.6223	2.8273	3.0613	21.39	8.37	0.90	22.07	8.57	0.93	10	4	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	2.5044	2.7351	2.9260	2.5722	2.7838	2.9748	18.26	7.38	0.79	18.75	7.51	0.80	0	1	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.011930	0.056610	0.091881	0.037042	0.054789	0.132219	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000002	0.000003	0.000007	0.000011
0.011492	0.055860	0.103219	0.035387	0.053917	0.149468	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000002	0.000003	0.000008	0.000012
0.007274	0.052029	0.097856	0.034619	0.053023	0.153692	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.016283	0.069299	0.160243	0.038513	0.067685	0.265236	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.014433	0.066303	0.144777	0.037899	0.065887	0.247783	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.009979	0.052605	0.105254	0.031057	0.049972	0.140674	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000001	0.000003	0.000005
0.012540	0.063286	0.135493	0.038720	0.065201	0.250022	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.010363	0.052637	0.087044	0.033665	0.051650	0.119771	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.011569	0.060966	0.129983	0.040973	0.065481	0.277090	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.010024	0.051910	0.087456	0.031724	0.051219	0.117790	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.011031	0.058952	0.127196	0.034668	0.060285	0.204822	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.009735	0.055956	0.121750	0.033704	0.060031	0.205386	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.006940	0.047998	0.088586	0.025433	0.048147	0.112913	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002
0.010303	0.054755	0.121768	0.035050	0.059346	0.212855	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.008679	0.049072	0.097786	0.024963	0.047274	0.121147	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000006	0.000009
0.004624	0.047997	0.102307	0.031062	0.053263	0.170789	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.008753	0.048634	0.095660	0.022298	0.045244	0.109002	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.008455	0.047751	0.081991	0.025005	0.046835	0.097000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000001	0.000003	0.000005
0.010020	0.048246	0.112691	0.024369	0.045319	0.136416	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.007089	0.045757	0.074182	0.024067	0.046032	0.089262	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002
0.005771	0.041926	0.101501	0.024000	0.042349	0.131795	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.008783	0.046182	0.061997	0.024371	0.046786	0.075393	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003	0.000006
0.003653	0.039210	0.093982	0.172386	0.115279	0.036969	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.008985	0.047232	0.060859	0.023147	0.059341	0.080927	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.007220	0.043453	0.054772	0.021669	0.044845	0.066604	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.010458	0.047386	0.057468	0.021149	0.056845	0.072896	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002
0.007058	0.042191	0.053415	0.021138	0.043224	0.063376	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000003	0.000003	0.000001	0.000001	0.000002	0.000009
0.006835	0.039932	0.043219	0.017257	0.039636	0.045678	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
																		Total for Pier:	**0.000073**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	2.7766	3.0252	3.0866	0.00	0.00	0.00	57.25	12.48	1.27	0	5	10.20	0.000003	0.000003
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	2.7648	3.0141	3.0866	0.00	0.00	0.00	54.58	11.90	1.22	0	5	10.20	0.000003	0.000003
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	2.7265	2.9677	3.0866	0.00	0.00	0.00	52.59	11.45	1.19	0	0	10.20	0.000003	0.000003
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	2.7616	2.9963	3.0866	0.00	0.00	0.00	47.93	11.96	1.23	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	2.7576	2.9883	3.0866	0.00	0.00	0.00	46.43	12.07	1.25	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	2.7312	2.9153	3.0866	0.00	0.00	0.00	44.52	11.88	1.26	0	4	1.64	0.000003	0.000013
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	2.7609	2.9888	3.0866	0.00	0.00	0.00	45.01	12.18	1.26	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	2.7418	2.9295	3.0866	0.00	0.00	0.00	43.18	12.00	1.26	0	0	1.64	0.000003	0.000013
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	2.7698	2.9966	3.0866	0.00	0.00	0.00	43.62	12.27	1.26	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	2.7275	2.9189	3.0866	0.00	0.00	0.00	41.39	11.96	1.26	0	1	1.64	0.000003	0.000013
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	2.7387	2.9584	3.0866	0.00	0.00	0.00	41.56	12.12	1.26	0	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	2.7246	2.9511	3.0866	0.00	0.00	0.00	39.72	12.05	1.26	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	2.6817	2.8785	3.0866	0.00	0.00	0.00	37.44	11.65	1.25	0	2	1.64	0.000003	0.000013
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	2.7286	2.9528	3.0866	0.00	0.00	0.00	38.09	11.95	1.25	0	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	2.6788	2.8732	3.0866	0.00	0.00	0.00	35.65	11.47	1.23	0	8	1.64	0.000003	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	2.7166	2.9204	3.0866	0.00	0.00	0.00	36.16	11.66	1.23	0	1	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	2.6648	2.8550	3.0866	0.00	0.00	0.00	33.65	11.18	1.21	0	0	1.64	0.000003	0.000013
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	2.6759	2.8705	3.0866	0.00	0.00	0.00	31.86	10.94	1.18	0	5	1.64	0.000003	0.000013
19	Ship	Bulk Carrier	40,000	2.6041	2.8194	3.0866	2.6745	2.8631	3.0866	31.00	10.74	1.18	31.84	10.91	1.18	0	1	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	2.6666	2.8619	3.0866	0.00	0.00	0.00	29.69	10.52	1.13	0	2	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	2.6696	2.8491	3.0866	0.00	0.00	0.00	29.73	10.47	1.13	0	1	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	2.6551	2.8608	3.0866	0.00	0.00	0.00	27.37	10.03	1.08	0	7	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	3.0866	2.8097	2.6447	0.00	0.00	0.00	31.82	9.85	0.93	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	2.6885	2.9165	3.0866	0.00	0.00	0.00	27.72	10.22	1.08	0	4	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	2.6264	2.8367	3.0788	0.00	0.00	0.00	24.72	9.34	1.01	0	1	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	2.6092	2.8190	3.0205	2.6617	2.8945	3.0866	24.56	9.29	0.99	25.05	9.53	1.02	1	2	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	2.5412	2.7614	2.9752	2.6223	2.8273	3.0613	21.39	8.37	0.90	22.07	8.57	0.93	10	4	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	2.5044	2.7351	2.9260	2.5722	2.7838	2.9748	18.26	7.38	0.79	18.75	7.51	0.80	0	1	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.011930	0.056610	0.091881	0.037042	0.054789	0.132219	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000004	0.000006	0.000015	0.000025
0.011492	0.055860	0.103219	0.035387	0.053917	0.149468	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000004	0.000006	0.000017	0.000027
0.007274	0.052029	0.097856	0.034619	0.053023	0.153692	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.016283	0.069299	0.160243	0.038513	0.067685	0.265236	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.014433	0.066303	0.144777	0.037899	0.065887	0.247783	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.009979	0.052605	0.105254	0.031057	0.049972	0.140674	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000002	0.000003	0.000008	0.000012
0.012540	0.063286	0.135493	0.038720	0.065201	0.250022	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.010363	0.052637	0.087044	0.033665	0.051650	0.119771	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.011569	0.060966	0.129983	0.040973	0.065481	0.277090	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.010024	0.051910	0.087456	0.031724	0.051219	0.117790	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.011031	0.058952	0.127196	0.034668	0.060285	0.204822	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.009735	0.055956	0.121750	0.033704	0.060031	0.205386	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.006940	0.047998	0.088586	0.025433	0.048147	0.112913	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000001	0.000003	0.000005
0.010303	0.054755	0.121768	0.035050	0.059346	0.212855	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.008679	0.049072	0.097786	0.024963	0.047274	0.121147	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000003	0.000005	0.000013	0.000021
0.004624	0.047997	0.102307	0.031062	0.053263	0.170789	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.008753	0.048634	0.095660	0.022298	0.045244	0.109002	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.008455	0.047751	0.081991	0.025005	0.046835	0.097000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000002	0.000003	0.000006	0.000011
0.010020	0.048246	0.112691	0.024369	0.045319	0.136416	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.007089	0.045757	0.074182	0.024067	0.046032	0.089262	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002	0.000004
0.005771	0.041926	0.101501	0.024000	0.042349	0.131795	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.008783	0.046182	0.061997	0.024371	0.046786	0.075393	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000002	0.000004	0.000007	0.000014
0.003653	0.039210	0.093982	0.172386	0.115279	0.036969	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.008985	0.047232	0.060859	0.023147	0.059341	0.080927	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003	0.000007
0.007220	0.043453	0.054772	0.021669	0.044845	0.066604	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002
0.010458	0.047386	0.057468	0.021149	0.056845	0.072896	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000001	0.000000	0.000001	0.000002	0.000004
0.007058	0.042191	0.053415	0.021138	0.043224	0.063376	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000001	0.000006	0.000007	0.000001	0.000002	0.000003	0.000021
0.006835	0.039932	0.043219	0.017257	0.039636	0.045678	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000001
																		Total for Pier:	**0.000163**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	1.7587	2.0094	2.4849	0.00	0.00	0.00	36.26	8.29	1.02	0	5	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	1.7339	1.9853	2.5223	0.00	0.00	0.00	34.23	7.84	1.00	0	5	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.7172	1.9605	2.5022	0.00	0.00	0.00	33.12	7.56	0.97	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.9605	2.1971	2.8675	0.00	0.00	0.00	34.02	8.77	1.14	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.9520	2.1846	2.8191	0.00	0.00	0.00	32.86	8.83	1.14	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.9287	2.1143	2.5148	0.00	0.00	0.00	31.44	8.62	1.02	0	4	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.9553	2.1851	2.8246	0.00	0.00	0.00	31.87	8.90	1.15	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.9395	2.1287	2.4727	0.00	0.00	0.00	30.54	8.72	1.01	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.9643	2.1930	2.8917	0.00	0.00	0.00	30.93	8.98	1.18	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.9084	2.1014	2.4466	0.00	0.00	0.00	28.96	8.61	1.00	0	1	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.9172	2.1386	2.6877	0.00	0.00	0.00	29.09	8.76	1.10	0	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.8754	2.1039	2.6653	0.00	0.00	0.00	27.34	8.59	1.09	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.8170	2.0153	2.3684	0.00	0.00	0.00	25.36	8.16	0.96	0	2	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.8746	2.1007	2.6810	0.00	0.00	0.00	26.17	8.50	1.09	0	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	1.8122	2.0082	2.3855	0.00	0.00	0.00	24.12	8.02	0.95	0	8	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.8768	2.0822	2.5663	0.00	0.00	0.00	24.98	8.31	1.02	0	1	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	1.7944	1.9862	2.3359	0.00	0.00	0.00	22.66	7.77	0.91	0	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	1.8019	1.9980	2.3108	0.00	0.00	0.00	21.45	7.61	0.88	0	5	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	1.7332	1.9503	2.3202	1.8042	1.9944	2.4164	20.63	7.43	0.88	21.48	7.60	0.92	0	1	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	1.7805	1.9774	2.2725	0.00	0.00	0.00	19.83	7.27	0.84	0	2	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	1.7916	1.9726	2.3886	0.00	0.00	0.00	19.95	7.25	0.88	0	1	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	1.7370	1.9444	2.2045	0.00	0.00	0.00	17.91	6.82	0.77	0	7	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	1.7521	1.9185	2.3044	0.00	0.00	0.00	18.06	6.73	0.81	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	1.8639	2.0938	2.3416	0.00	0.00	0.00	19.22	7.34	0.82	0	4	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	1.6719	1.8839	2.1280	0.00	0.00	0.00	15.74	6.21	0.70	0	1	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	1.7438	1.9554	2.1585	1.7968	2.0315	2.2676	16.41	6.44	0.71	16.91	6.69	0.75	1	2	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	1.5829	1.8049	2.0204	1.6646	1.8713	2.1073	13.33	5.47	0.61	14.01	5.67	0.64	10	4	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	1.4798	1.7124	1.9048	1.5481	1.7615	1.9540	10.79	4.62	0.51	11.29	4.75	0.53	0	1	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.002859	0.015649	0.032574	0.009381	0.016545	0.053043	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000001	0.000001	0.000003	0.000005
0.002678	0.015032	0.036373	0.008704	0.015807	0.059915	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000001	0.000001	0.000004	0.000005
0.001697	0.013800	0.033653	0.008592	0.015620	0.062138	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003716	0.018949	0.063182	0.009247	0.020015	0.127118	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003238	0.017702	0.054631	0.008978	0.019181	0.114520	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002236	0.013541	0.035733	0.007311	0.013897	0.053155	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000002	0.000002
0.002800	0.016672	0.049739	0.009189	0.019013	0.115938	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002324	0.013571	0.028758	0.007973	0.014547	0.044453	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002577	0.015925	0.046879	0.009773	0.019258	0.134005	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002142	0.012788	0.027816	0.007146	0.013749	0.041906	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002345	0.014703	0.043932	0.007807	0.016545	0.084973	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001905	0.012854	0.038923	0.007019	0.015372	0.080994	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001289	0.010271	0.025010	0.004968	0.011206	0.035387	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.001990	0.012419	0.038466	0.007225	0.015081	0.084274	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001611	0.010565	0.028225	0.004846	0.010911	0.038175	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.000917	0.010844	0.030941	0.006595	0.013620	0.063429	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001607	0.010364	0.027259	0.004253	0.010181	0.032904	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001534	0.010039	0.022522	0.004753	0.010603	0.028885	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.001847	0.010333	0.033179	0.004674	0.010294	0.043388	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001237	0.009215	0.019325	0.004410	0.010056	0.025436	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.001027	0.008490	0.027776	0.004500	0.009359	0.040533	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001402	0.008629	0.014811	0.004081	0.009464	0.019671	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.000619	0.007502	0.024136	0.003584	0.007640	0.032433	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001886	0.011315	0.017959	0.005034	0.015456	0.026895	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.001029	0.007258	0.011668	0.003242	0.008133	0.015537	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001961	0.010295	0.015498	0.004085	0.013233	0.021688	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000996	0.006957	0.011194	0.003129	0.007724	0.014463	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000002
0.000789	0.005467	0.007505	0.002077	0.005791	0.008385	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000025**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	1.7587	2.0094	2.4849	0.00	0.00	0.00	36.26	8.29	1.02	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	1.7339	1.9853	2.5223	0.00	0.00	0.00	34.23	7.84	1.00	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.7172	1.9605	2.5022	0.00	0.00	0.00	33.12	7.56	0.97	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.9605	2.1971	2.8675	0.00	0.00	0.00	34.02	8.77	1.14	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.9520	2.1846	2.8191	0.00	0.00	0.00	32.86	8.83	1.14	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.9287	2.1143	2.5148	0.00	0.00	0.00	31.44	8.62	1.02	0	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.9553	2.1851	2.8246	0.00	0.00	0.00	31.87	8.90	1.15	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.9395	2.1287	2.4727	0.00	0.00	0.00	30.54	8.72	1.01	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.9643	2.1930	2.8917	0.00	0.00	0.00	30.93	8.98	1.18	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.9084	2.1014	2.4466	0.00	0.00	0.00	28.96	8.61	1.00	0	0	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.9172	2.1386	2.6877	0.00	0.00	0.00	29.09	8.76	1.10	0	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.8754	2.1039	2.6653	0.00	0.00	0.00	27.34	8.59	1.09	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.8170	2.0153	2.3684	0.00	0.00	0.00	25.36	8.16	0.96	0	0	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.8746	2.1007	2.6810	0.00	0.00	0.00	26.17	8.50	1.09	0	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	1.8122	2.0082	2.3855	0.00	0.00	0.00	24.12	8.02	0.95	0	3	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.8768	2.0822	2.5663	0.00	0.00	0.00	24.98	8.31	1.02	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	1.7944	1.9862	2.3359	0.00	0.00	0.00	22.66	7.77	0.91	0	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	1.8019	1.9980	2.3108	0.00	0.00	0.00	21.45	7.61	0.88	0	1	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	1.8042	1.9944	2.4164	0.00	0.00	0.00	21.48	7.60	0.92	0	0	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	1.7805	1.9774	2.2725	0.00	0.00	0.00	19.83	7.27	0.84	0	1	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	1.7916	1.9726	2.3886	0.00	0.00	0.00	19.95	7.25	0.88	0	0	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	1.7370	1.9444	2.2045	0.00	0.00	0.00	17.91	6.82	0.77	0	0	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	1.7521	1.9185	2.3044	0.00	0.00	0.00	18.06	6.73	0.81	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	1.8639	2.0938	2.3416	0.00	0.00	0.00	19.22	7.34	0.82	0	3	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	1.6719	1.8839	2.1280	0.00	0.00	0.00	15.74	6.21	0.70	0	1	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	1.7968	2.0315	2.2676	0.00	0.00	0.00	16.91	6.69	0.75	0	2	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	1.6646	1.8713	2.1073	0.00	0.00	0.00	14.01	5.67	0.64	0	9	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	1.4798	1.7124	1.9048	1.5481	1.7615	1.9540	10.79	4.62	0.51	11.29	4.75	0.53	1	0	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.002859	0.015649	0.032574	0.009381	0.016545	0.053043	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002678	0.015032	0.036373	0.008704	0.015807	0.059915	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001697	0.013800	0.033653	0.008592	0.015620	0.062138	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003716	0.018949	0.063182	0.009247	0.020015	0.127118	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003238	0.017702	0.054631	0.008978	0.019181	0.114520	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002236	0.013541	0.035733	0.007311	0.013897	0.053155	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002800	0.016672	0.049739	0.009189	0.019013	0.115938	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002324	0.013571	0.028758	0.007973	0.014547	0.044453	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002577	0.015925	0.046879	0.009773	0.019258	0.134005	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002142	0.012788	0.027816	0.007146	0.013749	0.041906	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002345	0.014703	0.043932	0.007807	0.016545	0.084973	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001905	0.012854	0.038923	0.007019	0.015372	0.080994	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001289	0.010271	0.025010	0.004968	0.011206	0.035387	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001990	0.012419	0.038466	0.007225	0.015081	0.084274	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001611	0.010565	0.028225	0.004846	0.010911	0.038175	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000917	0.010844	0.030941	0.006595	0.013620	0.063429	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001607	0.010364	0.027259	0.004253	0.010181	0.032904	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001534	0.010039	0.022522	0.004753	0.010603	0.028885	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001847	0.010333	0.033179	0.004674	0.010294	0.043388	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001237	0.009215	0.019325	0.004410	0.010056	0.025436	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001027	0.008490	0.027776	0.004500	0.009359	0.040533	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001402	0.008629	0.014811	0.004081	0.009464	0.019671	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000619	0.007502	0.024136	0.003584	0.007640	0.032433	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001886	0.011315	0.017959	0.005034	0.015456	0.026895	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001029	0.007258	0.011668	0.003242	0.008133	0.015537	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001961	0.010295	0.015498	0.004085	0.013233	0.021688	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000996	0.006957	0.011194	0.003129	0.007724	0.014463	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000789	0.005467	0.007505	0.002077	0.005791	0.008385	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000002**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	1.7587	2.0094	2.4849	0.00	0.00	0.00	36.26	8.29	1.02	0	0	10.20	0.000004	0.000004
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	1.7339	1.9853	2.5223	0.00	0.00	0.00	34.23	7.84	1.00	0	0	10.20	0.000004	0.000004
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.7172	1.9605	2.5022	0.00	0.00	0.00	33.12	7.56	0.97	0	0	10.20	0.000004	0.000004
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.9605	2.1971	2.8675	0.00	0.00	0.00	34.02	8.77	1.14	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.9520	2.1846	2.8191	0.00	0.00	0.00	32.86	8.83	1.14	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.9287	2.1143	2.5148	0.00	0.00	0.00	31.44	8.62	1.02	0	0	1.64	0.000004	0.000013
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.9553	2.1851	2.8246	0.00	0.00	0.00	31.87	8.90	1.15	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.9395	2.1287	2.4727	0.00	0.00	0.00	30.54	8.72	1.01	0	0	1.64	0.000004	0.000013
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.9643	2.1930	2.8917	0.00	0.00	0.00	30.93	8.98	1.18	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.9084	2.1014	2.4466	0.00	0.00	0.00	28.96	8.61	1.00	0	0	1.64	0.000004	0.000013
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.9172	2.1386	2.6877	0.00	0.00	0.00	29.09	8.76	1.10	0	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.8754	2.1039	2.6653	0.00	0.00	0.00	27.34	8.59	1.09	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.8170	2.0153	2.3684	0.00	0.00	0.00	25.36	8.16	0.96	0	0	1.64	0.000004	0.000013
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.8746	2.1007	2.6810	0.00	0.00	0.00	26.17	8.50	1.09	0	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	1.8122	2.0082	2.3855	0.00	0.00	0.00	24.12	8.02	0.95	0	3	1.64	0.000004	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.8768	2.0822	2.5663	0.00	0.00	0.00	24.98	8.31	1.02	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	1.7944	1.9862	2.3359	0.00	0.00	0.00	22.66	7.77	0.91	0	0	1.64	0.000004	0.000013
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	1.8019	1.9980	2.3108	0.00	0.00	0.00	21.45	7.61	0.88	0	1	1.64	0.000004	0.000013
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	1.8042	1.9944	2.4164	0.00	0.00	0.00	21.48	7.60	0.92	0	0	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	1.7805	1.9774	2.2725	0.00	0.00	0.00	19.83	7.27	0.84	0	1	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	1.7916	1.9726	2.3886	0.00	0.00	0.00	19.95	7.25	0.88	0	0	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	1.7370	1.9444	2.2045	0.00	0.00	0.00	17.91	6.82	0.77	0	0	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	1.7521	1.9185	2.3044	0.00	0.00	0.00	18.06	6.73	0.81	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	1.8639	2.0938	2.3416	0.00	0.00	0.00	19.22	7.34	0.82	0	3	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	1.6719	1.8839	2.1280	0.00	0.00	0.00	15.74	6.21	0.70	0	1	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	1.7968	2.0315	2.2676	0.00	0.00	0.00	16.91	6.69	0.75	0	2	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	1.6646	1.8713	2.1073	0.00	0.00	0.00	14.01	5.67	0.64	0	9	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	1.4798	1.7124	1.9048	1.5481	1.7615	1.9540	10.79	4.62	0.51	11.29	4.75	0.53	1	0	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.002859	0.015649	0.032574	0.009381	0.016545	0.053043	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002678	0.015032	0.036373	0.008704	0.015807	0.059915	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001697	0.013800	0.033653	0.008592	0.015620	0.062138	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003716	0.018949	0.063182	0.009247	0.020015	0.127118	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003238	0.017702	0.054631	0.008978	0.019181	0.114520	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002236	0.013541	0.035733	0.007311	0.013897	0.053155	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002800	0.016672	0.049739	0.009189	0.019013	0.115938	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002324	0.013571	0.028758	0.007973	0.014547	0.044453	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002577	0.015925	0.046879	0.009773	0.019258	0.134005	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002142	0.012788	0.027816	0.007146	0.013749	0.041906	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002345	0.014703	0.043932	0.007807	0.016545	0.084973	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001905	0.012854	0.038923	0.007019	0.015372	0.080994	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001289	0.010271	0.025010	0.004968	0.011206	0.035387	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001990	0.012419	0.038466	0.007225	0.015081	0.084274	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001611	0.010565	0.028225	0.004846	0.010911	0.038175	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000917	0.010844	0.030941	0.006595	0.013620	0.063429	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001607	0.010364	0.027259	0.004253	0.010181	0.032904	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001534	0.010039	0.022522	0.004753	0.010603	0.028885	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001847	0.010333	0.033179	0.004674	0.010294	0.043388	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001237	0.009215	0.019325	0.004410	0.010056	0.025436	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001027	0.008490	0.027776	0.004500	0.009359	0.040533	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001402	0.008629	0.014811	0.004081	0.009464	0.019671	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000619	0.007502	0.024136	0.003584	0.007640	0.032433	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001886	0.011315	0.017959	0.005034	0.015456	0.026895	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.001029	0.007258	0.011668	0.003242	0.008133	0.015537	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001961	0.010295	0.015498	0.004085	0.013233	0.021688	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000996	0.006957	0.011194	0.003129	0.007724	0.014463	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000789	0.005467	0.007505	0.002077	0.005791	0.008385	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000004**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	3	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	1	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	1	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	3	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	1	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	2	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	9	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	1	0	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.277428	0.000000	0.000000	0.277428	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.279537	0.000000	0.000000	0.279537	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.278673	0.000000	0.000000	0.278673	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.282064	0.000000	0.000000	0.282064	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.283043	0.000000	0.000000	0.283043	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.282306	0.000000	0.000000	0.282306	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.283043	0.000000	0.000000	0.283043	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.282306	0.000000	0.000000	0.282306	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.283043	0.000000	0.000000	0.283043	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.285918	0.000000	0.000000	0.285918	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.286471	0.000000	0.000000	0.286471	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.292284	0.000000	0.000000	0.292284	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.295439	0.000000	0.000000	0.295439	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.293303	0.000000	0.000000	0.293303	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.295807	0.000000	0.000000	0.295807	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.290333	0.000000	0.000000	0.290333	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.296557	0.000000	0.000000	0.296557	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.297322	0.000000	0.000000	0.297322	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.296557	0.000000	0.000000	0.296557	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.299719	0.000000	0.000000	0.299719	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.298104	0.000000	0.000000	0.298104	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.305977	0.000000	0.000000	0.305977	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.300978	0.000000	0.000000	0.300978	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.287035	0.000000	0.000000	0.287035	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.312789	0.000000	0.000000	0.312789	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.295439	0.000000	0.000000	0.295439	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.313360	0.000000	0.000000	0.313360	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.325034	0.000000	0.000000	0.325034	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.6733	0.9572	1.3163	0.8083	1.0568	1.5285	13.88	3.95	0.54	16.67	4.36	0.63	0	5	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.6406	0.9254	1.3286	0.7716	1.0209	1.5534	12.65	3.65	0.52	15.23	4.03	0.61	0	5	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.6264	0.8934	1.2788	0.7750	1.0163	1.5535	12.08	3.45	0.49	14.95	3.92	0.60	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	1.1194	1.3813	1.8220	1.2124	1.4470	2.1119	19.43	5.51	0.73	21.04	5.78	0.84	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	1.1003	1.3558	1.7644	1.1997	1.4304	2.0597	18.52	5.48	0.71	20.20	5.78	0.83	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.5881	0.8531	1.2555	1.1798	1.3639	1.7610	9.59	3.48	0.51	19.23	5.56	0.72	0	4	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	1.0917	1.3392	1.7289	1.2029	1.4308	2.0651	17.80	5.46	0.70	19.61	5.83	0.84	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.5903	0.8549	1.1946	1.1904	1.3781	1.7193	9.30	3.50	0.49	18.75	5.64	0.70	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	1.0873	1.3279	1.7066	1.2118	1.4387	2.1318	17.12	5.44	0.70	19.08	5.89	0.87	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.5370	0.8049	1.1522	1.1439	1.3353	1.6777	8.15	3.30	0.47	17.36	5.47	0.69	0	1	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	1.0458	1.2850	1.6638	1.1502	1.3698	1.9144	15.87	5.27	0.68	17.45	5.61	0.78	0	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	1.0290	1.2104	1.5877	1.0827	1.3093	1.8662	15.00	4.94	0.65	15.79	5.35	0.76	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.5140	0.6479	1.0223	1.0290	1.2070	1.5571	7.18	2.62	0.41	14.36	4.89	0.63	0	2	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	1.0290	1.1975	1.5770	1.0772	1.3015	1.8770	14.36	4.85	0.64	15.04	5.27	0.76	0	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.5140	0.6568	1.0619	1.0290	1.1982	1.5724	6.84	2.62	0.42	13.70	4.78	0.63	4	8	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	1.0290	1.1811	1.5155	1.0929	1.2967	1.7768	13.70	4.72	0.61	14.55	5.18	0.71	0	1	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	0.5140	0.6450	1.0442	1.0290	1.1729	1.5198	6.49	2.52	0.41	12.99	4.59	0.59	0	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	0.5140	0.6289	0.9802	1.0290	1.1810	1.4912	6.12	2.40	0.37	12.25	4.50	0.57	1	5	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	1.0290	1.1373	1.5042	1.0290	1.1810	1.5996	12.25	4.33	0.57	12.25	4.50	0.61	0	1	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	1.0290	1.0813	1.3446	1.0290	1.1493	1.4420	11.46	3.97	0.49	11.46	4.22	0.53	1	2	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	1.0290	1.0778	1.4274	1.0290	1.1521	1.5647	11.46	3.96	0.52	11.46	4.23	0.58	0	1	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	1.0290	1.0290	1.2502	1.0290	1.0862	1.3442	10.61	3.61	0.44	10.61	3.81	0.47	1	7	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	1.3629	1.0290	1.0849	1.4676	10.61	3.61	0.48	10.61	3.80	0.51	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	1.0296	1.2291	1.4343	1.0948	1.3229	1.5687	10.61	4.31	0.50	11.29	4.64	0.55	2	4	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	1.0290	1.0290	1.1404	1.0290	1.0290	1.2340	9.68	3.39	0.38	9.68	3.39	0.41	0	1	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.1475	1.3490	1.0290	1.2230	1.4572	9.68	3.78	0.44	9.68	4.03	0.48	1	2	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	1.0290	1.0290	1.1244	1.0290	1.0290	1.2106	8.66	3.12	0.34	8.66	3.12	0.37	10	4	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	7.50	2.78	0.28	7.50	2.78	0.28	0	1	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000372	0.002321	0.006064	0.001284	0.002655	0.011097	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000335	0.002147	0.006653	0.001145	0.002437	0.012390	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000214	0.001956	0.006052	0.001145	0.002432	0.013030	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000449	0.002704	0.012688	0.001171	0.003062	0.031080	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000383	0.002455	0.010451	0.001115	0.002874	0.026823	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000265	0.001824	0.006209	0.000907	0.002005	0.010224	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000329	0.002284	0.009269	0.001144	0.002853	0.027251	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000276	0.001831	0.004865	0.000995	0.002123	0.008386	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000303	0.002165	0.008591	0.001222	0.002912	0.032921	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000237	0.001616	0.004438	0.000832	0.001876	0.007427	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000258	0.001873	0.007565	0.000905	0.002296	0.017499	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000187	0.001460	0.006001	0.000728	0.001924	0.015322	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000118	0.001069	0.003353	0.000475	0.001257	0.005231	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000191	0.001384	0.005825	0.000737	0.001861	0.015914	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000147	0.001102	0.003856	0.000460	0.001211	0.005664	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000092	0.001229	0.004587	0.000706	0.001725	0.011443	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000144	0.001065	0.003660	0.000395	0.001098	0.004662	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000135	0.001014	0.002903	0.000437	0.001143	0.004012	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000166	0.001067	0.004600	0.000436	0.001120	0.006475	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000103	0.000879	0.002330	0.000386	0.001031	0.003332	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000089	0.000823	0.003559	0.000407	0.000981	0.005798	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000103	0.000733	0.001572	0.000313	0.000863	0.002263	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000050	0.000676	0.002856	0.000302	0.000738	0.004180	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000204	0.001383	0.002649	0.000563	0.002038	0.004427	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000065	0.000528	0.001056	0.000213	0.000636	0.001528	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000181	0.001086	0.001986	0.000387	0.001486	0.003041	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000062	0.000497	0.000993	0.000202	0.000593	0.001387	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000037	0.000299	0.000507	0.000101	0.000335	0.000596	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000004**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.6733	0.9572	1.3163	0.8083	1.0568	1.5285	13.88	3.95	0.54	16.67	4.36	0.63	0	5	10.20	0.000003	0.000003
2	Ship	Tanker	110,000	0.6406	0.9254	1.3286	0.7716	1.0209	1.5534	12.65	3.65	0.52	15.23	4.03	0.61	0	5	10.20	0.000003	0.000003
3	Ship	Tanker	105,000	0.6264	0.8934	1.2788	0.7750	1.0163	1.5535	12.08	3.45	0.49	14.95	3.92	0.60	0	0	10.20	0.000003	0.000003
4	Ship	Bulk Carrier	85,000	1.1194	1.3813	1.8220	1.2124	1.4470	2.1119	19.43	5.51	0.73	21.04	5.78	0.84	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	1.1003	1.3558	1.7644	1.1997	1.4304	2.0597	18.52	5.48	0.71	20.20	5.78	0.83	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.5881	0.8531	1.2555	1.1798	1.3639	1.7610	9.59	3.48	0.51	19.23	5.56	0.72	0	4	1.64	0.000003	0.000013
7	Ship	Bulk Carrier	75,000	1.0917	1.3392	1.7289	1.2029	1.4308	2.0651	17.80	5.46	0.70	19.61	5.83	0.84	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.5903	0.8549	1.1946	1.1904	1.3781	1.7193	9.30	3.50	0.49	18.75	5.64	0.70	0	0	1.64	0.000003	0.000013
9	Ship	Bulk Carrier	70,000	1.0873	1.3279	1.7066	1.2118	1.4387	2.1318	17.12	5.44	0.70	19.08	5.89	0.87	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.5370	0.8049	1.1522	1.1439	1.3353	1.6777	8.15	3.30	0.47	17.36	5.47	0.69	0	1	1.64	0.000003	0.000013
11	Ship	Bulk Carrier	65,000	1.0458	1.2850	1.6638	1.1502	1.3698	1.9144	15.87	5.27	0.68	17.45	5.61	0.78	0	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	1.0290	1.2104	1.5877	1.0827	1.3093	1.8662	15.00	4.94	0.65	15.79	5.35	0.76	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.5140	0.6479	1.0223	1.0290	1.2070	1.5571	7.18	2.62	0.41	14.36	4.89	0.63	0	2	1.64	0.000003	0.000013
14	Ship	Bulk Carrier	55,000	1.0290	1.1975	1.5770	1.0772	1.3015	1.8770	14.36	4.85	0.64	15.04	5.27	0.76	0	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.5140	0.6568	1.0619	1.0290	1.1982	1.5724	6.84	2.62	0.42	13.70	4.78	0.63	4	8	1.64	0.000003	0.000013
16	Ship	Bulk Carrier	50,000	1.0290	1.1811	1.5155	1.0929	1.2967	1.7768	13.70	4.72	0.61	14.55	5.18	0.71	0	1	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	0.5140	0.6450	1.0442	1.0290	1.1729	1.5198	6.49	2.52	0.41	12.99	4.59	0.59	0	0	1.64	0.000003	0.000013
18	Ship	Tanker	40,000	0.5140	0.6289	0.9802	1.0290	1.1810	1.4912	6.12	2.40	0.37	12.25	4.50	0.57	1	5	1.64	0.000003	0.000013
19	Ship	Bulk Carrier	40,000	1.0290	1.1373	1.5042	1.0290	1.1810	1.5996	12.25	4.33	0.57	12.25	4.50	0.61	0	1	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	1.0290	1.0813	1.3446	1.0290	1.1493	1.4420	11.46	3.97	0.49	11.46	4.22	0.53	1	2	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	1.0290	1.0778	1.4274	1.0290	1.1521	1.5647	11.46	3.96	0.52	11.46	4.23	0.58	0	1	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	1.0290	1.0290	1.2502	1.0290	1.0862	1.3442	10.61	3.61	0.44	10.61	3.81	0.47	1	7	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	1.3629	1.0290	1.0849	1.4676	10.61	3.61	0.48	10.61	3.80	0.51	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	1.0296	1.2291	1.4343	1.0948	1.3229	1.5687	10.61	4.31	0.50	11.29	4.64	0.55	2	4	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	1.0290	1.0290	1.1404	1.0290	1.0290	1.2340	9.68	3.39	0.38	9.68	3.39	0.41	0	1	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.1475	1.3490	1.0290	1.2230	1.4572	9.68	3.78	0.44	9.68	4.03	0.48	1	2	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	1.0290	1.0290	1.1244	1.0290	1.0290	1.2106	8.66	3.12	0.34	8.66	3.12	0.37	10	4	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	7.50	2.78	0.28	7.50	2.78	0.28	0	1	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000372	0.002321	0.006064	0.001284	0.002655	0.011097	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.000335	0.002147	0.006653	0.001145	0.002437	0.012390	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000002	0.000002
0.000214	0.001956	0.006052	0.001145	0.002432	0.013030	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000449	0.002704	0.012688	0.001171	0.003062	0.031080	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000383	0.002455	0.010451	0.001115	0.002874	0.026823	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000265	0.001824	0.006209	0.000907	0.002005	0.010224	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000329	0.002284	0.009269	0.001144	0.002853	0.027251	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000276	0.001831	0.004865	0.000995	0.002123	0.008386	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000303	0.002165	0.008591	0.001222	0.002912	0.032921	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000237	0.001616	0.004438	0.000832	0.001876	0.007427	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000258	0.001873	0.007565	0.000905	0.002296	0.017499	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000187	0.001460	0.006001	0.000728	0.001924	0.015322	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000118	0.001069	0.003353	0.000475	0.001257	0.005231	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000191	0.001384	0.005825	0.000737	0.001861	0.015914	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000147	0.001102	0.003856	0.000460	0.001211	0.005664	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000092	0.001229	0.004587	0.000706	0.001725	0.011443	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000144	0.001065	0.003660	0.000395	0.001098	0.004662	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000135	0.001014	0.002903	0.000437	0.001143	0.004012	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000166	0.001067	0.004600	0.000436	0.001120	0.006475	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000103	0.000879	0.002330	0.000386	0.001031	0.003332	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000089	0.000823	0.003559	0.000407	0.000981	0.005798	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000103	0.000733	0.001572	0.000313	0.000863	0.002263	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000050	0.000676	0.002856	0.000302	0.000738	0.004180	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000204	0.001383	0.002649	0.000563	0.002038	0.004427	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000065	0.000528	0.001056	0.000213	0.000636	0.001528	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000181	0.001086	0.001986	0.000387	0.001486	0.003041	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000062	0.000497	0.000993	0.000202	0.000593	0.001387	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000037	0.000299	0.000507	0.000101	0.000335	0.000596	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000009**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	1.6538	1.9400	2.3021	1.7899	2.0405	2.5160	34.10	8.00	0.95	36.91	8.41	1.04	0	5	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	1.6335	1.9206	2.3271	1.7655	2.0168	2.5538	32.25	7.58	0.92	34.85	7.96	1.01	0	5	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	1.5982	1.8675	2.2560	1.7481	1.9913	2.5330	30.83	7.20	0.87	33.72	7.68	0.98	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	1.8913	2.1553	2.5997	1.9850	2.2216	2.8920	32.82	8.60	1.04	34.45	8.87	1.15	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	1.8764	2.1340	2.5460	1.9766	2.2093	2.8438	31.59	8.62	1.03	33.28	8.93	1.15	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	1.5542	1.8214	2.2271	1.9533	2.1389	2.5393	25.34	7.42	0.91	31.84	8.72	1.03	0	4	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	1.8678	2.1173	2.5103	1.9799	2.2097	2.8492	30.45	8.63	1.02	32.28	9.01	1.16	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	1.5564	1.8232	2.1657	1.9640	2.1532	2.4973	24.51	7.47	0.89	30.93	8.82	1.02	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	1.8633	2.1059	2.4877	1.9889	2.2176	2.9164	29.34	8.62	1.02	31.32	9.08	1.19	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	1.5232	1.7932	2.1434	1.9334	2.1264	2.4717	23.11	7.35	0.88	29.34	8.71	1.01	0	1	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	1.8371	2.0783	2.4602	1.9423	2.1637	2.7128	27.88	8.52	1.01	29.48	8.87	1.11	0	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	1.7895	2.0302	2.4105	1.9014	2.1298	2.6913	26.09	8.29	0.98	27.72	8.70	1.10	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	1.4179	1.6909	2.0684	1.8434	2.0418	2.3948	19.79	6.85	0.84	25.73	8.27	0.97	0	2	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	1.7850	2.0220	2.4046	1.9007	2.1268	2.7071	24.92	8.19	0.97	26.53	8.61	1.10	0	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	1.4259	1.7021	2.1105	1.8387	2.0347	2.4120	18.98	6.80	0.84	24.47	8.12	0.96	4	8	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	1.7778	1.9914	2.3285	1.9024	2.1079	2.5920	23.66	7.95	0.93	25.32	8.42	1.03	0	1	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	1.4194	1.6947	2.0972	1.8210	2.0128	2.3625	17.92	6.63	0.82	22.99	7.88	0.92	0	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	1.4103	1.6831	2.0374	1.8286	2.0247	2.3375	16.79	6.41	0.78	21.77	7.71	0.89	1	5	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	1.7598	1.9768	2.3468	1.8308	2.0210	2.4430	20.95	7.53	0.89	21.80	7.70	0.93	0	1	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	1.7205	1.9360	2.2014	1.8076	2.0045	2.2996	19.16	7.11	0.81	20.13	7.37	0.85	1	2	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	1.7256	1.9245	2.2769	1.8184	1.9994	2.4154	19.22	7.07	0.84	20.25	7.35	0.89	0	1	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	1.6816	1.9063	2.1378	1.7651	1.9724	2.2325	17.34	6.68	0.75	18.20	6.91	0.78	1	7	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	1.6916	1.8857	2.2261	1.7794	1.9458	2.3317	17.44	6.61	0.78	18.34	6.82	0.82	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	1.8233	2.0244	2.2314	1.8859	1.8845	2.3668	18.80	7.10	0.78	19.44	6.61	0.83	2	4	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	1.6179	1.8444	2.0627	1.7011	1.9131	2.1571	15.23	6.08	0.68	16.01	6.30	0.71	0	1	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	1.7703	1.9818	2.1850	1.8232	2.0579	2.2940	16.66	6.53	0.72	17.16	6.78	0.76	1	2	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	1.6122	1.8342	2.0497	1.6939	1.9006	2.1366	13.57	5.56	0.62	14.26	5.76	0.65	10	4	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	1.5110	1.7436	1.9361	1.5794	1.7928	1.9853	11.02	4.70	0.52	11.51	4.84	0.54	0	1	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.003021	0.016466	0.034016	0.009898	0.017362	0.055179	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000004	0.000006
0.002834	0.015833	0.037996	0.009194	0.016606	0.062340	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000005	0.000006
0.001796	0.014541	0.035178	0.009072	0.016407	0.064630	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003935	0.019954	0.065787	0.009778	0.021027	0.131532	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003431	0.018657	0.056967	0.009497	0.020162	0.118646	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002369	0.014286	0.037381	0.007735	0.014627	0.055422	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.002967	0.017578	0.051913	0.009720	0.019987	0.120102	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002462	0.014318	0.030113	0.008433	0.015306	0.046376	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002731	0.016796	0.048952	0.010335	0.020237	0.138630	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002273	0.013515	0.029170	0.007573	0.014493	0.043793	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002490	0.015534	0.045953	0.008274	0.017430	0.088368	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002029	0.013623	0.040835	0.007462	0.016238	0.084412	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001375	0.010913	0.026350	0.005294	0.011877	0.037161	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.002121	0.013168	0.040375	0.007684	0.015937	0.087830	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001719	0.011224	0.029719	0.005164	0.011567	0.040084	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000003	0.000004
0.000976	0.011496	0.032510	0.007005	0.014385	0.066219	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.001716	0.011014	0.028716	0.004535	0.010803	0.034598	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001639	0.010675	0.023755	0.005069	0.011249	0.030389	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.001971	0.010980	0.034914	0.004983	0.010919	0.045549	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001323	0.009814	0.020421	0.004711	0.010683	0.026804	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.001098	0.009039	0.029299	0.004802	0.009938	0.042603	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001505	0.009218	0.015705	0.004374	0.010087	0.020800	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002
0.000663	0.008004	0.025518	0.003832	0.008132	0.034193	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002003	0.011970	0.018878	0.005171	0.000081	0.044729	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.001109	0.007787	0.012426	0.003490	0.008704	0.016499	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002093	0.010935	0.016352	0.004354	0.014025	0.022814	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.001074	0.007468	0.011928	0.003370	0.008270	0.015371	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000001	0.000001	0.000000	0.000000	0.000001	0.000003
0.000858	0.005911	0.008056	0.002255	0.006249	0.008985	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000034**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	1.6538	1.9400	2.3021	1.7899	2.0405	2.5160	34.10	8.00	0.95	36.91	8.41	1.04	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	1.6335	1.9206	2.3271	1.7655	2.0168	2.5538	32.25	7.58	0.92	34.85	7.96	1.01	3	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.7481	1.9913	2.5330	0.00	0.00	0.00	33.72	7.68	0.98	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	1.8913	2.1553	2.5997	1.9850	2.2216	2.8920	32.82	8.60	1.04	34.45	8.87	1.15	2	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	1.8764	2.1340	2.5460	1.9766	2.2093	2.8438	31.59	8.62	1.03	33.28	8.93	1.15	2	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	1.5542	1.8214	2.2271	1.9533	2.1389	2.5393	25.34	7.42	0.91	31.84	8.72	1.03	3	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	1.8678	2.1173	2.5103	1.9799	2.2097	2.8492	30.45	8.63	1.02	32.28	9.01	1.16	1	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	1.5564	1.8232	2.1657	1.9640	2.1532	2.4973	24.51	7.47	0.89	30.93	8.82	1.02	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	1.8633	2.1059	2.4877	1.9889	2.2176	2.9164	29.34	8.62	1.02	31.32	9.08	1.19	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	1.5232	1.7932	2.1434	1.9334	2.1264	2.4717	23.11	7.35	0.88	29.34	8.71	1.01	0	0	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	1.8371	2.0783	2.4602	1.9423	2.1637	2.7128	27.88	8.52	1.01	29.48	8.87	1.11	2	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	1.7895	2.0302	2.4105	1.9014	2.1298	2.6913	26.09	8.29	0.98	27.72	8.70	1.10	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	1.4179	1.6909	2.0684	1.8434	2.0418	2.3948	19.79	6.85	0.84	25.73	8.27	0.97	2	0	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	1.7850	2.0220	2.4046	1.9007	2.1268	2.7071	24.92	8.19	0.97	26.53	8.61	1.10	1	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	1.4259	1.7021	2.1105	1.8387	2.0347	2.4120	18.98	6.80	0.84	24.47	8.12	0.96	8	3	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.9024	2.1079	2.5920	0.00	0.00	0.00	25.32	8.42	1.03	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	1.4194	1.6947	2.0972	1.8210	2.0128	2.3625	17.92	6.63	0.82	22.99	7.88	0.92	0	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	1.4103	1.6831	2.0374	1.8286	2.0247	2.3375	16.79	6.41	0.78	21.77	7.71	0.89	5	1	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	1.7598	1.9768	2.3468	1.8308	2.0210	2.4430	20.95	7.53	0.89	21.80	7.70	0.93	1	0	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	1.7205	1.9360	2.2014	1.8076	2.0045	2.2996	19.16	7.11	0.81	20.13	7.37	0.85	2	1	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	1.7256	1.9245	2.2769	1.8184	1.9994	2.4154	19.22	7.07	0.84	20.25	7.35	0.89	1	0	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	1.6816	1.9063	2.1378	1.7651	1.9724	2.2325	17.34	6.68	0.75	18.20	6.91	0.78	7	0	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	1.6916	1.8857	2.2261	1.7794	1.9458	2.3317	17.44	6.61	0.78	18.34	6.82	0.82	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	1.8233	2.0244	2.2314	1.8859	1.8845	2.3668	18.80	7.10	0.78	19.44	6.61	0.83	4	3	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	1.6179	1.8444	2.0627	1.7011	1.9131	2.1571	15.23	6.08	0.68	16.01	6.30	0.71	1	1	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	1.7703	1.9818	2.1850	1.8232	2.0579	2.2940	16.66	6.53	0.72	17.16	6.78	0.76	2	2	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	1.6122	1.8342	2.0497	1.6939	1.9006	2.1366	13.57	5.56	0.62	14.26	5.76	0.65	5	9	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	1.5110	1.7436	1.9361	1.5794	1.7928	1.9853	11.02	4.70	0.52	11.51	4.84	0.54	1	0	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.003021	0.016466	0.034016	0.009898	0.017362	0.055179	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002834	0.015833	0.037996	0.009194	0.016606	0.062340	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.001796	0.014541	0.035178	0.009072	0.016407	0.064630	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003935	0.019954	0.065787	0.009778	0.021027	0.131532	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003431	0.018657	0.056967	0.009497	0.020162	0.118646	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002369	0.014286	0.037381	0.007735	0.014627	0.055422	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002967	0.017578	0.051913	0.009720	0.019987	0.120102	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002462	0.014318	0.030113	0.008433	0.015306	0.046376	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002731	0.016796	0.048952	0.010335	0.020237	0.138630	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002273	0.013515	0.029170	0.007573	0.014493	0.043793	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002490	0.015534	0.045953	0.008274	0.017430	0.088368	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002029	0.013623	0.040835	0.007462	0.016238	0.084412	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001375	0.010913	0.026350	0.005294	0.011877	0.037161	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002121	0.013168	0.040375	0.007684	0.015937	0.087830	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001719	0.011224	0.029719	0.005164	0.011567	0.040084	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000976	0.011496	0.032510	0.007005	0.014385	0.066219	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001716	0.011014	0.028716	0.004535	0.010803	0.034598	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001639	0.010675	0.023755	0.005069	0.011249	0.030389	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001971	0.010980	0.034914	0.004983	0.010919	0.045549	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001323	0.009814	0.020421	0.004711	0.010683	0.026804	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001098	0.009039	0.029299	0.004802	0.009938	0.042603	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001505	0.009218	0.015705	0.004374	0.010087	0.020800	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000663	0.008004	0.025518	0.003832	0.008132	0.034193	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002003	0.011970	0.018878	0.005171	0.000081	0.044729	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001109	0.007787	0.012426	0.003490	0.008704	0.016499	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002093	0.010935	0.016352	0.004354	0.014025	0.022814	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001074	0.007468	0.011928	0.003370	0.008270	0.015371	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000858	0.005911	0.008056	0.002255	0.006249	0.008985	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000005**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	1.6538	1.9400	2.3021	1.7899	2.0405	2.5160	34.10	8.00	0.95	36.91	8.41	1.04	0	0	10.20	0.000004	0.000004
2	Ship	Tanker	110,000	1.6335	1.9206	2.3271	1.7655	2.0168	2.5538	32.25	7.58	0.92	34.85	7.96	1.01	3	0	10.20	0.000004	0.000004
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.7481	1.9913	2.5330	0.00	0.00	0.00	33.72	7.68	0.98	0	0	10.20	0.000004	0.000004
4	Ship	Bulk Carrier	85,000	1.8913	2.1553	2.5997	1.9850	2.2216	2.8920	32.82	8.60	1.04	34.45	8.87	1.15	2	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	1.8764	2.1340	2.5460	1.9766	2.2093	2.8438	31.59	8.62	1.03	33.28	8.93	1.15	2	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	1.5542	1.8214	2.2271	1.9533	2.1389	2.5393	25.34	7.42	0.91	31.84	8.72	1.03	3	0	1.64	0.000004	0.000013
7	Ship	Bulk Carrier	75,000	1.8678	2.1173	2.5103	1.9799	2.2097	2.8492	30.45	8.63	1.02	32.28	9.01	1.16	1	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	1.5564	1.8232	2.1657	1.9640	2.1532	2.4973	24.51	7.47	0.89	30.93	8.82	1.02	0	0	1.64	0.000004	0.000013
9	Ship	Bulk Carrier	70,000	1.8633	2.1059	2.4877	1.9889	2.2176	2.9164	29.34	8.62	1.02	31.32	9.08	1.19	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	1.5232	1.7932	2.1434	1.9334	2.1264	2.4717	23.11	7.35	0.88	29.34	8.71	1.01	0	0	1.64	0.000004	0.000013
11	Ship	Bulk Carrier	65,000	1.8371	2.0783	2.4602	1.9423	2.1637	2.7128	27.88	8.52	1.01	29.48	8.87	1.11	2	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	1.7895	2.0302	2.4105	1.9014	2.1298	2.6913	26.09	8.29	0.98	27.72	8.70	1.10	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	1.4179	1.6909	2.0684	1.8434	2.0418	2.3948	19.79	6.85	0.84	25.73	8.27	0.97	2	0	1.64	0.000004	0.000013
14	Ship	Bulk Carrier	55,000	1.7850	2.0220	2.4046	1.9007	2.1268	2.7071	24.92	8.19	0.97	26.53	8.61	1.10	1	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	1.4259	1.7021	2.1105	1.8387	2.0347	2.4120	18.98	6.80	0.84	24.47	8.12	0.96	8	3	1.64	0.000004	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.9024	2.1079	2.5920	0.00	0.00	0.00	25.32	8.42	1.03	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	1.4194	1.6947	2.0972	1.8210	2.0128	2.3625	17.92	6.63	0.82	22.99	7.88	0.92	0	0	1.64	0.000004	0.000013
18	Ship	Tanker	40,000	1.4103	1.6831	2.0374	1.8286	2.0247	2.3375	16.79	6.41	0.78	21.77	7.71	0.89	5	1	1.64	0.000004	0.000013
19	Ship	Bulk Carrier	40,000	1.7598	1.9768	2.3468	1.8308	2.0210	2.4430	20.95	7.53	0.89	21.80	7.70	0.93	1	0	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	1.7205	1.9360	2.2014	1.8076	2.0045	2.2996	19.16	7.11	0.81	20.13	7.37	0.85	2	1	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	1.7256	1.9245	2.2769	1.8184	1.9994	2.4154	19.22	7.07	0.84	20.25	7.35	0.89	1	0	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	1.6816	1.9063	2.1378	1.7651	1.9724	2.2325	17.34	6.68	0.75	18.20	6.91	0.78	7	0	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	1.6916	1.8857	2.2261	1.7794	1.9458	2.3317	17.44	6.61	0.78	18.34	6.82	0.82	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	1.8233	2.0244	2.2314	1.8859	1.8845	2.3668	18.80	7.10	0.78	19.44	6.61	0.83	4	3	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	1.6179	1.8444	2.0627	1.7011	1.9131	2.1571	15.23	6.08	0.68	16.01	6.30	0.71	1	1	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	1.7703	1.9818	2.1850	1.8232	2.0579	2.2940	16.66	6.53	0.72	17.16	6.78	0.76	2	2	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	1.6122	1.8342	2.0497	1.6939	1.9006	2.1366	13.57	5.56	0.62	14.26	5.76	0.65	5	9	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	1.5110	1.7436	1.9361	1.5794	1.7928	1.9853	11.02	4.70	0.52	11.51	4.84	0.54	1	0	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.003021	0.016466	0.034016	0.009898	0.017362	0.055179	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002834	0.015833	0.037996	0.009194	0.016606	0.062340	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000001
0.001796	0.014541	0.035178	0.009072	0.016407	0.064630	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003935	0.019954	0.065787	0.009778	0.021027	0.131532	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000001
0.003431	0.018657	0.056967	0.009497	0.020162	0.118646	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.002369	0.014286	0.037381	0.007735	0.014627	0.055422	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002967	0.017578	0.051913	0.009720	0.019987	0.120102	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002462	0.014318	0.030113	0.008433	0.015306	0.046376	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002731	0.016796	0.048952	0.010335	0.020237	0.138630	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002273	0.013515	0.029170	0.007573	0.014493	0.043793	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002490	0.015534	0.045953	0.008274	0.017430	0.088368	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002029	0.013623	0.040835	0.007462	0.016238	0.084412	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001375	0.010913	0.026350	0.005294	0.011877	0.037161	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002121	0.013168	0.040375	0.007684	0.015937	0.087830	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001719	0.011224	0.029719	0.005164	0.011567	0.040084	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000976	0.011496	0.032510	0.007005	0.014385	0.066219	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001716	0.011014	0.028716	0.004535	0.010803	0.034598	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001639	0.010675	0.023755	0.005069	0.011249	0.030389	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001971	0.010980	0.034914	0.004983	0.010919	0.045549	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001323	0.009814	0.020421	0.004711	0.010683	0.026804	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.001098	0.009039	0.029299	0.004802	0.009938	0.042603	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001505	0.009218	0.015705	0.004374	0.010087	0.020800	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000001
0.000663	0.008004	0.025518	0.003832	0.008132	0.034193	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002003	0.011970	0.018878	0.005171	0.000081	0.044729	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.001109	0.007787	0.012426	0.003490	0.008704	0.016499	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002093	0.010935	0.016352	0.004354	0.014025	0.022814	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.001074	0.007468	0.011928	0.003370	0.008270	0.015371	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.000858	0.005911	0.008056	0.002255	0.006249	0.008985	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000011**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.5140	0.5140	0.5140	0.5140	0.5140	0.5140	10.60	2.12	0.21	10.60	2.12	0.21	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.5140	0.5140	0.5140	0.5140	0.5140	0.5140	10.15	2.03	0.20	10.15	2.03	0.20	3	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	9.91	1.98	0.20	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	17.86	4.11	0.41	17.86	4.11	0.41	2	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	17.32	4.16	0.42	17.32	4.16	0.42	2	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	8.38	2.09	0.21	16.77	4.19	0.42	3	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	16.77	4.19	0.42	16.77	4.19	0.42	1	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	8.09	2.10	0.21	16.21	4.21	0.42	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	16.21	4.21	0.42	16.21	4.21	0.42	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	7.80	2.11	0.21	15.62	4.22	0.42	0	0	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	15.62	4.22	0.42	15.62	4.22	0.42	2	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	15.00	4.20	0.42	15.00	4.20	0.42	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	7.18	2.08	0.21	14.36	4.17	0.42	2	0	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	14.36	4.17	0.42	14.36	4.17	0.42	1	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.84	2.05	0.21	13.70	4.11	0.41	8	3	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	13.70	4.11	0.41	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.49	2.01	0.20	12.99	4.03	0.40	0	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	0.5140	0.5140	0.5140	1.0290	1.0290	1.0290	6.12	1.96	0.20	12.25	3.92	0.39	5	1	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	12.25	3.92	0.39	12.25	3.92	0.39	1	0	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	11.46	3.78	0.38	11.46	3.78	0.38	2	1	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	11.46	3.78	0.38	11.46	3.78	0.38	1	0	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	7	0	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	4	3	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	9.68	3.39	0.34	9.68	3.39	0.34	1	1	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	9.68	3.39	0.34	9.68	3.39	0.34	2	2	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	8.66	3.12	0.31	8.66	3.12	0.31	5	9	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	7.50	2.78	0.28	7.50	2.78	0.28	1	0	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000000	0.000002	0.000007	0.000001	0.000002	0.000017	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000007	0.000001	0.000002	0.000018	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000006	0.000001	0.000002	0.000020	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000016	0.000000	0.000002	0.000068	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000012	0.000000	0.000002	0.000051	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000005	0.000000	0.000001	0.000012	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000010	0.000000	0.000002	0.000052	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000004	0.000000	0.000001	0.000009	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000009	0.000000	0.000002	0.000071	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000003	0.000000	0.000001	0.000006	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000006	0.000000	0.000001	0.000022	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000003	0.000000	0.000001	0.000014	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000002	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000003	0.000000	0.000001	0.000014	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000002	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000002	0.000000	0.000001	0.000009	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000002	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000001	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000001	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000002	0.000000	0.000000	0.000003	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000001	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000002	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000001	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	10.60	2.12	0.21	0	5	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	10.15	2.03	0.20	0	5	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	9.91	1.98	0.20	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	17.86	4.11	0.41	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	17.32	4.16	0.42	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.77	4.19	0.42	0	4	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.77	4.19	0.42	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.21	4.21	0.42	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.21	4.21	0.42	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.62	4.22	0.42	0	1	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.62	4.22	0.42	0	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.00	4.20	0.42	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	14.36	4.17	0.42	0	2	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	14.36	4.17	0.42	0	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	13.70	4.11	0.41	0	8	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	13.70	4.11	0.41	0	1	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	12.99	4.03	0.40	0	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	12.25	3.92	0.39	0	5	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	12.25	3.92	0.39	0	1	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	11.46	3.78	0.38	0	2	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	11.46	3.78	0.38	0	1	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	10.61	3.61	0.36	0	7	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	10.61	3.61	0.36	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	10.61	3.61	0.36	0	4	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	9.68	3.39	0.34	0	1	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	9.68	3.39	0.34	0	2	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	8.66	3.12	0.31	0	4	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	7.50	2.78	0.28	7.50	2.78	0.28	0	1	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000365	0.000963	0.000399	0.000915	0.000595	0.000217	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000329	0.000889	0.000364	0.000822	0.000555	0.000206	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000213	0.000983	0.000444	0.000835	0.000579	0.000226	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000416	0.000810	0.000197	0.000805	0.000524	0.000094	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000362	0.000790	0.000213	0.000766	0.000501	0.000097	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000262	0.000803	0.000342	0.000682	0.000505	0.000221	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000318	0.000800	0.000246	0.000781	0.000487	0.000097	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000272	0.000796	0.000340	0.000720	0.000493	0.000195	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000295	0.000799	0.000271	0.000819	0.000459	0.000087	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000233	0.000689	0.000284	0.000607	0.000430	0.000168	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000251	0.000692	0.000234	0.000630	0.000432	0.000114	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000182	0.000546	0.000181	0.000496	0.000331	0.000081	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000115	0.000482	0.000189	0.000364	0.000299	0.000124	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000185	0.000510	0.000173	0.000487	0.000306	0.000074	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000143	0.000456	0.000174	0.000354	0.000293	0.000126	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000087	0.000638	0.000268	0.000508	0.000362	0.000123	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000140	0.000439	0.000167	0.000317	0.000296	0.000134	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000132	0.000424	0.000164	0.000334	0.000270	0.000116	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000160	0.000422	0.000164	0.000338	0.000280	0.000128	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000101	0.000389	0.000144	0.000295	0.000244	0.000104	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000086	0.000419	0.000190	0.000314	0.000255	0.000125	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000099	0.000278	0.000098	0.000231	0.000177	0.000066	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000045	0.000373	0.000188	0.000246	0.000231	0.000128	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000201	0.000648	0.000258	0.000465	0.000524	0.000159	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000062	0.000204	0.000060	0.000159	0.000130	0.000046	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000174	0.000435	0.000153	0.000318	0.000361	0.000107	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000059	0.000197	0.000059	0.000152	0.000126	0.000045	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000151	0.000011	0.000025	0.000077	0.000071	0.000021	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	10.60	2.12	0.21	0	5	10.20	0.000003	0.000003
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	10.15	2.03	0.20	0	5	10.20	0.000003	0.000003
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	9.91	1.98	0.20	0	0	10.20	0.000003	0.000003
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	17.86	4.11	0.41	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	17.32	4.16	0.42	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.77	4.19	0.42	0	4	1.64	0.000003	0.000013
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.77	4.19	0.42	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.21	4.21	0.42	0	0	1.64	0.000003	0.000013
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.21	4.21	0.42	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.62	4.22	0.42	0	1	1.64	0.000003	0.000013
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.62	4.22	0.42	0	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.00	4.20	0.42	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	14.36	4.17	0.42	0	2	1.64	0.000003	0.000013
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	14.36	4.17	0.42	0	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	13.70	4.11	0.41	0	8	1.64	0.000003	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	13.70	4.11	0.41	0	1	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	12.99	4.03	0.40	0	0	1.64	0.000003	0.000013
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	12.25	3.92	0.39	0	5	1.64	0.000003	0.000013
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	12.25	3.92	0.39	0	1	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	11.46	3.78	0.38	0	2	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	11.46	3.78	0.38	0	1	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	10.61	3.61	0.36	0	7	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	10.61	3.61	0.36	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	10.61	3.61	0.36	0	4	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	9.68	3.39	0.34	0	1	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	9.68	3.39	0.34	0	2	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	8.66	3.12	0.31	0	4	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	7.50	2.78	0.28	7.50	2.78	0.28	0	1	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000365	0.000963	0.000399	0.000915	0.000595	0.000217	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000329	0.000889	0.000364	0.000822	0.000555	0.000206	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000213	0.000983	0.000444	0.000835	0.000579	0.000226	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000416	0.000810	0.000197	0.000805	0.000524	0.000094	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000362	0.000790	0.000213	0.000766	0.000501	0.000097	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000262	0.000803	0.000342	0.000682	0.000505	0.000221	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000318	0.000800	0.000246	0.000781	0.000487	0.000097	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000272	0.000796	0.000340	0.000720	0.000493	0.000195	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000295	0.000799	0.000271	0.000819	0.000459	0.000087	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000233	0.000689	0.000284	0.000607	0.000430	0.000168	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000251	0.000692	0.000234	0.000630	0.000432	0.000114	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000182	0.000546	0.000181	0.000496	0.000331	0.000081	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000115	0.000482	0.000189	0.000364	0.000299	0.000124	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000185	0.000510	0.000173	0.000487	0.000306	0.000074	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000143	0.000456	0.000174	0.000354	0.000293	0.000126	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000087	0.000638	0.000268	0.000508	0.000362	0.000123	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000140	0.000439	0.000167	0.000317	0.000296	0.000134	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000132	0.000424	0.000164	0.000334	0.000270	0.000116	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000160	0.000422	0.000164	0.000338	0.000280	0.000128	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000101	0.000389	0.000144	0.000295	0.000244	0.000104	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000086	0.000419	0.000190	0.000314	0.000255	0.000125	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000099	0.000278	0.000098	0.000231	0.000177	0.000066	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000045	0.000373	0.000188	0.000246	0.000231	0.000128	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000201	0.000648	0.000258	0.000465	0.000524	0.000159	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000062	0.000204	0.000060	0.000159	0.000130	0.000046	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000174	0.000435	0.000153	0.000318	0.000361	0.000107	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000059	0.000197	0.000059	0.000152	0.000126	0.000045	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000151	0.000011	0.000025	0.000077	0.000071	0.000021	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000001**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	1.3164	0.8885	0.5140	0.00	0.00	0.00	27.14	3.66	0.21	0	5	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	1.3061	0.8821	0.5140	0.00	0.00	0.00	25.78	3.48	0.20	0	5	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.3079	0.9016	0.5140	0.00	0.00	0.00	25.23	3.48	0.20	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.5924	1.1383	1.0290	0.00	0.00	0.00	27.63	4.54	0.41	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.5884	1.1508	1.0290	0.00	0.00	0.00	26.74	4.65	0.42	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.6354	1.3384	1.0290	0.00	0.00	0.00	26.66	5.45	0.42	0	4	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.5821	1.1494	1.0290	0.00	0.00	0.00	25.79	4.68	0.42	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.6213	1.3091	1.0290	0.00	0.00	0.00	25.53	5.36	0.42	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.5649	1.1248	1.0290	0.00	0.00	0.00	24.64	4.61	0.42	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.6005	1.2874	1.0290	0.00	0.00	0.00	24.29	5.27	0.42	0	1	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.5794	1.1993	1.0290	0.00	0.00	0.00	23.97	4.91	0.42	0	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.5321	1.1421	1.0290	0.00	0.00	0.00	22.34	4.66	0.42	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.5521	1.2516	1.0290	0.00	0.00	0.00	21.67	5.07	0.42	0	2	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.5164	1.1257	1.0290	0.00	0.00	0.00	21.17	4.56	0.42	0	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	1.5517	1.2576	1.0290	0.00	0.00	0.00	20.65	5.02	0.41	0	8	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.5650	1.2298	1.0290	0.00	0.00	0.00	20.83	4.91	0.41	0	1	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	1.5615	1.2752	1.0290	0.00	0.00	0.00	19.72	4.99	0.40	0	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	1.5376	1.2438	1.0290	0.00	0.00	0.00	18.30	4.74	0.39	0	5	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	1.5485	1.2644	1.0290	0.00	0.00	0.00	18.43	4.82	0.39	0	1	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	1.5213	1.2276	1.0290	0.00	0.00	0.00	16.94	4.51	0.38	0	2	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	1.5367	1.2646	1.0290	0.00	0.00	0.00	17.11	4.65	0.38	0	1	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	1.4598	1.1484	1.0290	0.00	0.00	0.00	15.05	4.03	0.36	0	7	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	1.5351	1.2822	1.0290	0.00	0.00	0.00	15.83	4.49	0.36	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	1.6397	1.2786	1.0290	0.00	0.00	0.00	16.90	4.48	0.36	0	4	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	1.0947	1.0290	1.0290	0.00	0.00	0.00	10.30	3.39	0.34	0	1	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	1.5787	1.2186	1.0290	0.00	0.00	0.00	14.86	4.01	0.34	0	2	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	1.4088	1.0997	1.0290	0.00	0.00	0.00	11.86	3.33	0.31	0	4	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	1.4062	1.0619	1.0290	1.3163	1.0290	1.0290	10.25	2.86	0.28	9.60	2.78	0.28	0	1	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			Total
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.003138	0.009646	0.005951	0.008306	0.006776	0.003653	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000001	0.000000	0.000000	0.000001
0.002940	0.009269	0.005665	0.007742	0.006543	0.003589	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.001852	0.009801	0.006570	0.007723	0.006660	0.003840	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003945	0.009363	0.003571	0.008037	0.006882	0.001960	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003483	0.009165	0.003856	0.007787	0.006666	0.002052	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002460	0.008754	0.005573	0.006728	0.006127	0.003931	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003049	0.009134	0.004322	0.007953	0.006510	0.002042	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002555	0.008694	0.005537	0.007144	0.006080	0.003562	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002820	0.009019	0.004666	0.008390	0.006246	0.001868	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002350	0.008087	0.005005	0.006451	0.005686	0.003305	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002565	0.008350	0.004327	0.006817	0.005985	0.002441	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002083	0.007393	0.003790	0.006053	0.005215	0.001998	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.008207	0.004068	0.004658	0.004706	0.002912	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002171	0.007074	0.003694	0.006079	0.004974	0.001886	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001760	0.006578	0.003825	0.004562	0.004630	0.002971	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000942	0.007931	0.005033	0.005902	0.005293	0.002711	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001756	0.006433	0.003749	0.004121	0.004667	0.003150	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001676	0.006311	0.003724	0.004451	0.004427	0.002833	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002012	0.006234	0.003692	0.004421	0.004479	0.003038	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001344	0.006048	0.003268	0.004145	0.004198	0.002679	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001097	0.007349	0.003036	0.004254	0.004193	0.003036	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001522	0.005071	0.002770	0.003739	0.003585	0.002040	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000605	0.005734	0.004333	0.003519	0.003941	0.003211	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002070	0.007685	0.004217	0.004958	0.006877	0.003206	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001115	0.004355	0.001833	0.006088	0.001636	0.000057	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002134	0.006272	0.003087	0.004023	0.005649	0.002604	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001078	0.004254	0.001804	0.002919	0.003017	0.001580	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000851	0.003094	0.001038	0.001973	0.002277	0.000939	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000006**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.003138	0.009646	0.005951	0.008306	0.006776	0.003653	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002940	0.009269	0.005665	0.007742	0.006543	0.003589	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001852	0.009801	0.006570	0.007723	0.006660	0.003840	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003945	0.009363	0.003571	0.008037	0.006882	0.001960	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003483	0.009165	0.003856	0.007787	0.006666	0.002052	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002460	0.008754	0.005573	0.006728	0.006127	0.003931	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003049	0.009134	0.004322	0.007953	0.006510	0.002042	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002555	0.008694	0.005537	0.007144	0.006080	0.003562	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002820	0.009019	0.004666	0.008390	0.006246	0.001868	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002350	0.008087	0.005005	0.006451	0.005686	0.003305	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002565	0.008350	0.004327	0.006817	0.005985	0.002441	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002083	0.007393	0.003790	0.006053	0.005215	0.001998	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.008207	0.004068	0.004658	0.004706	0.002912	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002171	0.007074	0.003694	0.006079	0.004974	0.001886	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001760	0.006578	0.003825	0.004562	0.004630	0.002971	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000942	0.007931	0.005033	0.005902	0.005293	0.002711	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001756	0.006433	0.003749	0.004121	0.004667	0.003150	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001676	0.006311	0.003724	0.004451	0.004427	0.002833	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002012	0.006234	0.003692	0.004421	0.004479	0.003038	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001344	0.006048	0.003268	0.004145	0.004198	0.002679	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001097	0.007349	0.003036	0.004254	0.004193	0.003036	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001522	0.005071	0.002770	0.003739	0.003585	0.002040	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000605	0.005734	0.004333	0.003519	0.003941	0.003211	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002070	0.007685	0.004217	0.004958	0.006877	0.003206	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001115	0.004355	0.001833	0.006088	0.001636	0.000057	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002134	0.006272	0.003087	0.004023	0.005649	0.002604	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001078	0.004254	0.001804	0.002919	0.003017	0.001580	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000851	0.003094	0.001038	0.001973	0.002277	0.000939	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.003138	0.009646	0.005951	0.008306	0.006776	0.003653	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002940	0.009269	0.005665	0.007742	0.006543	0.003589	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001852	0.009801	0.006570	0.007723	0.006660	0.003840	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003945	0.009363	0.003571	0.008037	0.006882	0.001960	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003483	0.009165	0.003856	0.007787	0.006666	0.002052	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002460	0.008754	0.005573	0.006728	0.006127	0.003931	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003049	0.009134	0.004322	0.007953	0.006510	0.002042	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002555	0.008694	0.005537	0.007144	0.006080	0.003562	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002820	0.009019	0.004666	0.008390	0.006246	0.001868	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002350	0.008087	0.005005	0.006451	0.005686	0.003305	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002565	0.008350	0.004327	0.006817	0.005985	0.002441	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002083	0.007393	0.003790	0.006053	0.005215	0.001998	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.008207	0.004068	0.004658	0.004706	0.002912	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002171	0.007074	0.003694	0.006079	0.004974	0.001886	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001760	0.006578	0.003825	0.004562	0.004630	0.002971	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000942	0.007931	0.005033	0.005902	0.005293	0.002711	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001756	0.006433	0.003749	0.004121	0.004667	0.003150	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001676	0.006311	0.003724	0.004451	0.004427	0.002833	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002012	0.006234	0.003692	0.004421	0.004479	0.003038	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001344	0.006048	0.003268	0.004145	0.004198	0.002679	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001097	0.007349	0.003036	0.004254	0.004193	0.003036	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001522	0.005071	0.002770	0.003739	0.003585	0.002040	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000605	0.005734	0.004333	0.003519	0.003941	0.003211	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002070	0.007685	0.004217	0.004958	0.006877	0.003206	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001115	0.004355	0.001833	0.006088	0.001636	0.000057	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002134	0.006272	0.003087	0.004023	0.005649	0.002604	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001078	0.004254	0.001804	0.002919	0.003017	0.001580	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000851	0.003094	0.001038	0.001973	0.002277	0.000939	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			Total
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

SUBSTRUCTURE ANNUAL FREQUENCY OF COLLAPSE (WATER ELEVATION -0.1 CD)

Pier ID	Description	Ultimate Lateral Capacity, H (MN)	Annual Frequency of Collapse, AF			Return Period
		Foundation	Inbound	Outbound	Total	
1	Pier 14	**25**	0.00000000	0.00000000	0.00000000	67,312,597,279
2	Pier 15	**100**	0.00000000	0.00000000	0.00000000	-
3	Pier 16	**90**	0.00000087	0.00000000	0.00000087	1,145,120
	Total for Bridge Piers:		0.00000087	0.00000000	0.00000087	**1,145,101**

VESSEL FLEET CHARACTERISTICS

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Vessel Size (m)		Vessel Drafts (m)				Vessel Displacement (tonnes)		Channel Width, C (m)	Centerline Transit Path to Edge of Channel, x_C (m)	Minimum Design Impact Speed, V_{min} (m/sec)		Standard Deviation, σ (m)	
				Length Overall, LOA	Beam/ Width, B	Operational Loaded, D_O	Ballasted			Loaded, W_L	Ballasted, W_E			Loaded	Ballasted	Loaded	Ballasted
							Stern, D_{ES}	Bow, D_{EB}	Average, D_{AVG}								
1	Ship	Tanker	120,000	250	44	11.9	8.2	4.7	6.5	101,270	54,890	125.4	62.7	0.514	0.514	80	80
2	Ship	Tanker	110,000	240	44	11.8	8.3	4.9	6.6	95,920	53,650	125.4	62.7	0.514	0.514	79	79
3	Ship	Tanker	105,000	244	42	13.0	8.4	5.0	6.7	102,480	52,820	119.7	59.9	0.514	0.514	80	80
4	Ship	Bulk Carrier	85,000	229	32	11.7	8.6	5.4	7.0	67,920	40,640	110.0	55.0	1.029	1.029	78	78
5	Ship	Bulk Carrier	80,000	225	32	11.9	8.4	5.2	6.8	67,900	38,800	110.0	55.0	1.029	1.029	78	78
6	Ship	Tanker	75,000	228	34	11.3	8.3	5.1	6.7	66,730	39,570	110.0	55.0	0.514	1.029	78	78
7	Ship	Bulk Carrier	75,000	225	32	12.1	7.8	4.6	6.2	68,640	35,180	110.0	55.0	1.029	1.029	78	78
8	Ship	Tanker	70,000	228	32	11.0	7.4	4.2	5.8	62,330	32,870	110.0	55.0	0.514	1.029	78	78
9	Ship	Bulk Carrier	70,000	225	32	12.0	6.8	3.6	5.2	67,680	29,330	110.0	55.0	1.029	1.029	78	78
10	Ship	Tanker	65,000	214	32	10.9	7.5	4.5	6.0	57,520	31,660	110.0	55.0	0.514	1.029	77	77
11	Ship	Bulk Carrier	65,000	212	32	11.7	7.8	4.8	6.3	61,920	33,350	110.0	55.0	1.029	1.029	77	77
12	Ship	Bulk Carrier	60,000	193	32	11.6	7.2	4.5	5.9	55,590	28,040	110.0	55.0	1.029	1.029	75	75
13	Ship	Tanker	55,000	184	32	11.4	8.3	5.7	7.0	51,250	31,470	110.0	55.0	0.514	1.029	74	74
14	Ship	Bulk Carrier	55,000	190	32	10.9	6.3	3.6	5.0	51,210	23,260	110.0	55.0	1.029	1.029	75	75
15	Ship	Tanker	50,000	183	32	10.6	8.2	5.6	6.9	47,500	30,920	110.0	55.0	0.514	1.029	74	74
16	Ship	Bulk Carrier	50,000	199	30	12.2	7.0	4.2	5.6	56,210	25,810	110.0	55.0	1.029	1.029	76	76
17	Ship	Tanker	45,000	181	32	10.3	8.6	6.1	7.4	45,340	32,350	110.0	55.0	0.514	1.029	74	74
18	Ship	Tanker	40,000	179	28	10.1	7.5	5.0	6.3	38,430	23,780	110.0	55.0	0.514	1.029	74	74
19	Ship	Bulk Carrier	40,000	181	30	9.1	7.2	4.7	6.0	37,700	24,650	110.0	55.0	1.029	1.029	74	74
20	Ship	Tanker	35,000	173	27	10.2	7.3	4.9	6.1	35,600	21,290	110.0	55.0	1.029	1.029	73	73
21	Ship	Bulk Carrier	35,000	177	29	9.7	6.5	4.0	5.3	37,830	20,480	110.0	55.0	1.029	1.029	73	73
22	Ship	Tanker	30,000	159	27	9.2	6.5	4.3	5.4	29,160	17,120	110.0	55.0	1.029	1.029	71	71
23	Ship	Bulk Carrier	30,000	170	27	9.5	6.6	4.2	5.4	32,770	18,630	110.0	55.0	1.029	1.029	72	72
24	Ship	Articulated Tug/Barge	30,000	210	23	9.3	5.0	5.0	5.0	32,470	17,460	110.0	55.0	1.029	1.029	77	77
25	Ship	Tanker	25,000	146	24	9.2	6.5	4.5	5.5	22,970	13,740	110.0	55.0	1.029	1.029	69	69
26	Ship	Articulated Tug/Barge	25,000	184	24	8.3	5.0	5.0	5.0	26,090	15,720	110.0	55.0	1.029	1.029	74	74
27	Ship	Tanker	20,000	145	24	8.7	6.1	4.1	5.1	20,880	12,240	110.0	55.0	1.029	1.029	69	69
28	Ship	Tanker	15,000	127	20	8.1	6.3	4.5	5.4	14,280	9,520	110.0	55.0	1.029	1.029	65	65

Notes:

Weight of Water (W_W) = **0.9854** m^3/tonne (used to determine ship loaded/ballasted displacement tonnage based on approximate salinity of water in Vancouver Harbor)

VESSEL FLEET ANNUAL TRIP FREQUENCY

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Annual Number of Trips (N)						Existing Total Trips	Growth Factor [1]	Future Total Trips
				Inbound			Outbound					
				Loaded	Ballasted	Total	Loaded	Ballasted	Total			
1	Ship	Tanker	120,000	0	5	5	0	0	0	5	10.20	51
2	Ship	Tanker	110,000	0	4	4	0	0	0	4	10.20	41
3	Ship	Tanker	105,000	0	1	1	0	0	0	1	10.20	10
4	Ship	Bulk Carrier	85,000	0	5	5	3	0	3	8	1.28	10
5	Ship	Bulk Carrier	80,000	0	5	5	3	0	3	8	1.28	10
6	Ship	Tanker	75,000	0	3	3	0	0	0	3	1.64	5
7	Ship	Bulk Carrier	75,000	0	4	4	2	0	2	6	1.28	8
8	Ship	Tanker	70,000	0	0	0	0	0	0	0	1.64	0
9	Ship	Bulk Carrier	70,000	0	1	1	1	0	1	2	1.28	3
10	Ship	Tanker	65,000	0	1	1	0	0	0	1	1.64	2
11	Ship	Bulk Carrier	65,000	0	6	6	0	9	9	15	1.28	19
12	Ship	Bulk Carrier	60,000	0	2	2	0	0	0	2	1.28	3
13	Ship	Tanker	55,000	0	2	2	0	0	0	2	1.64	3
14	Ship	Bulk Carrier	55,000	0	3	3	0	0	0	3	1.28	4
15	Ship	Tanker	50,000	4	7	11	8	3	11	22	1.64	36
16	Ship	Bulk Carrier	50,000	0	0	0	0	0	0	0	1.28	0
17	Ship	Tanker	45,000	0	0	0	0	0	0	0	1.64	0
18	Ship	Tanker	40,000	1	4	5	5	0	5	10	1.64	16
19	Ship	Bulk Carrier	40,000	0	1	1	1	0	1	2	1.28	3
20	Ship	Tanker	35,000	1	2	3	2	1	3	6	1.64	10
21	Ship	Bulk Carrier	35,000	0	0	0	0	0	0	0	1.28	0
22	Ship	Tanker	30,000	0	7	7	7	0	7	14	1.64	23
23	Ship	Bulk Carrier	30,000	0	0	0	1	0	1	1	1.28	1
24	Ship	Articulated Tug/Barge	30,000	3	4	7	4	2	6	13	1.28	17
25	Ship	Tanker	25,000	0	1	1	1	0	1	2	1.64	3
26	Ship	Articulated Tug/Barge	25,000	1	2	3	2	1	3	6	1.28	8
27	Ship	Tanker	20,000	9	4	13	4	9	13	26	1.64	43
28	Ship	Tanker	15,000	0	1	1	1	0	1	2	1.64	3
		Total Trips:		19	75	94	45	25	70	164		332

Notes:

[1] As part of the risk analysis, vessel trips will include future growth in the waterway that are projected to the mid-point of the remaining design life (assumed 50 years) of the structure. This equates to growth rates per year as follows for a 25-year projection. GF = (1+PERCENT/100)^{25}

- Aframax Tankers (DWT greater than 100,000 tonnes) = 9.735%
- All Other Tankers = 2.0%
- All Other Vessels = 1.0%

VESSEL FLEET TRANSIT SPEEDS IN MAIN CHANNEL

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Vessel Transit Speeds (knots)				Vessel Transit Speeds (m/sec) [1]			
				Inbound		Outbound		Inbound		Outbound	
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted
1	Ship	Tanker	120,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
2	Ship	Tanker	110,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
3	Ship	Tanker	105,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
4	Ship	Bulk Carrier	85,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
5	Ship	Bulk Carrier	80,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
6	Ship	Tanker	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
7	Ship	Bulk Carrier	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
8	Ship	Tanker	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
9	Ship	Bulk Carrier	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
10	Ship	Tanker	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
11	Ship	Bulk Carrier	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
12	Ship	Bulk Carrier	60,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
13	Ship	Tanker	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
14	Ship	Bulk Carrier	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
15	Ship	Tanker	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
16	Ship	Bulk Carrier	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
17	Ship	Tanker	45,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
18	Ship	Tanker	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
19	Ship	Bulk Carrier	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
20	Ship	Tanker	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
21	Ship	Bulk Carrier	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
22	Ship	Tanker	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
23	Ship	Bulk Carrier	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
24	Ship	Articulated Tug/Barge	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
25	Ship	Tanker	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
26	Ship	Articulated Tug/Barge	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
27	Ship	Tanker	20,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
28	Ship	Tanker	15,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866

Notes:

[1] Conversion (knot to m/sec) = 0.51 (convert vessel transit speeds from knots to meters/second for use in risk assessment equations)

ABERRANCY BASE RATE COMPUTATIONS

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Code Recommended Aberrancy Base Rate, BR	Vessel Traffic Service, VTS	Electronic Chart Display & Information System, ECDIS	Other Navigation Aids	Port Control State, PCS	Pilotage 1 Pilot	Pilotage 2 Pilots (MRA-2)		Daytime Only Transit Restrictions (MRA-2)		Visibility Restrictions (MRA-2)	Adjusted Aberrancy Base Rate, BR [1]	
										Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
2	Ship	Tanker	110,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
3	Ship	Tanker	105,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
4	Ship	Bulk Carrier	85,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
5	Ship	Bulk Carrier	80,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
6	Ship	Tanker	75,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
7	Ship	Bulk Carrier	75,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
8	Ship	Tanker	70,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
9	Ship	Bulk Carrier	70,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
10	Ship	Tanker	65,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
11	Ship	Bulk Carrier	65,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
12	Ship	Bulk Carrier	60,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
13	Ship	Tanker	55,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
14	Ship	Bulk Carrier	55,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
15	Ship	Tanker	50,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
16	Ship	Bulk Carrier	50,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
17	Ship	Tanker	45,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
18	Ship	Tanker	40,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
19	Ship	Bulk Carrier	40,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
20	Ship	Tanker	35,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
21	Ship	Bulk Carrier	35,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
22	Ship	Tanker	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
23	Ship	Bulk Carrier	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
24	Ship	Articulated Tug/Barge	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
25	Ship	Tanker	25,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
26	Ship	Articulated Tug/Barge	25,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
27	Ship	Tanker	20,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
28	Ship	Tanker	15,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05

Notes:

[1] Adjustments to the aberrancy Base Rate (BR) due to waterway current restrictions are accounted for elsewhere in the vessel collision risk analysis (refer to correction factors R_C and R_{XC} for the Probability of Aberrancy at each transit leg).

MISCELLANEOUS INFORMATION

CHANNEL CHARACTERISTICS

Waterway Current Speed (V_{min}) =	**1.03**	m/sec
Mean High Water (MHW) Elevation =	**-0.10**	m (based on Chart Datum)
Sea Level Rise Adjustment =	**0.10**	m
Soft Soil Allowance =	**1.00**	m (assumed depth that vessels can "plow" through soft bottom material)

AVAILABLE WATER DEPTH AT PIERS

Pier ID	Description	Mudline Elevation (m) [1]		Water Elevation (m)	Soft Soil Allowance (m)	Design Water Depth (m)	
		Inbound	Outbound			Inbound	Outbound
1	**Pier 14**	**-5.00**	**N/A**	0.00	1.00	6.00	0.00
2	**Pier 15**	**-10.00**	**-9.00**	0.00	1.00	11.00	10.00
3	**Pier 16**	**-6.00**	**-5.00**	0.00	1.00	7.00	6.00

Notes:

[1] Mudline elevation is based on Chart Datum (CD) and was obtained from Nautical Chart 3494

PROBABILITY OF ABERRANCY VARIABLES FOR EACH VESSEL TRANSIT PATH

Leg ID	Waterway Region for Bridge Location	Angle of Channel Turn, θ (deg) [1]	Correction Factor, R_B	Current Angle to Vessel Path (deg) [2]	Parallel Current, V_C (m/sec)	Perpendicular Current, V_{XC} (m/sec)	Correction Factor, R_C	Correction Factor, R_{XC}	Vessel Traffic Density	Correction Factor, R_D	Summation (R_B*R_C*R_{XC}*R_D)	Aberrancy Distribution [3]	
												Inbound	Outbound
1	**Transition**	**7.7227**	1.0858	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.3095	**0.24**	**N/A**
2	**Turn/Bend**	**7.7227**	1.1716	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4130	**0.50**	**N/A**
3	**Turn/Bend**	**7.7227**	1.1716	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4130	**0.26**	**N/A**
4	**Transition**	**8.8764**	1.0986	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.3249	**N/A**	**0.24**
5	**Turn/Bend**	**8.8764**	1.1973	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4439	**N/A**	**0.50**
6	**Turn/Bend**	**8.8764**	1.1973	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4439	**N/A**	**0.26**

Notes:

[1] Angle of the turn region in accordance with information shown on Nautical Chart 3494, AIS transit data near the bridge, and CAN/CSA S6-14 Figure A3.3.1

[2] The angle between the water current direction and each channel transition leg

[3] Distribution of the Probability of Aberrancy for each channel transition leg is established as a ratio of the length of each leg to the overall length being considered (approximately 1 nautical mile or 2000m)

GEOMETRIC PROBABILITY DISTANCES FOR NORMAL DISTRIBUTION

Pier ID	Description	Leg 1 [1]			Leg 2 [1]			Leg 3 [1]			Leg 4 [1]			Leg 5 [1]			Leg 6 [1]		
		x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)	x_1 (m)	x (m)	x_2 (m)
1	Pier 14	**363.89**	375.26	**386.63**	**363.89**	375.26	**386.63**	**299.02**	308.72	**318.42**	**299.02**	308.72	**318.42**	**299.02**	308.72	**318.42**	**520.46**	532.27	**544.09**
2	Pier 15	**222.26**	234.22	**246.17**	**222.26**	234.22	**246.17**	**156.11**	166.57	**177.02**	**156.11**	166.57	**177.02**	**156.11**	166.57	**177.02**	**379.70**	392.04	**404.39**
3	Pier 16	**86.36**	98.32	**110.27**	**86.36**	98.32	**110.27**	**158.26**	168.71	**179.16**	**158.26**	168.71	**179.16**	**158.26**	168.71	**179.16**	**48.82**	61.17	**73.51**

Notes:

[1] Perpendicular distances at each channel transition leg from the centerline of vessel transit path to the bridge element being considered. Distance "x" is from the centerline of vessel transit path to the centerline of bridge element. Distance "x_1" (scaled from CADD drawing) is from the centerline of vessel transit path to the closest edge of the bridge element. Distance "x_2" (scaled from CADD drawing) is from the centerline of vessel transit path to the farthest edge of the bridge element.

PROTECTION FACTOR

Pier ID	Description	Leg 1		Leg 2		Leg 3		Leg 4		Leg 5		Leg 6	
		Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
1	Pier 14	**0.09**	**N/A**	**0.09**	**N/A**	**0.13**	**N/A**	**N/A**	**0.00**	**N/A**	**0.00**	**N/A**	**0.00**
2	Pier 15	**0.65**	**N/A**	**0.65**	**N/A**	**0.73**	**N/A**	**N/A**	**0.02**	**N/A**	**0.02**	**N/A**	**0.02**
3	Pier 16	**0.74**	**N/A**	**0.74**	**N/A**	**0.66**	**N/A**	**N/A**	**0.03**	**N/A**	**0.03**	**N/A**	**0.04**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	5	10.20	0.000002	0.000002	0.000010	0.000010	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	4	10.20	0.000002	0.000002	0.000008	0.000008	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	1	10.20	0.000002	0.000002	0.000008	0.000008	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	5	1.28	0.000006	0.000006	0.000005	0.000005	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	5	1.28	0.000006	0.000006	0.000004	0.000004	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	3	1.64	0.000002	0.000006	0.000005	0.000005	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	4	1.28	0.000006	0.000006	0.000004	0.000004	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.0290	0.00	21.75	0.00	32.41	0	0	1.64	0.000002	0.000006	0.000004	0.000004	0.000000	0.025405	0.0900	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.0290	0.00	18.99	0.00	32.41	0	1	1.28	0.000006	0.000006	0.000004	0.000004	0.000000	0.025405	0.0900	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.0290	0.00	20.95	0.00	31.23	0	1	1.64	0.000002	0.000006	0.000003	0.000003	0.000000	0.022170	0.0900	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	6	1.28	0.000006	0.000006	0.000003	0.000003	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.0290	0.00	18.56	0.00	30.01	0	2	1.28	0.000006	0.000006	0.000002	0.000002	0.000000	0.018538	0.0900	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	2	1.64	0.000002	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.0290	0.00	14.70	0.00	28.73	0	3	1.28	0.000006	0.000006	0.000002	0.000002	0.000000	0.014421	0.0900	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	7	1.64	0.000002	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.0290	0.00	17.08	0.00	27.39	0	0	1.28	0.000006	0.000006	0.000002	0.000002	0.000000	0.009702	0.0900	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	4	1.64	0.000002	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	1.0290	0.00	16.31	0.00	24.50	0	1	1.28	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	2	1.64	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	1.0290	0.00	13.32	0.00	22.92	0	0	1.28	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	1.0290	0.00	11.28	0.00	21.22	0	7	1.64	0.000006	0.000006	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	1.0290	0.00	12.27	0.00	21.22	0	0	1.28	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	1.0290	0.00	11.09	0.00	21.22	0	4	1.28	0.000006	0.000006	0.000002	0.000002	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	1.0290	0.00	9.09	0.00	19.37	0	1	1.64	0.000006	0.000006	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	1.0290	0.00	9.99	0.00	19.37	0	2	1.28	0.000006	0.000006	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	1.0290	0.00	7.85	0.00	17.32	0	4	1.64	0.000006	0.000006	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	1.0290	0.00	6.27	0.00	15.00	0	1	1.64	0.000006	0.000006	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	5	10.20	0.000003	0.000003	0.000010	0.000010	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	4	10.20	0.000003	0.000003	0.000008	0.000008	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	1	10.20	0.000003	0.000003	0.000008	0.000008	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	5	1.28	0.000013	0.000013	0.000005	0.000005	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	5	1.28	0.000013	0.000013	0.000004	0.000004	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	3	1.64	0.000003	0.000013	0.000005	0.000005	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	4	1.28	0.000013	0.000013	0.000004	0.000004	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.0290	0.00	21.75	0.00	32.41	0	0	1.64	0.000003	0.000013	0.000004	0.000004	0.000000	0.025405	0.0900	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.0290	0.00	18.99	0.00	32.41	0	1	1.28	0.000013	0.000013	0.000004	0.000004	0.000000	0.025405	0.0900	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.0290	0.00	20.95	0.00	31.23	0	1	1.64	0.000003	0.000013	0.000003	0.000003	0.000000	0.022170	0.0900	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	6	1.28	0.000013	0.000013	0.000003	0.000003	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.0290	0.00	18.56	0.00	30.01	0	2	1.28	0.000013	0.000013	0.000002	0.000002	0.000000	0.018538	0.0900	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	2	1.64	0.000003	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.0290	0.00	14.70	0.00	28.73	0	3	1.28	0.000013	0.000013	0.000002	0.000002	0.000000	0.014421	0.0900	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	7	1.64	0.000003	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.0290	0.00	17.08	0.00	27.39	0	0	1.28	0.000013	0.000013	0.000002	0.000002	0.000000	0.009702	0.0900	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000003	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	4	1.64	0.000003	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	1.0290	0.00	16.31	0.00	24.50	0	1	1.28	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	2	1.64	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	1.0290	0.00	13.32	0.00	22.92	0	0	1.28	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	1.0290	0.00	11.28	0.00	21.22	0	7	1.64	0.000013	0.000013	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	1.0290	0.00	12.27	0.00	21.22	0	0	1.28	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	1.0290	0.00	11.09	0.00	21.22	0	4	1.28	0.000013	0.000013	0.000002	0.000002	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	1.0290	0.00	9.09	0.00	19.37	0	1	1.64	0.000013	0.000013	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	1.0290	0.00	9.99	0.00	19.37	0	2	1.28	0.000013	0.000013	0.000001	0.000001	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	1.0290	0.00	7.85	0.00	17.32	0	4	1.64	0.000013	0.000013	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	1.0290	0.00	6.27	0.00	15.00	0	1	1.64	0.000013	0.000013	0.000000	0.000000	0.000000	0.000000	0.0900	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	5	10.20	0.000002	0.000002	0.000261	0.000261	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	4	10.20	0.000002	0.000002	0.000232	0.000232	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	1	10.20	0.000002	0.000002	0.000231	0.000231	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	5	1.28	0.000007	0.000007	0.000146	0.000146	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	5	1.28	0.000007	0.000007	0.000137	0.000137	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	3	1.64	0.000002	0.000007	0.000150	0.000150	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	4	1.28	0.000007	0.000007	0.000137	0.000137	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.0290	0.00	21.75	0.00	32.41	0	0	1.64	0.000002	0.000007	0.000143	0.000143	0.000000	0.025405	0.1300	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.0290	0.00	18.99	0.00	32.41	0	1	1.28	0.000007	0.000007	0.000137	0.000137	0.000000	0.025405	0.1300	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.0290	0.00	20.95	0.00	31.23	0	1	1.64	0.000002	0.000007	0.000116	0.000116	0.000000	0.022170	0.1300	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	6	1.28	0.000007	0.000007	0.000112	0.000112	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.0290	0.00	18.56	0.00	30.01	0	2	1.28	0.000007	0.000007	0.000078	0.000078	0.000000	0.018538	0.1300	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	2	1.64	0.000002	0.000007	0.000064	0.000064	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.0290	0.00	14.70	0.00	28.73	0	3	1.28	0.000007	0.000007	0.000073	0.000073	0.000000	0.014421	0.1300	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	7	1.64	0.000002	0.000007	0.000062	0.000062	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.0290	0.00	17.08	0.00	27.39	0	0	1.28	0.000007	0.000007	0.000083	0.000083	0.000000	0.009702	0.1300	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000059	0.000059	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	4	1.64	0.000002	0.000007	0.000050	0.000050	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	1.0290	0.00	16.31	0.00	24.50	0	1	1.28	0.000007	0.000007	0.000056	0.000056	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	2	1.64	0.000007	0.000007	0.000041	0.000041	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	1.0290	0.00	13.32	0.00	22.92	0	0	1.28	0.000007	0.000007	0.000049	0.000049	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	1.0290	0.00	11.28	0.00	21.22	0	7	1.64	0.000007	0.000007	0.000027	0.000027	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	1.0290	0.00	12.27	0.00	21.22	0	0	1.28	0.000007	0.000007	0.000038	0.000038	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	1.0290	0.00	11.09	0.00	21.22	0	4	1.28	0.000007	0.000007	0.000081	0.000081	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	1.0290	0.00	9.09	0.00	19.37	0	1	1.64	0.000007	0.000007	0.000015	0.000015	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	1.0290	0.00	9.99	0.00	19.37	0	2	1.28	0.000007	0.000007	0.000050	0.000050	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	1.0290	0.00	7.85	0.00	17.32	0	4	1.64	0.000007	0.000007	0.000014	0.000014	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	1.0290	0.00	6.27	0.00	15.00	0	1	1.64	0.000007	0.000007	0.000005	0.000005	0.000000	0.000000	0.1300	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000261	0.000261	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000232	0.000232	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000231	0.000231	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000146	0.000146	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000150	0.000150	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000143	0.000143	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000116	0.000116	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000112	0.000112	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000078	0.000078	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000064	0.000064	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000073	0.000073	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000062	0.000062	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000083	0.000083	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000059	0.000059	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.000050	0.000050	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000056	0.000056	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000041	0.000041	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000049	0.000049	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000027	0.000027	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000038	0.000038	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000081	0.000081	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000015	0.000015	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.000050	0.000050	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000014	0.000014	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006	0.000005	0.000005	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
																				Total for Pier:		**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004	0.000261	0.000261	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004	0.000232	0.000232	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004	0.000231	0.000231	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000146	0.000146	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000150	0.000150	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000143	0.000143	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000137	0.000137	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000116	0.000116	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000112	0.000112	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000078	0.000078	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000064	0.000064	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000073	0.000073	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000062	0.000062	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000083	0.000083	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000059	0.000059	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.000050	0.000050	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000056	0.000056	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000041	0.000041	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000049	0.000049	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000027	0.000027	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000038	0.000038	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000081	0.000081	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000015	0.000015	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.000050	0.000050	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000014	0.000014	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013	0.000005	0.000005	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 1
Description: Pier 14
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000
																				Total for Pier:		**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.6023	0.00	10.45	0.00	24.84	0	5	10.20	0.000002	0.000002	0.005802	0.005802	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.5710	0.00	9.18	0.00	22.54	0	4	10.20	0.000002	0.000002	0.005450	0.005450	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.5827	0.00	9.42	0.00	22.48	0	1	10.20	0.000002	0.000002	0.005365	0.005365	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.0435	0.00	23.23	0.00	36.22	0	5	1.28	0.000006	0.000006	0.003880	0.003880	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.0321	0.00	21.70	0.00	34.75	0	5	1.28	0.000006	0.000006	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.0407	0.00	22.50	0.00	33.93	0	3	1.64	0.000002	0.000006	0.003985	0.003985	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.0321	0.00	19.67	0.00	33.65	0	4	1.28	0.000006	0.000006	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.5286	1.0407	10.88	18.69	16.65	32.78	0	0	1.64	0.000002	0.000006	0.003850	0.003850	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.0321	0.00	16.40	0.00	32.51	0	1	1.28	0.000006	0.000006	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.5140	1.0290	9.50	17.60	15.60	31.23	0	1	1.64	0.000002	0.000006	0.003428	0.003428	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.0290	0.00	18.54	0.00	31.23	0	6	1.28	0.000006	0.000006	0.003367	0.003367	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.0290	0.00	15.59	0.00	30.01	0	2	1.28	0.000006	0.000006	0.002772	0.002772	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.0290	0.00	17.49	0.00	28.73	0	2	1.64	0.000002	0.000006	0.002486	0.002486	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	33.89	12.93	28.73	28.73	0	3	1.28	0.000006	0.000006	0.002677	0.002677	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.5140	1.0290	7.84	17.19	13.68	27.39	4	7	1.64	0.000002	0.000006	0.002454	0.002454	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.0290	0.00	14.35	0.00	27.39	0	0	1.28	0.000006	0.000006	0.002822	0.002822	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.5140	1.0290	7.49	18.01	12.98	25.99	0	0	1.64	0.000002	0.000006	0.002390	0.002390	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.5140	1.0290	6.35	13.22	12.24	24.50	1	4	1.64	0.000002	0.000006	0.002103	0.002103	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	23.86	13.70	24.50	24.50	0	1	1.28	0.000006	0.000006	0.002274	0.002274	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.0290	1.0290	23.56	11.83	22.92	22.92	1	2	1.64	0.000006	0.000006	0.001878	0.001878	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	24.69	11.38	22.92	22.92	0	0	1.28	0.000006	0.000006	0.002098	0.002098	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	18.56	9.52	21.22	21.22	0	7	1.64	0.000006	0.000006	0.001485	0.001485	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	21.18	10.36	21.22	21.22	0	0	1.28	0.000006	0.000006	0.001793	0.001793	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	20.78	9.71	21.22	21.22	3	4	1.28	0.000006	0.000006	0.002613	0.002613	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	14.62	7.64	19.37	19.37	0	1	1.64	0.000006	0.000006	0.001042	0.001042	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	15.71	8.74	19.37	19.37	1	2	1.28	0.000006	0.000006	0.002026	0.002026	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	12.91	6.80	17.32	17.32	9	4	1.64	0.000006	0.000006	0.001018	0.001018	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	8.47	5.29	15.00	15.00	0	1	1.64	0.000006	0.000006	0.000544	0.000544	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.6023	0.00	10.45	0.00	24.84	0	5	10.20	0.000003	0.000003	0.005802	0.005802	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.5710	0.00	9.18	0.00	22.54	0	4	10.20	0.000003	0.000003	0.005450	0.005450	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.5827	0.00	9.42	0.00	22.48	0	1	10.20	0.000003	0.000003	0.005365	0.005365	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.0435	0.00	23.23	0.00	36.22	0	5	1.28	0.000013	0.000013	0.003880	0.003880	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.0321	0.00	21.70	0.00	34.75	0	5	1.28	0.000013	0.000013	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.0407	0.00	22.50	0.00	33.93	0	3	1.64	0.000003	0.000013	0.003985	0.003985	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.0321	0.00	19.67	0.00	33.65	0	4	1.28	0.000013	0.000013	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.5286	1.0407	10.88	18.69	16.65	32.78	0	0	1.64	0.000003	0.000013	0.003850	0.003850	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.0321	0.00	16.40	0.00	32.51	0	1	1.28	0.000013	0.000013	0.003761	0.003761	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.5140	1.0290	9.50	17.60	15.60	31.23	0	1	1.64	0.000003	0.000013	0.003428	0.003428	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.0290	0.00	18.54	0.00	31.23	0	6	1.28	0.000013	0.000013	0.003367	0.003367	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.0290	0.00	15.59	0.00	30.01	0	2	1.28	0.000013	0.000013	0.002772	0.002772	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.0290	0.00	17.49	0.00	28.73	0	2	1.64	0.000003	0.000013	0.002486	0.002486	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.0290	1.0290	33.89	12.93	28.73	28.73	0	3	1.28	0.000013	0.000013	0.002677	0.002677	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.5140	1.0290	7.84	17.19	13.68	27.39	4	7	1.64	0.000003	0.000013	0.002454	0.002454	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.0290	0.00	14.35	0.00	27.39	0	0	1.28	0.000013	0.000013	0.002822	0.002822	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.5140	1.0290	7.49	18.01	12.98	25.99	0	0	1.64	0.000003	0.000013	0.002390	0.002390	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.5140	1.0290	6.35	13.22	12.24	24.50	1	4	1.64	0.000003	0.000013	0.002103	0.002103	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	23.86	13.70	24.50	24.50	0	1	1.28	0.000013	0.000013	0.002274	0.002274	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.0290	1.0290	23.56	11.83	22.92	22.92	1	2	1.64	0.000013	0.000013	0.001878	0.001878	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	24.69	11.38	22.92	22.92	0	0	1.28	0.000013	0.000013	0.002098	0.002098	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	18.56	9.52	21.22	21.22	0	7	1.64	0.000013	0.000013	0.001485	0.001485	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	21.18	10.36	21.22	21.22	0	0	1.28	0.000013	0.000013	0.001793	0.001793	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	20.78	9.71	21.22	21.22	3	4	1.28	0.000013	0.000013	0.002613	0.002613	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	14.62	7.64	19.37	19.37	0	1	1.64	0.000013	0.000013	0.001042	0.001042	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	15.71	8.74	19.37	19.37	1	2	1.28	0.000013	0.000013	0.002026	0.002026	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	12.91	6.80	17.32	17.32	9	4	1.64	0.000013	0.000013	0.001018	0.001018	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	8.47	5.29	15.00	15.00	0	1	1.64	0.000013	0.000013	0.000544	0.000544	0.000000	0.000000	0.6500	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	1.5822	0.00	72.14	0.00	65.25	0	5	10.20	0.000002	0.000002	0.040552	0.040552	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	1.5632	0.00	68.83	0.00	61.72	0	4	10.20	0.000002	0.000002	0.039452	0.039452	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	1.5542	0.00	66.98	0.00	59.95	0	1	10.20	0.000002	0.000002	0.038476	0.038476	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.8147	0.00	70.26	0.00	62.99	0	5	1.28	0.000007	0.000007	0.030162	0.030162	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.8076	0.00	66.56	0.00	60.87	0	5	1.28	0.000007	0.000007	0.029749	0.029749	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.8130	0.00	68.28	0.00	59.11	0	3	1.64	0.000002	0.000007	0.031022	0.031022	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.8076	0.00	60.35	0.00	58.93	0	4	1.28	0.000007	0.000007	0.029749	0.029749	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	1.4942	1.8130	86.97	56.72	47.06	57.10	0	0	1.64	0.000002	0.000007	0.030060	0.030060	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.8076	0.00	50.31	0.00	56.93	0	1	1.28	0.000007	0.000007	0.029749	0.029749	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	1.4612	1.7866	76.75	53.05	44.35	54.22	0	1	1.64	0.000002	0.000007	0.028549	0.028549	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.7825	0.00	55.63	0.00	54.10	0	6	1.28	0.000007	0.000007	0.028320	0.028320	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.7387	0.00	44.50	0.00	50.70	0	2	1.28	0.000007	0.000007	0.025962	0.025962	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.7144	0.00	48.56	0.00	47.86	0	2	1.64	0.000002	0.000007	0.024719	0.024719	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	1.7309	1.7309	95.89	36.59	48.33	48.33	0	3	1.28	0.000007	0.000007	0.025557	0.025557	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	1.3674	1.7115	55.51	47.55	36.40	45.56	4	7	1.64	0.000002	0.000007	0.024575	0.024575	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.7536	0.00	41.67	0.00	46.68	0	0	1.28	0.000007	0.000007	0.025596	0.025596	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	1.3600	1.7057	52.42	49.49	34.35	43.07	0	0	1.64	0.000002	0.000007	0.024285	0.024285	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	1.3525	1.6997	43.94	36.07	32.20	40.47	1	4	1.64	0.000002	0.000007	0.021912	0.021912	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.7057	1.7057	65.57	37.65	40.61	40.61	0	1	1.28	0.000007	0.000007	0.023227	0.023227	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	1.6807	1.6807	62.85	31.57	37.43	37.43	1	2	1.64	0.000007	0.000007	0.020575	0.020575	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6935	1.6935	66.89	30.84	37.72	37.72	0	0	1.28	0.000007	0.000007	0.022143	0.022143	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6298	1.6298	46.56	23.87	33.61	33.61	0	7	1.64	0.000007	0.000007	0.018487	0.018487	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6706	1.6706	55.84	27.30	34.45	34.45	0	0	1.28	0.000007	0.000007	0.020146	0.020146	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7783	1.7783	62.05	28.99	36.67	36.67	3	4	1.28	0.000007	0.000007	0.022591	0.022591	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5722	1.5722	34.13	17.83	29.59	29.59	0	1	1.64	0.000007	0.000007	0.015153	0.015153	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.7144	1.7144	43.61	24.26	32.27	32.27	1	2	1.28	0.000007	0.000007	0.020518	0.020518	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5672	1.5672	29.95	15.78	26.39	26.39	9	4	1.64	0.000007	0.000007	0.014991	0.014991	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4620	1.4620	17.11	10.68	21.32	21.32	0	1	1.64	0.000007	0.000007	0.010643	0.010643	0.000000	0.000000	0.7300	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	1.5822	0.00	72.14	0.00	65.25	0	0	10.20	0.000002	0.000002	0.040552	0.040552	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	1.5632	0.00	68.83	0.00	61.72	0	0	10.20	0.000002	0.000002	0.039452	0.039452	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	1.5542	0.00	67.22	0.00	59.95	0	0	10.20	0.000002	0.000002	0.038476	0.038476	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.8147	0.00	72.65	0.00	62.99	0	0	1.28	0.000006	0.000006	0.030162	0.030162	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.8076	0.00	67.49	0.00	60.87	0	0	1.28	0.000006	0.000006	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.8130	0.00	68.53	0.00	59.11	0	0	1.64	0.000002	0.000006	0.031022	0.031022	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.8076	0.00	60.35	0.00	58.93	0	0	1.28	0.000006	0.000006	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.8130	0.00	56.72	0.00	57.10	0	0	1.64	0.000002	0.000006	0.030060	0.030060	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.8076	0.00	50.31	0.00	56.93	0	0	1.28	0.000006	0.000006	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.7866	0.00	53.05	0.00	54.22	0	0	1.64	0.000002	0.000006	0.028549	0.028549	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.7825	0.00	55.63	0.00	54.10	0	9	1.28	0.000006	0.000006	0.028320	0.028320	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.7387	0.00	44.50	0.00	50.70	0	0	1.28	0.000006	0.000006	0.025962	0.025962	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.7144	0.00	50.21	0.00	47.86	0	0	1.64	0.000002	0.000006	0.024719	0.024719	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.7309	0.00	36.59	0.00	48.33	0	0	1.28	0.000006	0.000006	0.025557	0.025557	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	1.7115	0.00	48.70	0.00	45.56	0	3	1.64	0.000002	0.000006	0.024575	0.024575	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.7536	0.00	41.67	0.00	46.68	0	0	1.28	0.000006	0.000006	0.025596	0.025596	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	1.7057	0.00	52.69	0.00	43.07	0	0	1.64	0.000002	0.000006	0.024285	0.024285	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	1.6997	0.00	36.07	0.00	40.47	0	0	1.64	0.000002	0.000006	0.021912	0.021912	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.7057	1.7057	68.55	37.65	40.61	40.61	1	0	1.28	0.000006	0.000006	0.023227	0.023227	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	1.6807	0.00	31.57	0.00	37.43	0	1	1.64	0.000006	0.000006	0.020575	0.020575	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6935	1.6935	67.81	30.84	37.72	37.72	0	0	1.28	0.000006	0.000006	0.022143	0.022143	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6298	1.6298	48.41	23.87	33.61	33.61	7	0	1.64	0.000006	0.000006	0.018487	0.018487	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6706	1.6706	57.16	27.30	34.45	34.45	1	0	1.28	0.000006	0.000006	0.020146	0.020146	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7783	1.7783	64.18	28.99	36.67	36.67	4	2	1.28	0.000006	0.000006	0.022591	0.022591	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5722	1.5722	35.48	17.83	29.59	29.59	1	0	1.64	0.000006	0.000006	0.015153	0.015153	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.7144	1.7144	45.92	24.26	32.27	32.27	2	1	1.28	0.000006	0.000006	0.020518	0.020518	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5672	1.5672	31.42	15.78	26.39	26.39	4	9	1.64	0.000006	0.000006	0.014991	0.014991	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4620	1.4620	18.05	10.68	21.32	21.32	1	0	1.64	0.000006	0.000006	0.010643	0.010643	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	1.5822	0.00	72.14	0.00	65.25	0	0	10.20	0.000004	0.000004	0.040552	0.040552	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	1.5632	0.00	68.83	0.00	61.72	0	0	10.20	0.000004	0.000004	0.039452	0.039452	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	1.5542	0.00	67.22	0.00	59.95	0	0	10.20	0.000004	0.000004	0.038476	0.038476	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.8147	0.00	72.65	0.00	62.99	0	0	1.28	0.000013	0.000013	0.030162	0.030162	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.8076	0.00	67.49	0.00	60.87	0	0	1.28	0.000013	0.000013	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.8130	0.00	68.53	0.00	59.11	0	0	1.64	0.000004	0.000013	0.031022	0.031022	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.8076	0.00	60.35	0.00	58.93	0	0	1.28	0.000013	0.000013	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.8130	0.00	56.72	0.00	57.10	0	0	1.64	0.000004	0.000013	0.030060	0.030060	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.8076	0.00	50.31	0.00	56.93	0	0	1.28	0.000013	0.000013	0.029749	0.029749	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.7866	0.00	53.05	0.00	54.22	0	0	1.64	0.000004	0.000013	0.028549	0.028549	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.7825	0.00	55.63	0.00	54.10	0	9	1.28	0.000013	0.000013	0.028320	0.028320	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.7387	0.00	44.50	0.00	50.70	0	0	1.28	0.000013	0.000013	0.025962	0.025962	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.7144	0.00	50.21	0.00	47.86	0	0	1.64	0.000004	0.000013	0.024719	0.024719	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.7309	0.00	36.59	0.00	48.33	0	0	1.28	0.000013	0.000013	0.025557	0.025557	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	1.7115	0.00	48.70	0.00	45.56	0	3	1.64	0.000004	0.000013	0.024575	0.024575	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.7536	0.00	41.67	0.00	46.68	0	0	1.28	0.000013	0.000013	0.025596	0.025596	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	1.7057	0.00	52.69	0.00	43.07	0	0	1.64	0.000004	0.000013	0.024285	0.024285	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	1.6997	0.00	36.07	0.00	40.47	0	0	1.64	0.000004	0.000013	0.021912	0.021912	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.7057	1.7057	68.55	37.65	40.61	40.61	1	0	1.28	0.000013	0.000013	0.023227	0.023227	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	1.6807	0.00	31.57	0.00	37.43	0	1	1.64	0.000013	0.000013	0.020575	0.020575	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.6935	1.6935	67.81	30.84	37.72	37.72	0	0	1.28	0.000013	0.000013	0.022143	0.022143	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.6298	1.6298	48.41	23.87	33.61	33.61	7	0	1.64	0.000013	0.000013	0.018487	0.018487	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.6706	1.6706	57.16	27.30	34.45	34.45	1	0	1.28	0.000013	0.000013	0.020146	0.020146	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.7783	1.7783	64.18	28.99	36.67	36.67	4	2	1.28	0.000013	0.000013	0.022591	0.022591	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.5722	1.5722	35.48	17.83	29.59	29.59	1	0	1.64	0.000013	0.000013	0.015153	0.015153	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.7144	1.7144	45.92	24.26	32.27	32.27	2	1	1.28	0.000013	0.000013	0.020518	0.020518	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.5672	1.5672	31.42	15.78	26.39	26.39	4	9	1.64	0.000013	0.000013	0.014991	0.014991	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.4620	1.4620	18.05	10.68	21.32	21.32	1	0	1.64	0.000013	0.000013	0.010643	0.010643	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 2
Description: Pier 15
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.5140	0.00	7.61	0.00	21.20	0	0	10.20	0.000002	0.000002	0.000004	0.000004	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.5140	0.00	7.44	0.00	20.29	0	0	10.20	0.000002	0.000002	0.000003	0.000003	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.5140	0.00	7.35	0.00	19.83	0	0	10.20	0.000002	0.000002	0.000003	0.000003	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.0290	0.00	23.36	0.00	35.71	0	0	1.28	0.000007	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.0290	0.00	21.87	0.00	34.65	0	0	1.28	0.000007	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.0290	0.00	22.07	0.00	33.55	0	0	1.64	0.000002	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.0290	0.00	19.56	0.00	33.55	0	0	1.28	0.000007	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.0290	0.00	18.27	0.00	32.41	0	0	1.64	0.000002	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.0290	0.00	16.30	0.00	32.41	0	0	1.28	0.000007	0.000007	0.000002	0.000002	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.0290	0.00	17.60	0.00	31.23	0	0	1.64	0.000002	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.0290	0.00	18.54	0.00	31.23	0	9	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.0290	0.00	15.59	0.00	30.01	0	0	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.0290	0.00	18.09	0.00	28.73	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.0290	0.00	12.93	0.00	28.73	0	0	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	1.0290	0.00	17.60	0.00	27.39	0	3	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.0290	0.00	14.35	0.00	27.39	0	0	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	1.0290	0.00	19.18	0.00	25.99	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	1.0290	0.00	13.22	0.00	24.50	0	0	1.64	0.000002	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	24.95	13.70	24.50	24.50	1	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	1.0290	0.00	11.83	0.00	22.92	0	1	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	25.03	11.38	22.92	22.92	0	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	1.0290	1.0290	19.30	9.52	21.22	21.22	7	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	21.69	10.36	21.22	21.22	1	0	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	21.49	9.71	21.22	21.22	4	2	1.28	0.000007	0.000007	0.000001	0.000001	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	1.0290	1.0290	15.20	7.64	19.37	19.37	1	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	16.54	8.74	19.37	19.37	2	1	1.28	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	1.0290	1.0290	13.54	6.80	17.32	17.32	4	9	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	1.0290	1.0290	8.94	5.29	15.00	15.00	1	0	1.64	0.000007	0.000007	0.000000	0.000000	0.000000	0.000000	0.0200	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	2.5708	0.00	226.72	0.00	106.02	0	5	10.20	0.000002	0.000002	0.161512	0.161512	0.000000	0.016786	0.7400	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	2.5643	0.00	220.48	0.00	101.25	0	4	10.20	0.000002	0.000002	0.160908	0.160908	0.000000	0.012342	0.7400	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	2.5343	0.00	212.02	0.00	97.76	0	1	10.20	0.000002	0.000002	0.156289	0.156289	0.000000	0.008821	0.7400	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	2.5928	0.00	170.76	0.00	89.99	0	5	1.28	0.000006	0.000006	0.131184	0.131184	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	2.5901	0.00	162.68	0.00	87.21	0	5	1.28	0.000006	0.000006	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	2.5921	0.00	166.17	0.00	84.51	0	3	1.64	0.000002	0.000006	0.134715	0.134715	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	2.5901	0.00	145.79	0.00	84.44	0	4	1.28	0.000006	0.000006	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	2.5921	0.00	132.13	0.00	81.64	0	0	1.64	0.000002	0.000006	0.131118	0.131118	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	2.5901	0.00	110.87	0.00	81.58	0	1	1.28	0.000006	0.000006	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	2.5819	0.00	128.39	0.00	78.36	0	1	1.64	0.000002	0.000006	0.130079	0.130079	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	2.5803	0.00	138.16	0.00	78.32	0	6	1.28	0.000006	0.000006	0.129913	0.129913	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	2.5633	0.00	110.70	0.00	74.75	0	2	1.28	0.000006	0.000006	0.128069	0.128069	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	2.5539	0.00	128.28	0.00	71.30	0	2	1.64	0.000002	0.000006	0.126989	0.126989	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	2.5603	0.00	83.32	0.00	71.48	0	3	1.28	0.000006	0.000006	0.127726	0.127726	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	2.5527	0.00	125.93	0.00	67.95	0	7	1.64	0.000002	0.000006	0.126859	0.126859	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	2.5691	0.00	100.08	0.00	68.39	0	0	1.28	0.000006	0.000006	0.123982	0.123982	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.126593	0.126593	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	2.5481	0.00	95.73	0.00	60.67	0	4	1.64	0.000002	0.000006	0.117002	0.117002	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	2.5505	0.00	97.15	0.00	60.73	0	1	1.28	0.000006	0.000006	0.121920	0.121920	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	2.5408	0.00	84.26	0.00	56.59	0	2	1.64	0.000006	0.000006	0.113859	0.113859	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	2.5457	0.00	75.21	0.00	56.70	0	0	1.28	0.000006	0.000006	0.119052	0.119052	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	2.5210	0.00	62.66	0.00	51.98	0	7	1.64	0.000006	0.000006	0.111576	0.111576	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	2.5368	0.00	69.05	0.00	52.31	0	0	1.28	0.000006	0.000006	0.113415	0.113415	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	2.5787	0.00	63.86	0.00	53.17	0	4	1.28	0.000006	0.000006	0.107501	0.107501	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	2.4986	0.00	49.91	0.00	47.03	0	1	1.64	0.000006	0.000006	0.102204	0.102204	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	2.5539	0.00	56.39	0.00	48.07	0	2	1.28	0.000006	0.000006	0.108342	0.108342	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	2.4967	0.00	42.49	0.00	42.03	0	4	1.64	0.000006	0.000006	0.101978	0.101978	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	2.4559	0.00	33.07	0.00	35.81	0	1	1.64	0.000006	0.000006	0.088583	0.088583	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	2.5708	0.00	226.72	0.00	106.02	0	5	10.20	0.000003	0.000003	0.161512	0.161512	0.000000	0.016786	0.7400	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	2.5643	0.00	220.48	0.00	101.25	0	4	10.20	0.000003	0.000003	0.160908	0.160908	0.000000	0.012342	0.7400	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	2.5343	0.00	212.02	0.00	97.76	0	1	10.20	0.000003	0.000003	0.156289	0.156289	0.000000	0.008821	0.7400	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	2.5928	0.00	170.76	0.00	89.99	0	5	1.28	0.000013	0.000013	0.131184	0.131184	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	2.5901	0.00	162.68	0.00	87.21	0	5	1.28	0.000013	0.000013	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	2.5921	0.00	166.17	0.00	84.51	0	3	1.64	0.000003	0.000013	0.134715	0.134715	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	2.5901	0.00	145.79	0.00	84.44	0	4	1.28	0.000013	0.000013	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	2.5921	0.00	132.13	0.00	81.64	0	0	1.64	0.000003	0.000013	0.131118	0.131118	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	2.5901	0.00	110.87	0.00	81.58	0	1	1.28	0.000013	0.000013	0.130912	0.130912	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	2.5819	0.00	128.39	0.00	78.36	0	1	1.64	0.000003	0.000013	0.130079	0.130079	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	2.5803	0.00	138.16	0.00	78.32	0	6	1.28	0.000013	0.000013	0.129913	0.129913	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	2.5633	0.00	110.70	0.00	74.75	0	2	1.28	0.000013	0.000013	0.128069	0.128069	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	2.5539	0.00	128.28	0.00	71.30	0	2	1.64	0.000003	0.000013	0.126989	0.126989	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	2.5603	0.00	83.32	0.00	71.48	0	3	1.28	0.000013	0.000013	0.127726	0.127726	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	2.5527	0.00	125.93	0.00	67.95	0	7	1.64	0.000003	0.000013	0.126859	0.126859	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	2.5691	0.00	100.08	0.00	68.39	0	0	1.28	0.000013	0.000013	0.123982	0.123982	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000003	0.000013	0.126593	0.126593	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	2.5481	0.00	95.73	0.00	60.67	0	4	1.64	0.000003	0.000013	0.117002	0.117002	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	2.5505	0.00	97.15	0.00	60.73	0	1	1.28	0.000013	0.000013	0.121920	0.121920	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	2.5408	0.00	84.26	0.00	56.59	0	2	1.64	0.000013	0.000013	0.113859	0.113859	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	2.5457	0.00	75.21	0.00	56.70	0	0	1.28	0.000013	0.000013	0.119052	0.119052	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	2.5210	0.00	62.66	0.00	51.98	0	7	1.64	0.000013	0.000013	0.111576	0.111576	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	2.5368	0.00	69.05	0.00	52.31	0	0	1.28	0.000013	0.000013	0.113415	0.113415	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	2.5787	0.00	63.86	0.00	53.17	0	4	1.28	0.000013	0.000013	0.107501	0.107501	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	2.4986	0.00	49.91	0.00	47.03	0	1	1.64	0.000013	0.000013	0.102204	0.102204	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	2.5539	0.00	56.39	0.00	48.07	0	2	1.28	0.000013	0.000013	0.108342	0.108342	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	2.4967	0.00	42.49	0.00	42.03	0	4	1.64	0.000013	0.000013	0.101978	0.101978	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	2.4559	0.00	33.07	0.00	35.81	0	1	1.64	0.000013	0.000013	0.088583	0.088583	0.000000	0.000000	0.7400	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000001**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	1.5512	0.00	82.54	0.00	63.97	0	5	10.20	0.000002	0.000002	0.038455	0.038455	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	1.5318	0.00	78.68	0.00	60.48	0	4	10.20	0.000002	0.000002	0.037377	0.037377	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	1.5234	0.00	76.62	0.00	58.77	0	1	10.20	0.000002	0.000002	0.036459	0.036459	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	1.7903	0.00	81.41	0.00	62.14	0	5	1.28	0.000007	0.000007	0.028514	0.028514	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	1.7831	0.00	77.10	0.00	60.04	0	5	1.28	0.000007	0.000007	0.028111	0.028111	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	1.7885	0.00	79.11	0.00	58.31	0	3	1.64	0.000002	0.000007	0.029327	0.029327	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	1.7831	0.00	69.09	0.00	58.13	0	4	1.28	0.000007	0.000007	0.028111	0.028111	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.7885	0.00	62.91	0.00	56.33	0	0	1.64	0.000002	0.000007	0.028414	0.028414	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.7831	0.00	52.54	0.00	56.16	0	1	1.28	0.000007	0.000007	0.028111	0.028111	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.7616	0.00	59.77	0.00	53.47	0	1	1.64	0.000002	0.000007	0.026939	0.026939	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	1.7574	0.00	64.09	0.00	53.34	0	6	1.28	0.000007	0.000007	0.026716	0.026716	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.7129	0.00	49.43	0.00	49.95	0	2	1.28	0.000007	0.000007	0.024421	0.024421	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	1.6881	0.00	56.05	0.00	47.13	0	2	1.64	0.000002	0.000007	0.023214	0.023214	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.7049	0.00	36.95	0.00	47.60	0	3	1.28	0.000007	0.000007	0.024028	0.024028	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	1.6851	0.00	54.88	0.00	44.86	0	7	1.64	0.000002	0.000007	0.023075	0.023075	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.7280	0.00	45.28	0.00	46.00	0	0	1.28	0.000007	0.000007	0.024096	0.024096	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.022793	0.022793	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	1.6730	0.00	41.27	0.00	39.83	0	4	1.64	0.000002	0.000007	0.020551	0.020551	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	1.6791	0.00	42.11	0.00	39.98	0	1	1.28	0.000007	0.000007	0.021797	0.021797	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	1.6537	0.00	35.70	0.00	36.83	0	2	1.64	0.000007	0.000007	0.019270	0.019270	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	1.6667	0.00	32.24	0.00	37.12	0	0	1.28	0.000007	0.000007	0.020760	0.020760	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	1.6018	0.00	25.30	0.00	33.03	0	7	1.64	0.000007	0.000007	0.017255	0.017255	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	1.6434	0.00	28.98	0.00	33.89	0	0	1.28	0.000007	0.000007	0.018856	0.018856	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	1.7532	0.00	29.52	0.00	36.15	0	4	1.28	0.000007	0.000007	0.021291	0.021291	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	1.5431	0.00	19.03	0.00	29.05	0	1	1.64	0.000007	0.000007	0.014084	0.014084	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	1.6881	0.00	24.64	0.00	31.77	0	2	1.28	0.000007	0.000007	0.019256	0.019256	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	1.5380	0.00	16.12	0.00	25.89	0	4	1.64	0.000007	0.000007	0.013928	0.013928	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	1.4308	0.00	11.22	0.00	20.86	0	1	1.64	0.000007	0.000007	0.009812	0.009812	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.038455	0.038455	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.037377	0.037377	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.036459	0.036459	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.028514	0.028514	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.029327	0.029327	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.7885	0.00	65.72	0.00	56.33	0	0	1.64	0.000002	0.000006	0.028414	0.028414	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.7831	0.00	57.03	0.00	56.16	0	0	1.28	0.000006	0.000006	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.7616	0.00	61.41	0.00	53.47	0	0	1.64	0.000002	0.000006	0.026939	0.026939	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	9	1.28	0.000006	0.000006	0.026716	0.026716	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.7129	0.00	51.42	0.00	49.95	0	0	1.28	0.000006	0.000006	0.024421	0.024421	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.023214	0.023214	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.7049	0.00	40.36	0.00	47.60	0	0	1.28	0.000006	0.000006	0.024028	0.024028	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	3	1.64	0.000002	0.000006	0.023075	0.023075	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.7280	0.00	48.17	0.00	46.00	0	0	1.28	0.000006	0.000006	0.024096	0.024096	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.022793	0.022793	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006	0.020551	0.020551	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	1.6791	0.00	43.44	0.00	39.98	0	0	1.28	0.000006	0.000006	0.021797	0.021797	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	1	1.64	0.000006	0.000006	0.019270	0.019270	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	1.6667	0.00	34.95	0.00	37.12	0	0	1.28	0.000006	0.000006	0.020760	0.020760	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	1.6018	0.00	27.33	0.00	33.03	0	0	1.64	0.000006	0.000006	0.017255	0.017255	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	1.6434	0.00	31.31	0.00	33.89	0	0	1.28	0.000006	0.000006	0.018856	0.018856	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	1.7532	0.00	32.20	0.00	36.15	0	2	1.28	0.000006	0.000006	0.021291	0.021291	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	1.5431	0.00	20.45	0.00	29.05	0	0	1.64	0.000006	0.000006	0.014084	0.014084	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	1.6881	0.00	26.88	0.00	31.77	0	1	1.28	0.000006	0.000006	0.019256	0.019256	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	1.5380	0.00	17.54	0.00	25.89	0	9	1.64	0.000006	0.000006	0.013928	0.013928	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	1.4308	0.00	12.13	0.00	20.86	0	0	1.64	0.000006	0.000006	0.009812	0.009812	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004	0.038455	0.038455	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004	0.037377	0.037377	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004	0.036459	0.036459	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.028514	0.028514	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.029327	0.029327	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	1.7885	0.00	65.72	0.00	56.33	0	0	1.64	0.000004	0.000013	0.028414	0.028414	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	1.7831	0.00	57.03	0.00	56.16	0	0	1.28	0.000013	0.000013	0.028111	0.028111	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	1.7616	0.00	61.41	0.00	53.47	0	0	1.64	0.000004	0.000013	0.026939	0.026939	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	9	1.28	0.000013	0.000013	0.026716	0.026716	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	1.7129	0.00	51.42	0.00	49.95	0	0	1.28	0.000013	0.000013	0.024421	0.024421	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.023214	0.023214	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	1.7049	0.00	40.36	0.00	47.60	0	0	1.28	0.000013	0.000013	0.024028	0.024028	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	3	1.64	0.000004	0.000013	0.023075	0.023075	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	1.7280	0.00	48.17	0.00	46.00	0	0	1.28	0.000013	0.000013	0.024096	0.024096	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.022793	0.022793	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013	0.020551	0.020551	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	1.6791	0.00	43.44	0.00	39.98	0	0	1.28	0.000013	0.000013	0.021797	0.021797	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	1	1.64	0.000013	0.000013	0.019270	0.019270	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	1.6667	0.00	34.95	0.00	37.12	0	0	1.28	0.000013	0.000013	0.020760	0.020760	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	1.6018	0.00	27.33	0.00	33.03	0	0	1.64	0.000013	0.000013	0.017255	0.017255	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	1.6434	0.00	31.31	0.00	33.89	0	0	1.28	0.000013	0.000013	0.018856	0.018856	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	1.7532	0.00	32.20	0.00	36.15	0	2	1.28	0.000013	0.000013	0.021291	0.021291	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	1.5431	0.00	20.45	0.00	29.05	0	0	1.64	0.000013	0.000013	0.014084	0.014084	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	1.6881	0.00	26.88	0.00	31.77	0	1	1.28	0.000013	0.000013	0.019256	0.019256	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	1.5380	0.00	17.54	0.00	25.89	0	9	1.64	0.000013	0.000013	0.013928	0.013928	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	1.4308	0.00	12.13	0.00	20.86	0	0	1.64	0.000013	0.000013	0.009812	0.009812	0.000000	0.000000	0.0300	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] PA = $(BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS

Pier ID: 3
Description: Pier 16
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Pier, V (m/sec) [1]		Collision Energy, KE (MN-m)		Maximum Impact Force at Pier, P (MN) [1]		Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]		Geometric Probability, PG [3]		Probability of Collapse, PC [4]		Protection Factor, PF	Annual Frequency of Collapse, AF [5]		
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted	Total
1	Ship	Tanker	120,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.252334	0.252334	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
2	Ship	Tanker	110,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.253318	0.253318	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
3	Ship	Tanker	105,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002	0.245736	0.245736	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.210874	0.210874	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.211233	0.211233	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
6	Ship	Tanker	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.216444	0.216444	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007	0.211233	0.211233	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
8	Ship	Tanker	70,000	0.0000	3.0163	0.00	186.90	0.00	95.00	0	0	1.64	0.000002	0.000007	0.210963	0.210963	0.000000	0.005851	0.0400	0.000000	0.000000	0.000000
9	Ship	Bulk Carrier	70,000	0.0000	3.0160	0.00	163.15	0.00	94.99	0	0	1.28	0.000007	0.000007	0.211233	0.211233	0.000000	0.005841	0.0400	0.000000	0.000000	0.000000
10	Ship	Tanker	65,000	0.0000	3.0148	0.00	179.85	0.00	91.50	0	0	1.64	0.000002	0.000007	0.212262	0.212262	0.000000	0.001825	0.0400	0.000000	0.000000	0.000000
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	9	1.28	0.000007	0.000007	0.212456	0.212456	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
12	Ship	Bulk Carrier	60,000	0.0000	3.0122	0.00	159.01	0.00	87.84	0	0	1.28	0.000007	0.000007	0.214409	0.214409	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
13	Ship	Tanker	55,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.215404	0.215404	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
14	Ship	Bulk Carrier	55,000	0.0000	3.0117	0.00	125.95	0.00	84.08	0	0	1.28	0.000007	0.000007	0.214736	0.214736	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
15	Ship	Tanker	50,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	3	1.64	0.000002	0.000007	0.215518	0.215518	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
16	Ship	Bulk Carrier	50,000	0.0000	3.0130	0.00	146.44	0.00	80.20	0	0	1.28	0.000007	0.000007	0.206349	0.206349	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
17	Ship	Tanker	45,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.215746	0.215746	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
18	Ship	Tanker	40,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007	0.200954	0.200954	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
19	Ship	Bulk Carrier	40,000	0.0000	3.0103	0.00	139.61	0.00	71.67	0	0	1.28	0.000007	0.000007	0.208250	0.208250	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
20	Ship	Tanker	35,000	0.0000	0.0000	0.00	0.00	0.00	0.00	0	1	1.64	0.000007	0.000007	0.197827	0.197827	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
21	Ship	Bulk Carrier	35,000	0.0000	3.0097	0.00	113.95	0.00	67.03	0	0	1.28	0.000007	0.000007	0.204934	0.204934	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
22	Ship	Tanker	30,000	0.0000	3.0061	0.00	96.26	0.00	61.99	0	0	1.64	0.000007	0.000007	0.199365	0.199365	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
23	Ship	Bulk Carrier	30,000	0.0000	3.0084	0.00	104.91	0.00	62.03	0	0	1.28	0.000007	0.000007	0.198151	0.198151	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
24	Ship	Articulated Tug/Barge	30,000	0.0000	3.0143	0.00	95.19	0.00	62.15	0	2	1.28	0.000007	0.000007	0.177852	0.177852	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
25	Ship	Tanker	25,000	0.0000	3.0029	0.00	77.44	0.00	56.52	0	0	1.64	0.000007	0.000007	0.189289	0.189289	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
26	Ship	Articulated Tug/Barge	25,000	0.0000	3.0108	0.00	85.50	0.00	56.67	0	1	1.28	0.000007	0.000007	0.185399	0.185399	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
27	Ship	Tanker	20,000	0.0000	3.0027	0.00	66.86	0.00	50.55	0	9	1.64	0.000007	0.000007	0.189394	0.189394	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
28	Ship	Tanker	15,000	0.0000	2.9969	0.00	53.20	0.00	43.70	0	0	1.64	0.000007	0.000007	0.175586	0.175586	0.000000	0.000000	0.0400	0.000000	0.000000	0.000000
																					Total for Pier:	**0.000000**

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed at Pier" and "Maximum Impact Force at Pier" to also be a 0 value

[2] $PA = (BR)(R_B)(R_C)(R_{XC})(R_D)$(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

SUPERSTRUCTURE ANNUAL FREQUENCY OF COLLAPSE (WATER ELEVATION -0.1 CD)

Pier ID	Description	Ultimate Lateral Capacity, H (MN)	Annual Frequency of Collapse, AF			Return Period
		Superstructure	Inbound	Outbound	Total	
1	Main Span South	**0**	0.00029546	0.00000239	0.00029785	3,357
2	Main Span North	**0**	0.00005604	0.00001020	0.00006624	15,097
3	Anchor Span North	**0**	0.00000217	0.00000000	0.00000217	460,514
Total for Bridge Superstructure:			0.00035367	0.00001259	0.00036626	**2,730**

VESSEL FLEET CHARACTERISTICS (SUPERSTRUCTURE ONLY)

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Vessel Size (m)		Vessel Drafts (m)				Vessel Heights (m)									Vessel Displacement (tonnes) [3]		Channel Width, C (m)	Centerline Transit Path to Edge of Channel, x_C (m)	Minimum Design Impact Speed, V_{min} (m/sec)		Standard Deviation, σ (m)	
							Ballasted			Baseline [1]			Loaded [2]			Ballasted [2]										
				Length Overall, LOA	Beam/ Width, B	Operational Loaded, D_O	Stern, D_{ES}	Bow, D_{EB}	Average, D_{AVG}	Bow, H_{BH}	Deckhouse, H_{DH}	Mast, H_{MT}	Bow, H_{BH}	Deckhouse, H_{DH}	Mast, H_{MT}	Bow, H_{BH}	Deckhouse, H_{DH}	Mast, H_{MT}	Loaded, W_L	Ballasted, W_E			Loaded	Ballasted	Loaded	Ballasted
1	Ship	Tanker	120,000	250	44	11.9	8.2	4.7	6.5	26.53	40.24	51.50	14.63	28.34	39.60	21.83	32.04	43.30	101,270	54,890	125.4	62.7	0.514	0.514	80	80
2	Ship	Tanker	110,000	240	44	11.8	8.3	4.9	6.6	26.31	39.96	52.09	14.51	28.16	40.29	21.41	31.66	43.79	95,920	53,650	125.4	62.7	0.514	0.514	79	79
3	Ship	Tanker	105,000	244	42	13.0	8.4	5.0	6.7	26.19	39.80	52.29	13.19	26.80	39.29	21.19	31.40	43.89	102,480	52,820	119.7	59.9	0.514	0.514	80	80
4	Ship	Bulk Carrier	85,000	229	32	11.7	8.6	5.4	7.0	27.69	42.80	55.70	15.99	31.10	44.00	22.29	34.20	47.10	67,920	40,640	110.0	55.0	1.029	1.029	78	78
5	Ship	Bulk Carrier	80,000	225	32	11.9	8.4	5.2	6.8	27.34	42.25	55.19	15.44	30.35	43.29	22.14	33.85	46.79	67,900	38,800	110.0	55.0	1.029	1.029	78	78
6	Ship	Tanker	75,000	228	34	11.3	8.3	5.1	6.7	25.36	38.69	51.41	14.06	27.39	40.11	20.26	30.39	43.11	66,730	39,570	110.0	55.0	0.514	1.029	78	78
7	Ship	Bulk Carrier	75,000	225	32	12.1	7.8	4.6	6.2	26.96	41.67	54.64	14.86	29.57	42.54	22.36	33.87	46.84	68,640	35,180	110.0	55.0	1.029	1.029	78	78
8	Ship	Tanker	70,000	228	32	11.0	7.4	4.2	5.8	25.18	38.46	49.61	14.18	27.46	38.61	20.98	31.06	42.21	62,330	32,870	110.0	55.0	0.514	1.029	78	78
9	Ship	Bulk Carrier	70,000	225	32	12.0	6.8	3.6	5.2	26.56	41.04	54.06	14.56	29.04	42.06	22.96	34.24	47.26	67,680	29,330	110.0	55.0	1.029	1.029	78	78
10	Ship	Tanker	65,000	214	32	10.9	7.5	4.5	6.0	25.00	38.22	49.43	14.10	27.32	38.53	20.50	30.72	41.93	57,520	31,660	110.0	55.0	0.514	1.029	77	77
11	Ship	Bulk Carrier	65,000	212	32	11.7	7.8	4.8	6.3	26.12	40.36	53.43	14.42	28.66	41.73	21.32	32.56	45.63	61,920	33,350	110.0	55.0	1.029	1.029	77	77
12	Ship	Bulk Carrier	60,000	193	32	11.6	7.2	4.5	5.9	25.66	39.63	52.75	14.06	28.03	41.15	21.16	32.43	45.55	55,590	28,040	110.0	55.0	1.029	1.029	75	75
13	Ship	Tanker	55,000	184	32	11.4	8.3	5.7	7.0	24.58	37.66	49.38	13.18	26.26	37.98	18.88	29.36	41.08	51,250	31,470	110.0	55.0	0.514	1.029	74	74
14	Ship	Bulk Carrier	55,000	190	32	10.9	6.3	3.6	5.0	25.15	38.84	52.01	14.25	27.94	41.11	21.55	32.54	45.71	51,210	23,260	110.0	55.0	1.029	1.029	75	75
15	Ship	Tanker	50,000	183	32	10.6	8.2	5.6	6.9	24.35	37.35	49.65	13.75	26.75	39.05	18.75	29.15	41.45	47,500	30,920	110.0	55.0	0.514	1.029	74	74
16	Ship	Bulk Carrier	50,000	199	30	12.2	7.0	4.2	5.6	24.59	37.98	51.21	12.39	25.78	39.01	20.39	30.98	44.21	56,210	25,810	110.0	55.0	1.029	1.029	76	76
17	Ship	Tanker	45,000	181	32	10.3	8.6	6.1	7.4	24.08	37.00	49.13	13.78	26.70	38.83	17.98	28.40	40.53	45,340	32,350	110.0	55.0	0.514	1.029	74	74
18	Ship	Tanker	40,000	179	28	10.1	7.5	5.0	6.3	23.79	36.61	47.60	13.69	26.51	37.50	18.79	29.11	40.10	38,430	23,780	110.0	55.0	0.514	1.029	74	74
19	Ship	Bulk Carrier	40,000	181	30	9.1	7.2	4.7	6.0	23.29	35.95	49.32	14.19	26.85	40.22	18.59	28.75	42.12	37,700	24,650	110.0	55.0	1.029	1.029	74	74
20	Ship	Tanker	35,000	173	27	10.2	7.3	4.9	6.1	23.46	36.17	46.68	13.26	25.97	36.48	18.56	28.87	39.38	35,600	21,290	110.0	55.0	1.029	1.029	73	73
21	Ship	Bulk Carrier	35,000	177	29	9.7	6.5	4.0	5.3	22.51	34.73	48.19	12.81	25.03	38.49	18.51	28.23	41.69	37,830	20,480	110.0	55.0	1.029	1.029	73	73
22	Ship	Tanker	30,000	159	27	9.2	6.5	4.3	5.4	23.08	35.66	44.78	13.88	26.46	35.58	18.78	29.16	38.28	29,160	17,120	110.0	55.0	1.029	1.029	71	71
23	Ship	Bulk Carrier	30,000	170	27	9.5	6.6	4.2	5.4	21.61	33.33	46.89	12.11	23.83	37.39	17.41	26.73	40.29	32,770	18,630	110.0	55.0	1.029	1.029	72	72
24	Ship	Articulated Tug/Barge	30,000	210	23	9.3	5.0	5.0	5.0	23.08	35.66	44.78	13.78	26.36	35.48	18.08	30.66	39.78	32,470	17,460	110.0	55.0	1.029	1.029	77	77
25	Ship	Tanker	25,000	146	24	9.2	6.5	4.5	5.5	22.62	35.06	43.64	13.42	25.86	34.44	18.12	28.56	37.14	22,970	13,740	110.0	55.0	1.029	1.029	69	69
26	Ship	Articulated Tug/Barge	25,000	184	24	8.3	5.0	5.0	5.0	22.62	35.06	43.64	14.32	26.76	35.34	17.62	30.06	38.64	26,090	15,720	110.0	55.0	1.029	1.029	74	74
27	Ship	Tanker	20,000	145	24	8.7	6.1	4.1	5.1	22.07	34.32	42.76	13.37	25.62	34.06	17.97	28.22	36.66	20,880	12,240	110.0	55.0	1.029	1.029	69	69
28	Ship	Tanker	15,000	127	20	8.1	6.3	4.5	5.4	21.52	33.58	40.63	13.42	25.48	32.53	17.02	27.28	34.33	14,280	9,520	110.0	55.0	1.029	1.029	65	65

Notes:

[1] Vessel heights as measured from the baseline/keel of the vessel.

[2] Vessel heights as measured from the waterline. Use Operational Loaded Draft (D_O) for all loaded vessel heights. Use Ballasted Bow (D_{EB}) for ballasted vessel heights at the bow and Ballasted Stern (D_{ES}) for ballasted vessel heights at the deckhouse and mast.

[3] Weight of Water (W_W) = 0.9854 m^3/tonne (used to determine ship loaded/ballasted displacement tonnage based on approximate salinity of water in Vancouver Harbor)

VESSEL FLEET ANNUAL TRIP FREQUENCY (SUPERSTRUCTURE ONLY)

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Annual Number of Trips (N)						Existing Total Trips	Growth Factor [1]	Future Total Trips
				Inbound			Outbound					
				Loaded	Ballasted	Total	Loaded	Ballasted	Total			
1	Ship	Tanker	120,000	0	5	5	0	0	0	5	10.20	51
2	Ship	Tanker	110,000	0	4	4	0	0	0	4	10.20	41
3	Ship	Tanker	105,000	0	1	1	0	0	0	1	10.20	10
4	Ship	Bulk Carrier	85,000	0	5	5	3	0	3	8	1.28	10
5	Ship	Bulk Carrier	80,000	0	5	5	3	0	3	8	1.28	10
6	Ship	Tanker	75,000	0	3	3	0	0	0	3	1.64	5
7	Ship	Bulk Carrier	75,000	0	4	4	2	0	2	6	1.28	8
8	Ship	Tanker	70,000	0	0	0	0	0	0	0	1.64	0
9	Ship	Bulk Carrier	70,000	0	1	1	1	0	1	2	1.28	3
10	Ship	Tanker	65,000	0	1	1	0	0	0	1	1.64	2
11	Ship	Bulk Carrier	65,000	0	6	6	0	9	9	15	1.28	19
12	Ship	Bulk Carrier	60,000	0	2	2	0	0	0	2	1.28	3
13	Ship	Tanker	55,000	0	2	2	0	0	0	2	1.64	3
14	Ship	Bulk Carrier	55,000	0	3	3	0	0	0	3	1.28	4
15	Ship	Tanker	50,000	4	7	11	8	3	11	22	1.64	36
16	Ship	Bulk Carrier	50,000	0	0	0	0	0	0	0	1.28	0
17	Ship	Tanker	45,000	0	0	0	0	0	0	0	1.64	0
18	Ship	Tanker	40,000	1	4	5	5	0	5	10	1.64	16
19	Ship	Bulk Carrier	40,000	0	1	1	1	0	1	2	1.28	3
20	Ship	Tanker	35,000	1	2	3	2	1	3	6	1.64	10
21	Ship	Bulk Carrier	35,000	0	0	0	0	0	0	0	1.28	0
22	Ship	Tanker	30,000	0	7	7	7	0	7	14	1.64	23
23	Ship	Bulk Carrier	30,000	0	0	0	1	0	1	1	1.28	1
24	Ship	Articulated Tug/Barge	30,000	3	4	7	4	2	6	13	1.28	17
25	Ship	Tanker	25,000	0	1	1	1	0	1	2	1.64	3
26	Ship	Articulated Tug/Barge	25,000	1	2	3	2	1	3	6	1.28	8
27	Ship	Tanker	20,000	9	4	13	4	9	13	26	1.64	43
28	Ship	Tanker	15,000	0	1	1	1	0	1	2	1.64	3
		Total Trips:		19	75	94	45	25	70	164		332

Notes:

[1] As part of the risk analysis, vessel trips will include future growth in the waterway that are projected to the mid-point of the remaining design life (assumed 50 years) of the structure. This equates to growth rates per year as follows for a 25-year projection. GF = $(1+PERCENT/100)^{25}$

- Aframax Tankers (DWT greater than 100,000 tonnes) = 9.735%
- All Other Tankers = 2.0%
- All Other Vessels = 1.0%

VESSEL FLEET TRANSIT SPEEDS IN MAIN CHANNEL (SUPERSTRUCTURE ONLY)

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Vessel Transit Speeds (knots)				Vessel Transit Speeds (m/sec) [1]			
				Inbound		Outbound		Inbound		Outbound	
				Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted	Loaded	Ballasted
1	Ship	Tanker	120,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
2	Ship	Tanker	110,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
3	Ship	Tanker	105,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
4	Ship	Bulk Carrier	85,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
5	Ship	Bulk Carrier	80,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
6	Ship	Tanker	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
7	Ship	Bulk Carrier	75,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
8	Ship	Tanker	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
9	Ship	Bulk Carrier	70,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
10	Ship	Tanker	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
11	Ship	Bulk Carrier	65,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
12	Ship	Bulk Carrier	60,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
13	Ship	Tanker	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
14	Ship	Bulk Carrier	55,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
15	Ship	Tanker	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
16	Ship	Bulk Carrier	50,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
17	Ship	Tanker	45,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
18	Ship	Tanker	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
19	Ship	Bulk Carrier	40,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
20	Ship	Tanker	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
21	Ship	Bulk Carrier	35,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
22	Ship	Tanker	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
23	Ship	Bulk Carrier	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
24	Ship	Articulated Tug/Barge	30,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
25	Ship	Tanker	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
26	Ship	Articulated Tug/Barge	25,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
27	Ship	Tanker	20,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866
28	Ship	Tanker	15,000	6.0	6.0	6.0	6.0	3.0866	3.0866	3.0866	3.0866

Notes:

[1] Conversion (knot to m/sec) = 0.51 (convert vessel transit speeds from knots to meters/second for use in risk assessment equations)

ABERRANCY BASE RATE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Code Recommended Aberrancy Base Rate, BR	Vessel Traffic Service, VTS	Electronic Chart Display & Information System, ECDIS	Other Navigation Aids	Port Control State, PCS	Pilotage 1 Pilot	Pilotage 2 Pilots (MRA-2)		Daytime Only Transit Restrictions (MRA-2)		Visibility Restrictions (MRA-2)	Adjusted Aberrancy Base Rate, BR [1]	
										Loaded	Ballasted	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
2	Ship	Tanker	110,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
3	Ship	Tanker	105,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	0.54	0.50	0.50	0.50	4.93E-06	4.93E-06
4	Ship	Bulk Carrier	85,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
5	Ship	Bulk Carrier	80,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
6	Ship	Tanker	75,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
7	Ship	Bulk Carrier	75,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
8	Ship	Tanker	70,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
9	Ship	Bulk Carrier	70,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
10	Ship	Tanker	65,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
11	Ship	Bulk Carrier	65,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
12	Ship	Bulk Carrier	60,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
13	Ship	Tanker	55,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
14	Ship	Bulk Carrier	55,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
15	Ship	Tanker	50,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
16	Ship	Bulk Carrier	50,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
17	Ship	Tanker	45,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
18	Ship	Tanker	40,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	0.54	1.00	0.50	1.00	0.50	4.93E-06	1.83E-05
19	Ship	Bulk Carrier	40,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
20	Ship	Tanker	35,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
21	Ship	Bulk Carrier	35,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
22	Ship	Tanker	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
23	Ship	Bulk Carrier	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
24	Ship	Articulated Tug/Barge	30,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
25	Ship	Tanker	25,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
26	Ship	Articulated Tug/Barge	25,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
27	Ship	Tanker	20,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05
28	Ship	Tanker	15,000	6.00E-05	0.80	0.81	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.50	1.83E-05	1.83E-05

Notes:

[1] Adjustments to the aberrancy Base Rate (BR) due to waterway current restrictions are accounted for elsewhere in the vessel collision risk analysis (refer to correction factors R_C and R_{XC} for the Probability of Aberrancy at each transit leg).

MISCELLANEOUS INFORMATION (SUPERSTRUCTURE ONLY)

CHANNEL CHARACTERISTICS

Waterway Current Speed (V_{min}) =	**1.03**	m/sec
Mean High Water (MHW) Elevation =	**-0.10**	m (based on Chart Datum)
Sea Level Rise Adjustment =	**0.10**	m
Soft Soil Allowance =	**1.00**	m (assumed depth that vessels can "plow" through soft bottom material)

AVAILABLE WATER DEPTH AT PIERS

Pier ID	Description	Mudline Elevation (m) [1]		Water Elevation (m)	Soft Soil Allowance (m)	Design Water Depth (m)	
		Inbound	Outbound			Inbound	Outbound
1	**Main Span South**	**-6.00**	**-5.00**	0.00	1.00	7.00	6.00
2	**Main Span North**	**-10.00**	**-9.00**	0.00	1.00	11.00	10.00
3	**Anchor Span North**	**-5.00**	**N/A**	0.00	1.00	6.00	0.00

Notes:
[1] Mudline elevation is based on Chart Datum (CD) and was obtained from Nautical Chart 3494

PROBABILITY OF ABERRANCY VARIABLES FOR EACH VESSEL TRANSIT PATH

Leg ID	Waterway Region for Bridge Location	Angle of Channel Turn, θ (deg) [1]	Correction Factor, R_B	Current Angle to Vessel Path (deg) [2]	Parallel Current, V_C (m/sec)	Perpendicular Current, V_{XC} (m/sec)	Correction Factor, R_C	Correction Factor, R_{XC}	Vessel Traffic Density	Correction Factor, R_D	Summation (R_B*R_C*R_{XC}*R_D)	Aberrancy Distribution [3]	
												Inbound	Outbound
1	**Transition**	**7.7227**	1.0858	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.3095	**0.24**	**N/A**
2	**Turn/Bend**	**7.7227**	1.1716	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4130	**0.50**	**N/A**
3	**Turn/Bend**	**7.7227**	1.1716	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4130	**0.26**	**N/A**
4	**Transition**	**8.8764**	1.0986	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.3249	**N/A**	**0.24**
5	**Turn/Bend**	**8.8764**	1.1973	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4439	**N/A**	**0.50**
6	**Turn/Bend**	**8.8764**	1.1973	**0.0000**	1.0300	0.0000	1.2060	1.0000	**Low**	1.0	1.4439	**N/A**	**0.26**

Notes:
[1] Angle of the turn region in accordance with information shown on Nautical Chart 3494, AIS transit data near the bridge, and CAN/CSA S6-14 Figure A3.3.1
[2] The angle between the water current direction and each channel transition leg
[3] Distribution of the Probability of Aberrancy for each channel transition leg is established as a ratio of the length of each leg to the overall length being considered (approximately 1 nautical mile or 2000m)

PROTECTION FACTOR

Pier ID	Description	Leg 1		Leg 2		Leg 3		Leg 4		Leg 5		Leg 6	
		Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
1	Main Span South	**0.63**	**N/A**	**0.63**	**N/A**	**0.66**	**N/A**	**N/A**	**0.29**	**N/A**	**0.29**	**N/A**	**0.36**
2	Main Span North	**0.72**	**N/A**	**0.72**	**N/A**	**0.80**	**N/A**	**N/A**	**0.23**	**N/A**	**0.23**	**N/A**	**0.18**
3	Anchor Span North	**0.58**	**N/A**	**0.58**	**N/A**	**0.67**	**N/A**	**N/A**	**0.00**	**N/A**	**0.00**	**N/A**	**0.00**

SUPERSTRUCTURE CONTACT GEOMETRY - MAIN SPAN SOUTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Main Span South (Pier 16)																				
				Leg 1 [1]							Leg 2 [1]							Leg 3 [1]						
				Centerline of Pier 16	Loaded			Ballasted			Centerline of Pier 16	Loaded			Ballasted			Centerline of Pier 16	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	98.319	96.134	77.727	54.621	86.819	70.846	42.972	98.319	96.134	77.727	54.621	86.819	70.846	42.972	168.710	166.507	147.949	124.652	157.116	141.011	112.908
2	Ship	Tanker	110,000	98.319	96.288	78.061	52.783	87.362	71.553	40.984	98.319	96.288	78.061	52.783	87.362	71.553	40.984	168.710	166.663	148.286	122.799	157.664	141.724	110.903
3	Ship	Tanker	105,000	98.319	97.996	80.389	55.447	87.647	72.036	40.578	98.319	97.996	80.389	55.447	87.647	72.036	40.578	168.710	168.385	150.633	125.485	157.951	142.211	110.494
4	Ship	Bulk Carrier	85,000	98.319	94.374	72.594	40.132	86.224	66.829	23.820	98.319	94.374	72.594	40.132	86.224	66.829	23.820	168.710	164.733	142.774	110.044	156.516	136.961	93.598
5	Ship	Bulk Carrier	80,000	98.319	95.085	73.989	43.012	86.418	67.480	25.747	98.319	95.085	73.989	43.012	86.418	67.480	25.747	168.710	165.450	144.180	112.948	156.712	137.617	95.540
6	Ship	Tanker	75,000	98.319	96.871	79.493	53.262	88.850	73.914	43.743	98.319	96.871	79.493	53.262	88.850	73.914	43.743	168.710	167.250	149.730	123.282	159.164	144.105	113.685
7	Ship	Bulk Carrier	75,000	98.319	95.836	75.439	46.056	86.133	67.443	25.436	98.319	95.836	75.439	46.056	86.133	67.443	25.436	168.710	166.207	145.642	116.017	156.425	137.580	95.227
8	Ship	Tanker	70,000	98.319	96.716	79.363	57.259	87.919	72.669	47.395	98.319	96.716	79.363	57.259	87.919	72.669	47.395	168.710	167.094	149.599	127.312	158.225	142.849	117.367
9	Ship	Bulk Carrier	70,000	98.319	96.224	76.425	48.003	85.357	66.755	22.827	98.319	96.224	76.425	48.003	85.357	66.755	22.827	168.710	166.598	146.636	117.980	155.642	136.886	92.596
10	Ship	Tanker	65,000	98.319	96.819	79.623	57.472	88.539	73.300	48.413	98.319	96.819	79.623	57.472	88.539	73.300	48.413	168.710	167.198	149.861	127.527	158.851	143.486	118.394
11	Ship	Bulk Carrier	65,000	98.319	96.405	77.132	57.178	87.478	69.879	32.952	98.319	96.405	77.132	57.178	87.478	69.879	32.952	168.710	166.781	147.349	127.230	157.781	140.036	102.805
12	Ship	Bulk Carrier	60,000	98.319	96.871	78.303	50.491	87.686	70.121	32.903	98.319	96.871	78.303	50.491	87.686	70.121	32.903	168.710	167.250	148.530	120.488	157.990	140.280	103.306
13	Ship	Tanker	55,000	98.319	98.009	81.088	58.938	90.635	75.830	50.677	98.319	98.009	81.088	58.938	90.635	75.830	50.677	168.710	168.398	151.338	129.005	160.964	146.036	120.676
14	Ship	Bulk Carrier	55,000	98.319	96.625	78.471	50.598	87.188	69.916	32.455	98.319	96.625	78.471	50.598	87.188	69.916	32.455	168.710	167.002	148.699	120.596	157.481	140.074	102.304
15	Ship	Tanker	50,000	98.319	97.272	80.683	56.087	90.804	76.220	49.692	98.319	97.272	80.683	56.087	90.804	76.220	49.692	168.710	167.655	150.930	126.130	161.134	146.430	119.682
16	Ship	Bulk Carrier	50,000	98.319	96.801	81.709	56.193	88.681	72.817	39.280	98.319	96.801	81.709	56.193	88.681	72.817	39.280	168.710	167.180	151.964	126.237	158.994	142.999	109.185
17	Ship	Tanker	45,000	98.319	97.233	80.777	56.673	91.800	77.615	52.124	98.319	97.233	80.777	56.673	91.800	77.615	52.124	168.710	167.615	151.024	126.721	162.138	147.836	122.134
18	Ship	Tanker	40,000	98.319	97.350	80.765	60.217	90.751	76.295	53.289	98.319	97.350	80.765	60.217	90.751	76.295	53.289	168.710	167.733	151.012	130.294	161.081	146.505	123.309
19	Ship	Bulk Carrier	40,000	98.319	96.703	80.324	52.970	91.010	76.964	47.760	98.319	96.703	80.324	52.970	91.010	76.964	47.760	168.710	167.081	150.568	122.987	161.342	147.180	117.735
20	Ship	Tanker	35,000	98.319	97.906	81.463	62.589	91.049	76.741	55.207	98.319	97.906	81.463	62.589	91.049	76.741	55.207	168.710	168.294	151.716	132.686	161.381	146.955	125.243
21	Ship	Bulk Carrier	35,000	98.319	97.906	82.679	57.578	49.052	77.931	91.114	98.319	97.906	82.679	57.578	49.052	77.931	91.114	168.710	168.294	152.942	127.634	161.447	148.155	119.038
22	Ship	Tanker	30,000	98.319	97.104	81.223	65.332	90.765	76.201	58.139	98.319	97.104	81.223	65.332	90.765	76.201	58.139	168.710	167.485	151.474	135.452	161.095	146.411	128.199
23	Ship	Bulk Carrier	30,000	98.319	98.068	84.231	60.510	92.537	80.720	52.783	98.319	98.068	84.231	60.510	92.537	80.720	52.783	168.710	168.457	154.507	130.590	162.882	150.967	122.799
24	Ship	Articulated Tug/Barge	30,000	98.319	97.233	80.958	64.449	91.671	73.413	54.142	98.319	97.233	80.958	64.449	91.671	73.413	54.142	168.710	167.615	151.207	134.561	162.008	143.599	124.169
25	Ship	Tanker	25,000	98.319	97.699	81.606	66.383	61.176	77.317	91.618	98.319	97.699	81.606	66.383	61.176	77.317	91.618	168.710	168.085	151.860	136.511	161.955	147.536	131.261
26	Ship	Articulated Tug/Barge	25,000	98.319	96.534	80.665	57.179	92.266	74.528	57.179	98.319	96.534	80.665	57.179	92.266	74.528	57.179	168.710	166.911	150.911	134.824	162.608	144.724	127.231
27	Ship	Tanker	20,000	98.319	97.763	81.916	67.090	91.812	77.950	62.255	98.319	97.763	81.916	67.090	91.812	77.950	62.255	168.710	168.150	152.173	137.224	162.151	148.174	132.349
28	Ship	Tanker	15,000	98.319	97.699	82.097	69.934	93.041	79.698	66.587	98.319	97.699	82.097	69.934	93.041	79.698	66.587	168.710	168.085	152.355	140.092	163.390	149.936	136.717

Notes:

[1] Perpendicular distances at each channel transition leg (as measured in CADD drawing) from the centerline of vessel transit path to where the loaded/ballasted vessel bow, deckhouse, or mast makes first contact with the bottom chord of the truss superstructure adjacent to Pier 16. The absolute boundaries for "Main Span South" are the centerline of main span (between Piers 15-16) and the centerline of Pier 16. Note that the values for Leg 6 are shown as "N/A" since the extension of this particular vessel transit path occurs well south of the centerline of pier boundary.

SUPERSTRUCTURE CONTACT GEOMETRY - MAIN SPAN SOUTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Main Span South (Pier 16)																				
				Leg 4 [1]							Leg 5 [1]							Leg 6 [1]						
				Centerline of Pier 16	Loaded			Ballasted			Centerline of Pier 16	Loaded			Ballasted			Centerline of Pier 16	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	168.710	166.507	147.949	124.652	157.116	141.011	112.908	168.710	166.507	147.949	124.652	157.116	141.011	112.908	61.162	N/A	N/A	N/A	N/A	N/A	N/A
2	Ship	Tanker	110,000	168.710	166.663	148.286	122.799	157.664	141.724	110.903	168.710	166.663	148.286	122.799	157.664	141.724	110.903	61.162	N/A	N/A	N/A	N/A	N/A	N/A
3	Ship	Tanker	105,000	168.710	168.385	150.633	125.485	157.951	142.211	110.494	168.710	168.385	150.633	125.485	157.951	142.211	110.494	61.162	N/A	N/A	N/A	N/A	N/A	N/A
4	Ship	Bulk Carrier	85,000	168.710	164.733	142.774	110.044	156.516	136.961	93.598	168.710	164.733	142.774	110.044	156.516	136.961	93.598	61.162	N/A	N/A	N/A	N/A	N/A	N/A
5	Ship	Bulk Carrier	80,000	168.710	165.450	144.180	112.948	156.712	137.617	95.540	168.710	165.450	144.180	112.948	156.712	137.617	95.540	61.162	N/A	N/A	N/A	N/A	N/A	N/A
6	Ship	Tanker	75,000	168.710	167.250	149.730	123.282	159.164	144.105	113.685	168.710	167.250	149.730	123.282	159.164	144.105	113.685	61.162	N/A	N/A	N/A	N/A	N/A	N/A
7	Ship	Bulk Carrier	75,000	168.710	166.207	145.642	116.017	156.425	137.580	95.227	168.710	166.207	145.642	116.017	156.425	137.580	95.227	61.162	N/A	N/A	N/A	N/A	N/A	N/A
8	Ship	Tanker	70,000	168.710	167.094	149.599	127.312	158.225	142.849	117.367	168.710	167.094	149.599	127.312	158.225	142.849	117.367	61.162	N/A	N/A	N/A	N/A	N/A	N/A
9	Ship	Bulk Carrier	70,000	168.710	166.598	146.636	117.980	155.642	136.886	92.596	168.710	166.598	146.636	117.980	155.642	136.886	92.596	61.162	N/A	N/A	N/A	N/A	N/A	N/A
10	Ship	Tanker	65,000	168.710	167.198	149.861	127.527	158.851	143.486	118.394	168.710	167.198	149.861	127.527	158.851	143.486	118.394	61.162	N/A	N/A	N/A	N/A	N/A	N/A
11	Ship	Bulk Carrier	65,000	168.710	166.781	147.349	127.230	157.781	140.036	102.805	168.710	166.781	147.349	127.230	157.781	140.036	102.805	61.162	N/A	N/A	N/A	N/A	N/A	N/A
12	Ship	Bulk Carrier	60,000	168.710	167.250	148.530	120.488	157.990	140.280	103.306	168.710	167.250	148.530	120.488	157.990	140.280	103.306	61.162	N/A	N/A	N/A	N/A	N/A	N/A
13	Ship	Tanker	55,000	168.710	168.398	151.338	129.005	160.964	146.036	120.676	168.710	168.398	151.338	129.005	160.964	146.036	120.676	61.162	N/A	N/A	N/A	N/A	N/A	N/A
14	Ship	Bulk Carrier	55,000	168.710	167.002	148.699	120.596	157.481	140.074	102.304	168.710	167.002	148.699	120.596	157.481	140.074	102.304	61.162	N/A	N/A	N/A	N/A	N/A	N/A
15	Ship	Tanker	50,000	168.710	167.655	150.930	126.130	161.134	146.430	119.682	168.710	167.655	150.930	126.130	161.134	146.430	119.682	61.162	N/A	N/A	N/A	N/A	N/A	N/A
16	Ship	Bulk Carrier	50,000	168.710	167.180	151.964	126.237	158.994	142.999	109.185	168.710	167.180	151.964	126.237	158.994	142.999	109.185	61.162	N/A	N/A	N/A	N/A	N/A	N/A
17	Ship	Tanker	45,000	168.710	167.615	151.024	126.721	162.138	147.836	122.134	168.710	167.615	151.024	126.721	162.138	147.836	122.134	61.162	N/A	N/A	N/A	N/A	N/A	N/A
18	Ship	Tanker	40,000	168.710	167.733	151.012	130.294	161.081	146.505	123.309	168.710	167.733	151.012	130.294	161.081	146.505	123.309	61.162	N/A	N/A	N/A	N/A	N/A	N/A
19	Ship	Bulk Carrier	40,000	168.710	167.081	150.568	122.987	161.342	147.180	117.735	168.710	167.081	150.568	122.987	161.342	147.180	117.735	61.162	N/A	N/A	N/A	N/A	N/A	N/A
20	Ship	Tanker	35,000	168.710	168.294	151.716	132.686	161.381	146.955	125.243	168.710	168.294	151.716	132.686	161.381	146.955	125.243	61.162	N/A	N/A	N/A	N/A	N/A	N/A
21	Ship	Bulk Carrier	35,000	168.710	168.294	152.942	127.634	161.447	148.155	119.038	168.710	168.294	152.942	127.634	161.447	148.155	119.038	61.162	N/A	N/A	N/A	N/A	N/A	N/A
22	Ship	Tanker	30,000	168.710	167.485	151.474	135.452	161.095	146.411	128.199	168.710	167.485	151.474	135.452	161.095	146.411	128.199	61.162	N/A	N/A	N/A	N/A	N/A	N/A
23	Ship	Bulk Carrier	30,000	168.710	168.457	154.507	130.590	162.882	150.967	122.799	168.710	168.457	154.507	130.590	162.882	150.967	122.799	61.162	N/A	N/A	N/A	N/A	N/A	N/A
24	Ship	Articulated Tug/Barge	30,000	168.710	167.615	151.207	134.561	162.008	143.599	124.169	168.710	167.615	151.207	134.561	162.008	143.599	124.169	61.162	N/A	N/A	N/A	N/A	N/A	N/A
25	Ship	Tanker	25,000	168.710	168.085	151.860	136.511	161.955	147.536	131.261	168.710	168.085	151.860	136.511	161.955	147.536	131.261	61.162	N/A	N/A	N/A	N/A	N/A	N/A
26	Ship	Articulated Tug/Barge	25,000	168.710	166.911	150.911	134.824	162.608	144.724	127.231	168.710	166.911	150.911	134.824	162.608	144.724	127.231	61.162	N/A	N/A	N/A	N/A	N/A	N/A
27	Ship	Tanker	20,000	168.710	168.150	152.173	137.224	162.151	148.174	132.349	168.710	168.150	152.173	137.224	162.151	148.174	132.349	61.162	N/A	N/A	N/A	N/A	N/A	N/A
28	Ship	Tanker	15,000	168.710	168.085	152.355	140.092	163.390	149.936	136.717	168.710	168.085	152.355	140.092	163.390	149.936	136.717	61.162	N/A	N/A	N/A	N/A	N/A	N/A

SUPERSTRUCTURE CONTACT GEOMETRY - MAIN SPAN NORTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Main Span North (Pier 15)																				
				Leg 1 [1]							Leg 2 [1]							Leg 3 [1]						
				Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	234.213	232.028	213.621	190.515	222.713	206.740	178.866	234.213	232.028	213.621	190.515	222.713	206.740	178.866	166.562	164.359	145.801	122.504	154.967	138.863	110.759
2	Ship	Tanker	110,000	234.213	232.182	213.955	188.677	223.256	207.447	176.877	234.213	232.182	213.955	188.677	223.256	207.447	176.877	166.562	164.515	146.138	120.651	155.515	139.576	108.754
3	Ship	Tanker	105,000	234.213	233.890	216.283	191.341	223.541	207.930	176.472	234.213	233.890	216.283	191.341	223.541	207.930	176.472	166.562	166.237	148.485	123.337	155.802	140.063	108.345
4	Ship	Bulk Carrier	85,000	234.213	230.268	208.488	176.026	222.118	202.723	159.714	234.213	230.268	208.488	176.026	222.118	202.723	159.714	166.562	162.585	140.626	107.895	154.367	134.813	91.450
5	Ship	Bulk Carrier	80,000	234.213	230.979	209.883	178.906	222.312	203.373	161.640	234.213	230.979	209.883	178.906	222.312	203.373	161.640	166.562	163.302	142.032	110.799	154.563	135.469	93.392
6	Ship	Tanker	75,000	234.213	232.764	215.387	189.156	224.744	209.808	179.637	234.213	232.764	215.387	189.156	224.744	209.808	179.637	166.562	165.102	147.582	121.134	157.015	141.957	111.536
7	Ship	Bulk Carrier	75,000	234.213	231.730	211.333	181.950	222.027	203.337	161.330	234.213	231.730	211.333	181.950	222.027	203.337	161.330	166.562	164.059	143.494	113.868	154.276	135.432	93.079
8	Ship	Tanker	70,000	234.213	232.610	215.257	193.153	223.812	208.563	183.288	234.213	232.610	215.257	193.153	223.812	208.563	183.288	166.562	164.946	147.451	125.164	156.076	140.701	115.218
9	Ship	Bulk Carrier	70,000	234.213	232.118	212.319	183.896	221.251	202.648	158.721	234.213	232.118	212.319	183.896	221.251	202.648	158.721	166.562	164.450	144.488	115.831	153.493	134.738	90.448
10	Ship	Tanker	65,000	234.213	232.713	215.517	193.366	224.433	209.194	184.307	234.213	232.713	215.517	193.366	224.433	209.194	184.307	166.562	165.050	147.713	125.379	156.702	141.338	116.245
11	Ship	Bulk Carrier	65,000	234.213	213.026	193.072	168.846	223.372	205.773	168.846	234.213	213.026	193.072	168.846	223.372	205.773	168.846	166.562	164.633	145.201	125.082	155.632	137.888	100.657
12	Ship	Bulk Carrier	60,000	234.213	232.764	214.197	186.385	223.579	206.015	169.343	234.213	232.764	214.197	186.385	223.579	206.015	169.343	166.562	165.102	146.382	118.340	155.841	138.132	101.158
13	Ship	Tanker	55,000	234.213	233.903	216.982	194.832	226.529	211.723	186.571	234.213	233.903	216.982	194.832	226.529	211.723	186.571	166.562	166.386	149.190	126.857	158.815	143.888	118.528
14	Ship	Bulk Carrier	55,000	234.213	232.519	214.365	186.492	223.075	205.810	168.349	234.213	232.519	214.365	186.492	223.075	205.810	168.349	166.562	164.854	146.551	118.448	155.332	137.926	100.156
15	Ship	Tanker	50,000	234.213	233.166	216.577	191.981	226.698	212.114	185.585	234.213	233.166	216.577	191.981	226.698	212.114	185.585	166.562	165.507	148.782	123.982	158.985	144.282	117.534
16	Ship	Bulk Carrier	50,000	234.213	232.695	217.603	192.087	224.575	208.711	175.174	234.213	232.695	217.603	192.087	224.575	208.711	175.174	166.562	165.032	149.816	124.089	156.845	140.851	107.037
17	Ship	Tanker	45,000	234.213	233.127	216.671	192.567	227.693	213.509	188.017	234.213	233.127	216.671	192.567	227.693	213.509	188.017	166.562	165.467	148.876	124.573	159.989	145.688	119.986
18	Ship	Tanker	40,000	234.213	233.244	216.659	196.110	226.645	212.189	189.183	234.213	233.244	216.659	196.110	226.645	212.189	189.183	166.562	165.585	148.864	128.146	158.932	144.357	121.161
19	Ship	Bulk Carrier	40,000	234.213	232.597	216.218	188.863	226.904	212.858	183.653	234.213	232.597	216.218	188.863	226.904	212.858	183.653	166.562	164.933	148.420	120.839	159.193	145.032	115.586
20	Ship	Tanker	35,000	234.213	233.800	217.357	198.483	226.943	212.635	191.101	234.213	233.800	217.357	198.483	226.943	212.635	191.101	166.562	166.146	149.568	130.538	159.232	144.807	123.095
21	Ship	Bulk Carrier	35,000	234.213	233.962	218.573	193.472	227.008	213.825	184.946	234.213	233.962	218.573	193.472	227.008	213.825	184.946	166.562	166.146	150.794	125.486	159.298	146.007	116.889
22	Ship	Tanker	30,000	234.213	232.998	217.117	201.226	226.659	212.095	194.033	234.213	232.998	217.117	201.226	226.659	212.095	194.033	166.562	165.337	149.326	133.304	158.946	144.263	126.051
23	Ship	Bulk Carrier	30,000	234.213	233.962	220.125	196.404	228.431	216.614	188.677	234.213	233.962	220.125	196.404	228.431	216.614	188.677	166.562	166.309	152.359	128.442	160.733	148.819	120.651
24	Ship	Articulated Tug/Barge	30,000	234.213	233.127	216.852	200.343	227.564	209.306	190.036	234.213	233.127	216.852	200.343	227.564	209.306	190.036	166.562	165.467	149.059	132.413	159.859	141.451	122.021
25	Ship	Tanker	25,000	234.213	233.593	217.500	202.277	227.512	213.211	197.070	234.213	233.593	217.500	202.277	227.512	213.211	197.070	166.562	165.937	149.712	134.363	159.806	145.388	129.113
26	Ship	Articulated Tug/Barge	25,000	234.213	232.428	216.558	200.603	228.160	210.422	193.073	234.213	232.428	216.558	200.603	228.160	210.422	193.073	166.562	164.763	148.763	132.676	160.459	142.576	125.083
27	Ship	Tanker	20,000	234.213	233.657	217.810	213.844	227.706	213.844	198.149	234.213	233.657	217.810	213.844	227.706	213.844	198.149	166.562	166.002	150.025	135.076	160.002	146.026	130.201
28	Ship	Tanker	15,000	234.213	233.593	217.991	205.828	228.935	215.591	202.481	234.213	233.593	217.991	205.828	228.935	215.591	202.481	166.562	165.937	150.207	137.944	161.241	147.788	134.569

Notes:

[1] Perpendicular distances at each channel transition leg (as measured in CADD drawing) from the centerline of vessel transit path to where the loaded/ballasted vessel bow, deckhouse, or mast makes first contact with the bottom chord of the truss superstructure adjacent to Pier 15. The absolute boundaries for "Main Span North" are the centerline of main span (between Piers 15-16) and the centerline of Pier 15.

SUPERSTRUCTURE CONTACT GEOMETRY - MAIN SPAN NORTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Main Span North (Pier 15)																				
				Leg 4 [1]							Leg 5 [1]							Leg 6 [1]						
				Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	166.562	164.359	145.801	122.504	154.967	138.863	110.759	166.562	164.359	145.801	122.504	154.967	138.863	110.759	392.040	389.866	371.551	348.560	380.597	364.704	336.969
2	Ship	Tanker	110,000	166.562	164.515	146.138	120.651	155.515	139.576	108.754	166.562	164.515	146.138	120.651	155.515	139.576	108.754	392.040	390.020	371.883	346.731	381.138	365.407	334.990
3	Ship	Tanker	105,000	166.562	166.237	148.485	123.337	155.802	140.063	108.345	166.562	166.237	148.485	123.337	155.802	140.063	108.345	392.040	391.719	374.199	349.382	381.421	365.888	334.587
4	Ship	Bulk Carrier	85,000	166.562	162.585	140.626	107.895	154.367	134.813	91.450	166.562	162.585	140.626	107.895	154.367	134.813	91.450	392.040	388.115	366.444	334.142	380.005	360.707	317.912
5	Ship	Bulk Carrier	80,000	166.562	163.302	142.032	110.799	154.563	135.469	93.392	166.562	163.302	142.032	110.799	154.563	135.469	93.392	392.040	388.823	367.831	337.008	380.199	361.354	319.829
6	Ship	Tanker	75,000	166.562	165.102	147.582	121.134	157.015	141.957	111.536	166.562	165.102	147.582	121.134	157.015	141.957	111.536	392.040	390.599	373.308	347.208	382.618	367.757	337.736
7	Ship	Bulk Carrier	75,000	166.562	164.059	143.494	113.868	154.276	135.432	93.079	166.562	164.059	143.494	113.868	154.276	135.432	93.079	392.040	389.570	369.274	340.037	379.915	361.318	319.520
8	Ship	Tanker	70,000	166.562	164.946	147.451	125.164	156.076	140.701	115.218	166.562	164.946	147.451	125.164	156.076	140.701	115.218	392.040	390.445	373.179	351.185	381.692	366.518	341.369
9	Ship	Bulk Carrier	70,000	166.562	164.450	144.488	115.831	153.493	134.738	90.448	166.562	164.450	144.488	115.831	153.493	134.738	90.448	392.040	389.956	370.255	341.974	379.143	360.633	316.924
10	Ship	Tanker	65,000	166.562	165.050	147.713	125.379	156.702	141.338	116.245	166.562	165.050	147.713	125.379	156.702	141.338	116.245	392.040	390.548	373.438	351.397	382.310	367.146	342.383
11	Ship	Bulk Carrier	65,000	166.562	164.633	145.201	125.082	155.632	137.888	100.657	166.562	164.633	145.201	125.082	155.632	137.888	100.657	392.040	390.136	370.959	351.104	381.254	363.742	326.998
12	Ship	Bulk Carrier	60,000	166.562	165.102	146.382	118.340	155.841	138.132	101.158	166.562	165.102	146.382	118.340	155.841	138.132	101.158	392.040	390.599	372.124	344.450	381.460	363.982	327.493
13	Ship	Tanker	55,000	166.562	166.386	149.190	126.857	158.815	143.888	118.528	166.562	166.386	149.190	126.857	158.815	143.888	118.528	392.040	391.732	374.895	352.855	384.395	369.663	344.636
14	Ship	Bulk Carrier	55,000	166.562	164.854	146.551	118.448	155.332	137.926	100.156	166.562	164.854	146.551	118.448	155.332	137.926	100.156	392.040	390.355	372.291	344.557	380.958	363.779	326.504
15	Ship	Tanker	50,000	166.562	165.507	148.782	123.982	158.985	144.282	117.534	166.562	165.507	148.782	123.982	158.985	144.282	117.534	392.040	390.999	374.493	350.018	384.563	370.052	343.655
16	Ship	Bulk Carrier	50,000	166.562	165.032	149.816	124.089	156.845	140.851	107.037	166.562	165.032	149.816	124.089	156.845	140.851	107.037	392.040	390.530	375.513	350.124	382.451	366.666	333.295
17	Ship	Tanker	45,000	166.562	165.467	148.876	124.573	159.989	145.688	119.986	166.562	165.467	148.876	124.573	159.989	145.688	119.986	392.040	390.959	374.585	350.601	385.553	371.439	346.075
18	Ship	Tanker	40,000	166.562	165.585	148.864	128.146	158.932	144.357	121.161	166.562	165.585	148.864	128.146	158.932	144.357	121.161	392.040	391.076	374.573	354.128	384.510	370.126	347.234
19	Ship	Bulk Carrier	40,000	166.562	164.933	148.420	120.839	159.193	145.032	115.586	166.562	164.933	148.420	120.839	159.193	145.032	115.586	392.040	390.432	374.135	346.916	384.768	370.792	341.732
20	Ship	Tanker	35,000	166.562	166.146	149.568	130.538	159.232	144.807	123.095	166.562	166.146	149.568	130.538	159.232	144.807	123.095	392.040	391.630	375.268	356.488	384.806	370.570	349.143
21	Ship	Bulk Carrier	35,000	166.562	166.146	150.794	125.486	159.298	146.007	116.889	166.562	166.146	150.794	125.486	159.298	146.007	116.889	392.040	391.630	376.478	351.502	384.871	371.754	343.018
22	Ship	Tanker	30,000	166.562	165.337	149.326	133.304	158.946	144.263	126.051	166.562	165.337	149.326	133.304	158.946	144.263	126.051	392.040	390.831	375.029	359.218	384.524	370.033	352.060
23	Ship	Bulk Carrier	30,000	166.562	166.309	152.359	128.442	160.733	148.819	120.651	166.562	166.309	152.359	128.442	160.733	148.819	120.651	392.040	391.790	378.023	354.420	386.288	374.529	346.731
24	Ship	Articulated Tug/Barge	30,000	166.562	165.467	149.059	132.413	159.859	141.451	122.021	166.562	165.467	149.059	132.413	159.859	141.451	122.021	392.040	390.959	374.766	358.338	385.425	367.258	348.083
25	Ship	Tanker	25,000	166.562	165.937	149.712	134.363	159.806	145.388	129.113	166.562	165.937	149.712	134.363	159.806	145.388	129.113	392.040	391.423	375.410	360.263	385.373	371.143	355.082
26	Ship	Articulated Tug/Barge	25,000	166.562	164.763	148.763	132.676	160.459	142.576	125.083	166.562	164.763	148.763	132.676	160.459	142.576	125.083	392.040	390.265	374.474	358.598	386.017	368.368	351.105
27	Ship	Tanker	20,000	166.562	166.002	150.025	135.076	160.002	146.026	130.201	166.562	166.002	150.025	135.076	160.002	146.026	130.201	392.040	391.487	375.719	360.967	385.566	371.773	356.156
28	Ship	Tanker	15,000	166.562	165.937	150.207	137.944	161.241	147.788	134.569	166.562	165.937	150.207	137.944	161.241	147.788	134.569	392.040	391.423	375.899	363.797	386.789	373.512	360.466

SUPERSTRUCTURE CONTACT GEOMETRY - ANCHOR SPAN NORTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Anchor Span North (Pier 15)																				
				Leg 1 [1]							Leg 2 [1]							Leg 3 [1]						
				Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	234.213	236.504	263.350	375.210	248.745	273.741	375.210	234.213	236.504	263.350	375.210	248.745	273.741	375.210	166.562	168.195	195.940	308.722	181.215	206.416	308.722
2	Ship	Tanker	110,000	234.213	236.299	262.903	375.210	248.031	272.297	375.210	234.213	236.299	262.903	375.210	248.031	272.297	375.210	166.562	168.666	195.490	308.722	180.495	204.960	308.722
3	Ship	Tanker	105,000	234.213	234.055	259.531	375.210	247.657	271.310	375.210	234.213	234.055	259.531	375.210	247.657	271.310	375.210	166.562	166.403	192.090	308.722	180.118	203.965	308.722
4	Ship	Bulk Carrier	85,000	234.213	238.815	270.251	375.210	249.528	281.945	375.210	234.213	238.815	270.251	375.210	249.528	281.945	375.210	166.562	171.203	202.897	308.722	182.004	214.688	308.722
5	Ship	Bulk Carrier	80,000	234.213	237.880	268.333	375.210	249.273	280.616	375.210	234.213	237.880	268.333	375.210	249.273	280.616	375.210	166.562	170.260	200.964	308.722	181.747	213.348	308.722
6	Ship	Tanker	75,000	234.213	235.535	260.994	375.210	246.076	268.433	375.210	234.213	235.535	260.994	375.210	246.076	268.433	375.210	166.562	167.895	193.565	308.722	178.524	201.064	308.722
7	Ship	Bulk Carrier	75,000	234.213	236.894	266.399	375.210	249.647	280.691	375.210	234.213	236.894	266.399	375.210	249.647	280.691	375.210	166.562	169.266	199.014	308.722	182.124	213.424	308.722
8	Ship	Tanker	70,000	234.213	235.738	261.168	313.001	247.300	270.094	375.210	234.213	235.738	261.168	313.001	247.300	270.094	375.210	166.562	168.100	193.740	246.000	179.758	202.739	308.722
9	Ship	Bulk Carrier	70,000	234.213	236.385	265.085	375.210	250.667	282.097	375.210	234.213	236.385	265.085	375.210	250.667	282.097	375.210	166.562	168.752	197.690	308.722	183.152	214.841	308.722
10	Ship	Tanker	65,000	234.213	235.602	260.821	311.451	246.484	269.251	375.210	234.213	235.602	260.821	311.451	246.484	269.251	375.210	166.562	193.390	244.437	308.722	178.935	201.889	308.722
11	Ship	Bulk Carrier	65,000	234.213	232.299	236.147	260.902	245.944	271.522	375.210	234.213	232.299	236.147	260.902	245.944	271.522	375.210	166.562	168.512	193.472	308.722	178.390	204.179	308.722
12	Ship	Bulk Carrier	60,000	234.213	235.535	262.581	375.210	247.606	275.222	375.210	234.213	235.535	262.581	375.210	247.606	275.222	375.210	166.562	167.895	195.165	308.722	180.066	207.909	308.722
13	Ship	Tanker	55,000	234.213	258.192	306.075	375.210	243.730	265.879	375.210	234.213	258.192	306.075	375.210	243.730	265.879	375.210	166.562	190.740	239.018	308.722	176.158	198.489	308.722
14	Ship	Bulk Carrier	55,000	234.213	235.857	262.358	375.210	248.269	275.640	375.210	234.213	235.857	262.358	375.210	248.269	275.640	375.210	166.562	168.220	194.940	308.722	180.735	208.331	308.722
15	Ship	Tanker	50,000	234.213	235.007	259.407	321.526	243.509	265.358	375.210	234.213	235.007	259.407	321.526	243.509	265.358	375.210	166.562	167.363	191.965	254.595	175.935	197.964	308.722
16	Ship	Bulk Carrier	50,000	234.213	234.926	257.002	320.751	246.297	269.896	375.210	234.213	234.926	257.002	320.751	246.297	269.896	375.210	166.562	167.281	189.540	253.814	178.746	202.539	308.722
17	Ship	Tanker	45,000	234.213	235.059	259.283	317.264	242.200	263.498	375.210	234.213	235.059	259.283	317.264	242.200	263.498	375.210	166.562	167.415	191.840	250.298	174.615	196.090	308.722
18	Ship	Tanker	40,000	234.213	234.905	258.812	301.566	243.577	265.259	375.210	234.213	234.905	258.812	301.566	243.577	265.259	375.210	166.562	167.260	191.365	234.471	176.004	197.864	308.722
19	Ship	Bulk Carrier	40,000	234.213	235.756	259.655	375.210	243.237	264.366	375.210	234.213	235.756	259.655	375.210	243.237	264.366	375.210	166.562	168.118	192.215	308.722	175.661	196.965	308.722
20	Ship	Tanker	35,000	234.213	234.174	257.473	294.097	243.185	264.664	375.210	234.213	234.174	257.473	294.097	243.185	264.664	375.210	166.562	166.523	190.015	226.940	175.609	197.265	308.722
21	Ship	Bulk Carrier	35,000	234.213	233.962	255.143	375.210	243.100	263.077	375.210	234.213	233.962	255.143	375.210	243.100	263.077	375.210	166.562	166.309	187.665	243.849	175.523	195.665	308.722
22	Ship	Tanker	30,000	234.213	235.228	258.688	288.913	243.559	265.383	308.894	234.213	235.228	258.688	288.913	243.559	265.383	308.894	166.562	167.586	191.240	221.714	175.986	197.989	241.860
23	Ship	Bulk Carrier	30,000	234.213	233.962	252.167	300.532	241.231	259.358	375.210	234.213	233.962	252.167	300.532	241.231	259.358	375.210	166.562	184.665	233.429	308.722	173.638	191.915	308.722
24	Ship	Articulated Tug/Barge	30,000	234.213	235.059	258.440	288.337	242.369	269.102	375.210	234.213	235.059	258.440	288.337	242.369	269.102	375.210	166.562	167.415	190.990	221.133	174.786	201.739	308.722
25	Ship	Tanker	25,000	234.213	234.447	257.201	282.856	242.438	263.895	298.183	234.213	234.447	257.201	282.856	242.438	263.895	298.183	166.562	166.798	189.740	215.607	174.855	196.490	231.060
26	Ship	Articulated Tug/Barge	25,000	234.213	235.976	259.432	287.532	241.588	267.614	313.582	234.213	235.976	259.432	287.532	241.588	267.614	313.582	166.562	168.340	191.990	220.321	173.998	200.239	246.586
27	Ship	Tanker	20,000	234.213	234.361	256.605	281.413	242.183	263.052	295.133	234.213	234.361	256.605	281.413	242.183	263.052	295.133	166.562	166.712	189.140	214.152	174.598	195.640	227.985
28	Ship	Tanker	15,000	234.213	234.447	256.258	275.601	240.567	260.721	282.439	234.213	234.447	256.258	275.601	240.567	260.721	282.439	166.562	166.798	188.790	208.292	172.969	193.290	215.186

Notes:

[1] Perpendicular distances at each channel transition leg (as measured in CADD drawing) from the centerline of vessel transit path to where the loaded/ballasted vessel bow, deckhouse, or mast makes first contact with the bottom chord of the truss superstructure adjacent to Pier 15. The absolute boundaries for "Anchor Span North" are the centerline of Pier 15 and the centerline of Pier 14.

SUPERSTRUCTURE CONTACT GEOMETRY - ANCHOR SPAN NORTH

Vessel ID	Vessel Type	Description	Vessel Capacity, DWT (tonnes)	Distance to Superstructure Contact (m) @ Anchor Span North (Pier 15)																			
				Leg 4 [1]							Leg 5 [1]							Leg 6 [1]					
				Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted			Centerline of Pier 15	Loaded			Ballasted		
					Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}		Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}	Bow, x_{BH}	Deckhouse, x_{DH}	Mast, x_{MT}
1	Ship	Tanker	120,000	166.562	168.195	195.940	308.722	181.215	206.416	308.722	166.562	168.195	195.940	308.722	181.215	206.416	308.722	392.040	394.320	421.032	532.337	406.501	431.372	532.337
2	Ship	Tanker	110,000	166.562	168.666	195.490	308.722	180.495	204.960	308.722	166.562	168.666	195.490	308.722	180.495	204.960	308.722	392.040	394.116	420.588	532.337	405.790	429.935	532.337
3	Ship	Tanker	105,000	166.562	166.403	192.090	308.722	180.118	203.965	308.722	166.562	166.403	192.090	308.722	180.118	203.965	308.722	392.040	391.883	417.233	532.337	405.418	428.953	532.337
4	Ship	Bulk Carrier	85,000	166.562	171.203	202.897	308.722	182.004	214.688	308.722	166.562	171.203	202.897	308.722	182.004	214.688	308.722	392.040	396.620	427.899	532.337	407.279	439.535	532.337
5	Ship	Bulk Carrier	80,000	166.562	170.260	200.964	308.722	181.747	213.348	308.722	166.562	170.260	200.964	308.722	181.747	213.348	308.722	392.040	395.690	425.991	532.337	407.026	438.213	532.337
6	Ship	Tanker	75,000	166.562	167.895	193.565	308.722	178.524	201.064	308.722	166.562	167.895	193.565	308.722	178.524	201.064	308.722	392.040	393.356	418.689	532.337	403.845	426.090	532.337
7	Ship	Bulk Carrier	75,000	166.562	169.266	199.014	308.722	182.124	213.424	308.722	166.562	169.266	199.014	308.722	182.124	213.424	308.722	392.040	394.709	424.067	532.337	407.398	438.288	532.337
8	Ship	Tanker	70,000	166.562	168.100	193.740	246.000	179.758	202.739	308.722	166.562	168.100	193.740	246.000	179.758	202.739	308.722	392.040	393.558	418.861	470.437	405.063	427.743	532.337
9	Ship	Bulk Carrier	70,000	166.562	168.752	197.690	308.722	183.152	214.841	308.722	166.562	168.752	197.690	308.722	183.152	214.841	308.722	392.040	394.201	422.759	532.337	408.412	439.868	532.337
10	Ship	Tanker	65,000	166.562	193.390	244.437	308.722	178.935	201.889	308.722	166.562	193.390	244.437	308.722	178.935	201.889	308.722	392.040	393.423	418.516	468.895	404.251	426.904	532.337
11	Ship	Bulk Carrier	65,000	166.562	168.512	193.472	308.722	178.390	204.179	308.722	166.562	168.512	193.472	308.722	178.390	204.179	308.722	392.040	393.964	418.597	532.337	403.713	429.164	532.337
12	Ship	Bulk Carrier	60,000	166.562	167.895	195.165	308.722	180.066	207.909	308.722	166.562	167.895	195.165	308.722	180.066	207.909	308.722	392.040	393.356	420.268	532.337	405.367	432.845	532.337
13	Ship	Tanker	55,000	166.562	190.740	239.018	308.722	176.158	198.489	308.722	166.562	190.740	239.018	308.722	176.158	198.489	308.722	392.040	391.732	415.901	463.546	401.510	423.549	532.337
14	Ship	Bulk Carrier	55,000	166.562	168.220	194.940	308.722	180.735	208.331	308.722	166.562	168.220	194.940	308.722	180.735	208.331	308.722	392.040	393.676	420.045	532.337	406.027	433.262	532.337
15	Ship	Tanker	50,000	166.562	167.363	191.965	254.595	175.935	197.964	308.722	166.562	167.363	191.965	254.595	175.935	197.964	308.722	392.040	392.831	417.110	478.919	401.290	423.031	532.337
16	Ship	Bulk Carrier	50,000	166.562	167.281	189.540	253.814	178.746	202.539	308.722	166.562	167.281	189.540	253.814	178.746	202.539	308.722	392.040	392.750	414.716	478.148	404.064	427.546	532.337
17	Ship	Tanker	45,000	166.562	167.415	191.840	250.298	174.615	196.090	308.722	166.562	167.415	191.840	250.298	174.615	196.090	308.722	392.040	392.882	416.986	474.679	399.987	421.180	532.337
18	Ship	Tanker	40,000	166.562	167.260	191.365	234.471	176.004	197.864	308.722	166.562	167.260	191.365	234.471	176.004	197.864	308.722	392.040	392.729	416.517	459.058	401.358	422.932	532.337
19	Ship	Bulk Carrier	40,000	166.562	168.118	192.215	308.722	175.661	196.965	308.722	166.562	168.118	192.215	308.722	175.661	196.965	308.722	392.040	393.576	417.356	532.337	401.020	422.044	532.337
20	Ship	Tanker	35,000	166.562	166.523	190.015	226.940	175.609	197.265	308.722	166.562	166.523	190.015	226.940	175.609	197.265	308.722	392.040	392.002	415.185	451.626	400.968	422.340	532.337
21	Ship	Bulk Carrier	35,000	166.562	166.309	187.665	243.849	175.523	195.665	308.722	166.562	166.309	187.665	243.849	175.523	195.665	308.722	392.040	391.790	412.866	468.314	400.883	420.761	532.337
22	Ship	Tanker	30,000	166.562	167.586	191.240	221.714	175.986	197.989	241.860	166.562	167.586	191.240	221.714	175.986	197.989	241.860	392.040	393.051	416.394	446.469	401.340	423.055	466.350
23	Ship	Bulk Carrier	30,000	166.562	184.665	233.429	308.722	173.638	191.915	308.722	166.562	184.665	233.429	308.722	173.638	191.915	308.722	392.040	391.790	409.905	458.030	399.023	417.060	532.337
24	Ship	Articulated Tug/Barge	30,000	166.562	167.415	190.990	221.133	174.786	201.739	308.722	166.562	167.415	190.990	221.133	174.786	201.739	308.722	392.040	392.882	416.147	445.896	400.156	426.756	532.337
25	Ship	Tanker	25,000	166.562	166.798	189.740	215.607	174.855	196.490	231.060	166.562	166.798	189.740	215.607	174.855	196.490	231.060	392.040	392.273	414.914	440.442	400.224	421.575	455.692
26	Ship	Articulated Tug/Barge	25,000	166.562	168.340	191.990	220.321	173.998	200.239	246.586	166.562	168.340	191.990	220.321	173.998	200.239	246.586	392.040	393.795	417.134	445.094	399.378	425.276	471.015
27	Ship	Tanker	20,000	166.562	166.712	189.140	214.152	174.598	195.640	227.985	166.562	166.712	189.140	214.152	174.598	195.640	227.985	392.040	392.188	414.322	439.006	399.971	420.736	452.658
28	Ship	Tanker	15,000	166.562	166.798	188.790	208.292	172.969	193.290	215.186	166.562	166.798	188.790	208.292	172.969	193.290	215.186	392.040	392.273	413.976	433.223	398.363	418.417	440.027

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	2.7373	2.9686	3.0866	0.00	0.00	0.00	56.44	12.24	1.27	0	5	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	2.7249	2.9568	3.0866	0.00	0.00	0.00	53.79	11.67	1.22	0	4	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	2.6875	2.9116	3.0866	0.00	0.00	0.00	51.84	11.23	1.19	0	1	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	2.7307	2.9518	3.0866	0.00	0.00	0.00	47.39	11.78	1.23	0	5	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	2.7265	2.9436	3.0866	0.00	0.00	0.00	45.90	11.89	1.25	0	5	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	2.7002	2.8707	3.0866	0.00	0.00	0.00	44.02	11.70	1.26	0	3	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	2.7297	2.9440	3.0866	0.00	0.00	0.00	44.50	12.00	1.26	0	4	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	2.7108	2.8849	3.0866	0.00	0.00	0.00	42.69	11.81	1.26	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	2.7386	2.9519	3.0866	0.00	0.00	0.00	43.13	12.09	1.26	0	1	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	2.6958	2.8734	3.0866	0.00	0.00	0.00	40.91	11.77	1.26	0	1	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	2.7070	2.9127	3.0866	0.00	0.00	0.00	41.08	11.93	1.26	0	6	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	2.6917	2.9040	3.0866	0.00	0.00	0.00	39.25	11.86	1.26	0	2	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	2.6483	2.8304	3.0866	0.00	0.00	0.00	36.97	11.46	1.25	0	2	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	2.6955	2.9054	3.0866	0.00	0.00	0.00	37.63	11.76	1.25	0	3	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	2.6453	2.8251	3.0866	0.00	0.00	0.00	35.21	11.28	1.23	0	7	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	2.6842	2.8737	3.0866	0.00	0.00	0.00	35.73	11.47	1.23	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	2.6422	2.8219	3.0866	0.00	0.00	0.00	31.45	10.75	1.18	0	4	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	2.6409	2.8148	3.0866	0.00	0.00	0.00	31.44	10.72	1.18	0	1	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	2.6323	2.8127	3.0840	0.00	0.00	0.00	29.31	10.34	1.13	0	2	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	3.0866	2.8003	2.6357	0.00	0.00	0.00	34.37	10.29	0.97	0	0	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	2.6196	2.8098	3.0457	0.00	0.00	0.00	27.01	9.85	1.07	0	7	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	2.6102	2.7602	3.0866	0.00	0.00	0.00	26.91	9.68	1.08	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	2.6566	2.8707	3.0866	0.00	0.00	0.00	27.39	10.06	1.08	0	4	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	3.0028	2.7837	2.5896	0.00	0.00	0.00	28.26	9.17	0.85	0	1	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	2.6283	2.8464	3.0598	0.00	0.00	0.00	24.74	9.38	1.01	0	2	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	2.5853	2.7741	2.9878	0.00	0.00	0.00	21.76	8.41	0.91	0	4	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	2.5327	2.7270	2.9179	0.00	0.00	0.00	18.46	7.36	0.79	0	1	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.005210	0.050895	0.081717	0.029383	0.049013	0.107590	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000005	0.000009
0.004815	0.050143	0.090340	0.027794	0.048143	0.119144	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000005	0.000008
0.000757	0.047137	0.086747	0.027051	0.047311	0.122314	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.009440	0.062904	0.127053	0.030816	0.061279	0.183491	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000001	0.000004	0.000006
0.007679	0.060023	0.119141	0.030228	0.059533	0.176949	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000001	0.000004	0.000006
0.003396	0.047004	0.093145	0.023639	0.044351	0.115536	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.005860	0.057155	0.110620	0.031019	0.058872	0.178324	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000001	0.000003	0.000005
0.003764	0.047031	0.076886	0.026149	0.045934	0.095751	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004929	0.054947	0.105467	0.033189	0.059131	0.188591	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.003487	0.046281	0.077122	0.024305	0.045471	0.094109	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.004459	0.052960	0.070628	0.027139	0.054104	0.152271	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000004	0.000007
0.003306	0.050012	0.102134	0.026249	0.053743	0.155416	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002
0.000694	0.043935	0.076285	0.018357	0.042434	0.093948	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002
0.003865	0.048849	0.102317	0.027528	0.053083	0.157241	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.002357	0.043442	0.086461	0.017909	0.041606	0.099449	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000004	0.000007
0.003488	0.039723	0.088733	0.023702	0.047346	0.133844	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002439	0.043012	0.084415	0.015369	0.039693	0.093551	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002169	0.043249	0.070395	0.017969	0.041160	0.084590	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.003647	0.043154	0.098261	0.017351	0.039744	0.110287	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000912	0.042224	0.063397	0.017098	0.040376	0.078222	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.000917	0.038833	0.086411	0.161780	0.107850	0.036915	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002644	0.040559	0.052421	0.017470	0.040990	0.064869	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003	0.000005
0.000551	0.034540	0.079310	0.013365	0.031837	0.100550	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002509	0.043166	0.054773	0.016075	0.053253	0.070846	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000003
0.001304	0.040011	0.049527	0.110486	0.056402	0.039081	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000000	0.000000	0.000001
0.004049	0.041836	0.081997	0.014256	0.050724	0.062901	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.001166	0.039193	0.047834	0.014509	0.037555	0.054156	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000003
0.001231	0.037096	0.037784	0.011051	0.034087	0.042815	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
																		Total for Pier:	**0.000083**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	2.7373	2.9686	3.0866	0.00	0.00	0.00	56.44	12.24	1.27	0	5	10.20	0.000003	0.000003
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	2.7249	2.9568	3.0866	0.00	0.00	0.00	53.79	11.67	1.22	0	4	10.20	0.000003	0.000003
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	2.6875	2.9116	3.0866	0.00	0.00	0.00	51.84	11.23	1.19	0	1	10.20	0.000003	0.000003
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	2.7307	2.9518	3.0866	0.00	0.00	0.00	47.39	11.78	1.23	0	5	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	2.7265	2.9436	3.0866	0.00	0.00	0.00	45.90	11.89	1.25	0	5	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	2.7002	2.8707	3.0866	0.00	0.00	0.00	44.02	11.70	1.26	0	3	1.64	0.000003	0.000013
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	2.7297	2.9440	3.0866	0.00	0.00	0.00	44.50	12.00	1.26	0	4	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	2.7108	2.8849	3.0866	0.00	0.00	0.00	42.69	11.81	1.26	0	0	1.64	0.000003	0.000013
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	2.7386	2.9519	3.0866	0.00	0.00	0.00	43.13	12.09	1.26	0	1	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	2.6958	2.8734	3.0866	0.00	0.00	0.00	40.91	11.77	1.26	0	1	1.64	0.000003	0.000013
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	2.7070	2.9127	3.0866	0.00	0.00	0.00	41.08	11.93	1.26	0	6	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	2.6917	2.9040	3.0866	0.00	0.00	0.00	39.25	11.86	1.26	0	2	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	2.6483	2.8304	3.0866	0.00	0.00	0.00	36.97	11.46	1.25	0	2	1.64	0.000003	0.000013
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	2.6955	2.9054	3.0866	0.00	0.00	0.00	37.63	11.76	1.25	0	3	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	2.6453	2.8251	3.0866	0.00	0.00	0.00	35.21	11.28	1.23	0	7	1.64	0.000003	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	2.6842	2.8737	3.0866	0.00	0.00	0.00	35.73	11.47	1.23	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000003	0.000013
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	2.6422	2.8219	3.0866	0.00	0.00	0.00	31.45	10.75	1.18	0	4	1.64	0.000003	0.000013
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	2.6409	2.8148	3.0866	0.00	0.00	0.00	31.44	10.72	1.18	0	1	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	2.6323	2.8127	3.0840	0.00	0.00	0.00	29.31	10.34	1.13	0	2	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	3.0866	2.8003	2.6357	0.00	0.00	0.00	34.37	10.29	0.97	0	0	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	2.6196	2.8098	3.0457	0.00	0.00	0.00	27.01	9.85	1.07	0	7	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	2.6102	2.7602	3.0866	0.00	0.00	0.00	26.91	9.68	1.08	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	2.6566	2.8707	3.0866	0.00	0.00	0.00	27.39	10.06	1.08	0	4	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	3.0028	2.7837	2.5896	0.00	0.00	0.00	28.26	9.17	0.85	0	1	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	2.6283	2.8464	3.0598	0.00	0.00	0.00	24.74	9.38	1.01	0	2	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	2.5853	2.7741	2.9878	0.00	0.00	0.00	21.76	8.41	0.91	0	4	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	2.5327	2.7270	2.9179	0.00	0.00	0.00	18.46	7.36	0.79	0	1	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.005210	0.050895	0.081717	0.029383	0.049013	0.107590	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000003	0.000005	0.000012	0.000021
0.004815	0.050143	0.090340	0.027794	0.048143	0.119144	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000002	0.000004	0.000011	0.000017
0.000757	0.047137	0.086747	0.027051	0.047311	0.122314	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000001	0.000003	0.000004
0.009440	0.062904	0.127053	0.030816	0.061279	0.183491	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000002	0.000003	0.000010	0.000014
0.007679	0.060023	0.119141	0.030228	0.059533	0.176949	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000002	0.000003	0.000009	0.000014
0.003396	0.047004	0.093145	0.023639	0.044351	0.115536	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000005	0.000007
0.005860	0.057155	0.110620	0.031019	0.058872	0.178324	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000007	0.000011
0.003764	0.047031	0.076886	0.026149	0.045934	0.095751	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004929	0.054947	0.105467	0.033189	0.059131	0.188591	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.003487	0.046281	0.077122	0.024305	0.045471	0.094109	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002
0.004459	0.052960	0.070628	0.027139	0.054104	0.152271	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000002	0.000003	0.000010	0.000015
0.003306	0.050012	0.102134	0.026249	0.053743	0.155416	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000001	0.000003	0.000005
0.000694	0.043935	0.076285	0.018357	0.042434	0.093948	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000003	0.000004
0.003865	0.048849	0.102317	0.027528	0.053083	0.157241	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000005	0.000007
0.002357	0.043442	0.086461	0.017909	0.041606	0.099449	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000002	0.000004	0.000009	0.000015
0.003488	0.039723	0.088733	0.023702	0.047346	0.133844	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002439	0.043012	0.084415	0.015369	0.039693	0.093551	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002169	0.043249	0.070395	0.017969	0.041160	0.084590	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000005	0.000008
0.003647	0.043154	0.098261	0.017351	0.039744	0.110287	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.000912	0.042224	0.063397	0.017098	0.040376	0.078222	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000004
0.000917	0.038833	0.086411	0.161780	0.107850	0.036915	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002644	0.040559	0.052421	0.017470	0.040990	0.064869	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000002	0.000004	0.000006	0.000012
0.000551	0.034540	0.079310	0.013365	0.031837	0.100550	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002509	0.043166	0.054773	0.016075	0.053253	0.070846	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003	0.000006
0.001304	0.040011	0.049527	0.110486	0.056402	0.039081	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000001	0.000001	0.000003
0.004049	0.041836	0.081997	0.014256	0.050724	0.062901	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000003
0.001166	0.039193	0.047834	0.014509	0.037555	0.054156	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003	0.000006
0.001231	0.037096	0.037784	0.011051	0.034087	0.042815	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
																		Total for Pier:	**0.000183**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	1.7191	1.9523	2.3594	0.00	0.00	0.00	35.45	8.05	0.97	0	5	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	1.6938	1.9276	2.3796	0.00	0.00	0.00	33.44	7.61	0.94	0	4	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.6779	1.9039	2.3594	0.00	0.00	0.00	32.36	7.34	0.91	0	1	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.9293	2.1522	2.6466	0.00	0.00	0.00	33.48	8.59	1.06	0	5	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.9206	2.1395	2.6219	0.00	0.00	0.00	32.33	8.64	1.06	0	5	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.8975	2.0694	2.4167	0.00	0.00	0.00	30.93	8.43	0.98	0	3	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.9239	2.1399	2.6255	0.00	0.00	0.00	31.36	8.72	1.07	0	4	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.9082	2.0837	2.3746	0.00	0.00	0.00	30.05	8.53	0.97	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.9329	2.1479	2.6556	0.00	0.00	0.00	30.44	8.79	1.09	0	1	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.8765	2.0555	2.3479	0.00	0.00	0.00	28.48	8.42	0.96	0	1	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.8852	2.0926	2.5278	0.00	0.00	0.00	28.61	8.57	1.04	0	6	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.8423	2.0563	2.5030	0.00	0.00	0.00	26.86	8.39	1.02	0	2	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.7833	1.9669	2.2788	0.00	0.00	0.00	24.89	7.96	0.92	0	2	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.8413	2.0528	2.5118	0.00	0.00	0.00	25.70	8.31	1.02	0	3	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	1.7785	1.9597	2.2894	0.00	0.00	0.00	23.67	7.83	0.91	0	7	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.8440	2.0352	2.4392	0.00	0.00	0.00	24.54	8.13	0.97	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	1.7678	1.9490	2.2374	0.00	0.00	0.00	21.05	7.42	0.85	0	4	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	1.7703	1.9456	2.3101	0.00	0.00	0.00	21.08	7.41	0.88	0	1	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	1.7460	1.9278	2.2014	0.00	0.00	0.00	19.44	7.08	0.81	0	2	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	1.7574	1.9234	2.2870	0.00	0.00	0.00	19.57	7.07	0.84	0	0	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	1.7012	1.8930	2.1308	0.00	0.00	0.00	17.54	6.64	0.75	0	7	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	1.7173	1.8686	2.2261	0.00	0.00	0.00	17.71	6.55	0.78	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	1.8317	2.0476	2.2755	0.00	0.00	0.00	18.88	7.18	0.80	0	4	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	1.6347	1.8305	2.0514	0.00	0.00	0.00	15.39	6.03	0.68	0	1	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	1.7631	1.9830	2.1982	0.00	0.00	0.00	16.59	6.53	0.72	0	2	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	1.6273	1.8177	2.0332	0.00	0.00	0.00	13.70	5.51	0.62	0	4	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	1.5082	1.7042	1.8967	0.00	0.00	0.00	11.00	4.60	0.51	0	1	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.001229	0.013551	0.027462	0.007320	0.014258	0.040166	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000004
0.001104	0.012987	0.030047	0.006723	0.013587	0.044079	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.000174	0.012052	0.028288	0.006603	0.013421	0.045604	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.002119	0.016540	0.046005	0.007273	0.017428	0.076044	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000002	0.000003
0.001694	0.015405	0.041675	0.007037	0.016664	0.071642	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000002	0.000003
0.000749	0.011633	0.029851	0.005471	0.011860	0.040505	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.001287	0.014474	0.037654	0.007234	0.016507	0.072361	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000002	0.000002
0.000831	0.011659	0.024023	0.006088	0.012442	0.032978	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001080	0.013797	0.035270	0.007779	0.016720	0.078127	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000733	0.010949	0.023155	0.005379	0.011725	0.031018	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000932	0.012682	0.021403	0.006003	0.014260	0.056442	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000002	0.000003
0.000636	0.011007	0.030342	0.005365	0.013188	0.053592	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000126	0.009031	0.020284	0.003518	0.009454	0.027327	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000734	0.010611	0.030025	0.005572	0.012916	0.055117	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000429	0.008949	0.023437	0.003411	0.009190	0.028967	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.000689	0.008758	0.025375	0.004941	0.011610	0.045195	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000440	0.008767	0.022580	0.002876	0.008545	0.026345	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000386	0.008719	0.018181	0.003350	0.008913	0.023592	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000660	0.008852	0.027094	0.003264	0.008637	0.032208	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000156	0.008166	0.015577	0.003072	0.008428	0.020889	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000161	0.007611	0.022322	0.003128	0.007801	0.030523	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000414	0.007223	0.011694	0.002864	0.007904	0.015805	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000093	0.006419	0.019197	0.002332	0.006285	0.026379	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000518	0.009957	0.015403	0.003435	0.013316	0.022217	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000182	0.006391	0.009999	0.002196	0.006736	0.012237	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000745	0.008699	0.013571	0.002702	0.011301	0.017582	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000161	0.006186	0.009508	0.002100	0.006377	0.011510	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000139	0.004843	0.006192	0.001298	0.004708	0.007366	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000030**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.9082	2.0837	2.3746	0.00	0.00	0.00	30.05	8.53	0.97	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.9329	2.1479	2.6556	0.00	0.00	0.00	30.44	8.79	1.09	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.8765	2.0555	2.3479	0.00	0.00	0.00	28.48	8.42	0.96	0	0	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	9	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.8423	2.0563	2.5030	0.00	0.00	0.00	26.86	8.39	1.02	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.8413	2.0528	2.5118	0.00	0.00	0.00	25.70	8.31	1.02	0	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	3	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.8440	2.0352	2.4392	0.00	0.00	0.00	24.54	8.13	0.97	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	1.7703	1.9456	2.3101	0.00	0.00	0.00	21.08	7.41	0.88	0	0	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	1	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	1.7574	1.9234	2.2870	0.00	0.00	0.00	19.57	7.07	0.84	0	0	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	1.7012	1.8930	2.1308	0.00	0.00	0.00	17.54	6.64	0.75	0	0	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	1.7173	1.8686	2.2261	0.00	0.00	0.00	17.71	6.55	0.78	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	1.8317	2.0476	2.2755	0.00	0.00	0.00	18.88	7.18	0.80	0	2	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	1.6347	1.8305	2.0514	0.00	0.00	0.00	15.39	6.03	0.68	0	0	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	1.7631	1.9830	2.1982	0.00	0.00	0.00	16.59	6.53	0.72	0	1	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	1.6273	1.8177	2.0332	0.00	0.00	0.00	13.70	5.51	0.62	0	9	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	1.5082	1.7042	1.8967	0.00	0.00	0.00	11.00	4.60	0.51	0	0	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.001229	0.013551	0.027462	0.007320	0.014258	0.040166	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001104	0.012987	0.030047	0.006723	0.013587	0.044079	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000174	0.012052	0.028288	0.006603	0.013421	0.045604	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002119	0.016540	0.046005	0.007273	0.017428	0.076044	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001694	0.015405	0.041675	0.007037	0.016664	0.071642	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000749	0.011633	0.029851	0.005471	0.011860	0.040505	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001287	0.014474	0.037654	0.007234	0.016507	0.072361	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000831	0.011659	0.024023	0.006088	0.012442	0.032978	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001080	0.013797	0.035270	0.007779	0.016720	0.078127	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000733	0.010949	0.023155	0.005379	0.011725	0.031018	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000932	0.012682	0.021403	0.006003	0.014260	0.056442	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000636	0.011007	0.030342	0.005365	0.013188	0.053592	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000126	0.009031	0.020284	0.003518	0.009454	0.027327	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000734	0.010611	0.030025	0.005572	0.012916	0.055117	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000429	0.008949	0.023437	0.003411	0.009190	0.028967	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000689	0.008758	0.025375	0.004941	0.011610	0.045195	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000440	0.008767	0.022580	0.002876	0.008545	0.026345	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000386	0.008719	0.018181	0.003350	0.008913	0.023592	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000660	0.008852	0.027094	0.003264	0.008637	0.032208	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000156	0.008166	0.015577	0.003072	0.008428	0.020889	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000161	0.007611	0.022322	0.003128	0.007801	0.030523	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000414	0.007223	0.011694	0.002864	0.007904	0.015805	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000093	0.006419	0.019197	0.002332	0.006285	0.026379	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000518	0.009957	0.015403	0.003435	0.013316	0.022217	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000182	0.006391	0.009999	0.002196	0.006736	0.012237	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000745	0.008699	0.013571	0.002702	0.011301	0.017582	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000161	0.006186	0.009508	0.002100	0.006377	0.011510	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000139	0.004843	0.006192	0.001298	0.004708	0.007366	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000001**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.9082	2.0837	2.3746	0.00	0.00	0.00	30.05	8.53	0.97	0	0	1.64	0.000004	0.000013
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.9329	2.1479	2.6556	0.00	0.00	0.00	30.44	8.79	1.09	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.8765	2.0555	2.3479	0.00	0.00	0.00	28.48	8.42	0.96	0	0	1.64	0.000004	0.000013
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	9	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.8423	2.0563	2.5030	0.00	0.00	0.00	26.86	8.39	1.02	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.8413	2.0528	2.5118	0.00	0.00	0.00	25.70	8.31	1.02	0	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	3	1.64	0.000004	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.8440	2.0352	2.4392	0.00	0.00	0.00	24.54	8.13	0.97	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	1.7703	1.9456	2.3101	0.00	0.00	0.00	21.08	7.41	0.88	0	0	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	1	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	1.7574	1.9234	2.2870	0.00	0.00	0.00	19.57	7.07	0.84	0	0	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	1.7012	1.8930	2.1308	0.00	0.00	0.00	17.54	6.64	0.75	0	0	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	1.7173	1.8686	2.2261	0.00	0.00	0.00	17.71	6.55	0.78	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	1.8317	2.0476	2.2755	0.00	0.00	0.00	18.88	7.18	0.80	0	2	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	1.6347	1.8305	2.0514	0.00	0.00	0.00	15.39	6.03	0.68	0	0	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	1.7631	1.9830	2.1982	0.00	0.00	0.00	16.59	6.53	0.72	0	1	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	1.6273	1.8177	2.0332	0.00	0.00	0.00	13.70	5.51	0.62	0	9	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	1.5082	1.7042	1.8967	0.00	0.00	0.00	11.00	4.60	0.51	0	0	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.001229	0.013551	0.027462	0.007320	0.014258	0.040166	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001104	0.012987	0.030047	0.006723	0.013587	0.044079	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000174	0.012052	0.028288	0.006603	0.013421	0.045604	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002119	0.016540	0.046005	0.007273	0.017428	0.076044	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001694	0.015405	0.041675	0.007037	0.016664	0.071642	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000749	0.011633	0.029851	0.005471	0.011860	0.040505	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001287	0.014474	0.037654	0.007234	0.016507	0.072361	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000831	0.011659	0.024023	0.006088	0.012442	0.032978	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001080	0.013797	0.035270	0.007779	0.016720	0.078127	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000733	0.010949	0.023155	0.005379	0.011725	0.031018	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000932	0.012682	0.021403	0.006003	0.014260	0.056442	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000636	0.011007	0.030342	0.005365	0.013188	0.053592	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000126	0.009031	0.020284	0.003518	0.009454	0.027327	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000734	0.010611	0.030025	0.005572	0.012916	0.055117	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000429	0.008949	0.023437	0.003411	0.009190	0.028967	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000689	0.008758	0.025375	0.004941	0.011610	0.045195	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000440	0.008767	0.022580	0.002876	0.008545	0.026345	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000386	0.008719	0.018181	0.003350	0.008913	0.023592	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000660	0.008852	0.027094	0.003264	0.008637	0.032208	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000156	0.008166	0.015577	0.003072	0.008428	0.020889	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000161	0.007611	0.022322	0.003128	0.007801	0.030523	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000414	0.007223	0.011694	0.002864	0.007904	0.015805	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000093	0.006419	0.019197	0.002332	0.006285	0.026379	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000518	0.009957	0.015403	0.003435	0.013316	0.022217	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000182	0.006391	0.009999	0.002196	0.006736	0.012237	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000745	0.008699	0.013571	0.002702	0.011301	0.017582	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000161	0.006186	0.009508	0.002100	0.006377	0.011510	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000139	0.004843	0.006192	0.001298	0.004708	0.007366	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000002**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 1
Description: Main Span South
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	9	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	3	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	1	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	2	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	1	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	9	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.277428	0.000000	0.000000	0.277428	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.279537	0.000000	0.000000	0.279537	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.278673	0.000000	0.000000	0.278673	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.282064	0.000000	0.000000	0.282064	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.283043	0.000000	0.000000	0.283043	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.282306	0.000000	0.000000	0.282306	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.283043	0.000000	0.000000	0.283043	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.282306	0.000000	0.000000	0.282306	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.283043	0.000000	0.000000	0.283043	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.285918	0.000000	0.000000	0.285918	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.286471	0.000000	0.000000	0.286471	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.292284	0.000000	0.000000	0.292284	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.295439	0.000000	0.000000	0.295439	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.293303	0.000000	0.000000	0.293303	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.295807	0.000000	0.000000	0.295807	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.290333	0.000000	0.000000	0.290333	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.296557	0.000000	0.000000	0.296557	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.297322	0.000000	0.000000	0.297322	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.296557	0.000000	0.000000	0.296557	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.299719	0.000000	0.000000	0.299719	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.298104	0.000000	0.000000	0.298104	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.305977	0.000000	0.000000	0.305977	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.300978	0.000000	0.000000	0.300978	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.287035	0.000000	0.000000	0.287035	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.312789	0.000000	0.000000	0.312789	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.295439	0.000000	0.000000	0.295439	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.313360	0.000000	0.000000	0.313360	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.325034	0.000000	0.000000	0.325034	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.3600	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.7689	1.0003	1.4040	0.00	0.00	0.00	15.85	4.13	0.58	0	5	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.7317	0.9636	1.4120	0.00	0.00	0.00	14.45	3.80	0.56	0	4	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.7360	0.9602	1.4119	0.00	0.00	0.00	14.20	3.70	0.54	0	1	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.1814	1.4025	1.8928	0.00	0.00	0.00	20.50	5.60	0.76	0	5	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.1685	1.3857	1.8641	0.00	0.00	0.00	19.67	5.60	0.75	0	5	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.1488	1.3193	1.6637	0.00	0.00	0.00	18.73	5.38	0.68	0	3	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.1718	1.3861	1.8676	0.00	0.00	0.00	19.10	5.65	0.76	0	4	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.5515	0.7992	1.1147	1.1594	1.3335	1.6221	8.69	3.27	0.46	18.26	5.46	0.66	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.1807	1.3940	1.8976	0.00	0.00	0.00	18.59	5.71	0.78	0	1	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.5140	0.7480	1.0707	1.1122	1.2898	1.5798	7.80	3.06	0.44	16.88	5.28	0.65	0	1	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.1184	1.3241	1.7558	0.00	0.00	0.00	16.97	5.43	0.72	0	6	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.0499	1.2621	1.7052	0.00	0.00	0.00	15.31	5.15	0.70	0	2	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.0290	1.1590	1.4683	0.00	0.00	0.00	14.36	4.69	0.59	0	2	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	1.0290	1.1501	1.4888	1.0442	1.2540	1.7092	14.36	4.66	0.60	14.58	5.08	0.69	0	3	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.5140	0.5966	0.9757	1.0290	1.1501	1.4771	6.84	2.38	0.39	13.70	4.59	0.59	4	7	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.0604	1.2500	1.6507	0.00	0.00	0.00	14.11	4.99	0.66	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	0.5140	0.5846	0.9576	1.0290	1.1246	1.4401	6.49	2.29	0.37	12.99	4.40	0.56	0	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	0.5140	0.5739	0.8933	1.0290	1.1325	1.4185	6.12	2.19	0.34	12.25	4.31	0.54	1	4	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	1.0290	1.0911	1.4297	1.0290	1.1326	1.4942	12.25	4.16	0.54	12.25	4.31	0.57	0	1	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	1.0290	1.0406	1.2784	1.0290	1.1001	1.3715	11.46	3.82	0.47	11.46	4.04	0.50	1	2	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	1.0290	1.0441	1.3575	1.0290	1.1033	1.4640	11.46	3.84	0.50	11.46	4.05	0.54	0	0	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	1.0290	1.0290	1.1772	1.0290	1.0352	1.2711	10.61	3.61	0.41	10.61	3.63	0.45	0	7	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	1.2918	1.0290	1.0353	1.3899	10.61	3.61	0.45	10.61	3.63	0.49	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.1886	1.3822	1.0629	1.2771	1.5030	10.61	4.17	0.48	10.96	4.48	0.53	3	4	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	1.0290	1.0290	1.0874	1.0290	1.0290	1.1581	9.68	3.39	0.36	9.68	3.39	0.38	0	1	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0995	1.2957	1.0290	1.1750	1.3884	9.68	3.62	0.43	9.68	3.87	0.46	1	2	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.1371	8.66	3.12	0.31	8.66	3.12	0.34	9	4	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	7.50	2.78	0.28	7.50	2.78	0.28	0	1	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000158	0.001943	0.004866	0.000987	0.002212	0.007850	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000136	0.001791	0.005209	0.000871	0.002023	0.008442	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000022	0.001652	0.004843	0.000867	0.002019	0.008849	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000252	0.002277	0.008511	0.000906	0.002573	0.016038	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000197	0.002061	0.007418	0.000860	0.002409	0.014684	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000088	0.001512	0.004917	0.000668	0.001651	0.007255	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000149	0.001913	0.006532	0.000886	0.002389	0.014865	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000097	0.001518	0.003859	0.000748	0.001752	0.005798	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000125	0.001809	0.006017	0.000957	0.002439	0.016382	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000080	0.001333	0.003503	0.000616	0.001542	0.005115	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001657	0.003250	0.008083	0.000685	0.001907	0.010399	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000061	0.001202	0.004366	0.000547	0.001588	0.009030	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000011	0.000906	0.002573	0.000331	0.001019	0.003766	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000069	0.001137	0.004242	0.000559	0.001532	0.009222	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000038	0.000897	0.003021	0.000318	0.000980	0.003990	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000069	0.000970	0.003570	0.000520	0.001415	0.007434	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000039	0.000866	0.002859	0.000262	0.000885	0.003498	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000034	0.000848	0.002214	0.000303	0.000923	0.003084	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000058	0.000879	0.003534	0.000299	0.000902	0.004432	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000013	0.000751	0.001779	0.000264	0.000829	0.002577	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000008	0.000722	0.002709	0.000278	0.000785	0.004035	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000030	0.000587	0.001165	0.000216	0.000690	0.001707	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000007	0.000564	0.002149	0.000193	0.000582	0.003185	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000055	0.001176	0.002174	0.000378	0.001692	0.003466	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000011	0.000446	0.000861	0.000141	0.000503	0.001126	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000068	0.000881	0.001656	0.000251	0.001219	0.002328	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000010	0.000425	0.000166	0.000133	0.000467	0.001034	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000006	0.000253	0.000397	0.000062	0.000259	0.000493	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000005**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.7689	1.0003	1.4040	0.00	0.00	0.00	15.85	4.13	0.58	0	5	10.20	0.000003	0.000003
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.7317	0.9636	1.4120	0.00	0.00	0.00	14.45	3.80	0.56	0	4	10.20	0.000003	0.000003
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.7360	0.9602	1.4119	0.00	0.00	0.00	14.20	3.70	0.54	0	1	10.20	0.000003	0.000003
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.1814	1.4025	1.8928	0.00	0.00	0.00	20.50	5.60	0.76	0	5	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.1685	1.3857	1.8641	0.00	0.00	0.00	19.67	5.60	0.75	0	5	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.1488	1.3193	1.6637	0.00	0.00	0.00	18.73	5.38	0.68	0	3	1.64	0.000003	0.000013
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.1718	1.3861	1.8676	0.00	0.00	0.00	19.10	5.65	0.76	0	4	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.5515	0.7992	1.1147	1.1594	1.3335	1.6221	8.69	3.27	0.46	18.26	5.46	0.66	0	0	1.64	0.000003	0.000013
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.1807	1.3940	1.8976	0.00	0.00	0.00	18.59	5.71	0.78	0	1	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.5140	0.7480	1.0707	1.1122	1.2898	1.5798	7.80	3.06	0.44	16.88	5.28	0.65	0	1	1.64	0.000003	0.000013
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.1184	1.3241	1.7558	0.00	0.00	0.00	16.97	5.43	0.72	0	6	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.0499	1.2621	1.7052	0.00	0.00	0.00	15.31	5.15	0.70	0	2	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.0290	1.1590	1.4683	0.00	0.00	0.00	14.36	4.69	0.59	0	2	1.64	0.000003	0.000013
14	Ship	Bulk Carrier	55,000	1.0290	1.1501	1.4888	1.0442	1.2540	1.7092	14.36	4.66	0.60	14.58	5.08	0.69	0	3	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.5140	0.5966	0.9757	1.0290	1.1501	1.4771	6.84	2.38	0.39	13.70	4.59	0.59	4	7	1.64	0.000003	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.0604	1.2500	1.6507	0.00	0.00	0.00	14.11	4.99	0.66	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	0.5140	0.5846	0.9576	1.0290	1.1246	1.4401	6.49	2.29	0.37	12.99	4.40	0.56	0	0	1.64	0.000003	0.000013
18	Ship	Tanker	40,000	0.5140	0.5739	0.8933	1.0290	1.1325	1.4185	6.12	2.19	0.34	12.25	4.31	0.54	1	4	1.64	0.000003	0.000013
19	Ship	Bulk Carrier	40,000	1.0290	1.0911	1.4297	1.0290	1.1326	1.4942	12.25	4.16	0.54	12.25	4.31	0.57	0	1	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	1.0290	1.0406	1.2784	1.0290	1.1001	1.3715	11.46	3.82	0.47	11.46	4.04	0.50	1	2	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	1.0290	1.0441	1.3575	1.0290	1.1033	1.4640	11.46	3.84	0.50	11.46	4.05	0.54	0	0	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	1.0290	1.0290	1.1772	1.0290	1.0352	1.2711	10.61	3.61	0.41	10.61	3.63	0.45	0	7	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	1.2918	1.0290	1.0353	1.3899	10.61	3.61	0.45	10.61	3.63	0.49	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.1886	1.3822	1.0629	1.2771	1.5030	10.61	4.17	0.48	10.96	4.48	0.53	3	4	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	1.0290	1.0290	1.0874	1.0290	1.0290	1.1581	9.68	3.39	0.36	9.68	3.39	0.38	0	1	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0995	1.2957	1.0290	1.1750	1.3884	9.68	3.62	0.43	9.68	3.87	0.46	1	2	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.1371	8.66	3.12	0.31	8.66	3.12	0.34	9	4	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	7.50	2.78	0.28	7.50	2.78	0.28	0	1	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000158	0.001943	0.004866	0.000987	0.002212	0.007850	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000136	0.001791	0.005209	0.000871	0.002023	0.008442	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000022	0.001652	0.004843	0.000867	0.002019	0.008849	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000252	0.002277	0.008511	0.000906	0.002573	0.016038	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000197	0.002061	0.007418	0.000860	0.002409	0.014684	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000088	0.001512	0.004917	0.000668	0.001651	0.007255	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000149	0.001913	0.006532	0.000886	0.002389	0.014865	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000097	0.001518	0.003859	0.000748	0.001752	0.005798	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000125	0.001809	0.006017	0.000957	0.002439	0.016382	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000080	0.001333	0.003503	0.000616	0.001542	0.005115	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001657	0.003250	0.008083	0.000685	0.001907	0.010399	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000061	0.001202	0.004366	0.000547	0.001588	0.009030	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000011	0.000906	0.002573	0.000331	0.001019	0.003766	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000069	0.001137	0.004242	0.000559	0.001532	0.009222	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000038	0.000897	0.003021	0.000318	0.000980	0.003990	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000069	0.000970	0.003570	0.000520	0.001415	0.007434	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000039	0.000866	0.002859	0.000262	0.000885	0.003498	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000034	0.000848	0.002214	0.000303	0.000923	0.003084	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000058	0.000879	0.003534	0.000299	0.000902	0.004432	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000013	0.000751	0.001779	0.000264	0.000829	0.002577	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000008	0.000722	0.002709	0.000278	0.000785	0.004035	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000030	0.000587	0.001165	0.000216	0.000690	0.001707	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000007	0.000564	0.002149	0.000193	0.000582	0.003185	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000055	0.001176	0.002174	0.000378	0.001692	0.003466	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000011	0.000446	0.000861	0.000141	0.000503	0.001126	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000068	0.000881	0.001656	0.000251	0.001219	0.002328	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000010	0.000425	0.000166	0.000133	0.000467	0.001034	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000006	0.000253	0.000397	0.000062	0.000259	0.000493	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.7200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000011**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	1.7502	1.9834	2.3905	0.00	0.00	0.00	36.09	8.18	0.99	0	5	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	1.7253	1.9591	2.4111	0.00	0.00	0.00	34.06	7.74	0.95	0	4	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.7088	1.9348	2.3902	0.00	0.00	0.00	32.96	7.46	0.92	0	1	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.9538	2.1767	2.6711	0.00	0.00	0.00	33.91	8.69	1.07	0	5	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.9452	2.1641	2.6465	0.00	0.00	0.00	32.75	8.74	1.07	0	5	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.9220	2.0939	2.4412	0.00	0.00	0.00	31.33	8.53	0.99	0	3	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.9485	2.1645	2.6501	0.00	0.00	0.00	31.76	8.82	1.08	0	4	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	1.5173	1.7670	2.0851	1.9327	2.1083	2.3992	23.90	7.24	0.85	30.44	8.63	0.98	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.9575	2.1725	2.6803	0.00	0.00	0.00	30.83	8.90	1.10	0	1	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	1.4833	1.7358	2.0612	1.9015	2.0805	2.3730	22.51	7.11	0.84	28.86	8.52	0.97	0	1	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.9103	2.1177	2.5529	0.00	0.00	0.00	28.99	8.68	1.05	0	6	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.8683	2.0823	2.5290	0.00	0.00	0.00	27.24	8.50	1.03	0	2	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.8097	1.9933	2.3053	0.00	0.00	0.00	25.26	8.07	0.93	0	2	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	1.7517	1.9741	2.3156	1.8674	2.0789	2.5379	24.45	7.99	0.94	26.07	8.42	1.03	0	3	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	1.3837	1.6414	2.0236	1.8050	1.9862	2.3159	18.42	6.55	0.81	24.02	7.93	0.92	4	7	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.8697	2.0608	2.4649	0.00	0.00	0.00	24.89	8.23	0.98	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	1.3770	1.6338	2.0099	1.7871	1.9641	2.2822	17.39	6.40	0.79	22.57	7.69	0.89	0	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	1.3677	1.6277	1.9497	1.7946	1.9757	2.2641	16.28	6.20	0.74	21.36	7.53	0.86	1	4	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	1.7259	1.9303	2.2717	1.7969	1.9722	2.3367	20.55	7.35	0.87	21.39	7.51	0.89	0	1	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	1.6859	1.8949	2.1347	1.7731	1.9549	2.2285	18.77	6.96	0.78	19.74	7.18	0.82	1	2	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	1.6987	1.8904	2.2065	1.7842	1.9502	2.3138	18.92	6.95	0.81	19.87	7.17	0.85	0	0	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	1.6458	1.8549	2.0641	1.7293	1.9210	2.1588	16.97	6.50	0.72	17.83	6.73	0.76	0	7	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	1.6738	1.8509	2.1545	1.7446	1.8958	2.2534	17.26	6.49	0.76	17.99	6.65	0.79	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	1.7912	1.9836	2.1788	1.8569	2.0728	2.3007	18.47	6.95	0.76	19.14	7.27	0.81	3	4	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	1.5807	1.8009	2.0093	1.6639	1.8596	2.0806	14.88	5.93	0.66	15.66	6.13	0.69	0	1	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	1.7366	1.9334	2.1312	1.7895	2.0095	2.2246	16.34	6.37	0.70	16.84	6.62	0.73	1	2	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	1.5749	1.7925	1.9961	1.6566	1.8469	2.0625	13.26	5.43	0.60	13.95	5.60	0.63	9	4	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	1.4712	1.7002	1.8788	1.5395	1.7354	1.9279	10.72	4.59	0.51	11.22	4.68	0.52	0	1	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.001300	0.014275	0.028725	0.007727	0.014979	0.041879	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000003	0.000005
0.001169	0.013695	0.031445	0.007106	0.014291	0.045980	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000003	0.000004
0.000184	0.012713	0.029619	0.006976	0.014112	0.047554	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.002245	0.017438	0.048032	0.007694	0.018331	0.079054	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000003	0.000004
0.001796	0.016255	0.043562	0.007449	0.017537	0.074540	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000003	0.000003
0.000794	0.012288	0.031284	0.005792	0.012498	0.042333	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.001365	0.015279	0.039393	0.007657	0.017371	0.075282	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000002	0.000003
0.000880	0.012315	0.025196	0.006443	0.013106	0.034487	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001146	0.014569	0.036918	0.008232	0.017591	0.081228	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000778	0.011586	0.024324	0.005704	0.012374	0.032493	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000990	0.013415	0.022479	0.006367	0.015040	0.058908	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.000678	0.011681	0.031905	0.005707	0.013949	0.056063	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000076	0.009666	0.021410	0.003751	0.010032	0.028764	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000782	0.011266	0.031587	0.005929	0.013666	0.057664	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.000458	0.009520	0.024723	0.003637	0.009755	0.030490	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.000734	0.009292	0.026708	0.005252	0.012277	0.047325	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000470	0.009330	0.023831	0.003069	0.009079	0.027761	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000413	0.009283	0.019212	0.003576	0.009468	0.024870	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000705	0.009419	0.028569	0.003483	0.009173	0.033902	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000167	0.008707	0.016489	0.003284	0.008965	0.022057	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000172	0.008111	0.023588	0.003341	0.008294	0.032165	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000444	0.007727	0.012425	0.003073	0.008435	0.016748	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000002
0.000099	0.006854	0.020333	0.002495	0.006698	0.027870	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000550	0.010546	0.016215	0.003648	0.014067	0.023311	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002
0.000196	0.006865	0.010666	0.002366	0.007220	0.013024	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000796	0.009251	0.014342	0.002882	0.011992	0.018530	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000174	0.006648	0.010147	0.002264	0.006838	0.012259	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000001	0.000001	0.000000	0.000000	0.000000	0.000002
0.000151	0.005243	0.006658	0.001410	0.005088	0.007909	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.8000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000041**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	1.7502	1.9834	2.3905	0.00	0.00	0.00	36.09	8.18	0.99	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	1.7253	1.9591	2.4111	0.00	0.00	0.00	34.06	7.74	0.95	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.7088	1.9348	2.3902	0.00	0.00	0.00	32.96	7.46	0.92	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.9538	2.1767	2.6711	0.00	0.00	0.00	33.91	8.69	1.07	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.9452	2.1641	2.6465	0.00	0.00	0.00	32.75	8.74	1.07	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.9220	2.0939	2.4412	0.00	0.00	0.00	31.33	8.53	0.99	0	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.9485	2.1645	2.6501	0.00	0.00	0.00	31.76	8.82	1.08	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.9327	2.1083	2.3992	0.00	0.00	0.00	30.44	8.63	0.98	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.9575	2.1725	2.6803	0.00	0.00	0.00	30.83	8.90	1.10	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.9015	2.0805	2.3730	0.00	0.00	0.00	28.86	8.52	0.97	0	0	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.9103	2.1177	2.5529	0.00	0.00	0.00	28.99	8.68	1.05	0	9	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.8683	2.0823	2.5290	0.00	0.00	0.00	27.24	8.50	1.03	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.8097	1.9933	2.3053	0.00	0.00	0.00	25.26	8.07	0.93	0	0	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.8674	2.0789	2.5379	0.00	0.00	0.00	26.07	8.42	1.03	0	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	1.8050	1.9862	2.3159	0.00	0.00	0.00	24.02	7.93	0.92	0	3	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.8697	2.0608	2.4649	0.00	0.00	0.00	24.89	8.23	0.98	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	1.7871	1.9641	2.2822	0.00	0.00	0.00	22.57	7.69	0.89	0	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	1.7946	1.9757	2.2641	0.00	0.00	0.00	21.36	7.53	0.86	0	0	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	1.7259	1.9303	2.2717	1.7969	1.9722	2.3367	20.55	7.35	0.87	21.39	7.51	0.89	1	0	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	1.7731	1.9549	2.2285	0.00	0.00	0.00	19.74	7.18	0.82	0	1	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	1.6987	1.8904	2.2065	1.7842	1.9502	2.3138	18.92	6.95	0.81	19.87	7.17	0.85	0	0	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	1.6458	1.8549	2.0641	1.7293	1.9210	2.1588	16.97	6.50	0.72	17.83	6.73	0.76	7	0	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	1.6738	1.8509	2.1545	1.7446	1.8958	2.2534	17.26	6.49	0.76	17.99	6.65	0.79	1	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	1.7912	1.9836	2.1788	1.8569	2.0728	2.3007	18.47	6.95	0.76	19.14	7.27	0.81	4	2	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	1.5807	1.8009	2.0093	1.6639	1.8596	2.0806	14.88	5.93	0.66	15.66	6.13	0.69	1	0	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	1.7366	1.9334	2.1312	1.7895	2.0095	2.2246	16.34	6.37	0.70	16.84	6.62	0.73	2	1	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	1.5749	1.7925	1.9961	1.6566	1.8469	2.0625	13.26	5.43	0.60	13.95	5.60	0.63	4	9	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	1.4712	1.7002	1.8788	1.5395	1.7354	1.9279	10.72	4.59	0.51	11.22	4.68	0.52	1	0	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.001300	0.014275	0.028725	0.007727	0.014979	0.041879	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001169	0.013695	0.031445	0.007106	0.014291	0.045980	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000184	0.012713	0.029619	0.006976	0.014112	0.047554	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002245	0.017438	0.048032	0.007694	0.018331	0.079054	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001796	0.016255	0.043562	0.007449	0.017537	0.074540	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000794	0.012288	0.031284	0.005792	0.012498	0.042333	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001365	0.015279	0.039393	0.007657	0.017371	0.075282	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000880	0.012315	0.025196	0.006443	0.013106	0.034487	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001146	0.014569	0.036918	0.008232	0.017591	0.081228	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000778	0.011586	0.024324	0.005704	0.012374	0.032493	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000990	0.013415	0.022479	0.006367	0.015040	0.058908	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000678	0.011681	0.031905	0.005707	0.013949	0.056063	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000076	0.009666	0.021410	0.003751	0.010032	0.028764	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000782	0.011266	0.031587	0.005929	0.013666	0.057664	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000458	0.009520	0.024723	0.003637	0.009755	0.030490	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000734	0.009292	0.026708	0.005252	0.012277	0.047325	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000470	0.009330	0.023831	0.003069	0.009079	0.027761	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000413	0.009283	0.019212	0.003576	0.009468	0.024870	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000705	0.009419	0.028569	0.003483	0.009173	0.033902	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000167	0.008707	0.016489	0.003284	0.008965	0.022057	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000172	0.008111	0.023588	0.003341	0.008294	0.032165	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000444	0.007727	0.012425	0.003073	0.008435	0.016748	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000099	0.006854	0.020333	0.002495	0.006698	0.027870	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000550	0.010546	0.016215	0.003648	0.014067	0.023311	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000196	0.006865	0.010666	0.002366	0.007220	0.013024	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000796	0.009251	0.014342	0.002882	0.011992	0.018530	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000174	0.006648	0.010147	0.002264	0.006838	0.012259	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000151	0.005243	0.006658	0.001410	0.005088	0.007909	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000003**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	1.7502	1.9834	2.3905	0.00	0.00	0.00	36.09	8.18	0.99	0	0	10.20	0.000004	0.000004
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	1.7253	1.9591	2.4111	0.00	0.00	0.00	34.06	7.74	0.95	0	0	10.20	0.000004	0.000004
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	1.7088	1.9348	2.3902	0.00	0.00	0.00	32.96	7.46	0.92	0	0	10.20	0.000004	0.000004
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.9538	2.1767	2.6711	0.00	0.00	0.00	33.91	8.69	1.07	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.9452	2.1641	2.6465	0.00	0.00	0.00	32.75	8.74	1.07	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.9220	2.0939	2.4412	0.00	0.00	0.00	31.33	8.53	0.99	0	0	1.64	0.000004	0.000013
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.9485	2.1645	2.6501	0.00	0.00	0.00	31.76	8.82	1.08	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.9327	2.1083	2.3992	0.00	0.00	0.00	30.44	8.63	0.98	0	0	1.64	0.000004	0.000013
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.9575	2.1725	2.6803	0.00	0.00	0.00	30.83	8.90	1.10	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.9015	2.0805	2.3730	0.00	0.00	0.00	28.86	8.52	0.97	0	0	1.64	0.000004	0.000013
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.9103	2.1177	2.5529	0.00	0.00	0.00	28.99	8.68	1.05	0	9	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.8683	2.0823	2.5290	0.00	0.00	0.00	27.24	8.50	1.03	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.8097	1.9933	2.3053	0.00	0.00	0.00	25.26	8.07	0.93	0	0	1.64	0.000004	0.000013
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.8674	2.0789	2.5379	0.00	0.00	0.00	26.07	8.42	1.03	0	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	1.8050	1.9862	2.3159	0.00	0.00	0.00	24.02	7.93	0.92	0	3	1.64	0.000004	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.8697	2.0608	2.4649	0.00	0.00	0.00	24.89	8.23	0.98	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	1.7871	1.9641	2.2822	0.00	0.00	0.00	22.57	7.69	0.89	0	0	1.64	0.000004	0.000013
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	1.7946	1.9757	2.2641	0.00	0.00	0.00	21.36	7.53	0.86	0	0	1.64	0.000004	0.000013
19	Ship	Bulk Carrier	40,000	1.7259	1.9303	2.2717	1.7969	1.9722	2.3367	20.55	7.35	0.87	21.39	7.51	0.89	1	0	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	1.7731	1.9549	2.2285	0.00	0.00	0.00	19.74	7.18	0.82	0	1	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	1.6987	1.8904	2.2065	1.7842	1.9502	2.3138	18.92	6.95	0.81	19.87	7.17	0.85	0	0	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	1.6458	1.8549	2.0641	1.7293	1.9210	2.1588	16.97	6.50	0.72	17.83	6.73	0.76	7	0	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	1.6738	1.8509	2.1545	1.7446	1.8958	2.2534	17.26	6.49	0.76	17.99	6.65	0.79	1	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	1.7912	1.9836	2.1788	1.8569	2.0728	2.3007	18.47	6.95	0.76	19.14	7.27	0.81	4	2	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	1.5807	1.8009	2.0093	1.6639	1.8596	2.0806	14.88	5.93	0.66	15.66	6.13	0.69	1	0	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	1.7366	1.9334	2.1312	1.7895	2.0095	2.2246	16.34	6.37	0.70	16.84	6.62	0.73	2	1	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	1.5749	1.7925	1.9961	1.6566	1.8469	2.0625	13.26	5.43	0.60	13.95	5.60	0.63	4	9	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	1.4712	1.7002	1.8788	1.5395	1.7354	1.9279	10.72	4.59	0.51	11.22	4.68	0.52	1	0	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.001300	0.014275	0.028725	0.007727	0.014979	0.041879	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001169	0.013695	0.031445	0.007106	0.014291	0.045980	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000184	0.012713	0.029619	0.006976	0.014112	0.047554	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002245	0.017438	0.048032	0.007694	0.018331	0.079054	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001796	0.016255	0.043562	0.007449	0.017537	0.074540	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000794	0.012288	0.031284	0.005792	0.012498	0.042333	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001365	0.015279	0.039393	0.007657	0.017371	0.075282	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000880	0.012315	0.025196	0.006443	0.013106	0.034487	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001146	0.014569	0.036918	0.008232	0.017591	0.081228	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000778	0.011586	0.024324	0.005704	0.012374	0.032493	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000990	0.013415	0.022479	0.006367	0.015040	0.058908	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000001	0.000002	0.000003
0.000678	0.011681	0.031905	0.005707	0.013949	0.056063	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000076	0.009666	0.021410	0.003751	0.010032	0.028764	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000782	0.011266	0.031587	0.005929	0.013666	0.057664	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000458	0.009520	0.024723	0.003637	0.009755	0.030490	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000734	0.009292	0.026708	0.005252	0.012277	0.047325	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000470	0.009330	0.023831	0.003069	0.009079	0.027761	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000413	0.009283	0.019212	0.003576	0.009468	0.024870	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000705	0.009419	0.028569	0.003483	0.009173	0.033902	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000167	0.008707	0.016489	0.003284	0.008965	0.022057	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000172	0.008111	0.023588	0.003341	0.008294	0.032165	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000444	0.007727	0.012425	0.003073	0.008435	0.016748	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000099	0.006854	0.020333	0.002495	0.006698	0.027870	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000550	0.010546	0.016215	0.003648	0.014067	0.023311	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001
0.000196	0.006865	0.010666	0.002366	0.007220	0.013024	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000796	0.009251	0.014342	0.002882	0.011992	0.018530	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000174	0.006648	0.010147	0.002264	0.006838	0.012259	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001
0.000151	0.005243	0.006658	0.001410	0.005088	0.007909	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.2300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000007**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 2
Description: Main Span North
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	10.60	2.12	0.21	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	10.15	2.03	0.20	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.5140	0.5140	0.5140	0.00	0.00	0.00	9.91	1.98	0.20	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	17.86	4.11	0.41	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	17.32	4.16	0.42	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.77	4.19	0.42	0	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.77	4.19	0.42	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.21	4.21	0.42	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.21	4.21	0.42	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.62	4.22	0.42	0	0	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.62	4.22	0.42	0	9	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.00	4.20	0.42	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	14.36	4.17	0.42	0	0	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	14.36	4.17	0.42	0	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	13.70	4.11	0.41	0	3	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	13.70	4.11	0.41	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	12.99	4.03	0.40	0	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	12.25	3.92	0.39	0	0	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	12.25	3.92	0.39	12.25	3.92	0.39	1	0	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	11.46	3.78	0.38	0	1	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	11.46	3.78	0.38	11.46	3.78	0.38	0	0	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	7	0	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	1	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	10.61	3.61	0.36	10.61	3.61	0.36	4	2	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	9.68	3.39	0.34	9.68	3.39	0.34	1	0	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	9.68	3.39	0.34	9.68	3.39	0.34	2	1	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	8.66	3.12	0.31	8.66	3.12	0.31	4	9	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	1.0290	1.0290	1.0290	1.0290	1.0290	1.0290	7.50	2.78	0.28	7.50	2.78	0.28	1	0	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			Total
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000000	0.000001	0.000005	0.000001	0.000002	0.000010	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000005	0.000000	0.000001	0.000010	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000004	0.000000	0.000001	0.000011	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000009	0.000000	0.000002	0.000023	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000007	0.000000	0.000001	0.000020	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000004	0.000000	0.000001	0.000007	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000006	0.000000	0.000001	0.000020	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000003	0.000000	0.000001	0.000005	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000005	0.000000	0.000001	0.000023	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000002	0.000000	0.000001	0.000004	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000002	0.000000	0.000001	0.000010	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000002	0.000000	0.000000	0.000006	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000002	0.000000	0.000000	0.000006	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000002	0.000000	0.000000	0.000005	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000002	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000000	0.000001	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000001	0.000000	0.000001	0.000002	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.1800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Inbound
Channel Leg: 1

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	5	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	4	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	1	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	5	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	5	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	3	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	4	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.21	4.21	0.42	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.21	4.21	0.42	0	1	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.62	4.22	0.42	0	1	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	6	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.00	4.20	0.42	0	2	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	2	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	14.36	4.17	0.42	0	3	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	7	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	13.70	4.11	0.41	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	4	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	12.25	3.92	0.39	0	1	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	2	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	11.46	3.78	0.38	0	0	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	10.61	3.61	0.36	0	7	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	10.61	3.61	0.36	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	10.61	3.61	0.36	0	4	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	9.68	3.39	0.34	0	1	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	9.68	3.39	0.34	0	2	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	8.66	3.12	0.31	0	4	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	7.50	2.78	0.28	0	1	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000152	0.001071	0.000504	0.000778	0.000634	0.000315	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000130	0.000992	0.000461	0.000695	0.000588	0.000300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.001080	0.000560	0.000702	0.000610	0.000329	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000250	0.000886	0.000287	0.000684	0.000575	0.000163	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000196	0.000871	0.000298	0.000652	0.000548	0.000164	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000076	0.000897	0.000436	0.000559	0.000541	0.000308	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000146	0.000893	0.000326	0.000664	0.000537	0.000164	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000087	0.000889	0.000400	0.000603	0.000520	0.000285	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000119	0.000898	0.000347	0.000695	0.000517	0.000153	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000070	0.000772	0.000337	0.000502	0.000460	0.000243	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000095	0.000731	0.000475	0.000491	0.000210	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000053	0.000620	0.000236	0.000420	0.000365	0.000124	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000540	0.000228	0.000018	0.000284	0.000336	0.000166	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000063	0.000579	0.000225	0.000418	0.000336	0.000114	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000028	0.000518	0.000220	0.000275	0.000331	0.000167	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000031	0.000616	0.000334	0.000419	0.000390	0.000182	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000029	0.000498	0.000211	0.000235	0.000335	0.000176	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000023	0.000482	0.000194	0.000260	0.000306	0.000154	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000052	0.000479	0.000215	0.000260	0.000318	0.000168	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000442	0.000175	0.000228	0.000278	0.000137	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000446	0.000248	0.000241	0.000288	0.000165	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000024	0.000320	0.000108	0.000180	0.000204	0.000084	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000359	0.000230	0.000176	0.000260	0.000169	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000041	0.000723	0.000297	0.000346	0.000572	0.000229	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000004	0.000237	0.000074	0.000120	0.000152	0.000056	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000062	0.000493	0.000179	0.000230	0.000404	0.000141	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000003	0.000229	0.000073	0.000114	0.000147	0.000056	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000002	0.000125	0.000032	0.000054	0.000084	0.000026	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Inbound
Channel Leg: 2

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	5	10.20	0.000003	0.000003
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	4	10.20	0.000003	0.000003
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	1	10.20	0.000003	0.000003
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	5	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	5	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	3	1.64	0.000003	0.000013
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	4	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.21	4.21	0.42	0	0	1.64	0.000003	0.000013
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	16.21	4.21	0.42	0	1	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.62	4.22	0.42	0	1	1.64	0.000003	0.000013
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	6	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	15.00	4.20	0.42	0	2	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	2	1.64	0.000003	0.000013
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	14.36	4.17	0.42	0	3	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	7	1.64	0.000003	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	13.70	4.11	0.41	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000003	0.000013
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	4	1.64	0.000003	0.000013
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	12.25	3.92	0.39	0	1	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	2	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	11.46	3.78	0.38	0	0	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	10.61	3.61	0.36	0	7	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	10.61	3.61	0.36	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	10.61	3.61	0.36	0	4	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	9.68	3.39	0.34	0	1	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	9.68	3.39	0.34	0	2	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	8.66	3.12	0.31	0	4	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	1.0290	1.0290	1.0290	0.00	0.00	0.00	7.50	2.78	0.28	0	1	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000152	0.001071	0.000504	0.000778	0.000634	0.000315	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000130	0.000992	0.000461	0.000695	0.000588	0.000300	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.001080	0.000560	0.000702	0.000610	0.000329	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000250	0.000886	0.000287	0.000684	0.000575	0.000163	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000196	0.000871	0.000298	0.000652	0.000548	0.000164	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000076	0.000897	0.000436	0.000559	0.000541	0.000308	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000146	0.000893	0.000326	0.000664	0.000537	0.000164	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000087	0.000889	0.000400	0.000603	0.000520	0.000285	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000119	0.000898	0.000347	0.000695	0.000517	0.000153	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000070	0.000772	0.000337	0.000502	0.000460	0.000243	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000095	0.000731	0.000475	0.000491	0.000210	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000053	0.000620	0.000236	0.000420	0.000365	0.000124	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000540	0.000228	0.000018	0.000284	0.000336	0.000166	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000063	0.000579	0.000225	0.000418	0.000336	0.000114	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000028	0.000518	0.000220	0.000275	0.000331	0.000167	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000031	0.000616	0.000334	0.000419	0.000390	0.000182	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000029	0.000498	0.000211	0.000235	0.000335	0.000176	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000023	0.000482	0.000194	0.000260	0.000306	0.000154	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000052	0.000479	0.000215	0.000260	0.000318	0.000168	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000442	0.000175	0.000228	0.000278	0.000137	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000446	0.000248	0.000241	0.000288	0.000165	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000024	0.000320	0.000108	0.000180	0.000204	0.000084	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000359	0.000230	0.000176	0.000260	0.000169	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000041	0.000723	0.000297	0.000346	0.000572	0.000229	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000004	0.000237	0.000074	0.000120	0.000152	0.000056	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000062	0.000493	0.000179	0.000230	0.000404	0.000141	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000003	0.000229	0.000073	0.000114	0.000147	0.000056	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000002	0.000125	0.000032	0.000054	0.000084	0.000026	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.5800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Inbound
Channel Leg: 3

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted							
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted		Loaded	Ballasted
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	5	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	4	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	1	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	5	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	5	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	3	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	4	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	1.6624	1.4000	1.0290	0.00	0.00	0.00	26.18	5.73	0.42	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	1.6175	1.2542	1.0290	0.00	0.00	0.00	25.47	5.14	0.42	0	1	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	1.6424	1.3749	1.0290	0.00	0.00	0.00	24.92	5.63	0.42	0	1	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	6	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	1.5756	1.2392	1.0290	0.00	0.00	0.00	22.97	5.06	0.42	0	2	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	2	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	1.5587	1.2234	1.0290	0.00	0.00	0.00	21.76	4.95	0.42	0	3	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	7	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	1.6080	1.3237	1.0290	0.00	0.00	0.00	21.40	5.29	0.41	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	4	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	1.5931	1.3294	1.0290	0.00	0.00	0.00	18.97	5.06	0.39	0	1	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	2	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	1.5816	1.3301	1.0290	0.00	0.00	0.00	17.61	4.89	0.38	0	0	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	1.5068	1.2194	1.0290	0.00	0.00	0.00	15.53	4.27	0.36	0	7	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	1.5808	1.3488	1.0290	0.00	0.00	0.00	16.30	4.73	0.36	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	1.6819	1.3658	1.0290	0.00	0.00	0.00	17.34	4.79	0.36	0	4	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	1.4596	1.1659	1.0290	0.00	0.00	0.00	13.74	3.84	0.34	0	1	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	1.6230	1.3002	1.0290	0.00	0.00	0.00	15.27	4.28	0.34	0	2	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	1.4578	1.1712	1.0290	0.00	0.00	0.00	12.27	3.55	0.31	0	4	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	1.3688	1.0728	1.0290	0.00	0.00	0.00	9.98	2.89	0.28	0	1	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000917	0.010656	0.007163	0.006953	0.006856	0.004927	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001137	0.009900	0.006836	0.006447	0.006572	0.004855	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.010325	0.007898	0.006393	0.006653	0.005177	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002332	0.009718	0.004829	0.006715	0.007088	0.003077	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001853	0.009623	0.005029	0.006516	0.006858	0.003132	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000698	0.009347	0.006742	0.005426	0.006230	0.005130	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001373	0.009726	0.005406	0.006644	0.006739	0.003122	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000803	0.009284	0.005888	0.005888	0.006078	0.004820	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001120	0.009709	0.005676	0.006986	0.006566	0.002953	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.009356	0.005346	0.000739	0.005250	0.005767	0.004424	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000948	0.008329	0.005965	0.005008	0.006257	0.003977	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000594	0.008012	0.004660	0.005033	0.005435	0.002798	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.007268	0.004395	0.000613	0.003574	0.005023	0.003679	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000722	0.007668	0.004549	0.005134	0.005156	0.002649	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000338	0.007108	0.004443	0.003479	0.004974	0.003711	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000334	0.007433	0.005761	0.004796	0.005390	0.003721	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000355	0.006955	0.004297	0.003007	0.005028	0.003904	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000288	0.006823	0.003903	0.003403	0.004769	0.003539	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000641	0.006738	0.004559	0.003344	0.004826	0.003768	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.006526	0.003599	0.003134	0.004546	0.003341	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.006286	0.004772	0.003206	0.004507	0.003770	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000358	0.005534	0.002601	0.002868	0.003901	0.002281	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005321	0.004732	0.000619	0.002468	0.004211	0.003993	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000417	0.008198	0.004458	0.003626	0.007127	0.004289	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000073	0.004781	0.002060	0.002231	0.003391	0.001766	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000745	0.006762	0.003311	0.002860	0.005989	0.003004	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000046	0.004666	0.002037	0.002145	0.003316	0.001748	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000056	0.003444	0.001228	0.001352	0.002535	0.001065	0.000000	0.000000	0.000000	1.000000	1.000000	1.000000	0.6700	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000002**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Outbound
Channel Leg: 4

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000006
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000006	0.000006
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000006	0.000006

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000917	0.010656	0.007163	0.006953	0.006856	0.004927	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001137	0.009900	0.006836	0.006447	0.006572	0.004855	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.010325	0.007898	0.006393	0.006653	0.005177	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002332	0.009718	0.004829	0.006715	0.007088	0.003077	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001853	0.009623	0.005029	0.006516	0.006858	0.003132	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000698	0.009347	0.006742	0.005426	0.006230	0.005130	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001373	0.009726	0.005406	0.006644	0.006739	0.003122	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000803	0.009284	0.005888	0.005888	0.006078	0.004820	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001120	0.009709	0.005676	0.006986	0.006566	0.002953	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.009356	0.005346	0.000739	0.005250	0.005767	0.004424	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000948	0.008329	0.005965	0.005008	0.006257	0.003977	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000594	0.008012	0.004660	0.005033	0.005435	0.002798	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.007268	0.004395	0.000613	0.003574	0.005023	0.003679	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000722	0.007668	0.004549	0.005134	0.005156	0.002649	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000338	0.007108	0.004443	0.003479	0.004974	0.003711	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000334	0.007433	0.005761	0.004796	0.005390	0.003721	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000355	0.006955	0.004297	0.003007	0.005028	0.003904	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000288	0.006823	0.003903	0.003403	0.004769	0.003539	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000641	0.006738	0.004559	0.003344	0.004826	0.003768	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.006526	0.003599	0.003134	0.004546	0.003341	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.006286	0.004772	0.003206	0.004507	0.003770	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000358	0.005534	0.002601	0.002868	0.003901	0.002281	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005321	0.004732	0.000619	0.002468	0.004211	0.003993	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000417	0.008198	0.004458	0.003626	0.007127	0.004289	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000073	0.004781	0.002060	0.002231	0.003391	0.001766	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000745	0.006762	0.003311	0.002860	0.005989	0.003004	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000046	0.004666	0.002037	0.002145	0.003316	0.001748	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000056	0.003444	0.001228	0.001352	0.002535	0.001065	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Outbound
Channel Leg: 5

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000004	0.000004
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000004	0.000013
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000013	0.000013
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000013	0.000013

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000917	0.010656	0.007163	0.006953	0.006856	0.004927	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001137	0.009900	0.006836	0.006447	0.006572	0.004855	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.010325	0.007898	0.006393	0.006653	0.005177	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002332	0.009718	0.004829	0.006715	0.007088	0.003077	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001853	0.009623	0.005029	0.006516	0.006858	0.003132	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000698	0.009347	0.006742	0.005426	0.006230	0.005130	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001373	0.009726	0.005406	0.006644	0.006739	0.003122	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000803	0.009284	0.005888	0.005888	0.006078	0.004820	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001120	0.009709	0.005676	0.006986	0.006566	0.002953	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.009356	0.005346	0.000739	0.005250	0.005767	0.004424	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000948	0.008329	0.005965	0.005008	0.006257	0.003977	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000594	0.008012	0.004660	0.005033	0.005435	0.002798	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.007268	0.004395	0.000613	0.003574	0.005023	0.003679	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000722	0.007668	0.004549	0.005134	0.005156	0.002649	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000338	0.007108	0.004443	0.003479	0.004974	0.003711	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000334	0.007433	0.005761	0.004796	0.005390	0.003721	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000355	0.006955	0.004297	0.003007	0.005028	0.003904	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000288	0.006823	0.003903	0.003403	0.004769	0.003539	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000641	0.006738	0.004559	0.003344	0.004826	0.003768	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.006526	0.003599	0.003134	0.004546	0.003341	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.006286	0.004772	0.003206	0.004507	0.003770	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000358	0.005534	0.002601	0.002868	0.003901	0.002281	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.005321	0.004732	0.000619	0.002468	0.004211	0.003993	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000417	0.008198	0.004458	0.003626	0.007127	0.004289	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000073	0.004781	0.002060	0.002231	0.003391	0.001766	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000745	0.006762	0.003311	0.002860	0.005989	0.003004	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000046	0.004666	0.002037	0.002145	0.003316	0.001748	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000056	0.003444	0.001228	0.001352	0.002535	0.001065	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Span ID: 3
Description: Anchor Span North
Vessel Direction: Outbound
Channel Leg: 6

Vessel ID	Vessel Type	Description	Single Vessel DWT (tonnes)	Impact Speed at Superstructure, V (m/sec) [1]						Maximum Impact Force on Superstructure, P (MN) [1]						Vessel Frequency, N [1]		Vessel Trip Growth Factor, GF	Probability of Aberrancy, PA [2]	
				Loaded			Ballasted			Loaded			Ballasted						Loaded	Ballasted
				V_{BH}	V_{DH}	V_{MT}	V_{BH}	V_{DH}	V_{MT}	P_{BH}	P_{DH}	P_{MT}	P_{BH}	P_{DH}	P_{MT}	Loaded	Ballasted			
1	Ship	Tanker	120,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
2	Ship	Tanker	110,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
3	Ship	Tanker	105,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	10.20	0.000002	0.000002
4	Ship	Bulk Carrier	85,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
5	Ship	Bulk Carrier	80,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
6	Ship	Tanker	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
7	Ship	Bulk Carrier	75,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
8	Ship	Tanker	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
9	Ship	Bulk Carrier	70,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
10	Ship	Tanker	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
11	Ship	Bulk Carrier	65,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
12	Ship	Bulk Carrier	60,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
13	Ship	Tanker	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
14	Ship	Bulk Carrier	55,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
15	Ship	Tanker	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
16	Ship	Bulk Carrier	50,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
17	Ship	Tanker	45,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
18	Ship	Tanker	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000002	0.000007
19	Ship	Bulk Carrier	40,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
20	Ship	Tanker	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
21	Ship	Bulk Carrier	35,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
22	Ship	Tanker	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
23	Ship	Bulk Carrier	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
24	Ship	Articulated Tug/Barge	30,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
25	Ship	Tanker	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
26	Ship	Articulated Tug/Barge	25,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.28	0.000007	0.000007
27	Ship	Tanker	20,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007
28	Ship	Tanker	15,000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0	0	1.64	0.000007	0.000007

Notes:

[1] A value of 0 under "Vessel Frequency" indicates that either there are no vessel trips documented or the vessel has run aground, therefore causing the "Impact Speed" and "Maximum Impact Force" to also be a 0 value

[2] PA = (BR)(R_B)(R_C)(R_{XC})(R_D)(Assigned Aberrancy Distribution for Each Leg & Vessel Direction)

[3] Normal distribution for the Geometric Probability (PG) is centered on the centerline of vessel transit path at each defined transit path leg

[4] Probability of Collapse (PC) is based on the ratio of bridge ultimate lateral capacity (H) to vessel impact force (P)

[5] AF = (N)(GF)(PA)(PG)(PC)(PF)

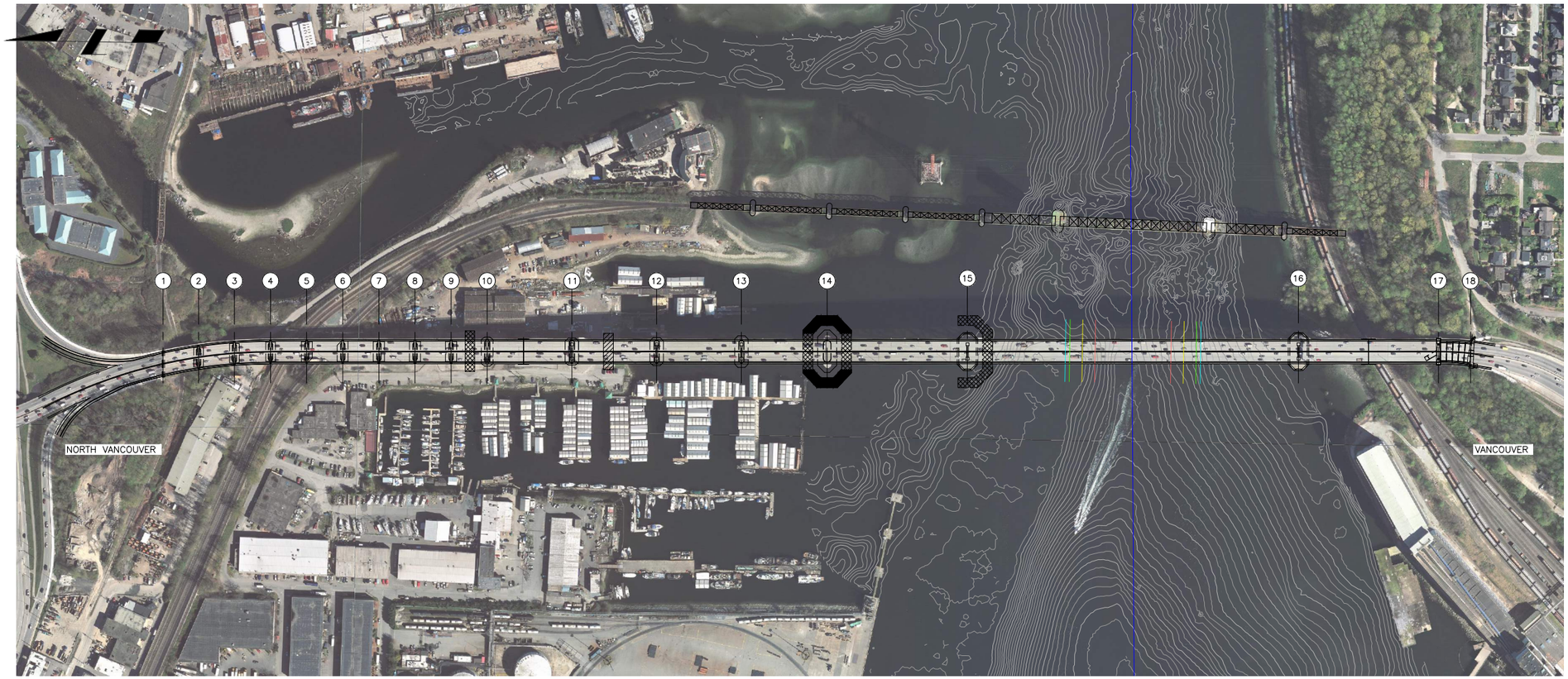
ANNUAL FREQUENCY OF COLLAPSE COMPUTATIONS (SUPERSTRUCTURE ONLY)

Geometric Probability, PG [3]						Probability of Collapse, PC [4]						Protection Factor, PF	Annual Frequency of Collapse, AF [5]						Total
Loaded			Ballasted			Loaded			Ballasted				Loaded			Ballasted			
Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast	Bow	Deck House	Mast		Bow	Deck House	Mast	Bow	Deck House	Mast	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
																		Total for Pier:	**0.000000**

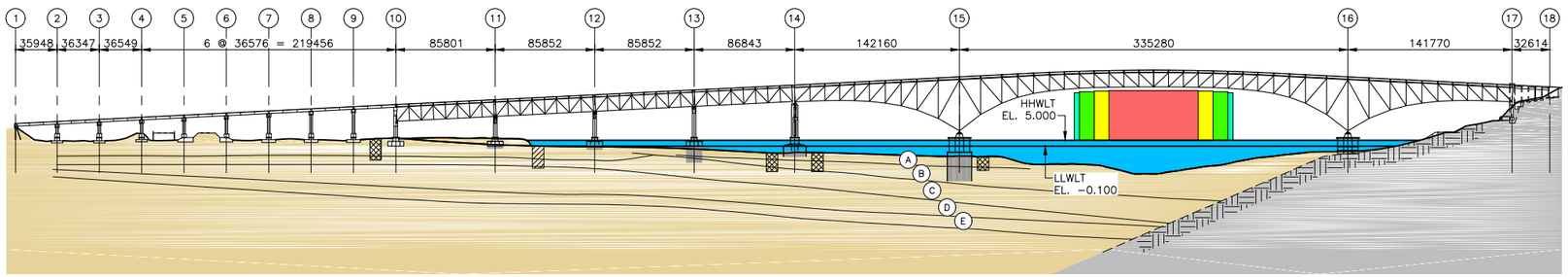
APPENDIX

B

CONCEPT DRAWINGS FOR PHYSICAL PROTECTION



PLAN
SCALE: 1:5000



ELEVATION
SCALE: 1:5000

GROUND IMPROVEMENT LEGEND

GROUND IMPROVEMENT USING VIBRO-REPLACEMENT STONE COLUMNS OR GRAVEL COMPACTION PILES

TO BE IMPROVED USING TIMBER OR GRAVEL COMPACTION PILES

STRATIGRAPHY LEGEND

UNIT No.	STRATUM DESCRIPTION
A	LOOSE GRAVEL, SOME SAND TO GRAVEL AND SAND, SOME COBBLES
B	LOOSE TO COMPACT SAND, SOME GRAVELLY LAYERS
C	COMPACT SANDY GRAVEL TO GRAVEL AND SAND
D	COMPACT GRAVEL AND SAND TO SANDY GRAVEL
E	COMPACT SAND AND SILT AND SAND, WITH MARINE SHELLS

NAVIGATION CHANNEL LEGEND

27.0m BEAM AND LESS – MAX VESSEL AIR DRAFT = 42.70m HHWLT; CORRESPONDING CHANNEL WIDTH REQUIRED* = 66.4m TO 77.0m

27.1m TO 36.0m BEAM – MAX VESSEL AIR DRAFT = 42.38m HHWLT; CORRESPONDING CHANNEL WIDTH REQUIRED* = 77.2m TO 102.6m

36.1m TO 45.0m BEAM – MAX VESSEL AIR DRAFT = 41.82m HHWLT; CORRESPONDING CHANNEL WIDTH REQUIRED* = 102.9m TO 128.3m

45.1m TO 48.1m BEAM – MAX VESSEL AIR DRAFT = 40.95m HHWLT; CORRESPONDING CHANNEL WIDTH REQUIRED* = 128.5m TO 137.1m

* CHANNEL WDITH REQUIRED VARIES AND DEPENDS ON VESSEL BEAM. FULL MATRIX OF VALUES PROVIDED IN APPENDIX C OF THE POV'S PORT INFORMATION GUIDE (AUGUST, 2016)

NOTES:

1. ALL ELEVATIONS ARE IN METERS AND REFERENCED TO CHART DATUM.
2. THE SOIL STRATIGRAPHY SHOWN IS BASED ON THE PRELIMINARY GEOTECH STUDY IN 1991.

MMM GROUP

Rev	Date	Description	Init
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.

REVISIONS

BRITISH COLUMBIA
Ministry of Transportation & Infrastructure
South Coast Region

01459 IRONWORKERS MEMORIAL BRIDGE
VESSEL COLLISION RISK MITIGATION STUDY
EXISTING STRUCTURE AND CHANNEL

.

PREPARED UNDER THE DIRECTION OF

KEITH HOLMES
ENGINEER OF RECORD

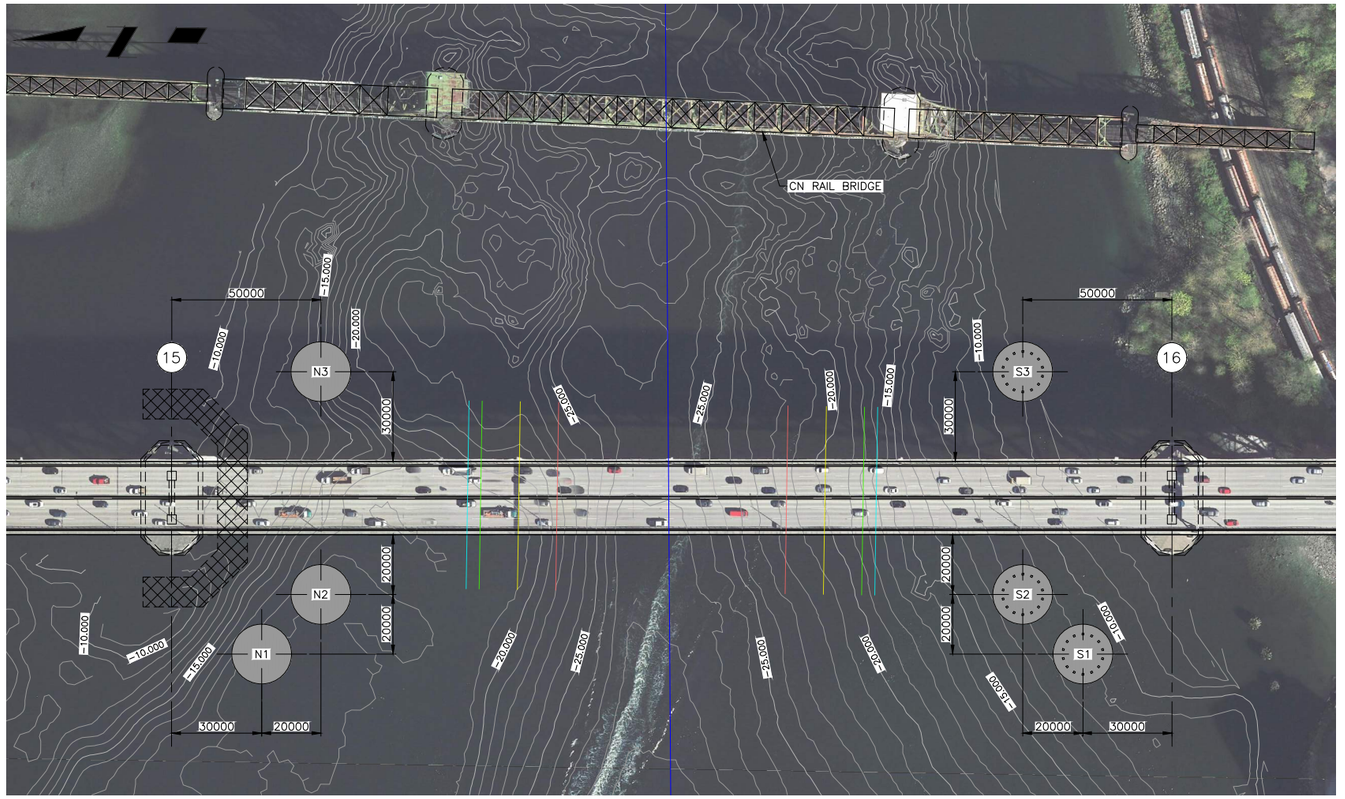
DATE

DESIGNED KH DATE SEPT, 2017
CHECKED SC / JJ DATE SEPT, 2017
DRAWN SH DATE SEPT, 2017
SCALE AS SHOWN
NEGATIVE No.

FILE No. | PROJECT No. 83118 | REG. . | DRAWING No. 01459-B001

CANCEL PRINTS BEARING PREVIOUS LETTER

H-308-1-1-(07-08)

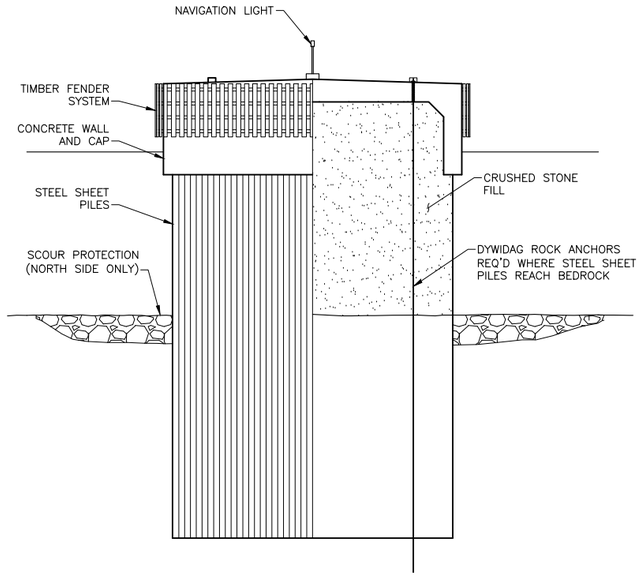


PLAN
SCALE: 1:2000

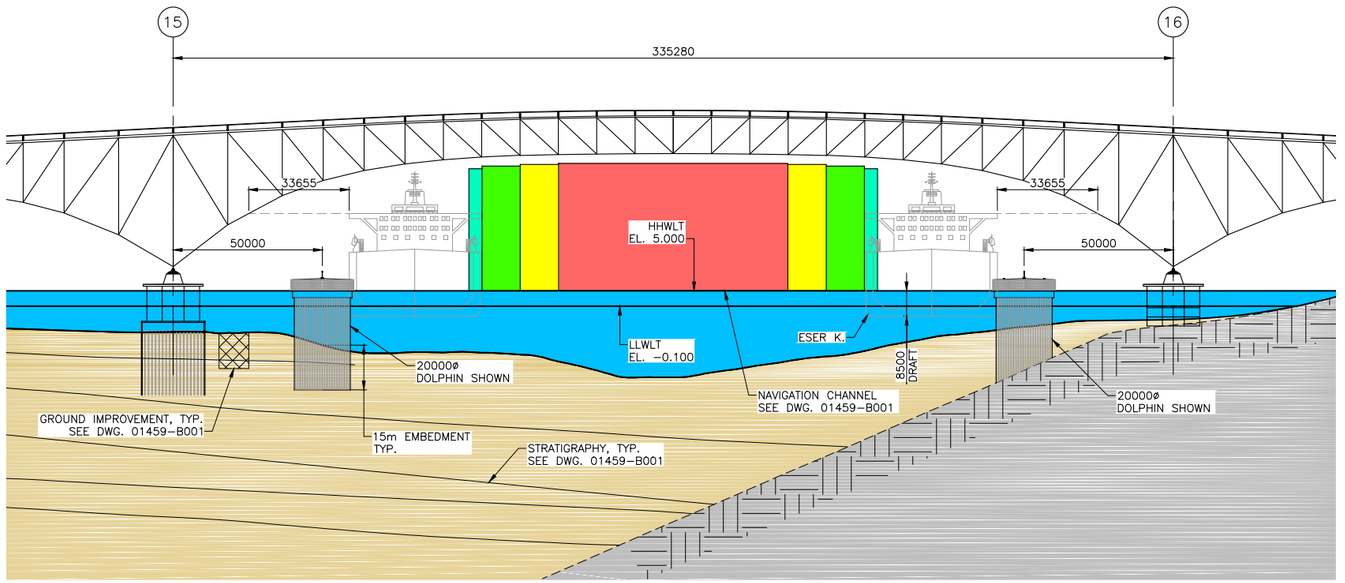


ESER K. – TYPICAL AFRAMAX TANKER

VESSEL CAPACITY (DEAD WEIGHT TONNAGE):	115,800
LENGTH OVERALL (LOA):	250m
BREADTH/BEAM:	44m
DEPTH TO MAIN DECK:	22m
DESIGN (SCANTLING) DRAFT:	15m
LOADED DRAFT:	13.6m
LOADED DISPLACEMENT:	134,800 tonnes
BLOCK COEFFICIENT:	0.835



TYPICAL DOLPHIN DETAIL
SCALE: 1:400



ELEVATION
SCALE: 1:2000

NOTES:

1. ALL ELEVATIONS ARE IN METERS AND REFERENCED TO CHART DATUM.
2. THE SOIL STRATIGRAPHY SHOWN IS BASED ON THE PRELIMINARY GEOTECH STUDY IN 1991.

MMM GROUP

Rev	Date	Description	Init
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.

REVISIONS

BRITISH COLUMBIA | Ministry of Transportation & Infrastructure
South Coast Region

01459 IRONWORKERS MEMORIAL BRIDGE
VESSEL COLLISION RISK MITIGATION STUDY
DOLPHIN CONCEPT

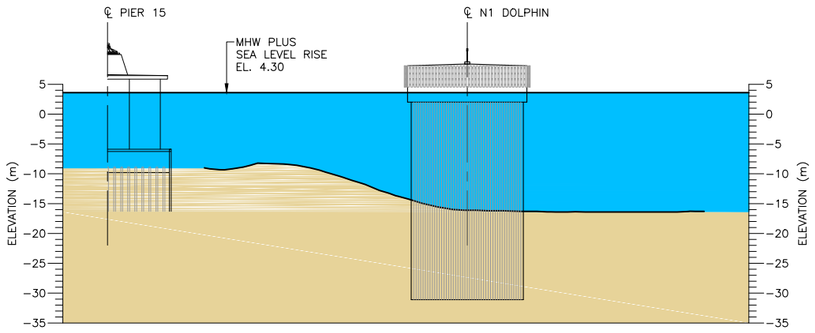
PREPARED UNDER THE DIRECTION OF
KEITH HOLMES
ENGINEER OF RECORD
DATE

DESIGNED KH DATE SEPT. 2017
CHECKED SC / JJ DATE SEPT. 2017
DRAWN SH DATE SEPT. 2017
SCALE AS SHOWN
NEGATIVE No.

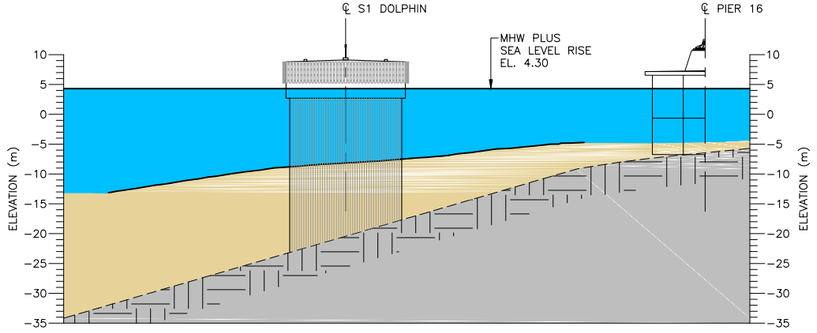
FILE No.	PROJECT No.	REG.	DRAWING No.
	83118	.	01459-B002

CANCEL PRINTS BEARING PREVIOUS LETTER

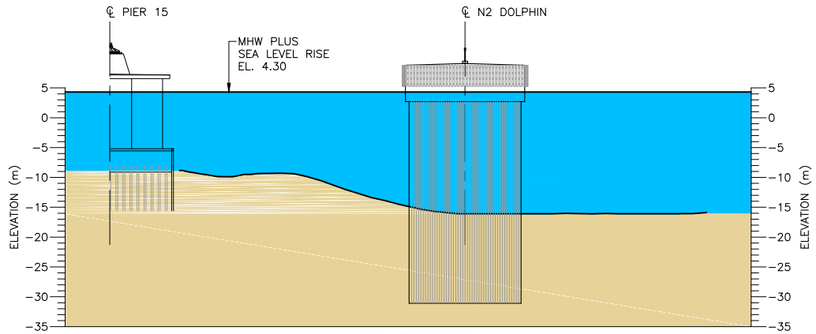
H-308-1-1-(07-08)



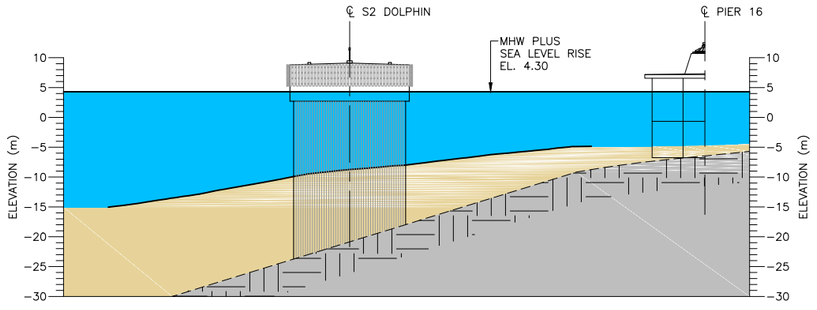
N1 PROFILE
SCALE: 1:1000



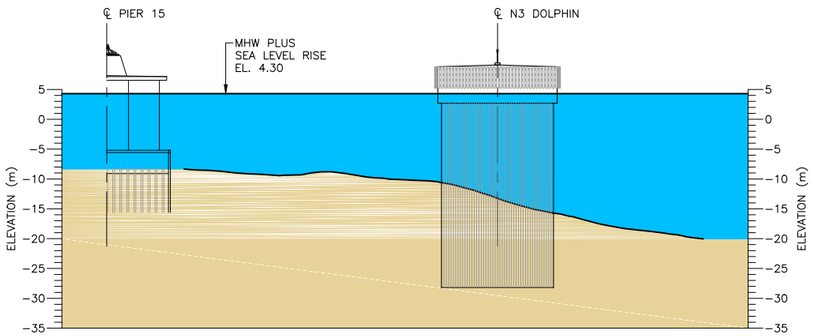
S1 PROFILE
SCALE: 1:1000



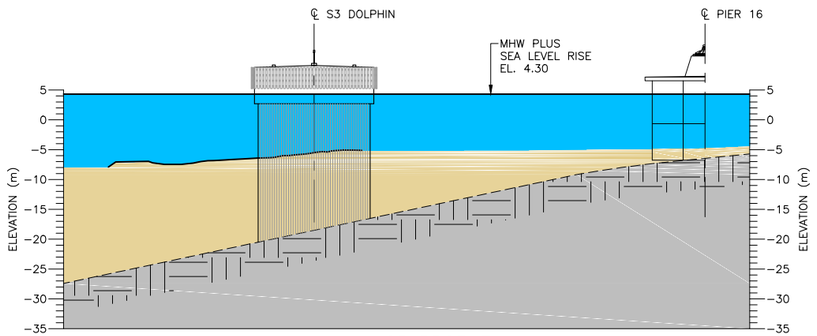
N2 PROFILE
SCALE: 1:1000



S2 PROFILE
SCALE: 1:1000



N3 PROFILE
SCALE: 1:1000



S3 PROFILE
SCALE: 1:1000

NOTES:

1. ALL ELEVATIONS ARE IN METERS AND REFERENCED TO CHART DATUM.
2. BEDROCK ELEVATIONS ARE APPROXIMATED FOR ILLUSTRATION PURPOSES.

MMM GROUP

Rev	Date	Description	Init
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.

REVISIONS

BRITISH COLUMBIA | Ministry of Transportation & Infrastructure
South Coast Region

01459 IRONWORKERS MEMORIAL BRIDGE
VESSEL COLLISION RISK MITIGATION STUDY
DOLPHIN GEOMETRY

.

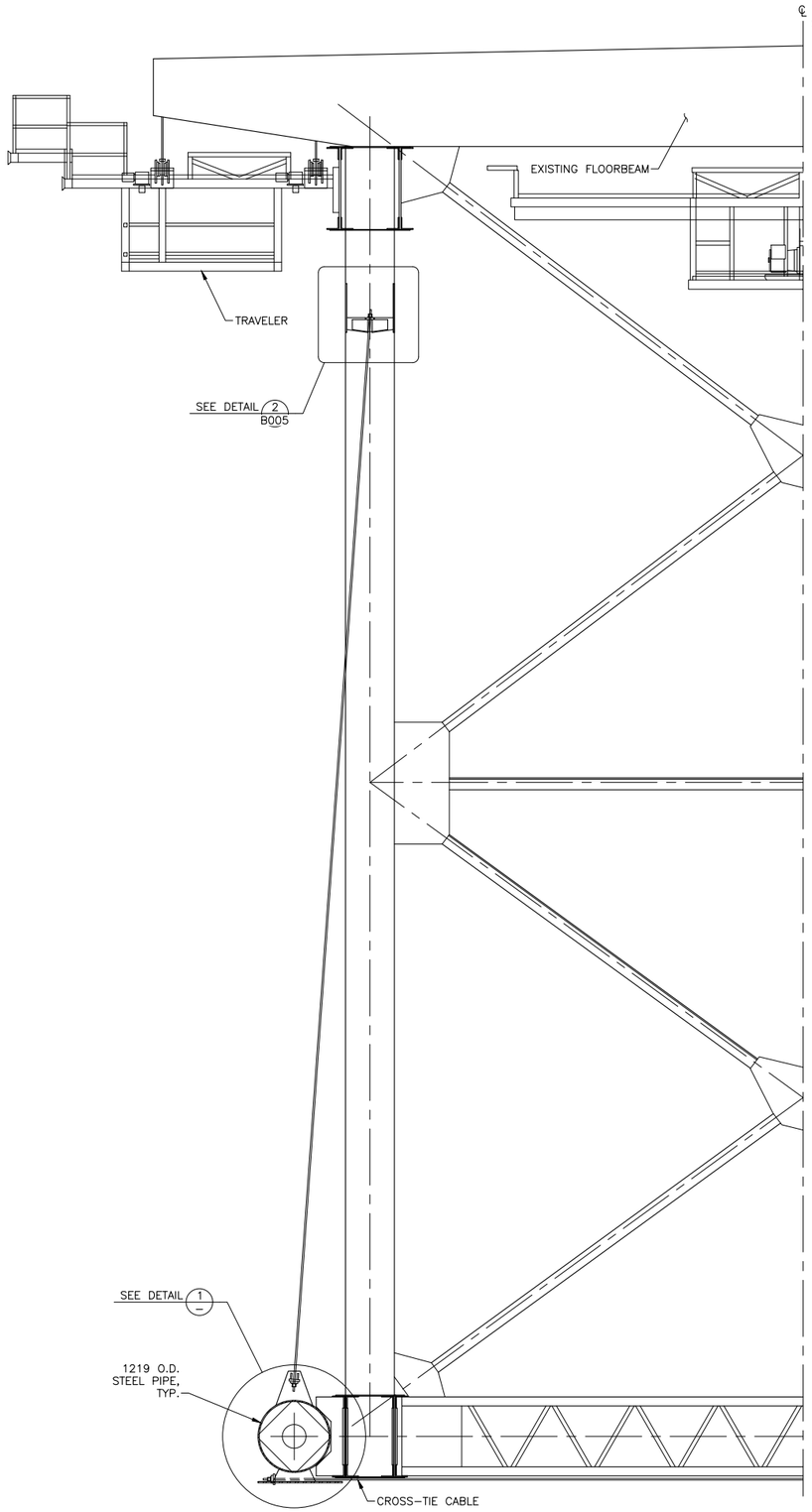
PREPARED UNDER THE DIRECTION OF
KEITH HOLMES
ENGINEER OF RECORD
DATE

DESIGNED KH DATE SEPT, 2017
CHECKED SC / JJ DATE SEPT, 2017
DRAWN SH DATE SEPT, 2017
SCALE AS SHOWN
NEGATIVE No.

FILE No.	PROJECT No.	REG.	DRAWING No.
	83118	.	01459–B003

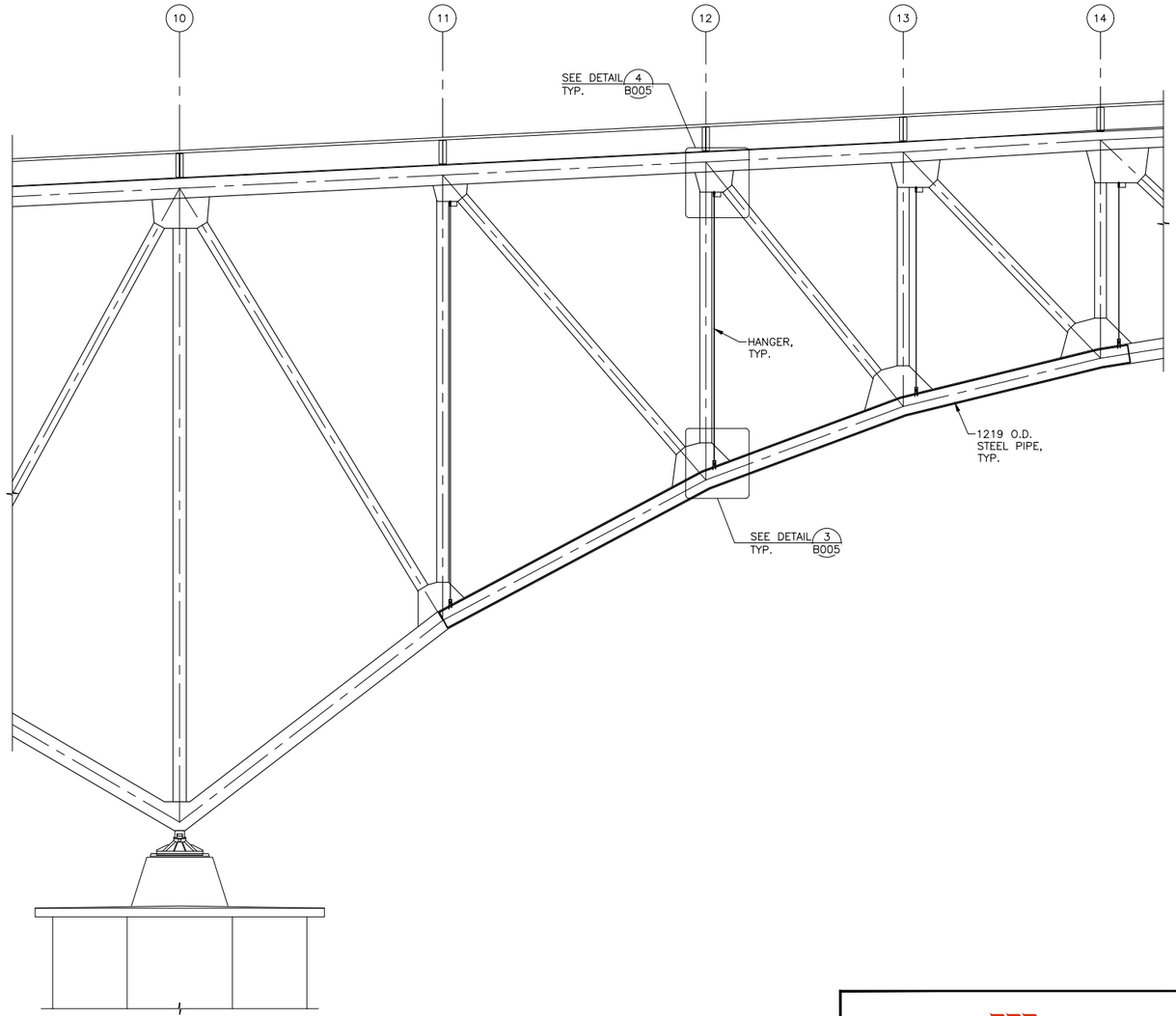
CANCEL PRINTS BEARING PREVIOUS LETTER

H-308(r1-c(07-08))



TYPICAL CROSS SECTION AT NODE

NOTE: BRIDGE DECK NOT SHOWN FOR CLARITY

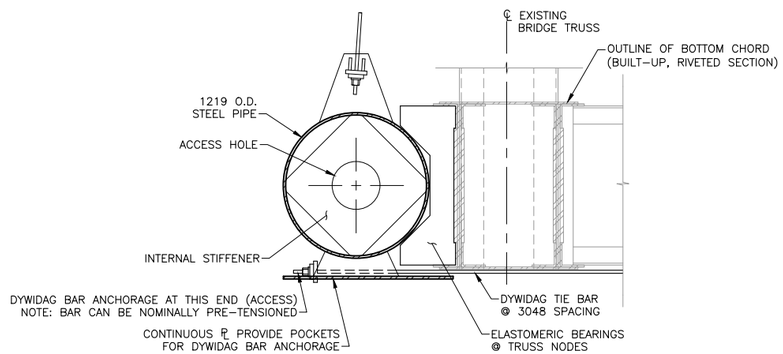


SCHEMATIC LAYOUT

SCALE 1:400

(12 STEEL PIPES REQ'D)

(16 HANGERS REQ'D)



DETAIL 1 –

SCALE 1:50

MMM GROUP

Rev	Date	Description	Init
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.

REVISIONS

BRITISH COLUMBIA

Ministry of Transportation & Infrastructure

South Coast Region

01459 IRONWORKERS MEMORIAL BRIDGE

VESSEL COLLISION RISK MITIGATION STUDY

BOTTOM CHORD FENDER

SHEET 1

PREPARED UNDER THE DIRECTION OF

KEITH HOLMES

ENGINEER OF RECORD

DATE

DESIGNED KH DATE SEPT, 2017

CHECKED SC / JJ DATE SEPT, 2017

DRAWN SH DATE SEPT, 2017

SCALE

NEGATIVE No.

FILE No.

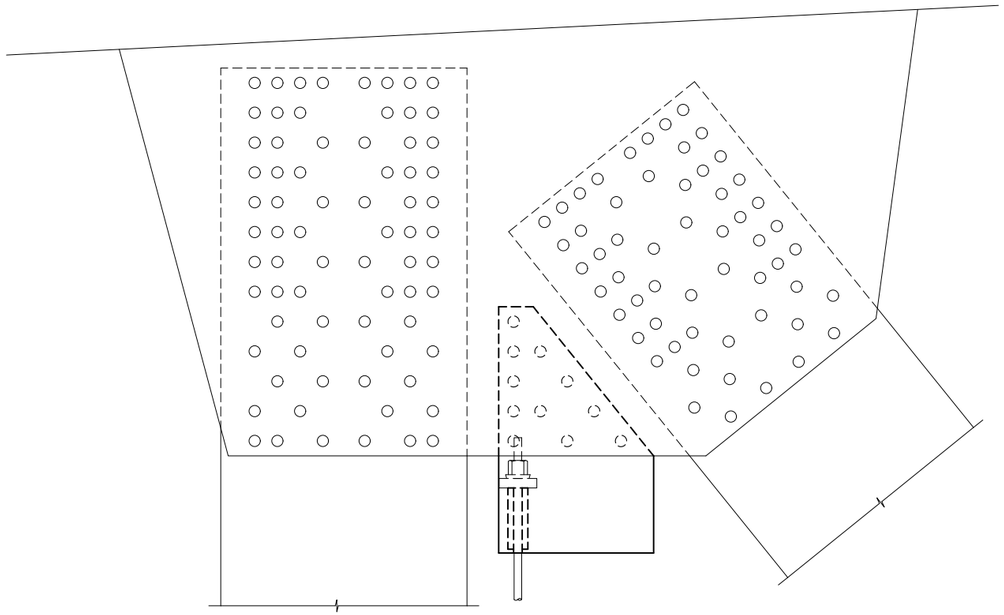
PROJECT No. 83118

REG. .

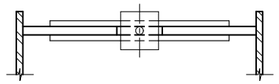
DRAWING No. 01459–B004

H–308–r1–(07–08)

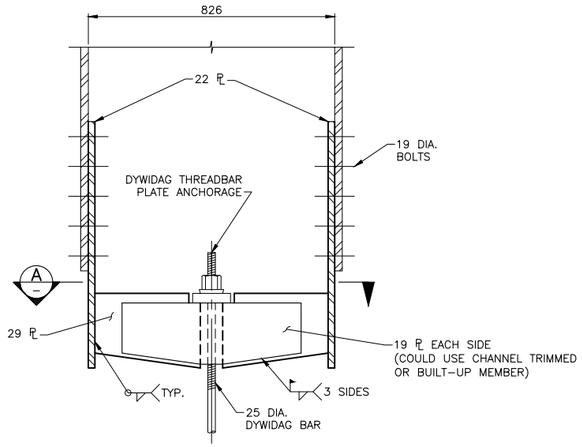
CANCEL PRINTS BEARING PREVIOUS LETTER



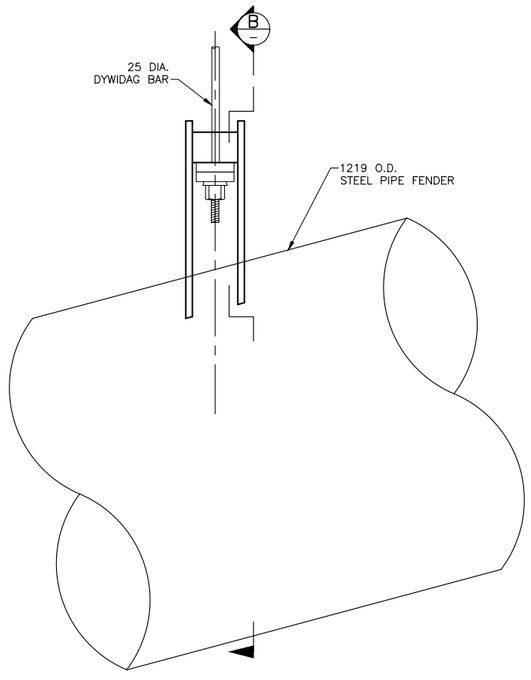
DETAIL 4 — SCALE 1:20 — B004



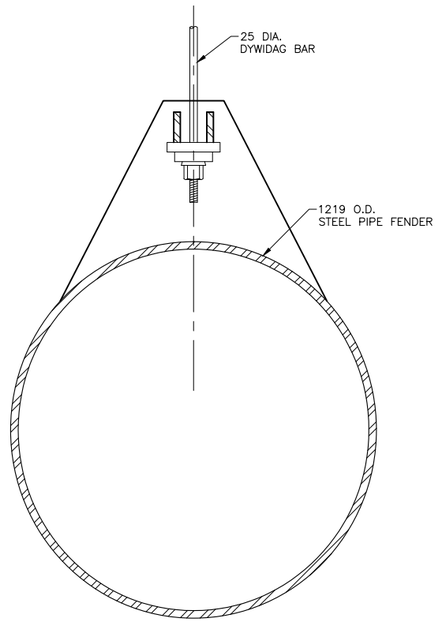
SECTION A — SCALE 1:20



DETAIL 2 — SCALE 1:20 — B004



DETAIL 3 — SCALE 1:20 — B004



SECTION B — SCALE 1:20

MMM GROUP

Rev	Date	Description	Init
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.

REVISIONS

BRITISH COLUMBIA | Ministry of Transportation & Infrastructure
South Coast Region

01459 IRONWORKERS MEMORIAL BRIDGE
VESSEL COLLISION RISK MITIGATION STUDY

BOTTOM CHORD FENDER
SHEET 2

PREPARED UNDER THE DIRECTION OF

KEITH HOLMES
ENGINEER OF RECORD

DATE

DESIGNED KH DATE SEPT. 2017
CHECKED SC / JJ DATE SEPT. 2017
DRAWN SH DATE SEPT. 2017
SCALE
NEGATIVE No.

FILE No.	PROJECT No.	REG.	DRAWING No.
	83118	.	01459–B005

CANCEL PRINTS BEARING PREVIOUS LETTER

H-308;1-1=(07-08)

APPENDIX

C

HYRAULIC IMPACT ASSESSMENT

30 Gostick Place | North Vancouver, BC V7M 3G3 | 604.980.6011 | www.nhcweb.com

nhc
northwest hydraulic consultants ltd

NHC Ref. No. 3002614

23 August 2017

MMM Group Limited
1045 Howe St #700
Vancouver, BC
V6Z 2A9

Attention: **Keith Holmes, P.Eng.**
Manager, Vancouver Bridges

Via email: Keith.holmes@wsp.com

Re: **Lions Gate Bridge and Ironworkers Memorial Bridge Vessel Collision Study**
Ironworkers Memorial Bridge Concept Hydraulic Impact Assessment

Dear Mr. Holmes:

This report presents the details of the study of the hydraulic effects of the proposed vessel collision mitigations structure near Ironworkers Memorial Bridge in Burrard Inlet, Vancouver.

1 INTRODUCTION

The British Columbia Ministry of Transportation and Infrastructure (the Ministry) is undertaking a review and risk assessment of vessel impact issues for the 01481 Lions Gate Bridge at First Narrows and the 01459 Ironworkers Memorial Bridge (IWMB) at Second Narrows in Vancouver's Burrard Inlet Harbour. A hydrotechnical analysis of the proposed physical vessel impact mitigation concept was conducted by Northwest Hydraulic Consultants Ltd. (NHC), and this report presents our preliminary findings and discusses potential implications for the IWMB mitigation concept.

1 IWMB VESSEL COLLISION PROTECTION CONCEPT

The concept evaluated is referred to as "18 m Diameter Dolphin Concept". The concept plan view of the 16 m Berm Concept received from MMM Group Limited WSP on June 28, 2017 are reproduced in **Figure 1**.

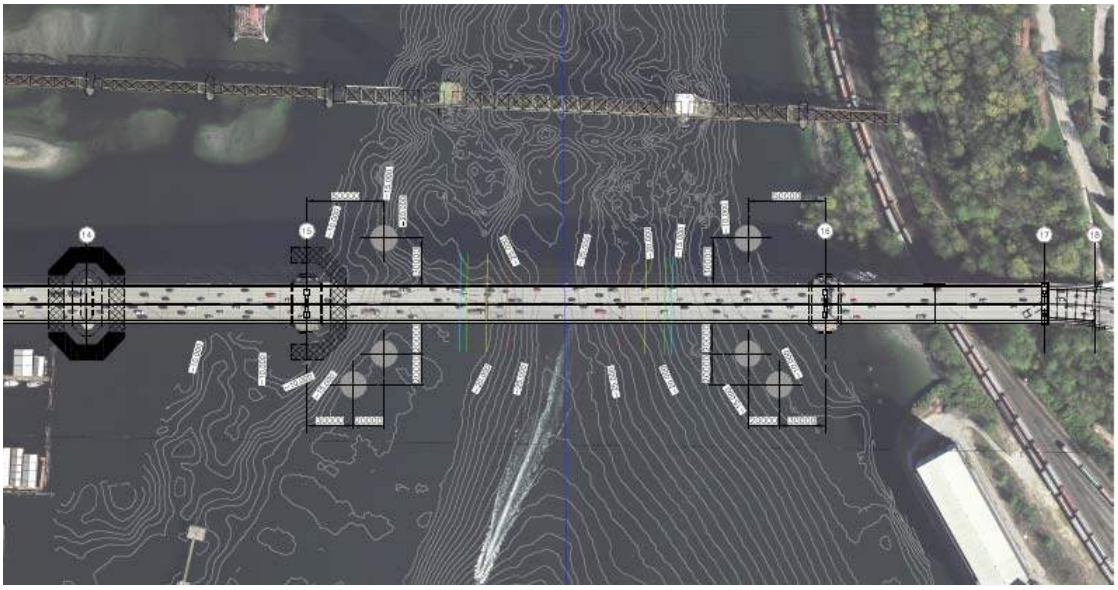


Figure 1. Plan view illustrating locations of the proposed dolphins – North is to the left of the figure.

2 MODEL METHODOLOGY

A hydrodynamic model of the Burrard Inlet encompassing English Bay, Vancouver Harbour, and Indian Arm was developed to assess the hydraulic conditions that are expected to occur with the proposed physical mitigation concept. The model extent is shown in **Figure 2**. The model was developed using Delft3D, a 3D hydrodynamic model which calculates non-steady flow and transport phenomena that result from tidal and river flow forcing on a rectilinear or a curvilinear grid. Delft3D uses a finite difference scheme that numerically solves the horizontal momentum equation and includes discharge sources. The equations and model description are provided in detail in Lesser et al. (2014).

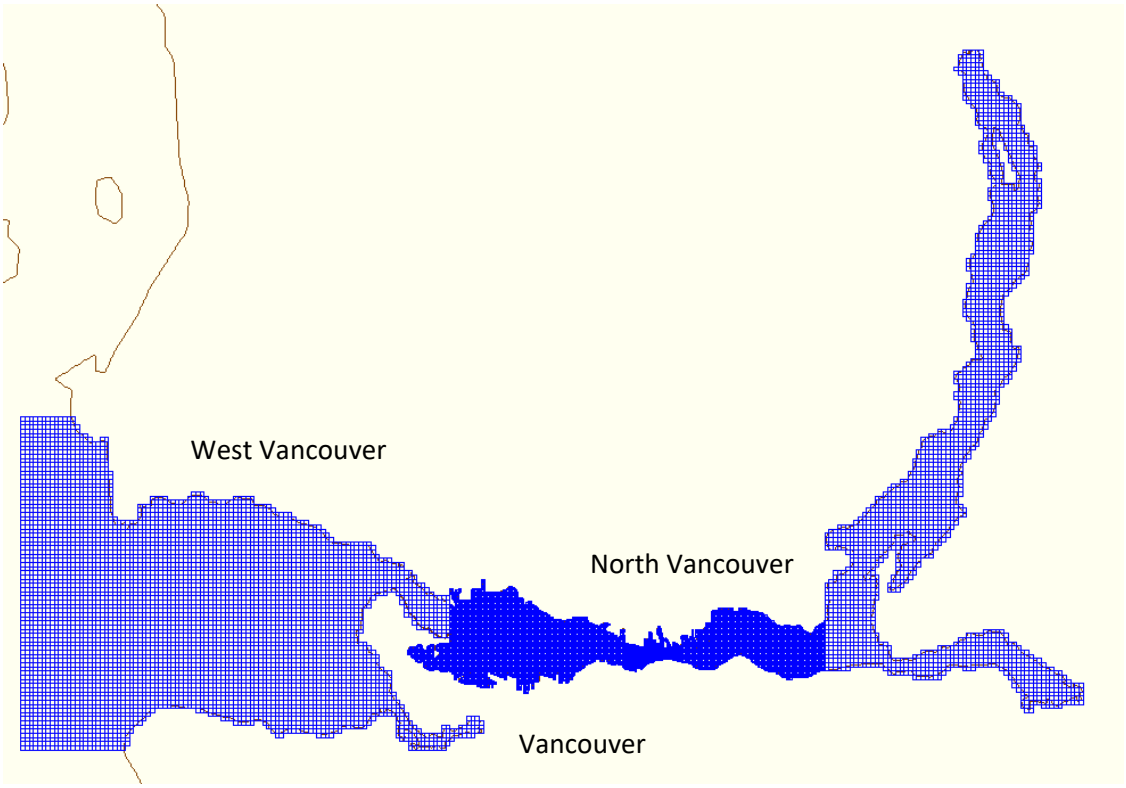


Figure 2. Burrard Inlet model grids

The Burrard Inlet model consists of three 2-way coupled domains with progressively fining resolution. The finest horizontal grid resolution is near the Second Narrows crossing where grid size is 5 m. In the vertical direction, the models consist of 15 sigma layers.

Tides are simulated with amplitudes and phases of 16 locally dominant tidal constituents along the open ocean boundary (Point Atkinson). The bathymetry for the models is derived using datasets from Canadian Hydrographic Service (CHS) hydrographic charts as well as available Vancouver Fraser Port Authority (VFPA) survey data.

2.1 Model Validation

The model was validated against water level at Vancouver Harbour and against 1981 Vancouver Harbour Tidal Current Atlas (VHTC). **Figure 3** shows the model output two hours before a turn to ebb. Vectors are shown with 200 m spacing. **Figure 4** shows the corresponding figure from the 1981 VHTC. The model captures the three eddies just east of Second Narrows Bridge as well as the eddy in the northern portion of Vancouver Harbour. The velocity magnitude generally agrees well. **Figure 5** shows the model output one hour after turn to ebb. **Figure 6** shows the corresponding figure from the 1981 VHTC. The modelled velocity magnitude and pattern between the two figures are similar.

The results show that the model is capable of reproducing similar velocity magnitude and pattern against 1981 VHCA.

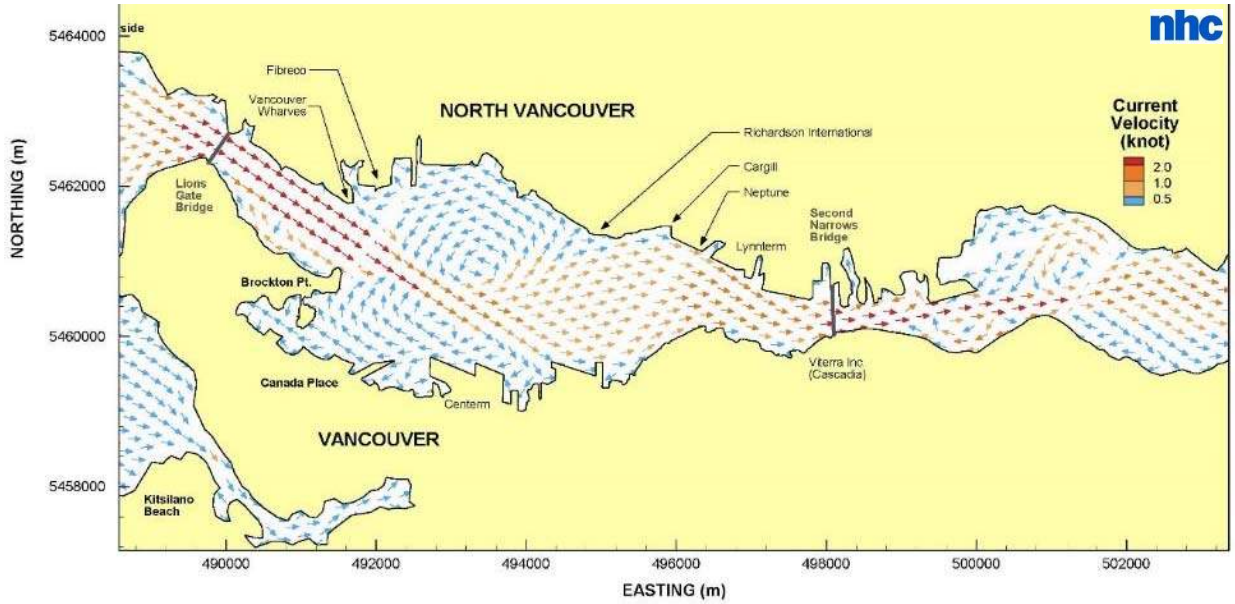


Figure 3. Two hours before turn to ebb – Burrard Inlet model output

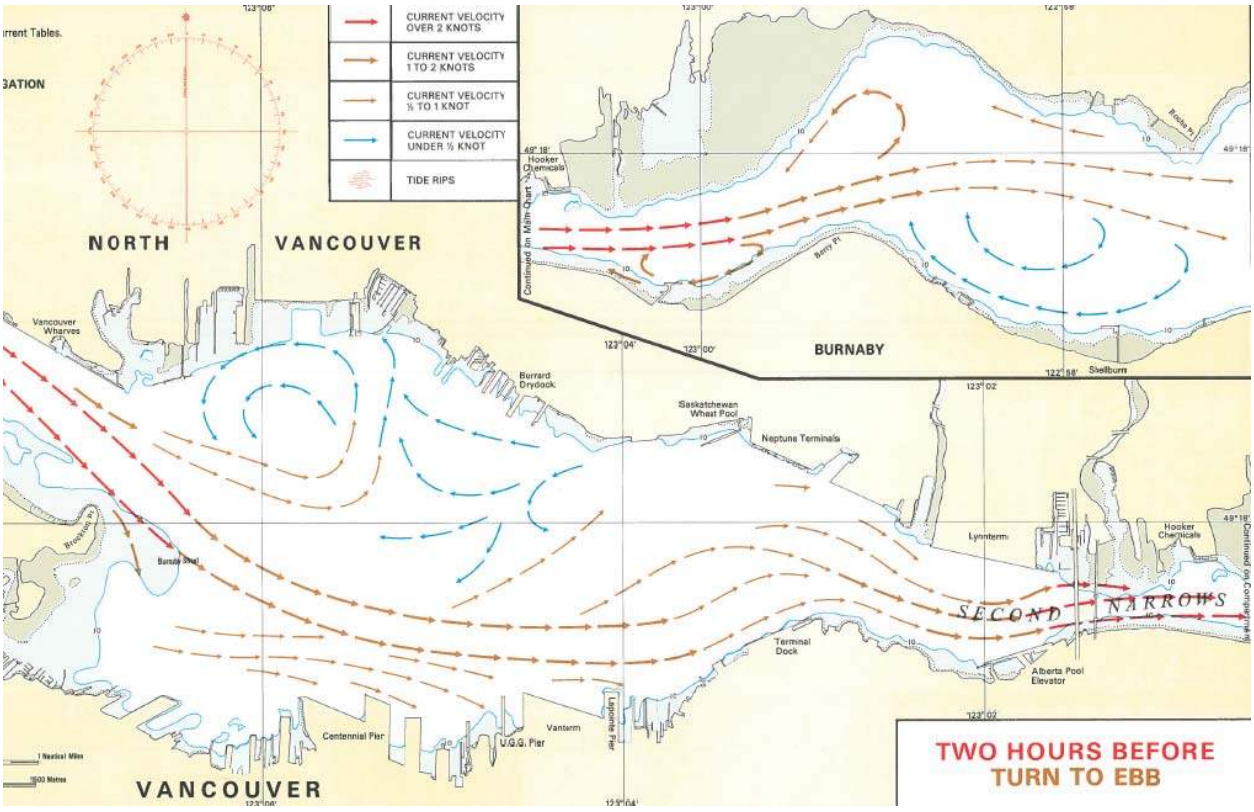


Figure 4. Two hours before turn to ebb – reproduced from 1981 CHS VHTC

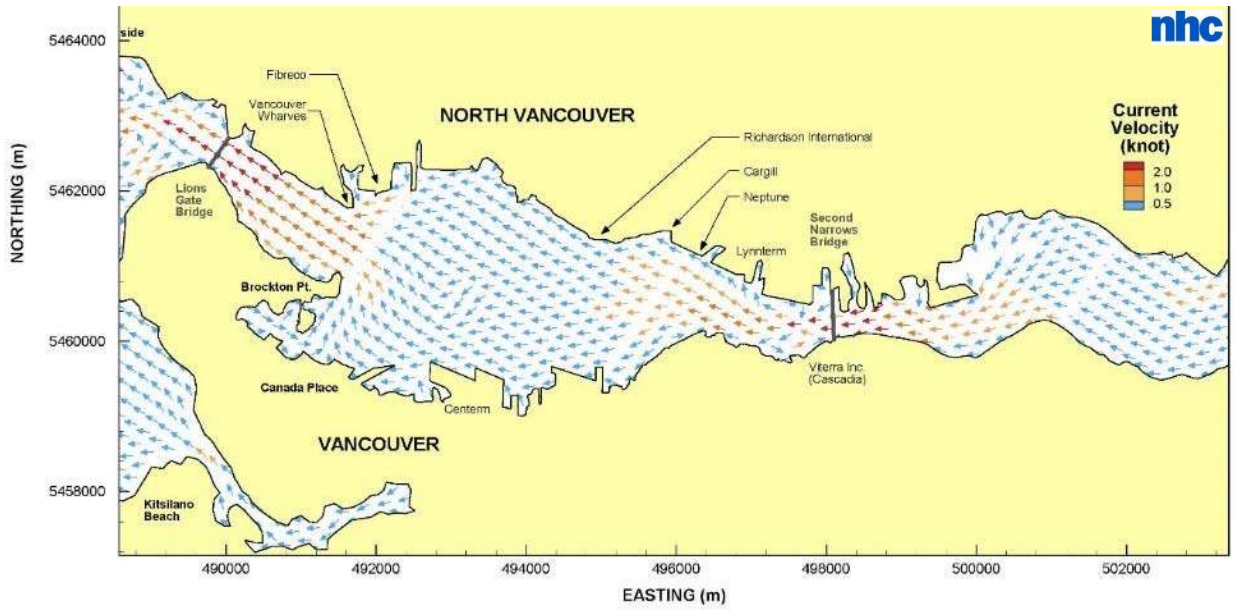


Figure 5. One hour after turn to ebb – Burrard Inlet model output

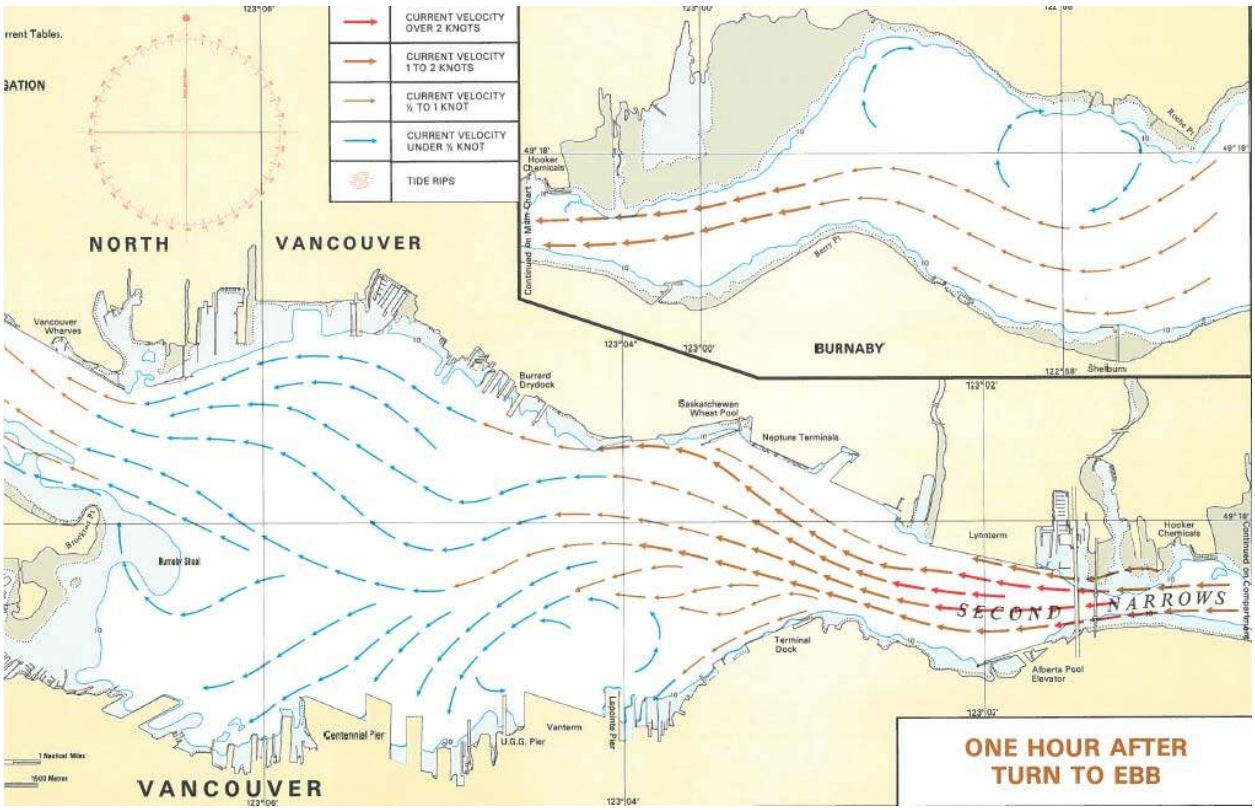


Figure 6. One hours after turn to ebb – reproduced from 1981 CHS VHTC

2.2 DESIGN EVENT SELECTION

Tides at Vancouver Harbour are mixed with mean Higher High Water value of 4.4 m, mean Lower Low Water value of 1.1 m and mean tidal range of 3.3 m. Two months of predicted hourly tidal elevations at Vancouver Harbour are shown in **Figure 7**, illustrating the biweekly tidal variability at Vancouver Harbour.

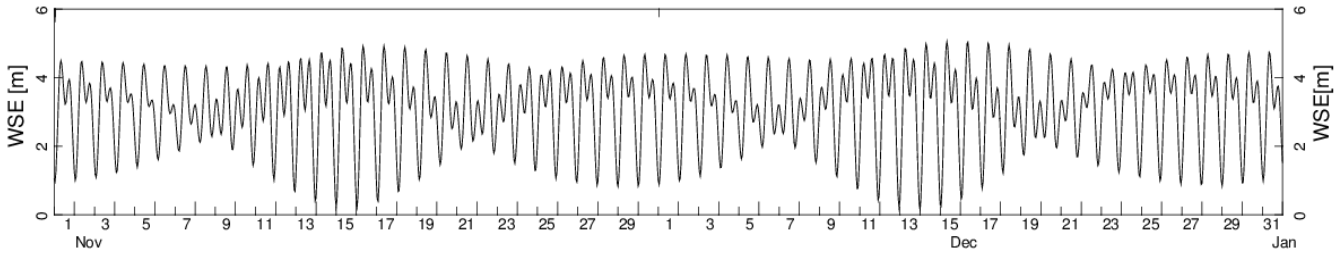


Figure 7. Predicted tides at Vancouver Harbour from November 1 to December 31, 2012.

The key hydraulic design consideration for the proposed mitigative concept is its impact on the navigability of waterways. Strong tidal currents occur during large tidal swings in Burrard Inlet and pose greater challenges for navigation. The November 14-15, 2012 tidal cycle (**Figure 8**) was selected for the assessment. Over this tidal cycle the water level decreased from 4.4 m Chart Datum (CD) to 0.3 m CD for a tidal range of -4.1 m during ebb tide and increased from 0.3 m CD to 5.0 m CD for a tidal range of +4.7 m during flood tide. **Figure 9** shows a histogram of tidal range at Vancouver Harbour station between 1940 and 2014. The figure shows that tidal range less than -4.1 m occurred about 1.5% of the time and tidal range exceeded +4.7 m about 0.5% of the time.

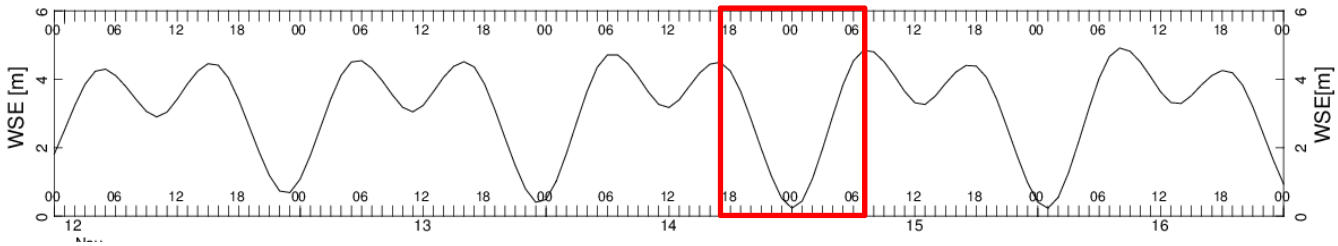


Figure 8. Tidal conditions for the design simulation period of November 14-15, 2012

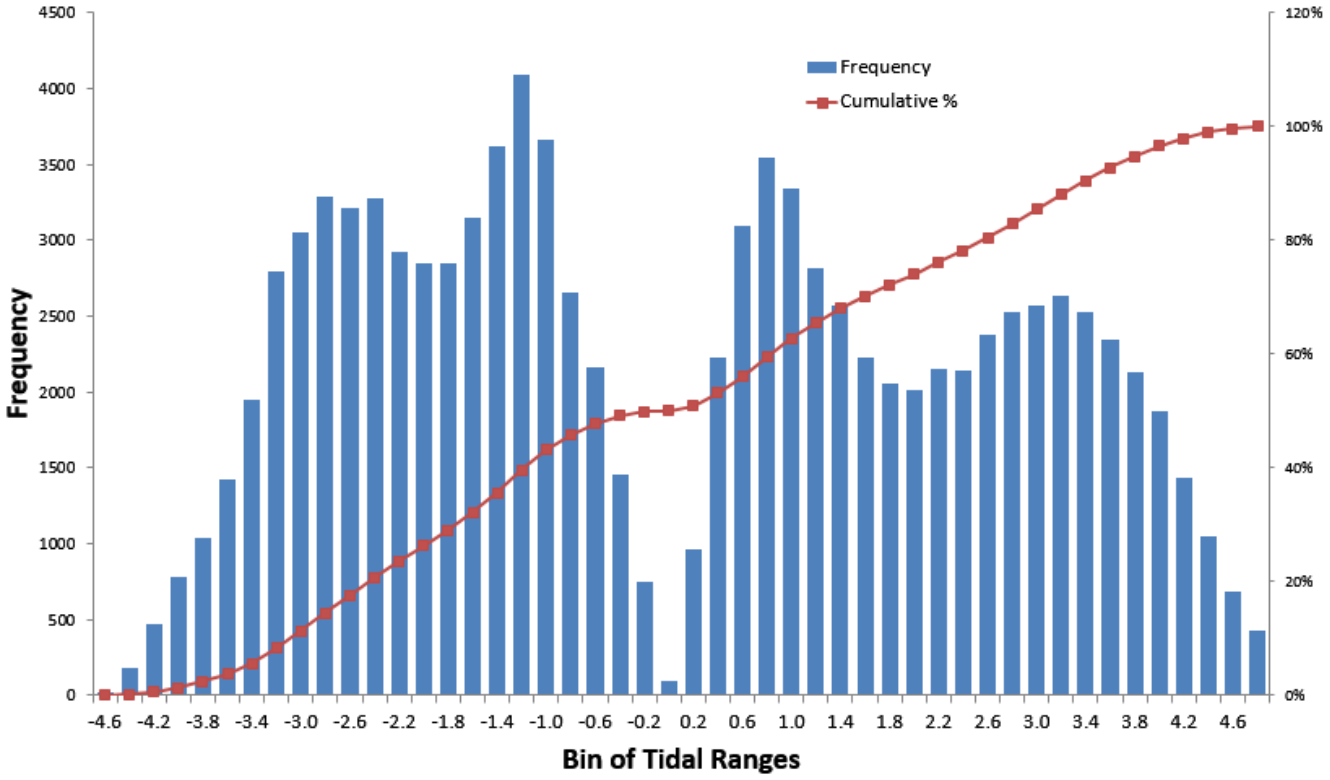


Figure 9. Vancouver Harbour Tidal range histogram.

3 HYDRAULIC ANALYSIS

To evaluate the potential hydraulic impact of the proposed mitigation concept, current distributions at surface, El. -5 m CD and at -10 m CD during the November 14-15, 2012 tidal cycle were evaluated.

3.1 EBB TIDE CONDITIONS

Figure 10 and **Figure 11** show the surface current velocities for the existing conditions and with mitigation concept near the time of maximum ebb at 21:00 on November 14th, 2012. The contour colouring indicates the flow velocity. The figures show that the surface current at the Second Narrows crossing during the modelled ebb tide conditions is relatively uniform across the crossing with magnitude of about 3.5 m/s.

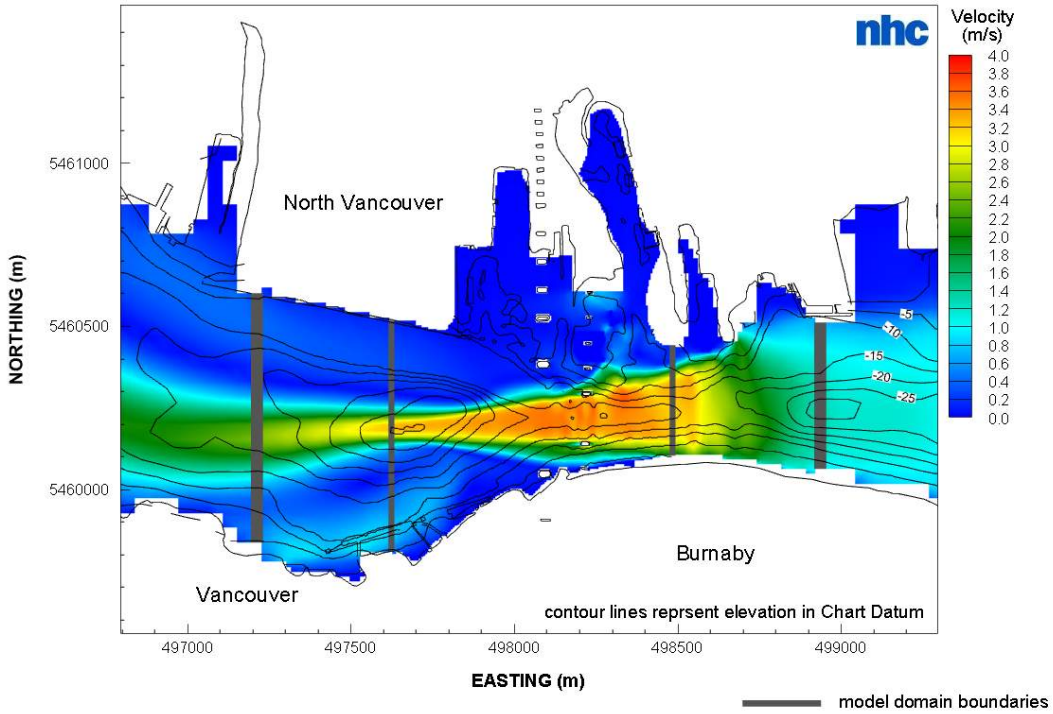


Figure 10. Surface velocities during ebb tide – Existing Conditions

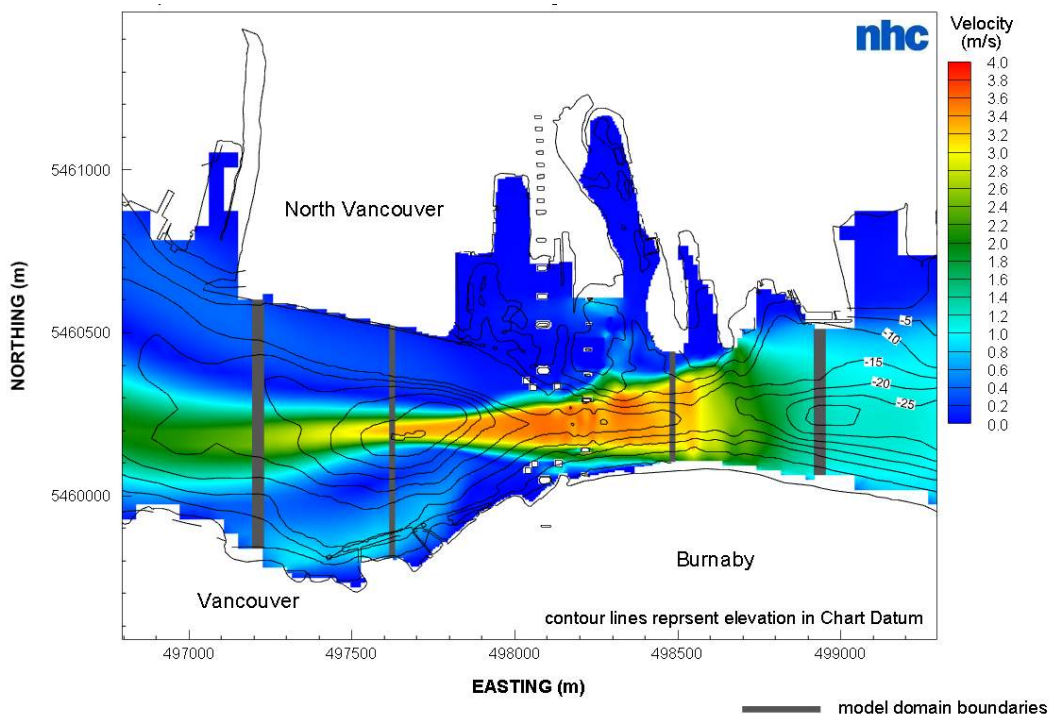


Figure 11. Surface velocities during ebb tide – Proposed Conditions

To better visualize the difference between the existing conditions and with concept conditions, surface velocity difference map was prepared and presented in **Figure 12** (with concept subtracts existing conditions). The yellow and red shading indicates regions experiencing velocity increase under the with concept conditions and the blue shadings represent regions experiencing velocity decrease. Velocity difference of less than ±0.10 m/s is considered not significant.

The results show that:

1. The proposed mitigation concept shifts the current northward resulting in velocity increase up to 0.8 m/s - from 1.6 m/s to 2.4 m/s - on the north side of the channel. This shift also resulted in velocity reduction up to 1.3 m/s - from 2.2 m/s to 0.9 m/s - on the south side of the channel. The extent of the impact is about 1000 m.; and
2. The region between the proposed south dolphins and IWMB Pier#16 experiences velocity increase of about 0.7 m/s - from 0.4 m/s to 1.1 m/s.

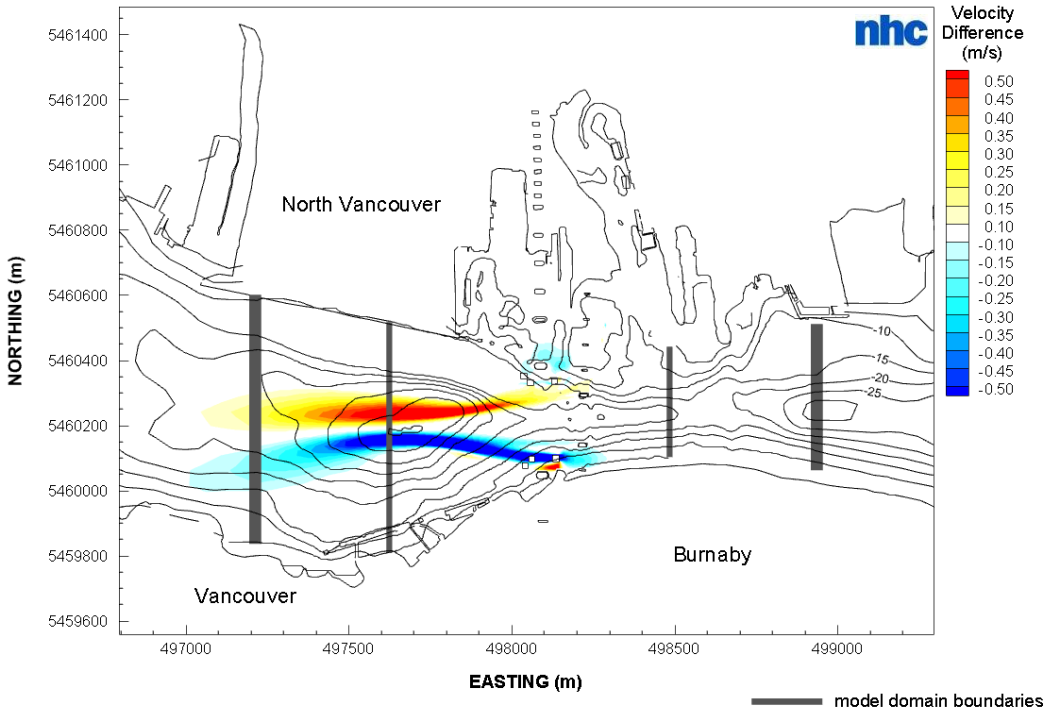


Figure 12. Differences in surface velocity during ebb tide

Figure 13 and **Figure 14** show the differences in velocity between existing conditions and with mitigation concept at El. -5 m CD and El. -10 m CD. The results show that greatest impact occur at the surface and decreases with depth.

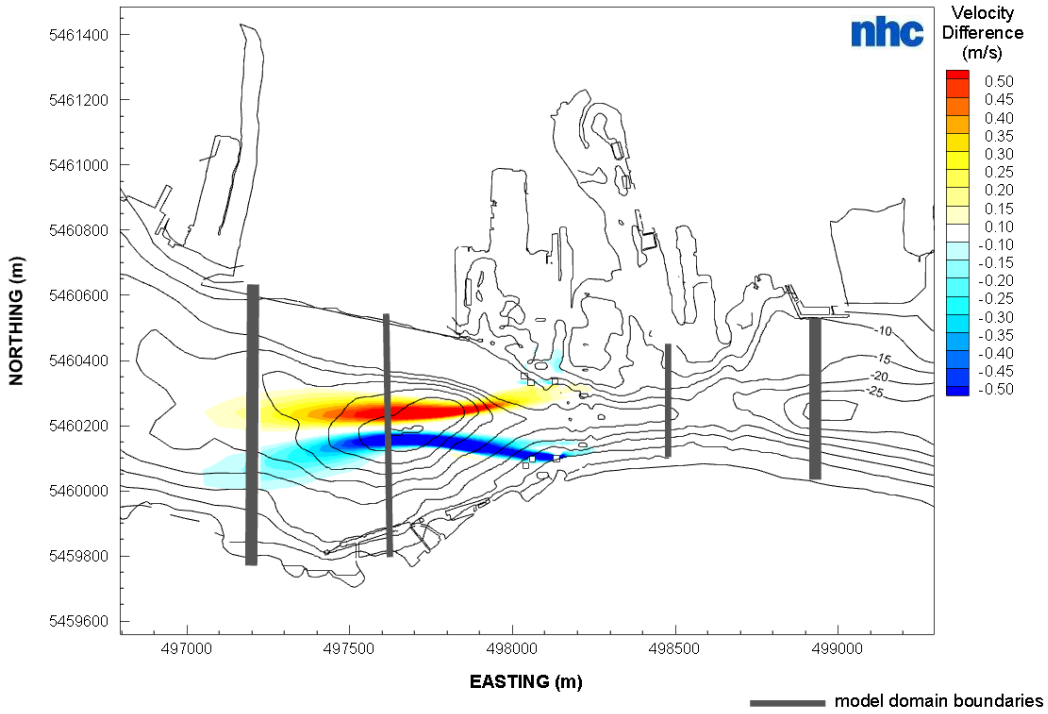


Figure 13. Differences in velocity at El. -5 m CD during ebb tide

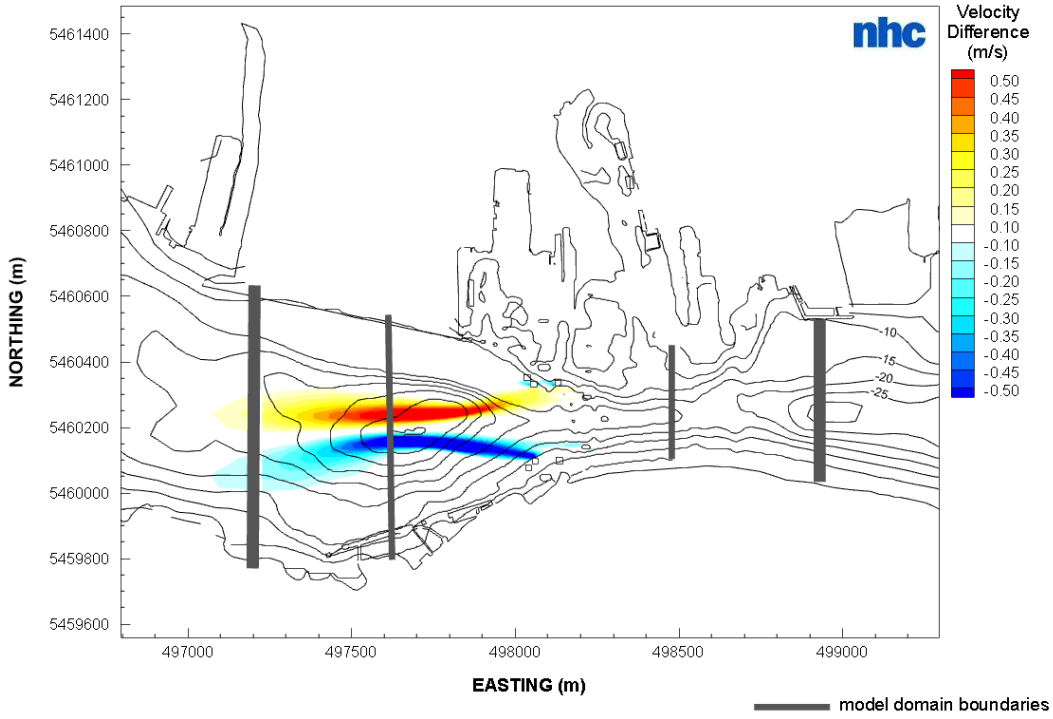


Figure 14. Differences in velocity at El. -10 m CD during ebb tide

3.2 FLOOD TIDE CONDITIONS

Figure 15 and **Figure 16** show the surface current velocities for the existing conditions and with mitigation concept near the time of maximum flood at 4:00 on November 15th, 2012. The contour colouring indicates the flow velocity. The general surface current at the Second Narrows crossing during the modelled flood tide conditions is at about 2.3 m/s. Higher velocity of 4.0 m/s is predicted east of IWMB.

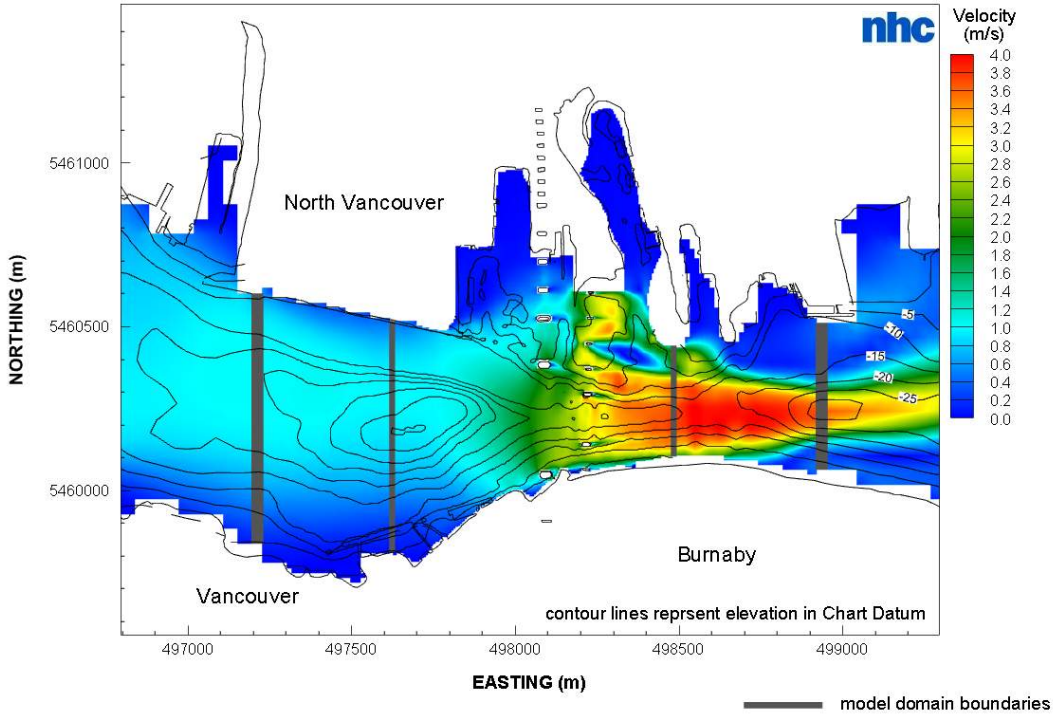


Figure 15. Surface velocities during flood tide – Existing Conditions

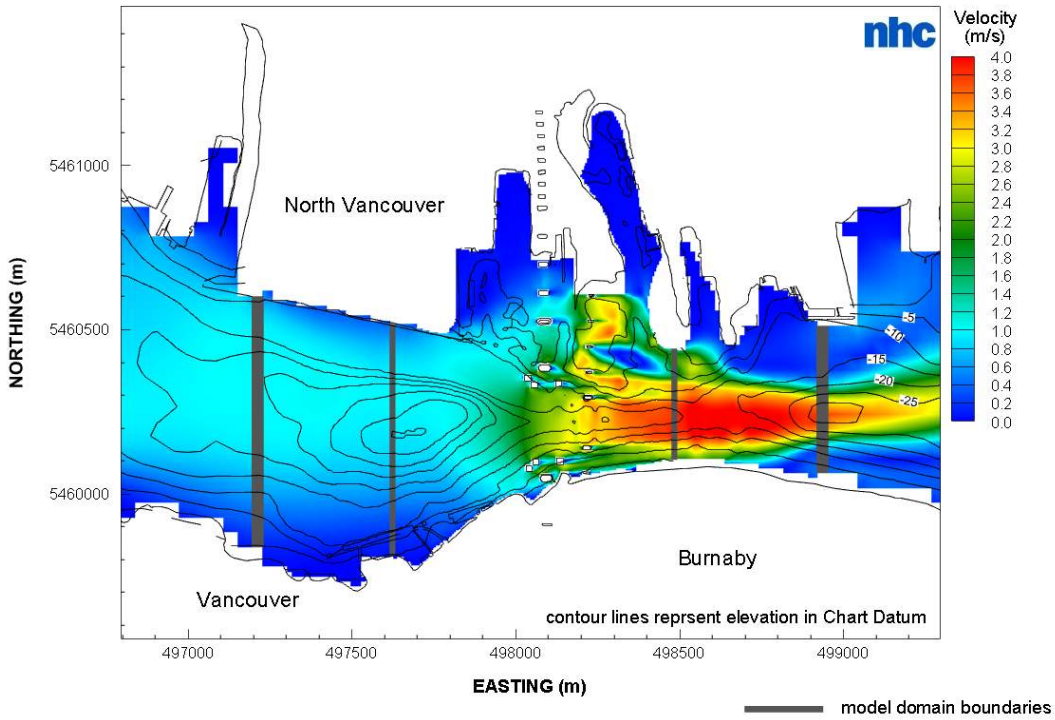


Figure 16. Surface velocities during flood tide – Proposed Conditions

To better visualize the difference between the existing conditions and with concept conditions, surface velocity difference map was prepared and presented in **Figure 17** (with concept subtracts existing conditions). The yellow and red shading indicates regions experiencing velocity increase under the with concept conditions and the blue shadings represent regions experiencing velocity decrease. Velocity difference of less than ±0.10 m/s is considered not significant.

The results show that

1. The proposed mitigation concept resulted in velocity increase of about 0.3 m/s – from 2.3 m/s to 2.6 m/s - at Second Narrows crossing. The extent of the impact is about 500 m.
2. Localized velocity increases up to 0.8 m/s- from 1.8 m/s to 2.6 m/s - is predicted near the proposed dolphins and existing railway bridge piers.
3. The region leeward of the proposed mitigation concept experiences velocity reduction by up to 2.6 m/s – from 2.65 m/s to 0.05 m/s. The extent of this impact is about 1000 m.; and
4. The region between the proposed south dolphins and IWMB Pier#16 experiences velocity increase of about 0.4 m/s – from 1.7 m/s to 2.1 m/s.

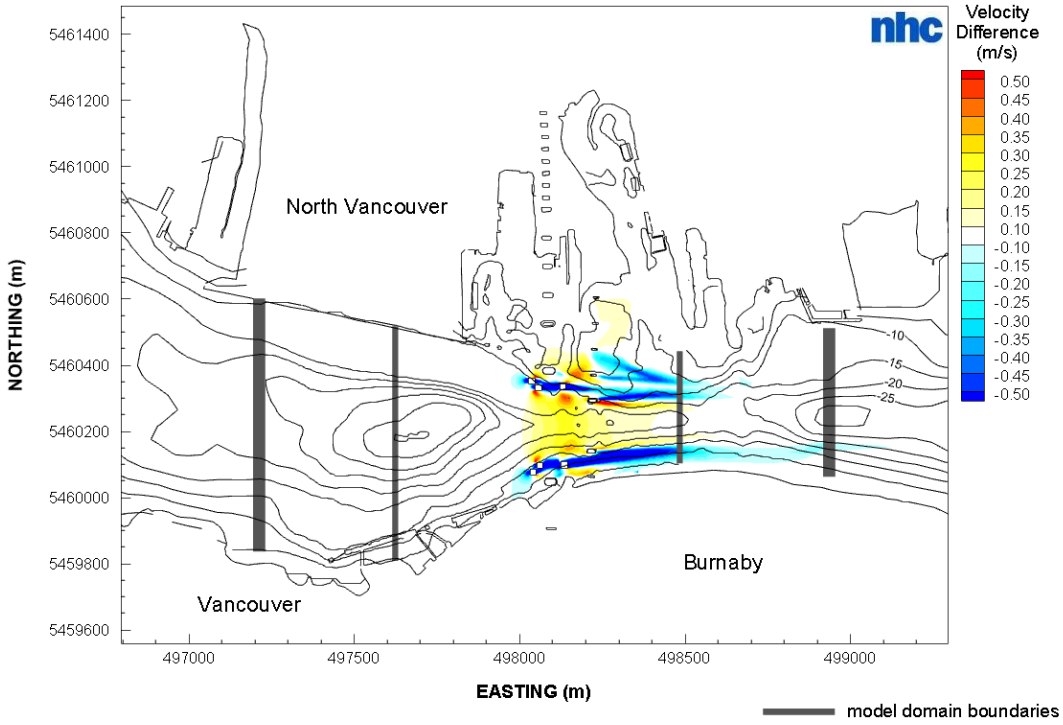


Figure 17. Differences in surface velocity during flood tide

Figure 18 and **Figure 19** show the differences in velocity at El. -5 m CD and El. -10 m CD. Similar to the findings from the ebb tide conditions, the results show that greatest impact occur at the surface and decreases with depth.

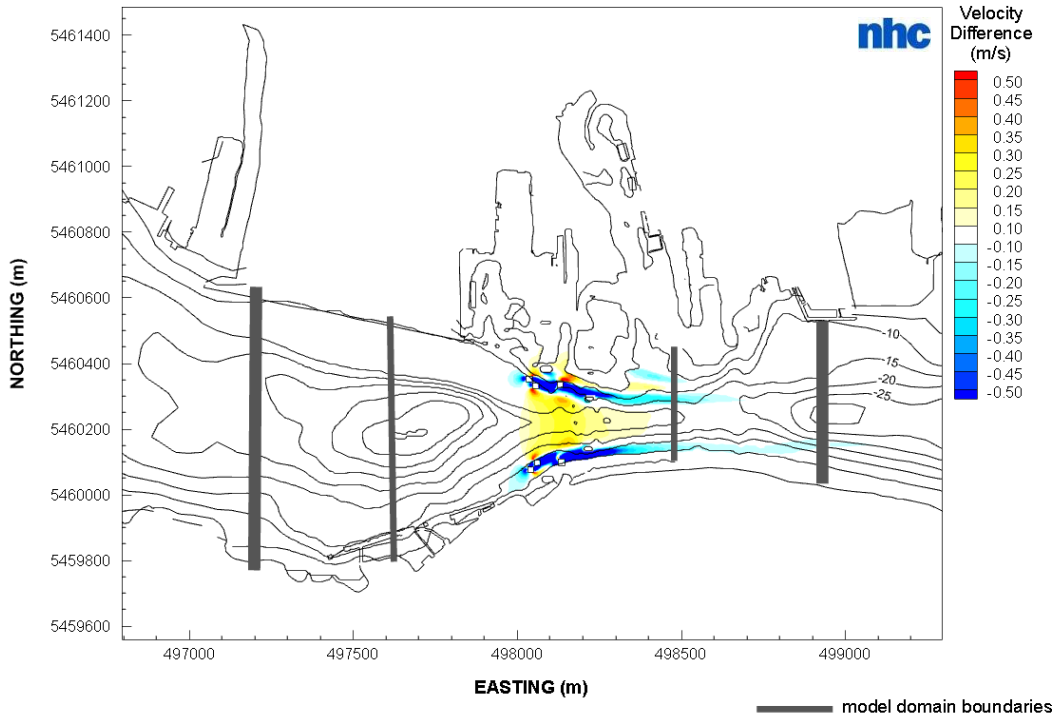


Figure 18. Differences in velocity at El. -5 m CD during flood tide

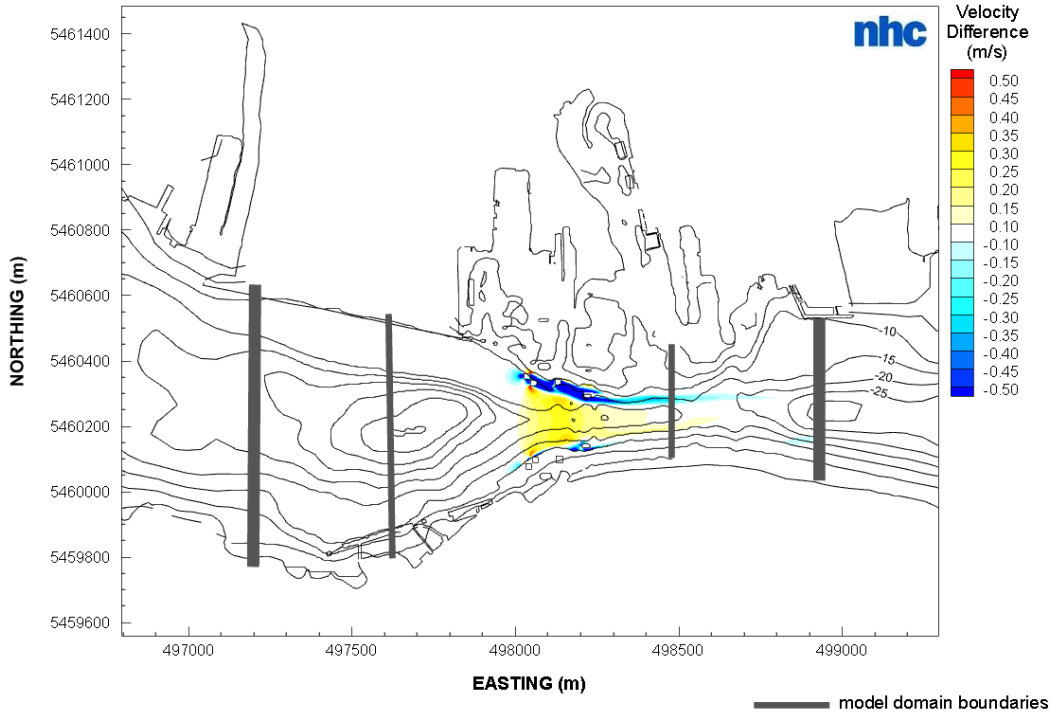


Figure 19. Differences in velocity at El. -10 m CD during flood tide

4 CONCLUSIONS

The study shows that:

1. The extent of the hydraulic impact due to the proposed mitigation concept is about 2000 m - 1000 m west and 1000 m east of IWMB.
2. The proposed mitigation concept results in greater hydraulic impact in the channel during the ebb tide than during the flood tide.
3. During the ebb tide, maximum velocity increase due to the proposed mitigation concept is about 0.8 m/s and occurs on the north side of the channel west of the crossing. The maximum velocity reduction is 1.3 m/s and occurs on the south side of the channel west of the crossing.; and
4. During the flood tide, maximum velocity increase due toe the proposed mitigation concept is about 0.8 m/s and occurs near the proposed dolphins and existing railway bridge piers. The maximum velocity reduction is 2.6 m/s and occurs in the region leeward of the proposed mitigation concept.

5 CLOSURE

We hope this work and report meets your current needs. If you have any questions or would like to further discuss these findings, please contact Edwin Wang at our North Vancouver office at (604) 980-6011 or by email (ewang@nhcweb.com).

Sincerely,

Northwest Hydraulic Consultants Ltd.

Prepared by:	Reviewed by:
Unsigned draft by….	*Unsigned draft by….*
Edwin Wang, P.Eng.	Barry Chilibeck, P.Eng.
Hydrotechnical Engineer	Principal

DISCLAIMER

This document has been prepared by Northwest Hydraulic Consultants Ltd. in accordance with generally accepted engineering practices and is intended for the exclusive use and benefit of MMM Group Ltd. and their authorized representatives for specific application to the Lions Gate and Ironworkers Memorial Bridge Vessel Collision Study. The contents of this document are not to be relied upon or used, in whole or in part, by or for the benefit of others without specific written authorization from Northwest Hydraulic Consultants Ltd. No other warranty, expressed or implied, is made. Northwest Hydraulic Consultants Inc. and its officers, directors, employees, and agents assume no responsibility for the reliance upon this document or any of its contents by any parties other than MMM Group Ltd.

30 Gostick Place | North Vancouver, BC V7M 3G3 | 604.980.6011 | www.nhcweb.com

nhc
northwest hydraulic consultants ltd

NHC Ref. No. 3002614

29 September 2017

MMM Group Limited
1045 Howe St #700
Vancouver, BC
V6Z 2A9

Attention: **Keith Holmes, P.Eng.**
Manager, Vancouver Bridges

Via email: Keith.holmes@wsp.com

Re: **Lions Gate Bridge and Ironworkers Memorial Bridge Vessel Collision Study**
Ironworkers Memorial Bridge Concept - 2 knot Current Transit Window Assessment

Dear Mr. Holmes:

This report presents the details of the assessment conducted to examine the potential impact of the proposed vessel collision mitigation structures on the 2 knot current transit window near Ironworkers Memorial Bridge in Burrard Inlet, Vancouver.

1 INTRODUCTION

The British Columbia Ministry of Transportation and Infrastructure (the Ministry) is undertaking a review and risk assessment of vessel impact issues for the 01481 Lions Gate Bridge at First Narrows and the 01459 Ironworkers Memorial Bridge (IWMB) at Second Narrows in Vancouver's Burrard Inlet Harbour. Traffic within the Burrard Inlet follows the navigation rules outlined in the Harbour Operations Manual published by Port of Vancouver (2010). Vessel travels in MRA[1] is restricted to transit only during operational periods. Operational periods are established on either side of high and low water slack tides and are based on slack water or stemming 2 knot limiting current at the Canadian National (CN) Rail Bridge. These periods are referred herein as 2 knot current transit windows. The proposed physical vessel impact mitigation concepts could potentially increase the current in the MRA and result in a reduction of operational periods.

[1] MRA means the Second Narrows Movement Restriction Area and comprises that area enclosed within lines drawn 000 degrees True north from the fixed light on the northeastern end of Terminal Dock to the North Vancouver Shoreline at Neptune Terminals and a line drawn 000 degrees true north from Berry Point Light to the North Shore on the opposite side of the channel.

A hydrotechnical analysis of the proposed physical vessel impact mitigation concept was conducted by Northwest Hydraulic Consultants Ltd. (NHC), and this report presents our preliminary findings and discusses potential implications for the IWMB mitigation concept on the 2 knot current transit window.

2 IWMB VESSEL COLLISION PROTECTION CONCEPT

The concept evaluated is referred to as the "18 m Diameter Dolphin Concept". The concept plan view of the 18 m Berm Concept received from MMM Group Limited WSP on June 28, 2017 are reproduced in **Figure 1**.

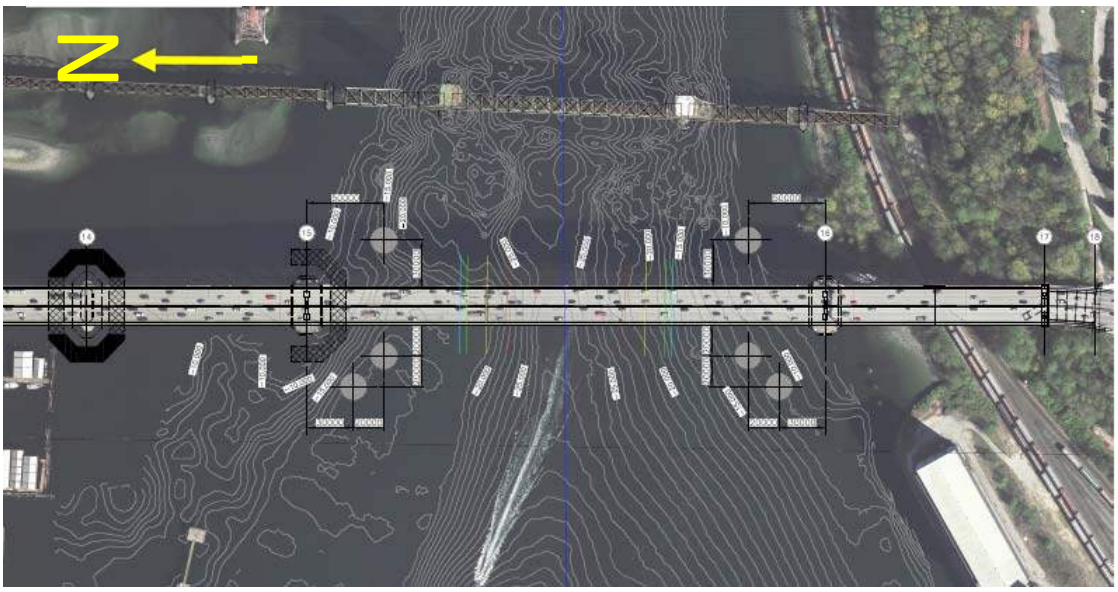


Figure 1. Plan view illustrating locations of the proposed dolphins.

3 MODEL METHODOLOGY

A hydrodynamic model of the Burrard Inlet encompassing English Bay, Vancouver Harbour, and Indian Arm was developed to assess the hydraulic conditions that are expected to occur with the proposed physical mitigation concept. Further details on the development and calibration of the model can be found in the IWMB Hydraulic Assessment report (NHC 2017).

Tides at Vancouver Harbour are mixed with a mean Higher High Water value of 4.4 m, mean Lower Low Water value of 1.1 m and mean tidal range of 3.3 m. Two months of predicted hourly tidal elevations at Vancouver Harbour are shown in **Figure 2**, illustrating the biweekly tidal variability at Vancouver Harbour.

To evaluate the impact of the proposed vessel collision mitigations structures on the 2 knot current transit window, numerical model simulations were conducted for 10-day tidal simulation that was chosen to include both neap and large magnitude spring tides that are inclusive of the range of expected operational conditions.

The chosen representative tide window for the simulations is between January 4th and January 13th, 2017 (**Figure 3**). The simulations do not consider the effect of local wind events and storm surges on tidal currents. The simulations were run both with and without the mitigation structures in place to evaluate and compare the effect of these structures on the flow.

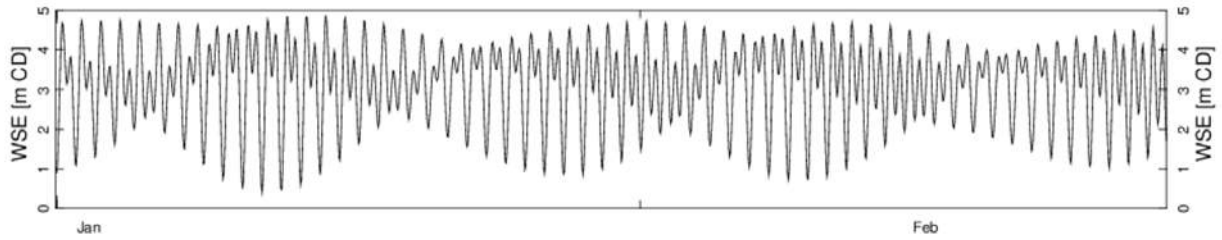


Figure 2. Predicted tides at Vancouver Harbour from January 1 to February 28, 2017.

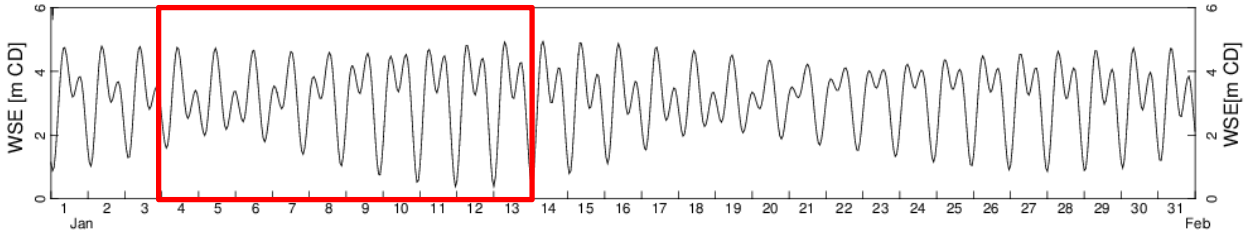


Figure 3. Tidal conditions for the design simulation period of January 4th to 13th, 2017

4 HYDRAULIC ANALYSIS

To evaluate the impact of the proposed mitigation concept on the 2 knot current transit window, a time-series of the average velocity in the upper two-third of the water column at four locations, West, Centre, East and CN Bridge, were evaluated (**Figure 4**). The average velocity in the upper two-thirds of the water column was selected for the assessment because the vessel draft, which is the portion of the vessel in contact with water currents, extends to about two-thirds of water column at the Second Narrows crossing.



Figure 4. 2 knot current transit window assessment locations

The top panel on **Figure 5** shows the time-series of average current in the upper two-thirds of the water column at the CN Bridge location without mitigation structures (blue) and with mitigation structures (red). The middle panel shows changes in speed due to the proposed mitigative structures and the bottom panel shows the corresponding water level over the same time period. The figure shows that increases in the average current in the upper two-thirds of the water column occur primarily during large flood tides at the CN Bridge, whereas there is little observed change in current velocities on the ebb tides. This is due to the contraction of the channel. Similar patterns occurred at Centre.

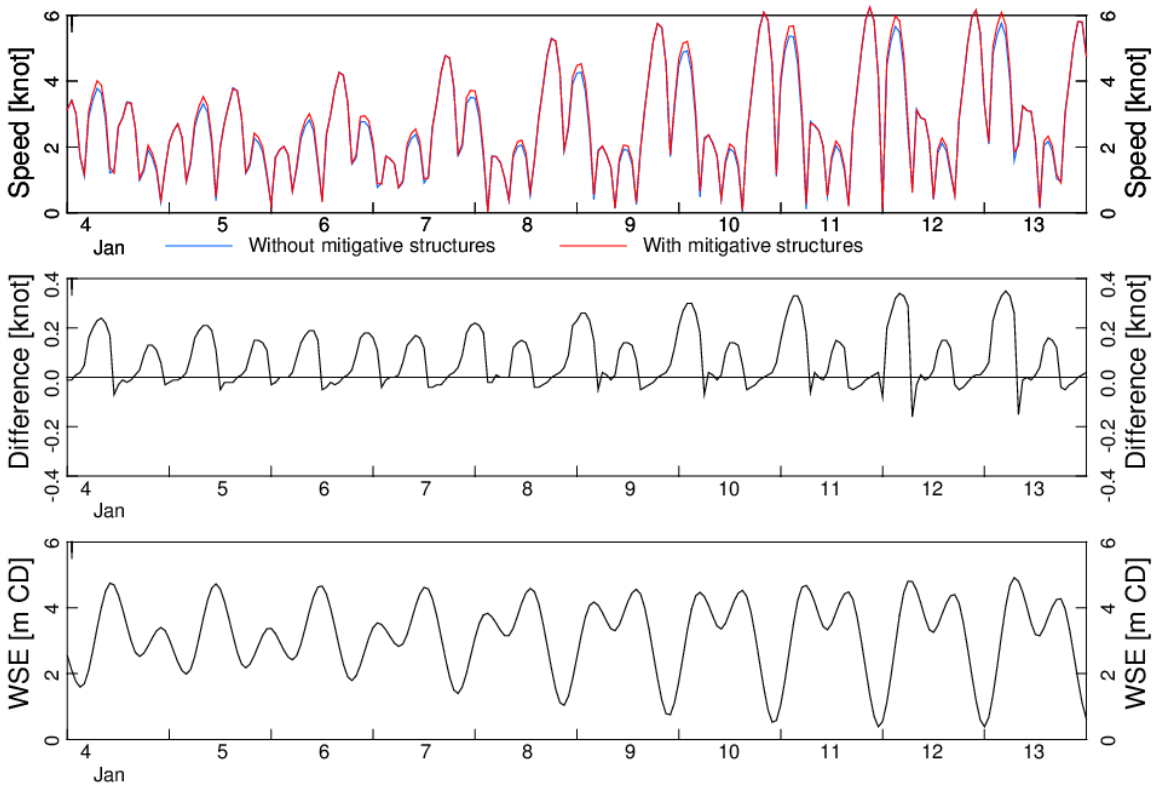


Figure 5. Average velocity in the upper two-thirds of the water column, changes in average velocity current in the upper two-thirds of the water column and water level at CN Bridge

Table 1 summarizes the number of hours with the average currents in the upper two-thirds of the water column less than 2 knots over the course of the simulation. Over the course of the 10-day period, the reductions in available hours at the four locations varied between 1 hour and 8 hours (or 1.3% to 8.7%). The CN Bridge site experienced the largest reduction in available hours for transit.

Table 2 summaries the times and the corresponding velocities when the available transit hours are negatively affected at CN Bridge (i.e., exceeding 2 knots). The results show that the velocities under the existing conditions at these times are close to 2 knots. The largest velocity increase due to the proposed mitigative structures in these eight hours is 0.16 knots or 0.08 m/s. In four of the eight exceedance occurrences, the exceedance values were less or equal to 2.05 knots (1.05 m/s) which is 0.02 m/s over the 2 knots criterion (1.03 m/s). The value of 0.02 m/s is within the natural variability of the tidal flow across CN Bridge and numerical model uncertainty. If the threshold for the transit window were to increase from 2 knots to 2.05 knots to account for natural variability in the system and numerical model uncertainty, then the reduction in available transit hours at CN Bridge will be reduced by half to 4 hours (or 4.3%).

Table 1. Summary of hours with average current in the upper two-third water column less than 2 knot

Location	Conditions	Total hours	Hours with currents < 2 knots	Changes in available hours	% changes in available hours
West	Without mitigation structures	240	167	-	-
	With mitigation structures	240	163	-4	2.4%
Centre	Without mitigation structures	240	111	-	-
	With mitigation structures	240	105	-6	5.4%
CN Bridge	Without mitigation structures	240	92	-	-
	With mitigation structures	240	84	-8	8.7%
East	Without mitigation structures	240	77	-	-
	With mitigation structures	240	76	-1	1.3%

Table 2. Times and the corresponding velocities when the available transit hours are negatively affected at CN Bridge.

Time	Average current in the upper two-third of the water column without mitigation structures (knot)	Average current in the upper two-third of the water column with mitigation structures (knot)	Changes in Average current in the upper two-third of the water column (knot)
1/4/2017 19:00	1.92	2.05	0.13
1/7/2017 00:00	1.97	2.13	0.16
1/7/2017 8:00	1.94	2.07	0.13
1/9/2017 11:00	1.93	2.06	0.13
1/9/2017 12:00	1.89	2.03	0.14
1/10/2017 12:00	1.95	2.09	0.14
1/12/2017 15:00	1.88	2.03	0.15
1/13/2017 16:00	1.87	2.02	0.15

5 HYDRAULIC ANALYSIS – YEAR ROUND IMPACT

An additional study was conducted by Westmar Project Advisors Inc. (Appendix A – 01459 Ironworkers Memorial Bridge - Vessel Collision Risk Mitigation - Hydraulic Impact Assessment on Allowable Vessel Transit Windows) to develop an estimate of the year-round impact of the proposed mitigative structures on the 2-knot transit window based on the findings from the 10-day period presented in the previous section. The study examined the tide conditions over the 10-day period and established a relationship between number of hours lost per tidal cycle and tidal range. Based on this relationship, the study examined the tide conditions for 2017 and estimated that the 2-knot transit window is reduced by about 100 hours a year due to the presence of the proposed mitigative structures. This corresponds to a 2.6% reduction to the 2-knot transit window.

6 CONCLUSIONS

The study shows:

- Over the course of the 10-day period (240 hours), which includes neap and spring tidal cycles, the reduction in hours when the average currents are less than 2 knots varied between 1 hour and 8 hours (or 1.3% to 8.7%) for the locations East, Centre, CN Bridge and West, Centre.

- Increases in the average current in the upper two-thirds of the water column occur primarily during large flood tides at Centre and CN Bridge, whereas there is little observed change in current velocities on the ebb tides.

- The CN Bridge site experienced the largest reduction (eight hours) in available hours for transit. The largest velocity increase due to the proposed mitigative structures in these eight hours is 0.16 knots or 0.08 m/s. This is within the natural variability of the tidal flow across CN Bridge.

- If the threshold for the transit window were to increase from 2 knots to 2.05 knots (from 1.03 m/s to 1.05 m/s) by considering natural variability in the tidal flow system and numerical model uncertainty, then the reduction in available hours at CN Bridge will be reduced by half to 4 hours (or 4.3%).

- An additional study conducted by Westmar Project Advisors Inc. using the results from the 10-day period estimated that the 2-knot transit window is reduced by about 100 hours a year due to the presence of the proposed mitigative structures. This corresponds to a 2.6% reduction to the 2-knot transit window.

- The findings from the study are based on results from numerical model simulations over a 10-day period which includes typical neap and spring tidal cycles at Vancouver Harbour. Confidence in the analysis can be improved by conducting numerical model simulation over additional periods.

7 CLOSURE

We hope this work and report meets your current needs. If you have any questions or would like to further discuss these findings, please contact Edwin Wang at our North Vancouver office at (604) 980-6011 or by email (ewang@nhcweb.com).

Sincerely,

Northwest Hydraulic Consultants Ltd.

Prepared by:	Reviewed by:
Unsigned draft by….	*Unsigned draft by….*
Edwin Wang, M.Eng., P.Eng.	Grant Lamont, M.A.Sc., P.Eng.
Coastal Engineer	Coastal Engineer

DISCLAIMER

This document has been prepared by Northwest Hydraulic Consultants Ltd. in accordance with generally accepted engineering practices and is intended for the exclusive use and benefit of MMM Group Ltd. and their authorized representatives for specific application to the Lions Gate and Ironworkers Memorial Bridge Vessel Collision Study. The contents of this document are not to be relied upon or used, in whole or in part, by or for the benefit of others without specific written authorization from Northwest Hydraulic Consultants Ltd. No other warranty, expressed or implied, is made. Northwest Hydraulic Consultants Inc. and its officers, directors, employees, and agents assume no responsibility for the reliance upon this document or any of its contents by any parties other than MMM Group Ltd.

REFERENCES

NHC (2017). “Ironworkers Memorial Bridge Concept Hydraulic Impact Assessment”. A report prepared for MMM Group Limited.

Vancouver Fraser Port Authority (2010). “Harbour Operations Manual”.

Westmar Project Advisors Inc (2017). “01459 Ironworkers Memorial Bridge, Vessel Collision Risk Mitigation, Hydraulic Impact Assessment on Allowable Vessel Transit Windows”.

ATTACHMENT A
WESTMAR PROJECT ADVISORS REPORT

Westmar
Project Advisors

September 26, 2017
Project No: 2015-00-020

Memorandum

Subject: **01459 Ironworkers Memorial Bridge**
Vessel Collision Risk Mitigation
Hydraulic Impact Assessment on Allowable Vessel Transit Windows

INTRODUCTION

Northwest Hydraulic Consultants Ltd. (NHC) completed an initial assessment of the impact of the proposed collision mitigation "dolphin concept" structures on the tidal currents in the navigation channel under the 01459 Ironworkers Memorial Bridge (IWMB, Ref. 1). NHC estimated that under certain tide conditions, the currents in the channel would be increased, potentially adversely affecting the Port of Vancouver (POV) operations.

The NHC analysis considered the POV's vessel transit windows defined by maximum currents of 2 knots over a single 10-day period. Given the significance of the potential impact to the POV, it was agreed that it was necessary to estimate the current impacts over an entire year in order to assess the percentage increase of time in the year that the current would be increased to greater than 2 knots, relative to the time over which this presently occurs.

As requested, Westmar Project Advisors (Westmar) has completed a brief assessment of the NHC report (Ref. 1) to examine the applicability of the NHC 10-day results to year-round vessel transit operations.

NHC STUDY

The NHC study considered changes to the 2-knot window at four locations near the bridge, triggered by the construction of in-water "dolphin" structures around the main piers of the IWMB. It undertook numerical simulations to determine hourly currents at the four locations over a 10-day period, from January 4 to January 14, 2017. These simulations were undertaken both with and without the dolphin structures in place to determine, for each of the four sites,

those instances in which an acceptable current (≤ 2 knots) is no longer acceptable (> 2 knots) due to the presence of the structures.

The impact to currents was most pronounced at the CN Bridge site ("CN site"). It was determined that, of the 240 hours examined, there were 91 available or acceptable hours (i.e. current ≤ 2 knots) without the structures in place, and this was reduced to 84 available hours with the structures in place. That is, the presence of the structures results in a loss of 7 available hours, or a loss of 7/91 = 7.7% in available hours.

Overall, the report is very useful and is sound in the context of its findings with respect to the selected 10-day window.

It is noted that there were, in fact, 9 instances or hours when the 2-knot window was altered. In all but one case, the structures cause the current to increase by about 0.15 knots. However, in one case, the structures cause the current to *decrease* by 0.05 knot. It is suggested that this data point be discarded, so that the loss corresponds to 8 hours rather than 7. Therefore, the above summary statement would be amended to the following: There were 91 available hours without the structures in place, and 83 available hours with the structures in place. That is, the presence of the structures results in a loss of 8 available hours, or a loss of 8/91 = 8.8% in available hours. These 8 conditions are listed in Table 2 of Ref. 1.

EXTENSION TO YEAR-ROUND OPERATIONS

The primary objective of the present review is to utilize the NHC report to develop an estimate of the year-round impact of the proposed dolphin structures on the 2-knot window. It is noted that the following analysis refers only to the CN Bridge location since the POV has identified this location as the reference point for measuring currents and defining the vessel transit windows, and since NHC found that, of the four locations considered, this location led to the most severe impact on the 2-knot window.

General Methodology

In general, larger tidal ranges lead to larger currents at the site, and therefore to a larger increase of currents due to the dolphin structures; and so, in turn, to an increased likelihood of reductions in the 2-knot window. For lower tidal ranges, it is more likely that the currents remain below 2 knots, leading to no changes in the 2-knot window. This general linkage has been relied on to relate the tidal range to the extent of reductions in the 2-knot window, and then to apply such a relationship to conditions year-round.

Tide Data

First, tide data for the entire year, 2017 was obtained from the Department of Fisheries and Oceans Canada (Ref. 2). This data indicates 342 tidal cycles during 2017 (the tidal day is longer than the normal day), with the tidal range (HHW minus LLW) extending from 2.3 m to 4.8 m. The NHC study refers to the 10-day window, January 4 to January 14, 2017. The data covers 10 tidal cycles, with the tidal range extending from 2.6 m to 4.6 m.

Tidal Range – 2-knot Window Relationship

The NHC data was used to identify the specific hours during the 10-day window that the loss of each of the 8 hours occurs. It is noted that these losses occur during flood tides only. Therefore, a correlation was sought with a tidal range defined by the subsequent HW minus the preceding LW. However, such a correlation was not evident. Instead, the correlation with the tidal range now defined by the subsequent HHW minus the preceding LLW, was much more evident. Using this definition of tidal range, it is more likely that hours lost in the 2-knot transit window occur for higher tidal ranges, whereas, when the tidal range is sufficiently small, such a loss should not occur at all (as might be expected, since currents are smaller for smaller tides).

The NHC data and the assumed correlation between the number of hours lost and the tidal range are indicated in Figure 1. In this figure, X is the tidal range defined as HHW minus the preceding LLW, and Y is the number of hours lost per tidal cycle for all tides ≤ X. The blue circles represent the lost time per tide cycle (provided in the NHC data), while the heavy lines show the proposed fit to the data that has been used in the present analysis. This interpolation assumes that there are no losses when the tidal range is 2.6 m or less.

The assumed relationship indicated by the heavy lines in Figure 1 has been applied to tidal conditions over the entire year. The above relationship has been used to estimate the number of hours lost for each of the 342 tidal cycles (defined by the tidal range) occurring throughout the year. These have been totaled, to estimate the total number of hour losses over the year. This is found to be approximately 100 hours.

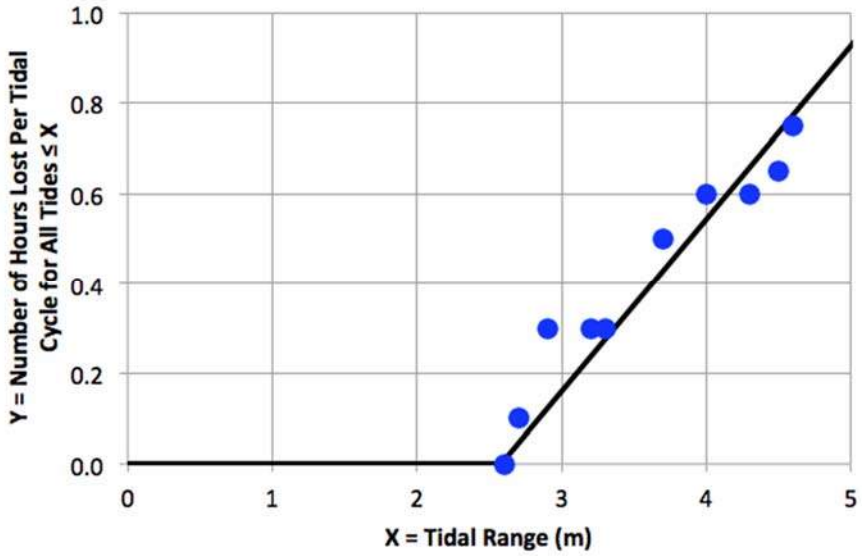


Figure 1: Measurements and fit of Y vs. tidal range

Periods of Acceptable Currents

To express the 100 hours as a percentage change in the loss of available hours, one requires the total number of hours in the year that the current is considered acceptable (≤ 2 knots). Presumably, this information is available (NHC has subsequently referred to "published 2-knot window data"). However, without access to such information at short notice, the NHC data itself has been used as follows. For the 10-day window, NHC found that the current is acceptable for 91 of the 240 hours examined, or 38% of the time. If this percentage were applied to the entire year, the loss of available hours, expressed as a percentage of the number of available hours would be 100 / [38% × 8,760 hours in the year] = 3.0%. However, the extent to which the current is considered acceptable is itself dependent on tidal range. Therefore, we have also used the NHC data to examine the correlation between the tidal range and the number of hours when the current is acceptable, and have thereby estimated a revised percentage of time that the current is acceptable to be 44% of the time (c.f. 38% of the time, when based on the 10-day window).

Therefore, an improved estimate of the loss of available hours, expressed as a percentage of the number of available hours = 100 / [44% × 8,760 hours in the year] = 2.6%.

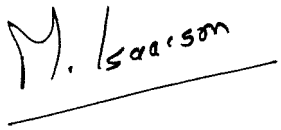
FINDINGS

Based on the foregoing, the following are the findings of this study:

- The NHC report is very useful and is sound in the context of its findings with respect to the selected 10-day window.
- The data in the NHC study has been used to estimate that, for the CN site, the 2-knot window is reduced by about 100 hours a year due to the presence of the dolphin structures.
- Based on a further estimate of the extent that currents are acceptable (≤ 2 knots) for the CN site, the 2-knot window is reduced by about 2.6% due to the presence of the dolphin structures.
- The above estimates are very approximate and may be improved by a reliance on published current data, and by an increased reliance of numerical simulations over additional periods.

We trust the above provides sufficient information to inform further discussions with the POV. Should you require further information or clarification, we are available at your convenience.

Prepared by:



Dr. Michael Isaacson, P.Eng.
Principal Consultant

REFERENCES

1. Northwest Hydraulic Consultants Ltd: *Lions Gate Bridge and Ironworkers Memorial Bridge Vessel Collision Study Ironworkers Memorial Bridge Concept - 2 knot Current Windows Assessment*, Letter Report to MMM Group Limited, Vancouver, September 11, 2017.
2. Department of Fisheries and Oceans Canada: *Tides, Currents and Water Levels*, http://tides.gc.ca/

APPENDIX

D

STRENGTH EVALUATION OF MAIN SPAN TRUSS FOR VESSEL MAST COLLISION LOADS

DOCUMENT HISTORY

Date	Rev	Prepared by:	Checked by:	Description
2017-09-20	0	JC	KH / JK	First Draft
2017-09-30	1	KH	-	Final (minor changes to Draft)
2018-02-24	2	KH	-	Minor Updates to Match Final Report

1 INTRODUCTION

The British Columbia Ministry of Transportation and Infrastructure (the Ministry) is undertaking a review and risk assessment of vessel impact issues for the 01459 Ironworkers Memorial Bridge (IWMB, **Figure 1**) at Second Narrows Burrard Inlet Harbour. A report (**1**) prepared by MMM Group Ltd. summarized a detailed probabilistic risk analysis of the IWMB. From this report, the lower chord of the main span steel truss was identified as a primary vulnerability to potential impacts, including the relatively low impact force from a ship's mast. However, the report further noted that the truss superstructure was modelled conservatively as having no lateral resistance strength for vessel impacts (H=0.0 MN). With small increases in lateral capacity of the bottom chord, the collision risks to the structure are significantly reduced. As such, a refined evaluation of the truss strength capacity was recommended. This memorandum provides a summary of the refined evaluation, including assessment findings, local component capacities, global load path, and governing mast collision force. Recommendations are also provided to mitigate damage to the main span truss.



Figure 1 - Looking North East at Main Span of IWMB

The IWMB is a 1,292m long steel truss cantilever bridge spanning the Second Narrows of Burrard Inlet with a 335m main span. The main span is composed of two cantilever spans and a drop-in, suspended span in the middle (**Figure 2**). The main span is supported by two piers, each bearing on reinforced concrete pedestals and foundations. The main truss span is nearly symmetrical about its centerline, with some minor differences in the length of truss members in the first two bays near the North and South ends.

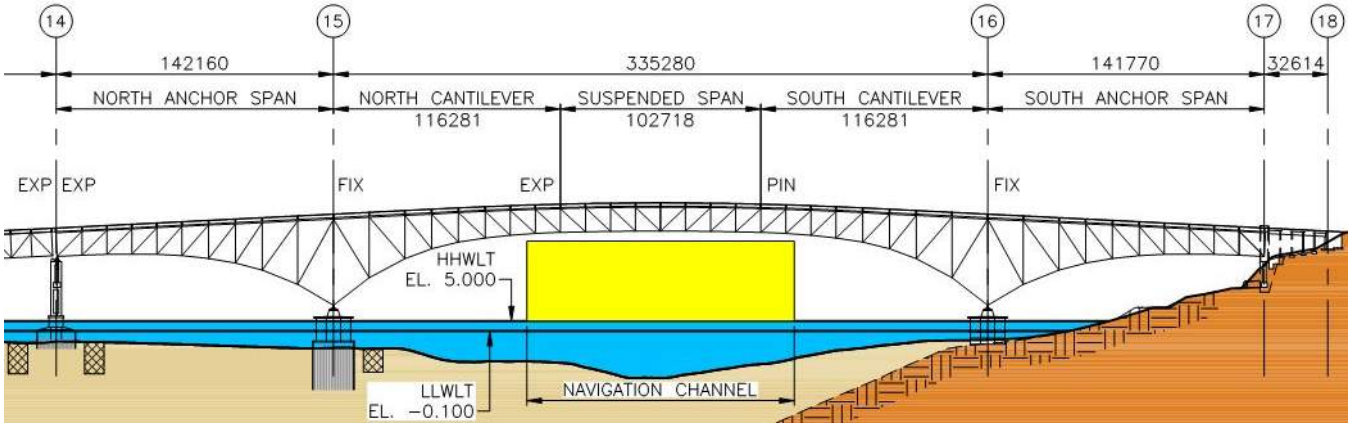


Figure 2 - Elevation View of IWMB Main Span

2 STRUCTURAL EVALUATION CRITERIA

Reference Documents and Details: All evaluation work has been completed in accordance with the Canadian Highway Bridge Design Code ("CHBDC", **2**). For supplementary guidance relating to vessel collision, the AASHTO LRFD Bridge Design Specifications ("AASHTO", **3**) has been referenced.

The navigational envelope and truss members vulnerable to vessel impact were referenced from the IWMB Vessel Collision Risk Assessment and Mitigation Report (**1**). Geometry of structural components was obtained from the following resources:

- Original Design Drawings by Swan Wooster & Partners, 1959 (**4**);
- Widening & Seismic Study by Buckland & Taylor, 1992 (**5**)
- Seismic Safety Retrofit As-Built Drawings by Buckland & Taylor, 2000 (**6**);
- Sidewalk and Fence Upgrades, Truss Reinforcing Record Drawings by COWI, 2016 (**7**).

Member Capacities: For this evaluation, the strength of members are primarily based on the capacities used for the 2016 Sidewalk and Fence Upgrades project (**7**). However, the member capacities were not explicitly specified on the project's record drawings or any supporting reports. Instead, these capacities were provided by COWI directly to the MMM team and have been summarized in **Appendix A** to this memo. In addition, the MMM team independently calculated the member capacities to confirm the COWI values. The methodology used to calculate the member capacities is summarized in **Section 3**. The yield stress of built-up steel components used in this analysis are summarized in **Table 1**. All resistance factors are based on Section 10 of the CHBDC (**2**).

Table 1 – History and Yield Stress of Steel Truss Components in Cantilever Spans

Bottom Chord Truss Component	Yield Stress (F_y) (MPa)			
	Original Construction 1959 (4)	Truss Upgrades before 1992 [1]	Seismic Safety Retrofit 2000 (6)	Sidewalk and Fence Upgrades 2016 (7)
Bottom Chords	379	-	-	-
Struts	227	-	300 (Reinforced)	-
X-Braces	227	300 (assumed)	300 (Replaced, North End Only)	300 (Reinforced)
K-Braces	*Not available*	300 (assumed)	-	300 (Reinforced)

Member Demands: Load demands on truss members are drawn from the following sources:

- Dead and live load member demands are based on data provided by COWI and used for the 2016 Sidewalk and Fence project (**Appendix A**).
- Vessel collision load demands are based on a simplified bottom chord finite element model, described in **Section 3**;

The CHBDC (**2**) considers a vessel collision event as an exceptional load ("H") to be included only for Ultimate Limit State Combination 8 ("ULS 8"). ULS 8 combines (a) the vessel collision load with a factor (α_H) of 1.0; with (b) the permanent loads on the structure with typical dead load factors (α_D). Live loads (L) are not to be included for ULS 8 (α_L=0). In dialog with the project team, the CHBDC ULS 8 combination was viewed as potentially unconservative given the high traffic volumes on the bridge at most times of day. As such, three load combinations, listed in **Table 2**, were established to assess the sensitivity of the truss evaluation to live load demands.

Table 2 - Load Factors

ULS Combination & Rationale		Live Load (L)	Permanent Loads (D)			Vessel Collision Load (H)
			Steel	Concrete	Wearing Surface	
ULS 8	*Consistent with the CHBDC (**2**).*	α_L = 0	Max α_D = 1.10 Min α_D = 0.95	Max α_D = 1.20 Min α_D = 0.90	Min α_D = 1.50 Min α_D = 0.65	α_H = 1.00
ULS 8A	*Consistent with the AASHTO requirements (**3**)*	α_L = 0.50				
ULS 8B	*Established as a practical upper bound for evaluation.*	α_L = 1.00				

[1] Details of this work are not available however upgrades are inferred based on comparison of 1992 report (**5**) and original design drawings (**4**).

3 METHODOLOGY

3.1 MEMBER CAPACITIES

The structural components that form the primary vessel collision load path to the main piers are labelled in **Figure 3** and include (a) truss bottom chords members; (b) transverse "struts"; (c) in-plan "X-braces" in the bottom chord; and (d) in-plan "K-braces" in the bottom chord. Additional "K-brace sub-struts" are not part of the primary load path but were included in the analysis to stabilize the K-braces about their weak axis. Note that the 2000 upgrades (**6**) included the replacement of the X-braces and strengthening of struts in select locations. Additionally, the 2016 upgrades (**7**) included strengthening of X-braces and K-braces.

All truss members are built-up sections consisting of 3/8" to 1-1/8" steel plates and angles riveted together. Newer steel angles, as a part of the struts and braces strengthening works, are bolted to original sections. **Figure 4** and **Figure 5** provides typical photographic and cross-sectional views, respectively. Most members have different built-up configurations depending on the bay location, with greater built-up sections in the cantilever span near the pier ends.

Note that a conventional structural truss is configured as a network of axially loaded members. Bending and shear demands in axial truss members are typically low and not considered in conventional truss bridge evaluations. As noted in **Section 2**, the axial capacity of members have been established in past projects, most recently the 2016 Sidewalk and Fence Project (**7**), and have been used for this study (**Appendix A**). In all cases where information was available, the axial capacities were independently verified by our team's own calculations and found to be accurate within 1%-15%. The methodology used for these capacity calculations followed the requirements of the CHBDC (**2**).

For a direct mast collision impact, the bottom chord is loaded in out-of-plane bending and shear. This load path was not considered in the original bridge design, nor past strengthening projects. As such, the out-of-plane evaluation of the bottom chord members was based on calculations by the MMM team, with key methodology described under the following headings.

Local Member Demands: The maximum bending moment and shear demands on the bottom chord were conservatively determined by (a) applying the mast collision force as a point load, respectively, at the mid-span and at 5% of the unbraced length away from the ends of the chord; and (b) considering the member as pinned at both ends.

Bending Capacity: Bending capacity of the bottom chord member was based on the elastic section modulus (S) (ie: Class 3 section), rather than the plastic section modulus (Z). This was viewed as conservative but appropriate since the member is heavily loaded and non-redundant. Furthermore, any option to repair the bottom chord after a collision event would be challenging and require significant public disruption.

Combined Axial and Bending Effects: Combined axial compression and bending was considered for the bottom chord members. In-plane bending demands were based solely on the self-weight of the member and are relatively small. Out-of-plane bending demands were based on the vessel collision load.

Shear Capacity: For calculation of out-of-plane shear, the large access holes in the member flanges were considered however small drain holes were neglected. This is consistent with guidance by Redwood and Shrivastava (**8**) that notes that "*holes with heights less than 30% of the beam height will not cause much reduction in beam resistance*".

Torsional Response: A torsional response of the built-up bottom chord is difficult to evaluate given the load impact from a mast collision may reach only, or initially, the bottom flange of the member. This consideration introduces a wide range of load conditions, beyond the intended scope of this evaluation. However, as the assignment has evolved, it became evident that a new bottom chord fender will be recommended to circumvent an out-of-plane response of the bottom chord. In discussion with the Ministry, therefore, an enhanced evaluation of the torsional load path of the bottom chard was deemed unnecessary.

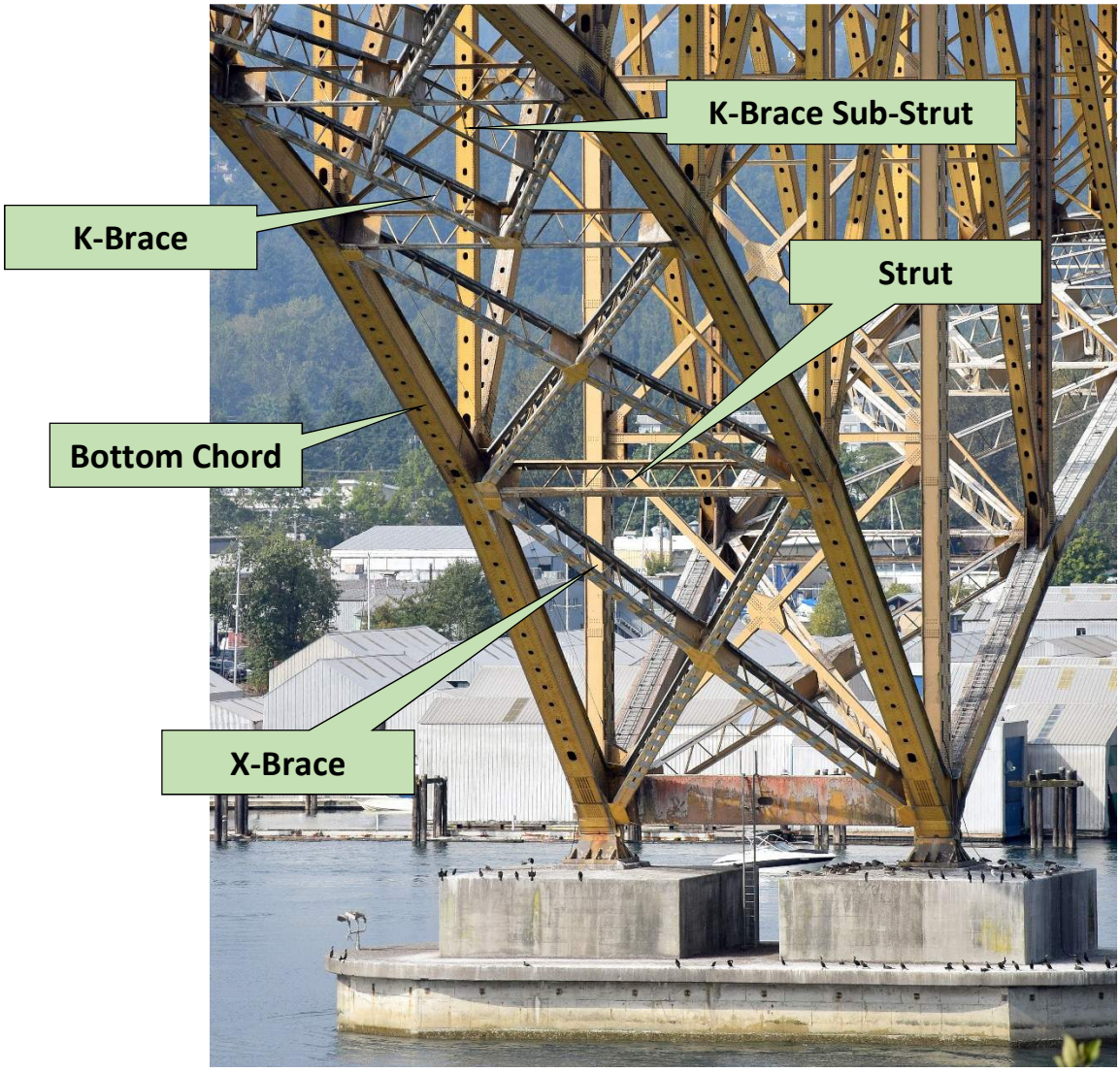


Figure 3: Structural Component Labels

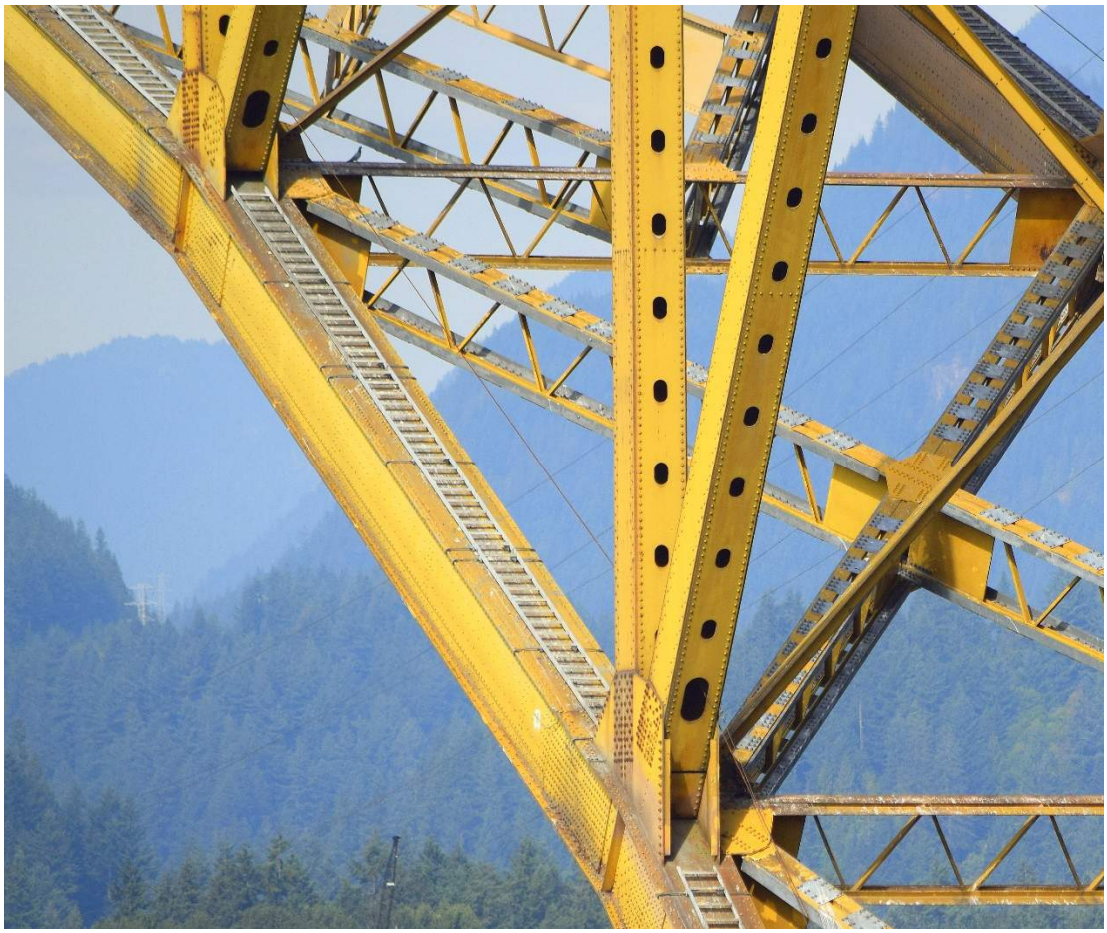


Figure 4: Built-Up Truss Component Sections

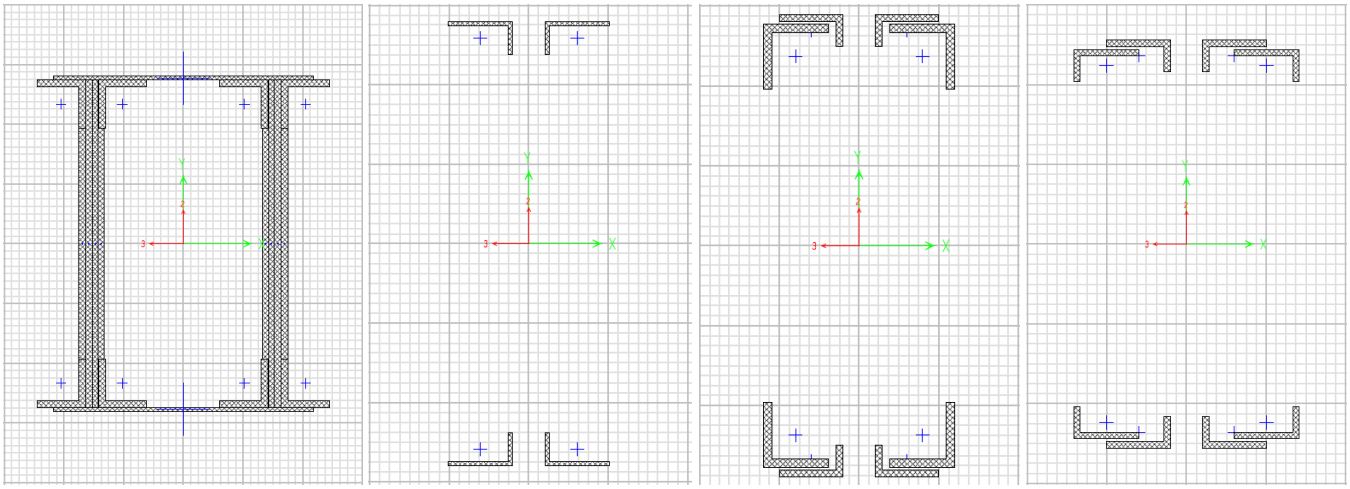


Figure 5 - Cross-Sectional View of Components (Left to Right: Bottom Chord, Strut, X-Brace, and K-Brace)

3.2 GLOBAL LATERAL LOAD PATH

The global lateral load path of the truss's bottom chord includes the axially loaded transverse struts and plan bracing ("X" and "K"), as well as the parallel bottom chord members acting as a tension/compression force couple. To determine the overall load distribution of the mast collision force, a planar two-dimensional (2D) finite element model of the main span truss bottom chord was developed (**Figure 6**). Conservatively, the upper truss members and bridge deck were not modelled as their contribution to a bottom chord lateral load path were considered insignificant. While modelled in 2D, all truss members were modelled based on their "true-length geometry", accounting for both their horizontal and vertical length changes. Initially, only the north cantilever span was modelled but was then refined to include the suspended and south cantilever span, (a) providing a minor improvement in load distribution; and (b) reflecting different member capacities at each end. Boundary conditions and member links were used to ensure the span articulation was modelled accurately.

The 2017 risk assessment and mitigation study (**1**) identified that truss members in Bays 11 to 14 are vulnerable to vessel impact **Figure 7**. To determine the governing member in the load path for a variety of impact locations, load cases were developed for fourteen impact locations, including load application directly on truss nodes and midway between the truss nodes. A unit load was applied for each load case and then scaled to pinpoint the governing member in the load path (ie: the weakest link in the chain). Each member was evaluated based on their Capacity/ Demand Ratio (C/D) using the following equation.

$$C/D = \frac{R_r}{\alpha_L L + \sum \alpha_D D + \sum \alpha_H H}$$

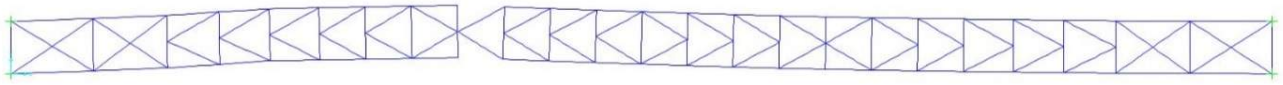


Figure 6 – "True Length Geometry" Plan View of Bottom Chord Model, Showing Deflected Shape and Confirmed Articulation

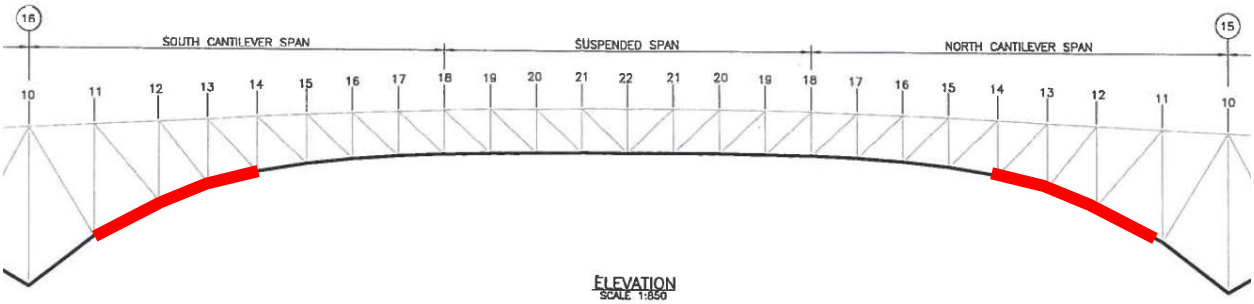


Figure 7 - Main Span Truss Bay Notation; Bays Vulnerable to Mast Collision Highlighted by Red Line

4 STRUCTURAL EVALUATION RESULTS

4.1 BOTTOM CHORD LOCAL OUT-OF-PLANE RESPONSE

The governing mast collision forces due to local out-of-plane effects of the bottom chord members are summarised in **Table 3**. The governing mast collision force was calculated to be 1157 kN, based on coincident bending and axial compression of Chord 11-12 in the South Cantilever Span.

Table 3 - Summary of Local Component Effects

Chord No.	L_u (m)	C_f[1] (kN)	C_r[1] (kN)	C_f / C_r	$U_{1x} M_{fx} / M_{rx}$[1]	M_{ry}[2] (kN-m)	Governing Mast Collision Force Based on C+M[3] (kN)	V_r[4] (kN)	Governing Mast Collision Force Based on V_r (kN)
11 - 12 North	20.7	63165	90650	0.70	0.084	28546	**1210**	2965	**3121**
11 - 12 South	21.5	63258	90650	0.70	0.084	28546	**1157**	2964	**3120**
12 - 13	14.6	60452	93128	0.65	0.083	27711	**2031**	2973	**3129**
13 - 14	14.1	55019	85059	0.65	0.083	25174	**2130**	2974	**3130**

4.2 GLOBAL TRUSS LATERAL LOAD PATH

The governing mast collision forces due to axial response of the bottom chord truss members are summarized in **Table 4**. These results are based conservatively on the highest factored live loads represented by ULS 8B. The critical truss member and corresponding load case are also tabulated. The critical truss member for each component is the first of its type to reach a C/D Ratio of 1.0. The governing mast collision force is 3725 kN, which corresponds to the buckling of the North Bottom Chord between Nodes No. 10 to 11, when the impact load is applied at Node 14. The governing response for each of the main eight truss components (chord, strut, X-brace,

[2] C_f, C_r, and $U_{1x} M_{fx} / M_{rx}$ values are based on data from (**6**). M_{ry} and V_r values were calculated by the MMM Team for this project. See **Section 3.1.**

[3] Mast Collision Force for C+M is calculated as per Clause 10.9.4.1 of CHBDC (**2**) The value is obtained by assuming coincident bending and axial compressive force such that $C_f / C_r + U_{1x} M_{fx} / M_{fx} + U_{1y} M_{fy} / M_{fy} = 1.0$.

[4] V_r is governed by access holes at the ends of bottom chord members. In this case, the shear capacity is conservatively assumed to be provided by the non-perforated top cover plate only.

K-brace for both North and South cantilevers) is shown graphically in the sketches provided in **Appendix B** of this memo.

Table 4 - Summary of Governing Mast Collision Force (ULS 8B; α_L = 1.00)

Truss Bottom Chord Component	Governing Mast Collision Force (kN)		Critical Truss Member	Load Case
	North Cantilever	South Cantilever		
Bottom Chord	3725	4705	Chord 10 - 11	Node 14
Strut	4030	4166	Strut 13	Mid Node 13 - 14
X-Brace	7205	5766	X-Brace 11 - 12	Node 12
K-Brace	4482	-	K-Brace 12 - 13	Mid Node 13 - 14
	-	4042	K-Brace 13 - 14	Node 14

A sensitivity analysis was performed to assess the influence of the ULS 8 live load factor on the overall evaluation. Results of the sensitivity analysis are summarized in **Table 5** and **Table 6** for the North and South Cantilevers, respectively. The bottom chord members are primary vertical load members and are, therefore, significantly more sensitive to changes in live load when compared with the struts, X-braces and K-braces.

Table 5 - Sensitivity Analysis of Live Load Factor (North Cantilever)

Truss Bottom Chord Component	Governing Mast Collision Force (kN)			% Change from α_L = 1.00 to α_L = 0.50	% Change from α_L = 0.50 to α_L = 0
	ULS 8B (α_L = 1.00)	ULS 8A (α_L = 0.50)	ULS 8 (α_L = 0)		
Bottom Chord	3725	4952	6179	32.9%	24.8%
Strut	4030	4231	4397	5.0%	3.9%
X-Brace	7205	7485	7764	3.9%	3.7%
K-Brace	4482	4711	4939	5.1%	4.9%

Table 6 - Sensitivity Analysis of Live Load Factor (South Cantilever)

Truss Bottom Chord Component	Governing Mast Collision Force (kN)			% Change from α_L = 1.00 to α_L = 0.50	% Change from α_L = 0.50 to α_L = 0
	ULS 8B (α_L = 1.00)	ULS 8A (α_L = 0.50)	ULS 8B (α_L = 0)		
Bottom Chord	4705	6289	7872	33.7%	25.2%
Strut	4166	4351	4508	4.4%	3.6%
X-Brace	5766	5999	6231	4.0%	3.9%
K-Brace	4042	4297	4536	6.3%	5.6%

4.3 MISCELLANEOUS LOAD PATH CONSIDERATIONS

In addition to the primary truss bottom chord load path, this project's evaluation has considered the following load path components:

- **Pier Bearings:** The main truss is supported on its original pin bearings at Piers 15 and 16. As part of the 1992 seismic assessment (**5**), the original pin bearings were assessed for a transverse capacity of 7,900 kN and 13,600 kN for pedestal and anchor bolt capacity, respectively. The 2000 upgrades included a pedestal encasement (DWGs 1459-212 and 213 in (**6**)) providing robust but un-specified strengthening. Since the original capacities for the pier bearing assemblies are considerably higher than the governing mast collision forces (**Table 4**), no further evaluation was completed for this assignment.

- **Suspended Span Expansion Joint:** Longitudinal expansion of the suspended span is accommodated using large stainless steel pins in the top and bottom chords to form a structural hinge (**Figure 8**). This differs from a traditional bridge bearing in that there is no mechanism for a loss of span. Note that "dummy members" provide visual continuity but do not contribute to the global load path of the truss. Expansion of the dummy members is accommodated through a sleeved member, providing 305-381mm of seating length (**5**). While this was deemed seismically inadequate in the 1992 evaluation, no upgrade was completed (**6**), presumably because these members do not serve the global load path. A similar conclusion has been extended to the mast collision scenario considered in this study.

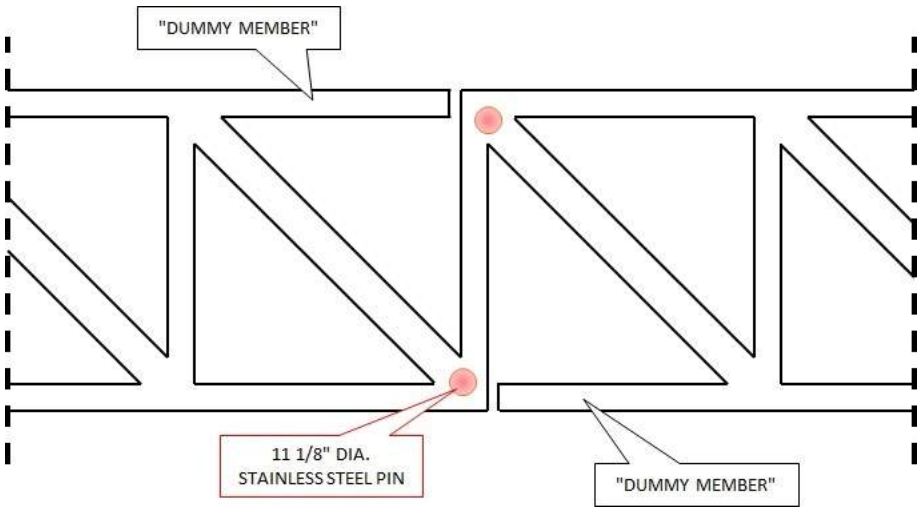


Figure 8: Schematic View of Suspended Span Articulation

5 INTERPRETATION AND RECOMMENDATIONS

5.1 RECOMMENDED MAST COLLISION LOAD

This memo has provided a summary of the structural capacity of the IWMB main span truss bottom chord members when impacted by the mast of a large commercial vessel. Two main aspects of the truss's structural capacity have been considered:

- **Bottom Chord Local Out-of-Plane Response:** The first contact of a vessel's mast with the bottom chord will generate an out-of-plane structural response that may include local member bending, shear and torsion. Neither the original bridge design, nor the subsequent strengthening works, considered this load scenario. Based on a simplified calculation (ie: torsion not included), the governing mast collision load for this local out-of-plane response is approximately **1000 kN**.

- **Global Truss Lateral Load Path:** A mast loading applied to the bottom chord would engage the truss nodes as lateral supports, at which point, the global lateral load path of the truss would be engaged. This load path includes the axially loaded transverse struts and plan bracing ("X" and "K"), as well as the parallel bottom chord members acting as a tension/compression force couple. This is a conventional lateral load path that was originally required for wind and seismic loading but can also accommodate a mast collision load. The governing mast collision load for the global truss lateral load path is approximately **3500 kN**. The limiting member is the bottom chord member directly adjacent to the pier acting in compression.

To appropriately interpret and utilize these structural capacities, further project context must be considered:

1. The IWMB is a six-lane lifeline structure in BC's Lower Mainland with Average Annual Daily Traffic (AADT) of over 124,000 in 2016 (**9**). A bridge closure for evaluation and/or repairs would only be considered in drastic circumstances relating to public safety.

2. The bottom chords members are heavily loaded in compression and serve as fracture-critical (ie: non-redundant) structural members for the vertical (dead, live) load path. Strengthening and/or repairs to these members is exceptionally challenging.

3. The other global lateral load path members (struts, braces) provide member stability and load path for lateral loads. These members are not fracture-critical and, while access is challenging, can be strengthened and/or repaired. As part of past strengthening works, many of these members have already been upgraded.

4. The mast collision force is a code-specified load that is simply calculated as 10% of a vessel's deck house collision force. This approach is based on limited empirical data and intended to cover a wide range of mast / funnel geometries and stiffnesses.

With this context in mind, any reliance on the bottom chord members for an out-of-plane response is strongly **not recommended**. In plain language, the bottom chord members were not designed for such loading, cannot be easily repaired and are too important to put at risk.

The global truss lateral load path can be viewed differently in that (a) it is being engaged in a manner consistent with its original design; and (b) its member's axial capacity can be reliably estimated. From a capacity perspective, therefore, a governing mast collision load of **3500 kN** can be considered reliable, provided the out-of-plane response of the bottom chord can be circumvented. For incorporation into the risk analysis, a reduced capacity may be appropriate to account for the uncertainty in mast collision load demand (Bullet #4, above).

5.2 PROPOSED BOTTOM CHORD FENDER

To circumvent the local out-of-plane response of the bottom chord and engage the reliable capacity of the global lateral load path, a new bottom chord fender could be considered, located in front of the bottom chord. The fender would intercept a vessel's mast and divert the collision load to the truss nodes without engaging the bottom chord. Ideally the fender would not add significant dead load to the bridge, nor compromise the bottom chord's strength or stiffness, either permanently or during installation.

One such fender concept is shown in the attached sketches provided in **Appendix C** of this memo, comprised of a round steel pipe mounted in front of each of the vulnerable bottom chord components. While still subject to detailed design refinements, key features of this fender concept are as follows:

- A round steel section is selected to provide a smooth collision contact surface for a variety of mast impact scenarios. Steel is well suited for high strength and energy-absorbing ductility. Also, the shape is stable and relatively light-weight to facilitate installation.

- The steel pipe is sized 1.2m (48") diameter to match the exposed face of the bottom chord section. A range of pipe wall thicknesses are feasible and can be confirmed pending the preferred mast collision load.

- For a mast collision, the fender pipe would laterally react against the truss nodes through a flexible (ie: elastomeric) bearing connection. A flexible connection ensures a uniform bearing reaction to the node and avoids any unintended interaction between the truss and the fender. The flexible pad assembly would be sized such that, on mast collision, the fender pipe would have adequate offset to plastically deform without engaging the bottom chord, except at the bearing connections.

- The fender pipe would be vertically supported by DYWIDAG hangers that could be anchored to the vertical truss members or, as shown in the sketches, the underside of the existing floor beams. The latter option is preferred as it would be a relatively simple modification to the floor beams to attach the DYWIDAG hangers (**Figure 9)**. The DYWIDAG hangers would be in line with the vertical truss members, and if painted yellow, impose only limited visual impact to the bridge.

- The underside of the fender pipe on each side of the truss would be connected with a lightly-tensioned cross-tie cable or rod. This cross-tie would ensure the fender system stays in place under wind loading and traffic vibration.

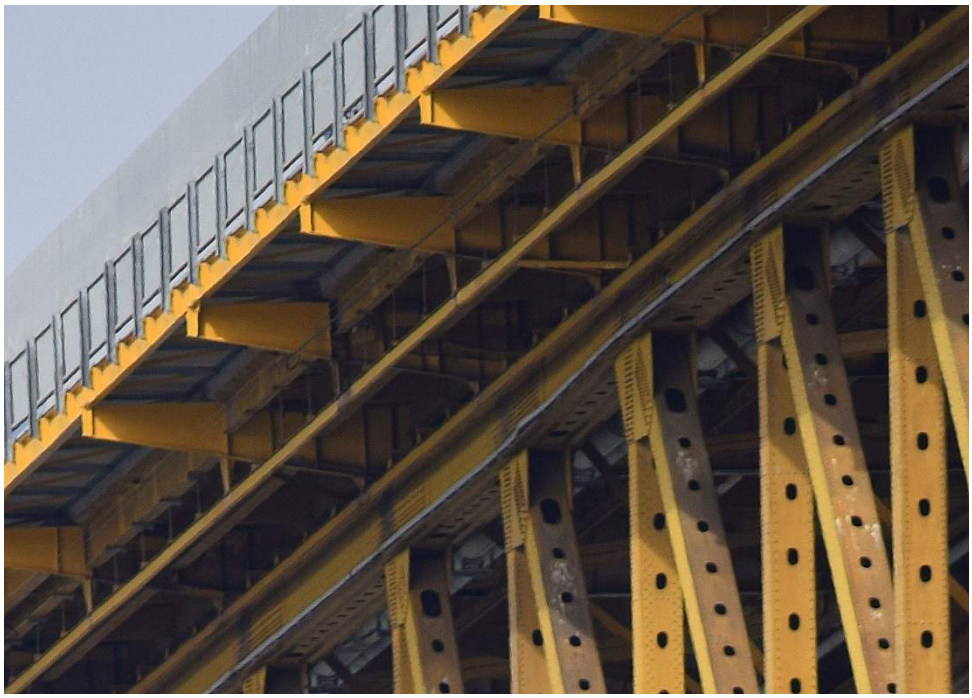


Figure 9: Underside of Deck Extension

REFERENCES

1. 01459 Ironworkers Memorial Bridge, Vessel Collision Risk Assessment and Mitigation, Final Report by *MMM Group Ltd.*, Vancouver, BC, March 2018.
2. Canadian Highway Bridge Design Code (CAN/CSA-S6-14), *Canada Standards Association*, Toronto, 2014.
3. LFRD Bridge Design Specifications, 7th Edition, *American Association of State Highway and Transportation Officials (AASHTO)*, Washington, DC, 2014.
4. Second Narrows Crossing Design Drawings by *Swan Wooster & Partners*, 1959.
5. Second Narrows Bridge #1489 Widening & Seismic Study by *Buckland & Taylor*, North Vancouver, BC. Final Report Issued November 1991; Revised March 1992.
6. Second Narrows Bridge Seismic Safety Retrofit As-Built Drawings by *Buckland & Taylor*, North Vancouver, BC, 2000.
7. Ironworkers Memorial Bridge No. 01459 Sidewalk and Fence Upgrades Record Drawings by *COWI*, North Vancouver, BC, 2016
8. Design Recommendations for Steel Beams with Web Holes, Redwood and Shrivastava, *Canadian Journal of Civil Engineering, 1980.*
9. Traffic Data Program*, British Columbia Ministry of Transportation,* http://www.th.gov.bc.ca/trafficdata/

APPENDIX A – IWMB TRUSS MEMBER DATA

APPENDIX A – IWMB TRUSS MEMBER DATA

Axial Capacity and Demand Values for North Cantilever Bottom Truss Elements

	Bottom Chord								Strut								X-Brace		K-Brace					
Chord Member	Chord 10 - 11	Chord 11 - 12	Chord 12 - 13	Chord 13 - 14	Chord 14 - 15	Chord 15 - 16	Chord 16 - 17	Chord 17 - 18	Strut 11	Strut 12	Strut 13	Strut 14	Strut 15	Strut 16	Strut 17	Strut 18	X-Brace 10 - 11	X-Brace 11 - 12	K-Brace 12 - 13	K-Brace 13 - 14	K-Brace 14 - 15	K-Brace 15 - 16	K-Brace 16 - 17	K-Brace 17 - 18
Buckland & Taylor Nomenclature *(See Buckland & Taylor DWG 1127-M1)*	134, 184	133, 183	132, 182	131, 181	130, 180	129, 179	128, 178	127, 177	436	435, 497	434, 481	433, 480	432, 479	431, 478	430, 477	428, 475	567, 568	565, 566	563, 564	561, 562	559, 560	557, 558	555, 556	553, 554
Compressive Capacity																								
COWI Sidewalk Upgrades 2016	88488	90650	93128	85059	69833	49647	33077	33081	5631	2282	2282	2282	2282	2282	1343	2553[3]	10057	7873	5929	4960	2215	2175	2175	2180
MMM Group Calculations 2017	83927	88460	97206	88959	78914	53328	35328	35337	5286	2630	2630	2630	2630	2630	1599	2630	10618	8472	N/A	N/A	N/A	N/A	N/A	N/A
% Difference COWI and MMM Group	-5.2%	-2.4%	4.4%	4.6%	13.0%	7.4%	6.8%	6.8%	-6.1%	15.3%	15.3%	15.3%	15.3%	15.3%	19.0%	3.0%	5.6%	7.6%						
Compressive Demand																								
COWI Sidewalk Upgrades 2016																								
Dead Load – Steel	29327	27303	24892	22010	17584	12660	7980	3634	302	147	13	-9	0	0	0	0	-343	-285	-13	-13	-9	-4	0	-4
Dead Load – Concrete	14621	14475	14314	13242	11103	8225	5311	2478	-351	-178	-22	4	4	4	0	0	369	316	22	0	-9	9	9	9
Dead Load – Wearing Surface	4226	4186	4137	3830	3207	2375	1535	716	-102	-53	-4	0	0	0	0	0	107	93	9	0	4	0	0	4
Live Load	9332	9484	9688	9172	7927	6094	4110	2273	0	169	209	209	222	227	0	9	538	552	507	534	534	552	534	454
Tensile Capacity																								
COWI Sidewalk Upgrades 2016									-3995	-3207	-3207	-3207	-3207	-3207	-3207	-1908	-9497[4]	-8469[4]	-5449	-5449	-3207	-3207	-3207	-3207
Tensile Demand																								
COWI Sidewalk Upgrades 2016																								
Live Load									-196	-307	-298	-307	-329	-311	-62	-9	-294	-329	-507	-534	-534	-552	-534	-454

Note:

1. All loads are unfactored and in "kN" unless otherwise noted. Positive values are in compression.
2. Dead Load Factors:

MAX	MIN
1.1	0.95
1.2	0.90
1.5	0.65

3. Referenced from the 1992 Widening & Seismic Study by Buckland & Taylor.
4. Calculated by MMM Group.

APPENDIX A – IWMB TRUSS MEMBER DATA

Axial Capacity and Demand Values for South Cantilever Bottom Truss Elements

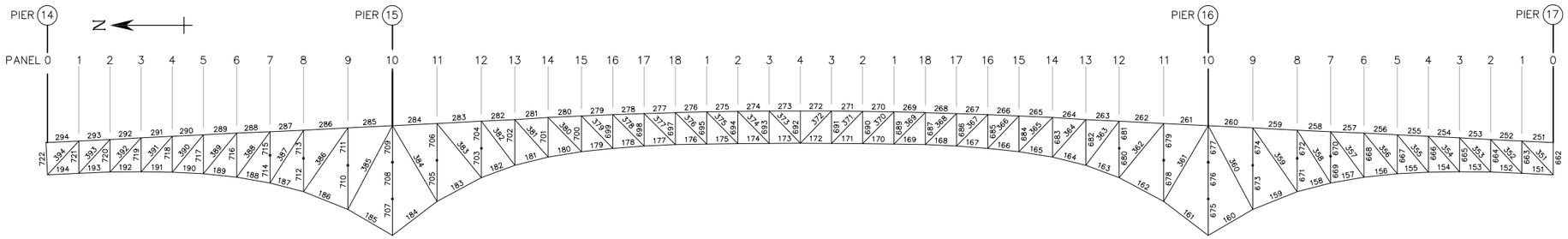
		Bottom Chord								Strut								X-Brace		K-Brace					
Chord Member		Chord 10 - 11	Chord 11 - 12	Chord 12 - 13	Chord 13 - 14	Chord 14 - 15	Chord 15 - 16	Chord 16 - 17	Chord 17 - 18	Strut 11	Strut 12	Strut 13	Strut 14	Strut 15	Strut 16	Strut 17	Strut 18	X-Brace 10 - 11	X-Brace 11 - 12	K-Brace 12 - 13	K-Brace 13 - 14	K-Brace 14 - 15	K-Brace 15 - 16	K-Brace 16 - 17	K-Brace 17 - 18
Buckland & Taylor Nomenclature *(See Buckland & Taylor DWG 1127-M1)*		111, 161	112, 162	113, 163	114, 164	115, 165	116, 166	117, 167	118, 168	412	413, 496	414, 461	415, 462	416, 463	417, 464	418, 465	420, 467	521, 522	523, 524	525, 526	527, 528	529, 530	531, 532	533, 534	535, 536
Compressive Capacity																									
COWI Sidewalk Upgrades 2016		88488	90650	93128	85059	69833	49647	33077	33081	1637	2282	2282	2282	2282	2282	1343	2553[3]	8207	6530	4978	4275	3060	1455	1459	1459
MMM Group Calculations 2017		87767	86445	97206	88959	78914	53328	35328	35337	N/A	2630	2630	2630	2630	2630	1599	2630	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
% Difference COWI and MMM Group		-0.8%	-4.6%	4.4%	4.6%	13.0%	7.4%	6.8%	6.8%		15.3%	15.3%	15.3%	15.3%	15.3%	19.0%	3.0%								
Compressive Demand																									
COWI Sidewalk Upgrades 2016																									
Dead Load	Steel	29060	27090	24688	21814	17419	12540	7896	3590	307	156	18	-9	9	9	9	0	-338	-285	-27	-18	-18	-18	-13	-4
	Concrete	14644	14501	14323	13233	11094	8220	5307	2478	-351	-182	-22	-4	4	-4	-4	0	374	320	27	4	-4	-4	-4	9
	Wearing Surface	4230	4190	4141	3825	3207	2375	1535	716	-102	-53	-4	0	0	0	0	0	107	93	9	0	0	0	0	4
Live Load		9595	9773	9831	9288	7998	6147	4141	2273	0	147	187	191	205	205	0	4	431	472	440	480	489	494	480	436
Tensile Capacity																									
COWI Sidewalk Upgrades 2016										-3207	-3207	-3207	-3207	-3207	-3207	-3207	-1908	-9497[4]	-9497[4]	-5449	-5449	-3683	-3207	-3207	-3207
Tensile Demand																									
COWI Sidewalk Upgrades 2016																									
Live Load										-196	-307	-298	-307	-329	-311	-62	-9	-294	-329	-507	-534	-534	-552	-534	-454

Note:

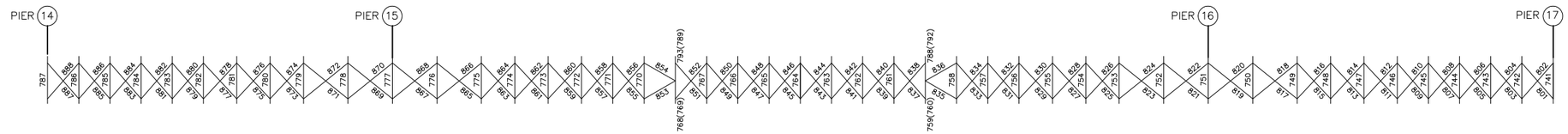
1. All loads are unfactored and in "kN" unless otherwise noted. Positive values are in compression.
2. Dead Load Factors:

MAX	MIN
1.1	0.95
1.2	0.90
1.5	0.65

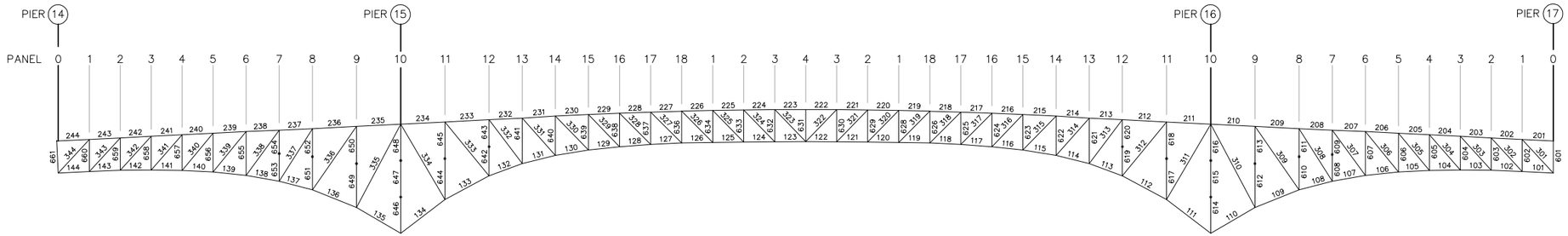
3. Referenced from the 1992 Widening & Seismic Study by Buckland & Taylor.
4. Calculated by MMM Group.



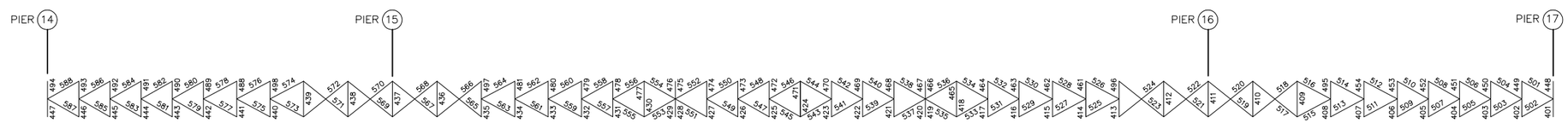
EAST ELEVATION LOOKING EAST



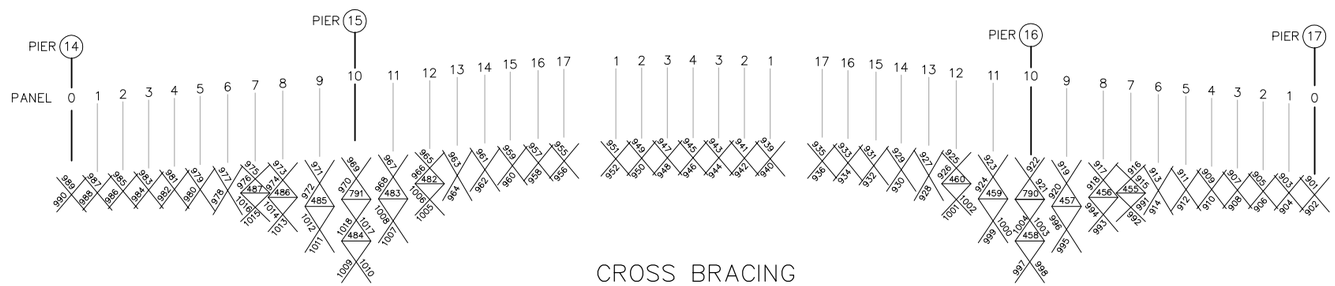
TOP BRACING AND FLOORBEAMS



WEST ELEVATION LOOKING EAST



BOTTOM BRACING AND STRUTS



CROSS BRACING

BUCKLAND and TAYLOR Ltd.
CONSULTING ENGINEERS NORTH VANCOUVER , B.C. , CANADA

Province of British Columbia
MINISTRY OF TRANSPORTATION AND HIGHWAYS
BRIDGE ENGINEERING BRANCH

SCALE 1"=80'-0"

DESIGNED DDM DATE 91/11/07
CHECKED PRT DATE 91/11/07
DRAWN MSS DATE 91/11/07

Rev	Date	Description	Init

REVISIONS

SECOND NARROWS BRIDGE No. 1459
EXISTING BRIDGE – MAIN SPAN
MEMBER NUMBERING SYSTEM

PREPARED BY	RECOMMENDED	ACCEPTED FOR CONSTRUCTION
DATE 91/11/07	DIRECTOR OF BRIDGE ENGINEERING DATE	CHIEF HIGHWAY ENGINEER DATE
FILE No.	NEGATIVE No.	REG.

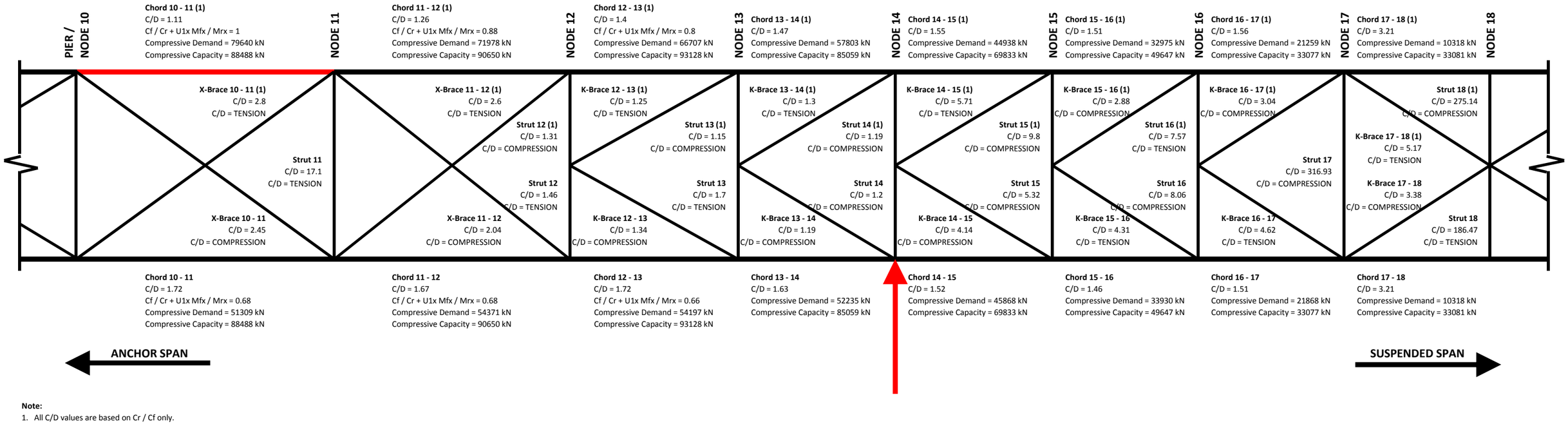
DRAWING No. 1127–M1

APPENDIX B – IWMB TRUSS BOTTOM CHORD C/D STATUS

Appendix B – IWMB Truss Bottom Chord C/D Status

Axial Capacity / Demand Ratio Diagram for Cantilever Bottom Truss Elements

Truss End	North	**Load Case**	Node 14	**Critical Component**	Bottom Chord



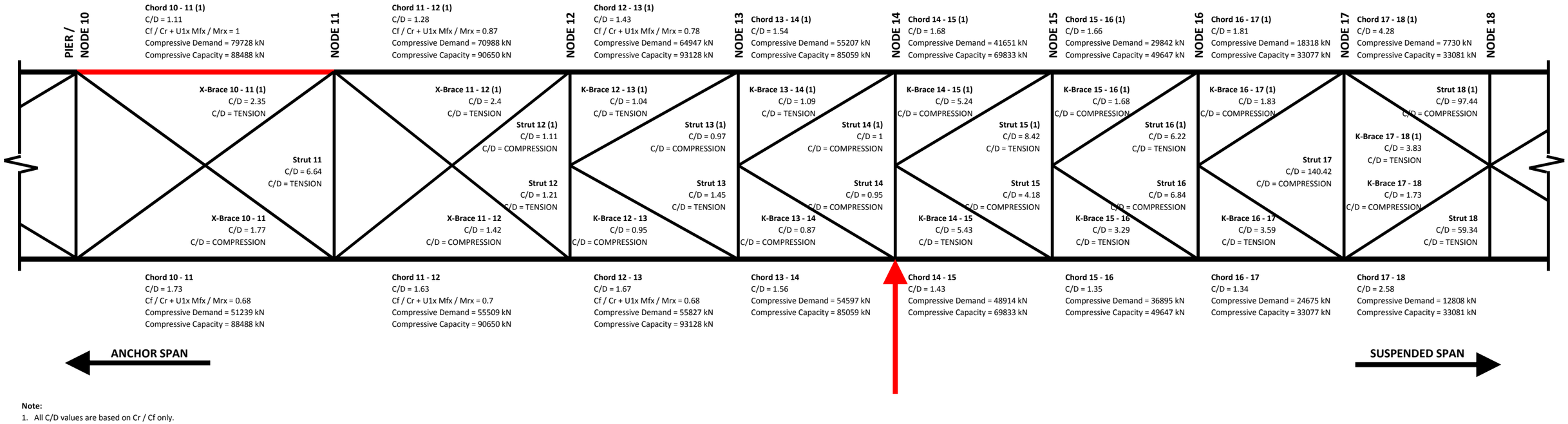
Note:

1. All C/D values are based on Cr / Cf only.
2. Combined axial compression and bending ratios are only listed for bottom chord members in between Nodes 10 to 13 where axial compression loads due to a mast collision force are highest. In-plane bending demands are based on the self-weight of bottom chords.

Appendix B – IWMB Truss Bottom Chord C/D Status

Axial Capacity / Demand Ratio Diagram for Cantilever Bottom Truss Elements

Truss End	South	**Load Case**	Node 14	**Critical Component**	Bottom Chord



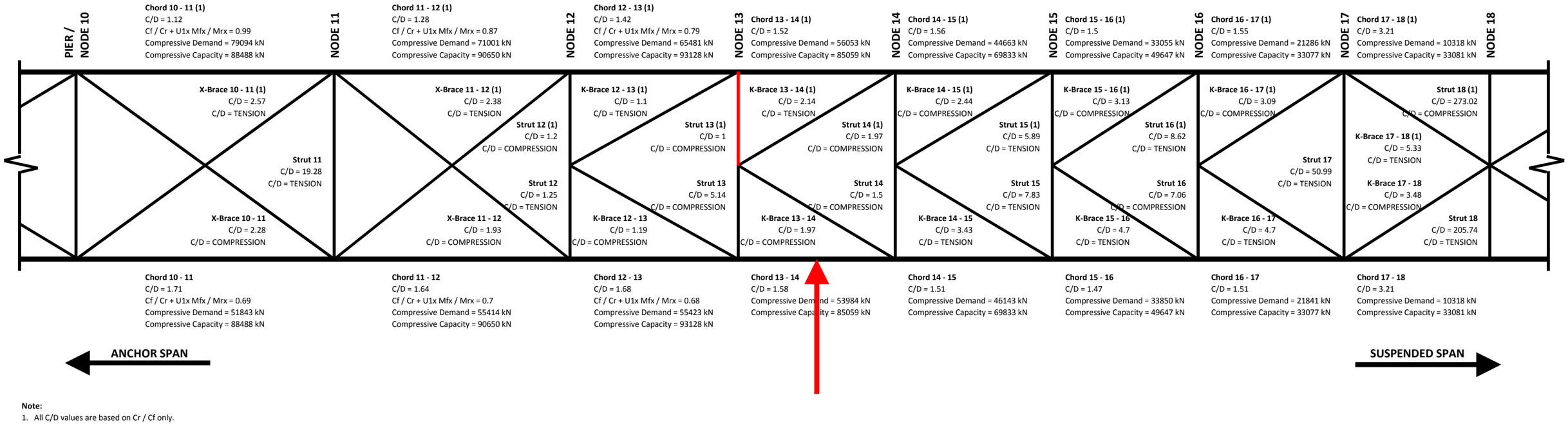
Note:

1. All C/D values are based on Cr / Cf only.
2. Combined axial compression and bending ratios are only listed for bottom chord members in between Nodes 10 to 13 where axial compression loads due to a mast collision force are highest. In-plane bending demands are based on the self-weight of bottom chords.

Appendix B – IWMB Truss Bottom Chord C/D Status

Axial Capacity / Demand Ratio Diagram for Cantilever Bottom Truss Elements

Truss End	North	**Load Case**	Mid Node 13 - 14	**Critical Component**	Strut



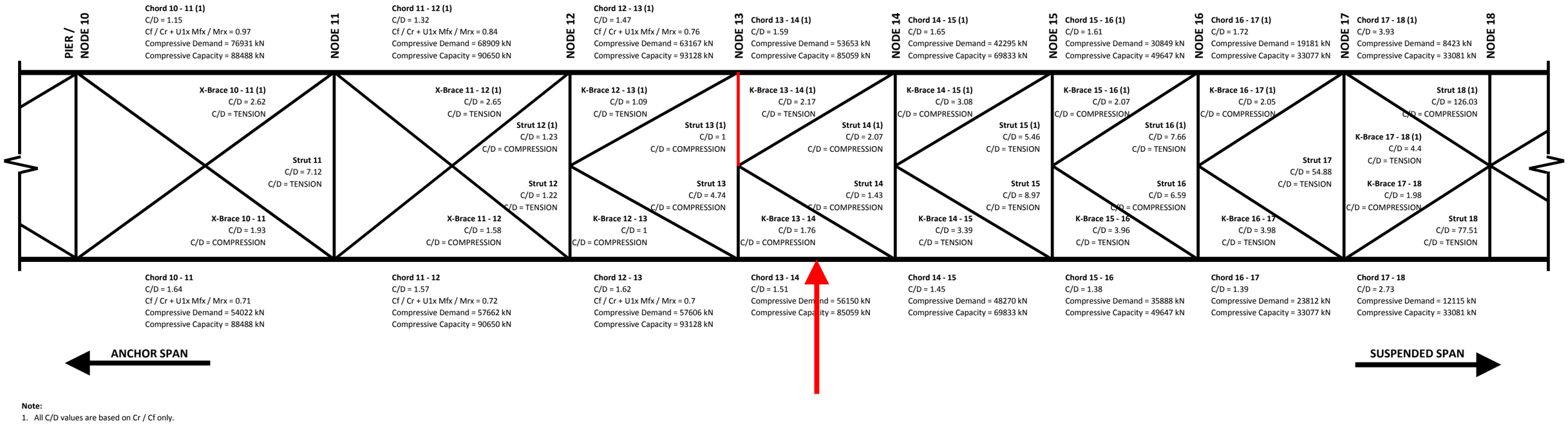
Note:

1. All C/D values are based on Cr / Cf only.
2. Combined axial compression and bending ratios are only listed for bottom chord members in between Nodes 10 to 13 where axial compression loads due to a mast collision force are highest. In-plane bending demands are based on the self-weight of bottom chords.

Appendix B – IWMB Truss Bottom Chord C/D Status

Axial Capacity / Demand Ratio Diagram for Cantilever Bottom Truss Elements

Truss End	South	**Load Case**	Mid Node 13 - 14	**Critical Component**	Strut



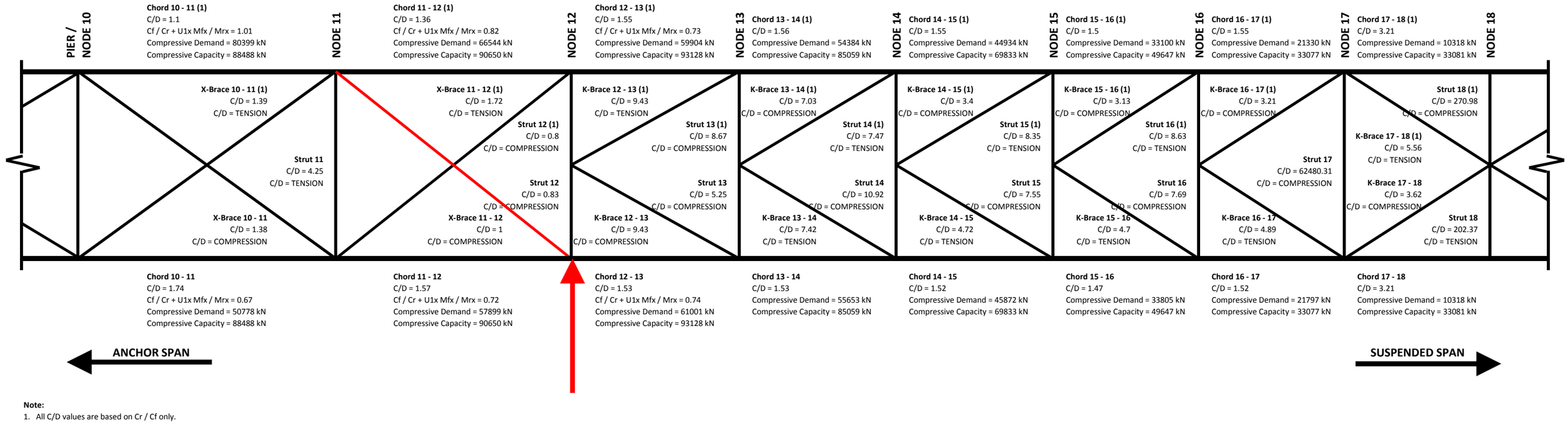
Note:

1. All C/D values are based on Cr / Cf only.
2. Combined axial compression and bending ratios are only listed for bottom chord members in between Nodes 10 to 13 where axial compression loads due to a mast collision force are highest. In-plane bending demands are based on the self-weight of bottom chords.

Appendix B – IWMB Truss Bottom Chord C/D Status

Axial Capacity / Demand Ratio Diagram for Cantilever Bottom Truss Elements

Truss End	North	**Load Case**	Node 12	**Critical Component**	X-Brace



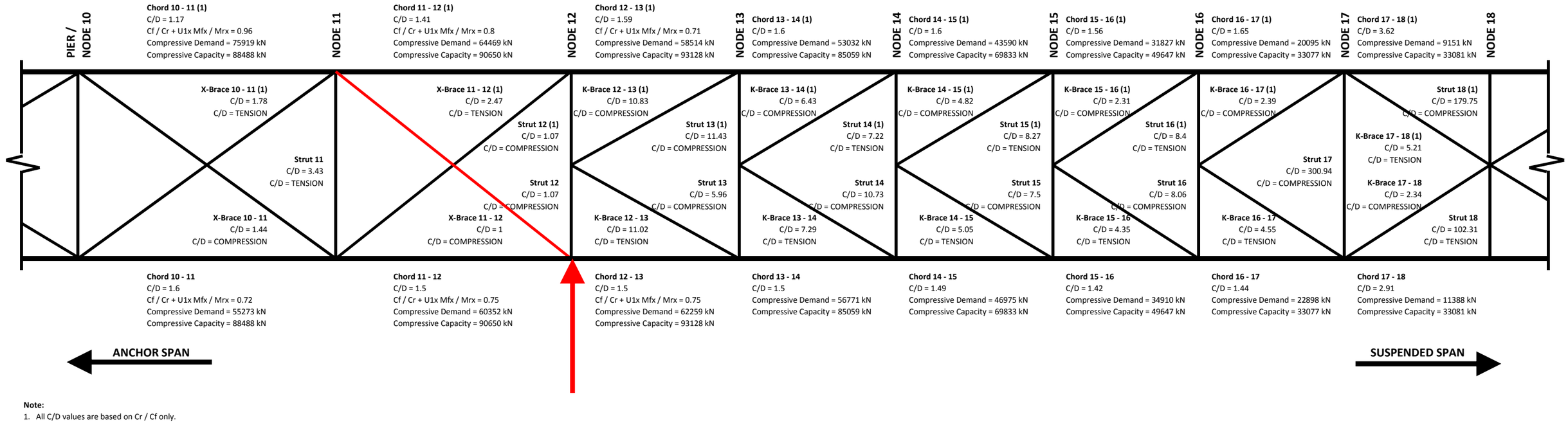
Note:

1. All C/D values are based on Cr / Cf only.
2. Combined axial compression and bending ratios are only listed for bottom chord members in between Nodes 10 to 13 where axial compression loads due to a mast collision force are highest. In-plane bending demands are based on the self-weight of bottom chords.

Appendix B – IWMB Truss Bottom Chord C/D Status

Axial Capacity / Demand Ratio Diagram for Cantilever Bottom Truss Elements

Truss End	South	**Load Case**	Node 12	**Critical Component**	X-Brace



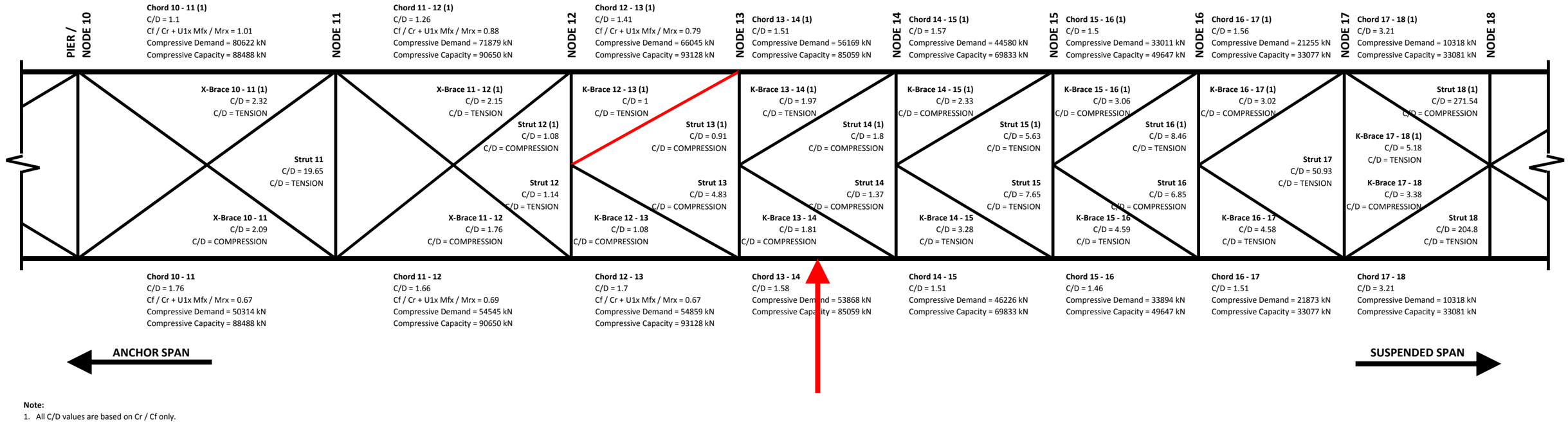
Note:

1. All C/D values are based on Cr / Cf only.
2. Combined axial compression and bending ratios are only listed for bottom chord members in between Nodes 10 to 13 where axial compression loads due to a mast collision force are highest. In-plane bending demands are based on the self-weight of bottom chords.

Appendix B – IWMB Truss Bottom Chord C/D Status

Axial Capacity / Demand Ratio Diagram for Cantilever Bottom Truss Elements

Truss End	North	**Load Case**	Mid Node 13 - 14	**Critical Component**	K-Brace



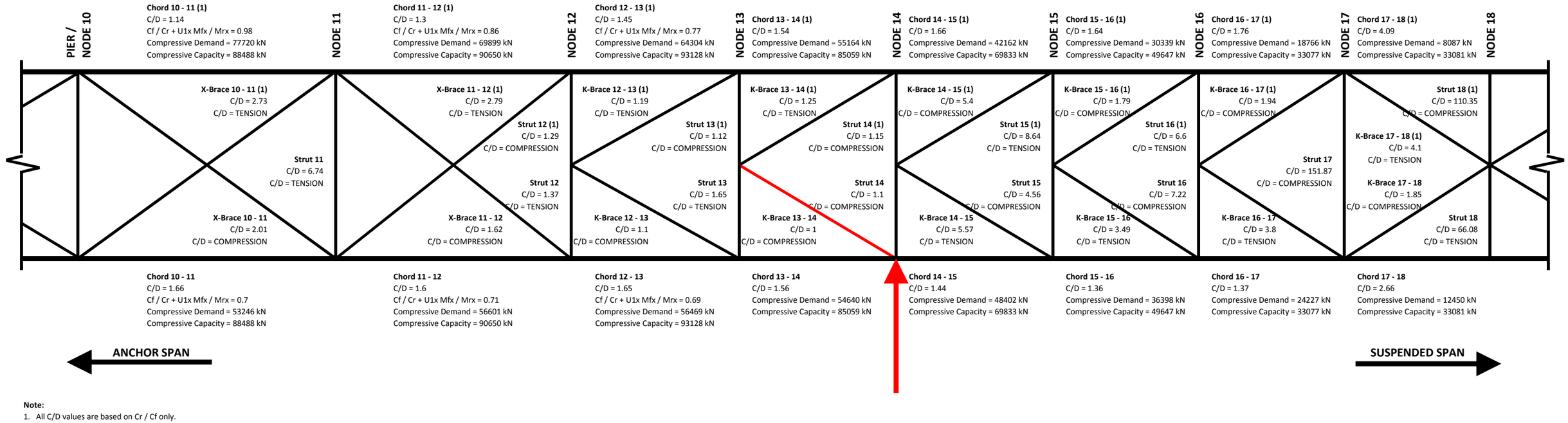
Note:

1. All C/D values are based on Cr / Cf only.
2. Combined axial compression and bending ratios are only listed for bottom chord members in between Nodes 10 to 13 where axial compression loads due to a mast collision force are highest. In-plane bending demands are based on the self-weight of bottom chords.

Appendix B – IWMB Truss Bottom Chord C/D Status

Axial Capacity / Demand Ratio Diagram for Cantilever Bottom Truss Elements

Truss End	South	**Load Case**	Node 14	**Critical Component**	K-Brace



Note:

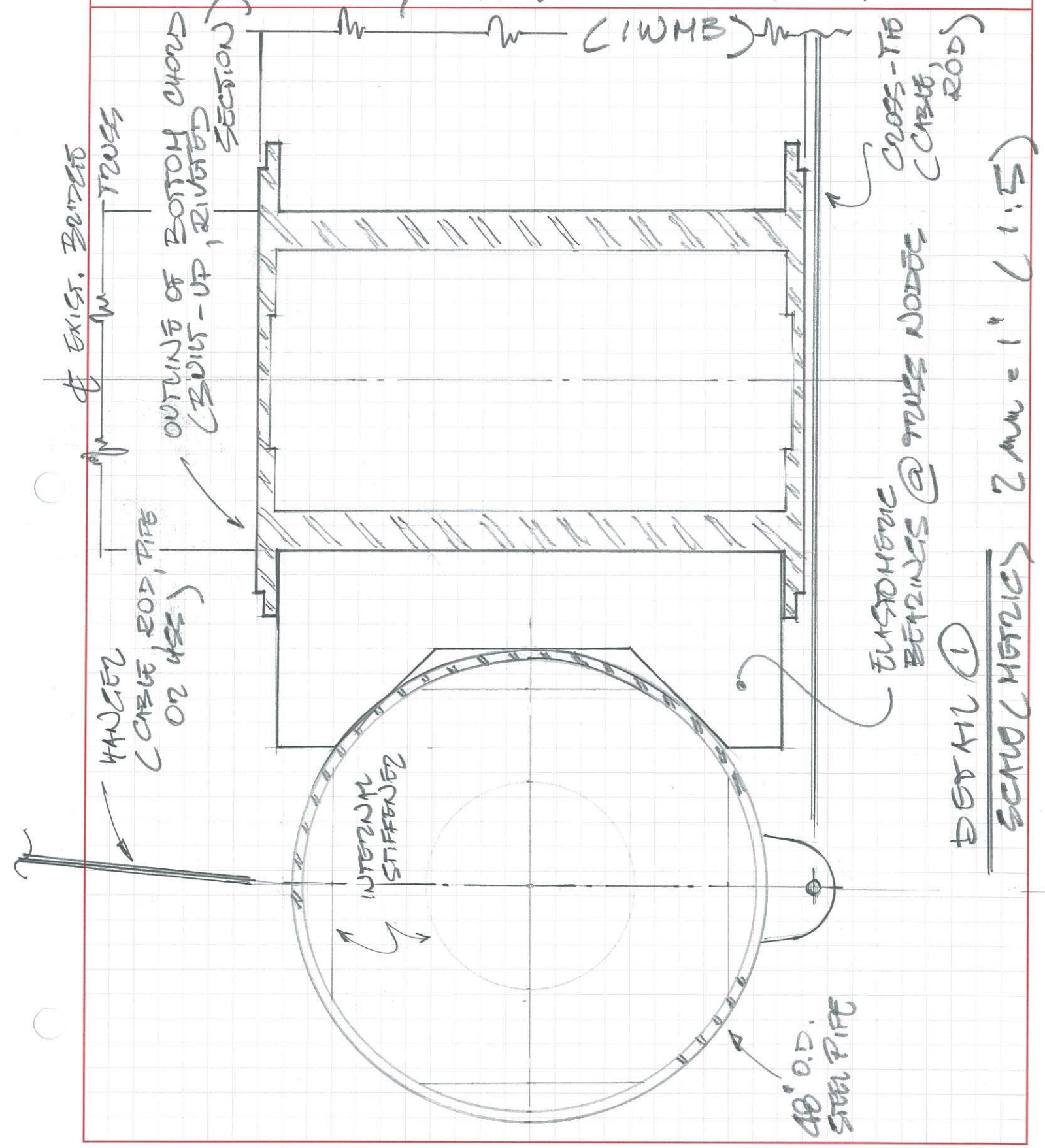
1. All C/D values are based on Cr / Cf only.
2. Combined axial compression and bending ratios are only listed for bottom chord members in between Nodes 10 to 13 where axial compression loads due to a mast collision force are highest. In-plane bending demands are based on the self-weight of bottom chords.

APPENDIX C – BOTTOM CHORD BARRIER CONCEPT SKETCHES

WSP | MMM GROUP

Project No. :	File :
By : JAN KOCABA	Date : JULY 26TH/17
Checked by :	Page : ____ of ____

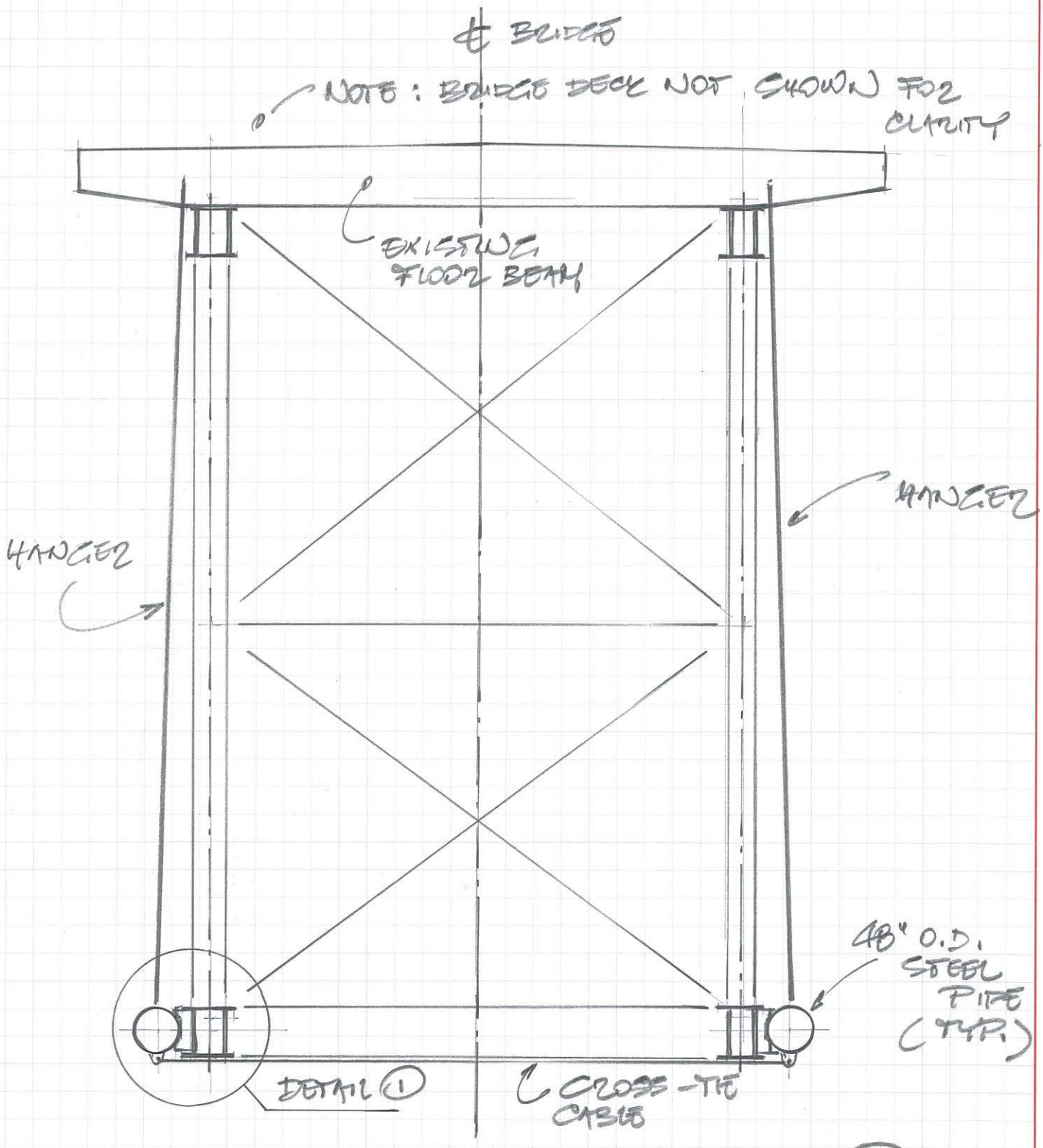
Subject : BRIDGE / VESSEL COLLISION STUDY



WSP | MMM GROUP

Project No. :	File :
By : JAN KOCABA	Date : JULY 26TH/17
Checked by :	Page : ____ of ____

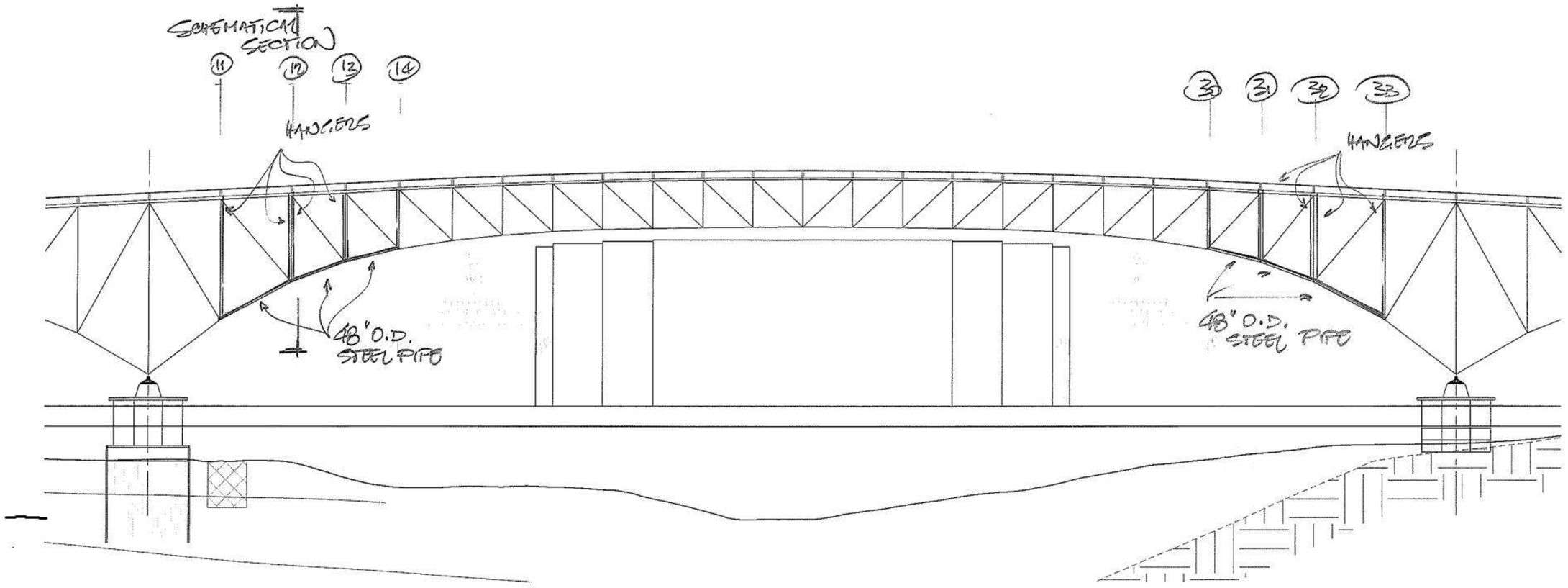
Subject : BRIDGE/VESSEL COLLISION STUDY (IWHB)



SCHEMATICAL SECTION AT NODE (12)

SCALE (METRIC) 2 mm = 1'-0" (1 : 50)

Metric - 5mm Grid



SCHEMATICAL LAYOUT - MAST/TUNNEL PROTECTION STUDY

N.T.S.

JULY 26TH, 2017

APPENDIX

E

RISK ANALYSIS FOR VESSEL COLLISION MITIGATION

DOCUMENT HISTORY

Date	Rev	Prepared by:	Checked by:	Description
2017-09-15	0	Mike Knott (M&N)	Keith Holmes, Jason Chen (MMM)	First Draft
2017-09-29	1	Mike Knott (M&N)	Keith Holmes (MMM)	Final
2018-02-21	2	Keith Holmes (MMM)	Mike Knott (M&N)	Minor Updates to Match Final Report

1. BACKGROUND AND PURPOSE

A vessel collision risk assessment was completed for 01459 Ironworkers Memorial Bridge (IWMB) (**1**) in accordance with the requirements and procedures of the Canadian Highway Bridge Design Code (the Code) (**2**), supplemented by the American Association of State Highway and Transportation Officials Standards (**3**) (**4**). A Method II probability-based risk analysis was completed for estimating the annual frequency of collapse (AFC) due to an aberrant ship. The IWMB was classified as a Class I bridge of critical importance that must remain open to all traffic after a vessel collision. For this class, the maximum AFC for the entire bridge is 0.0001, which is a return period of 1 in 10,000 years.

For the risk analysis (**1**), the estimated AFC for the Base Case (Present Day Vessel Traffic) condition is 1 in 1,282 years, not meeting the AFC requirement for a Class I bridge. The estimated AFC for the Base Case (Future Vessel Traffic) condition is 1 in 740 years, also not meeting the AFC requirement for a Class I Bridge. In addition to the base case, the analysis considered a variety of sensitivity runs including variations in the (a) estimated growth rates for vessel traffic; (b) probability of vessel aberrancy accident base rate; (c) tethered tug safety factor; (d) protection provided by the rail bridge (with and without protection); and (e) increasing the steel truss bottom chord (span) resistance strength.

Physical protection measures are being considered to reduce the AFC of the existing (unprotected) bridge to meet the Class I bridge requirements. The purpose of this report is to provide the results of the risk analysis conducted to evaluate the effectiveness of several physical mitigation alternatives in reducing the risk to acceptable levels.

2. MITIGATION ALTERNATIVES

Both operational and physical protection alternatives were considered in the IWMB vessel collision study. However, significant vessel operational requirements and movement restrictions have been previously implemented for the Second Narrows waterway (the Traffic Control Zone 2 or “TCZ-2”); therefore, additional operational restrictions were not considered practical or cost-effective. As discussed in (**1**), the existing TCZ-2 operational requirements have made a significant reduction in the vessel collision risk since their implementation in the early 1980s.

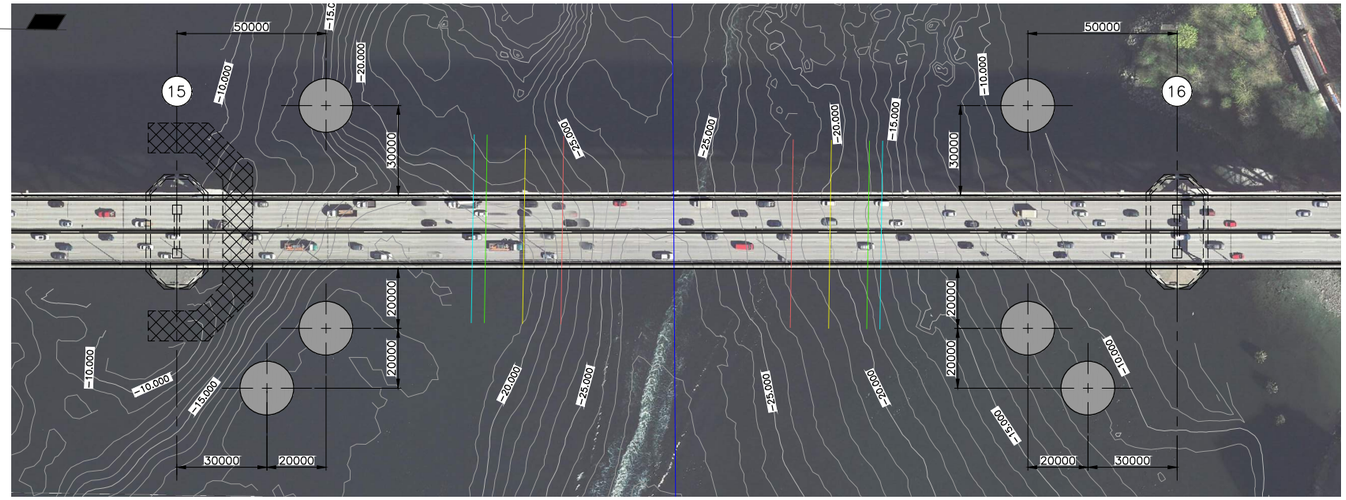
Physical protection alternatives need to be efficient, cost-effective, and minimize potential adverse impacts to the waterway environment, including currents. Protection islands surrounding bridge piers are considered the most effective physical solution for complete protection due to aberrant ships; however, because of their relatively large size they can block water flows in the waterway and sometimes cause significant increases in currents. In addition, the large underwater footprint of islands can potentially cause adverse impacts to existing environmental habitat. For the IWMB, the size of such islands would need to extend from around the bridge piers to include portions of the main span near the navigation channel in order to prevent mast and deckhouse collisions with the lower chord of the steel arch main span truss. As its name implies, the Second Narrows waterway is relatively narrow with relatively high maximum currents, so the use of large protective islands would block a significant portion of the waterway causing unacceptable impacts to currents and marine navigation as well as the marine environment. As a result, island alternatives are considered impractical for the IWMB location.

As discussed in (**1**), the two types of physical mitigation alternatives considered most suitable for IWMB are (a) the use of large diameter dolphins; and (b) potential strengthening of the structural resistance of the lower chord of the steel arch truss; or (c) a combination of both alternatives. The dolphins would be approximately 18m in diameter and were sized to resist the impact forces of the design vessels established in (**1**). The vessel collision assessment (**1**) found that the greatest risk for IWMB collapse is due to mast and deckhouse impacts on the bottom chord of the steel arch truss from inbound ballasted ships. The risks associated with loaded outbound vessels and impacts to the bridge piers exist, but are lower risks than for inbound vessel impacts on portions of the main span (**Figure 1**).

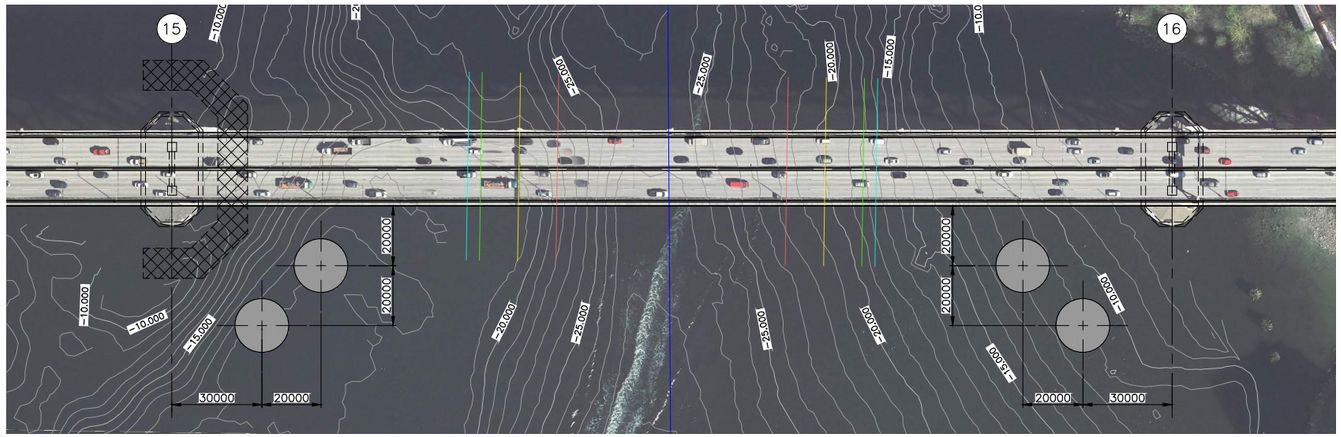
The number and placement of dolphins for an effective protection system is a balance of competing goals, including, (a) the system must reduce the AFC to the desired Class I level; (b) dolphins are relatively expensive, so the number required should be minimized to reduce overall project cost; (c) dolphins should be located as far from the navigation channel as possible to minimize potential impacts on shipping, but also must be close enough to the channel to minimize potential mast impacts with the bottom chord of the steel arch truss; (d) the number of dolphins should be minimized to reduce potential adverse impacts to currents and the ship transit windows through the Second Narrows; and (e) the number of dolphins should be minimized to reduce potential environmental impacts.

Based on the above, three alternative dolphin configurations were developed for the mitigation risk analysis as shown in the Dolphin Configurations drawing (**overleaf**). Dolphin Configuration 1 consists of six dolphins, two each on the inbound side of the North Main Pier (#15) and the South Main Pier (#16), and a single dolphin on the outbound side of each main pier. Dolphin Configuration 2 consists of 4 dolphins, two each on the inbound side of the North Main Pier (#15) and the South Main Pier (#16), and no dolphins on the outbound side. Dolphin Configuration 3 consists of two dolphins, one each on the inbound side of the North Main Pier (#15) and the South Main Pier (#16), and no dolphins on the outbound side.

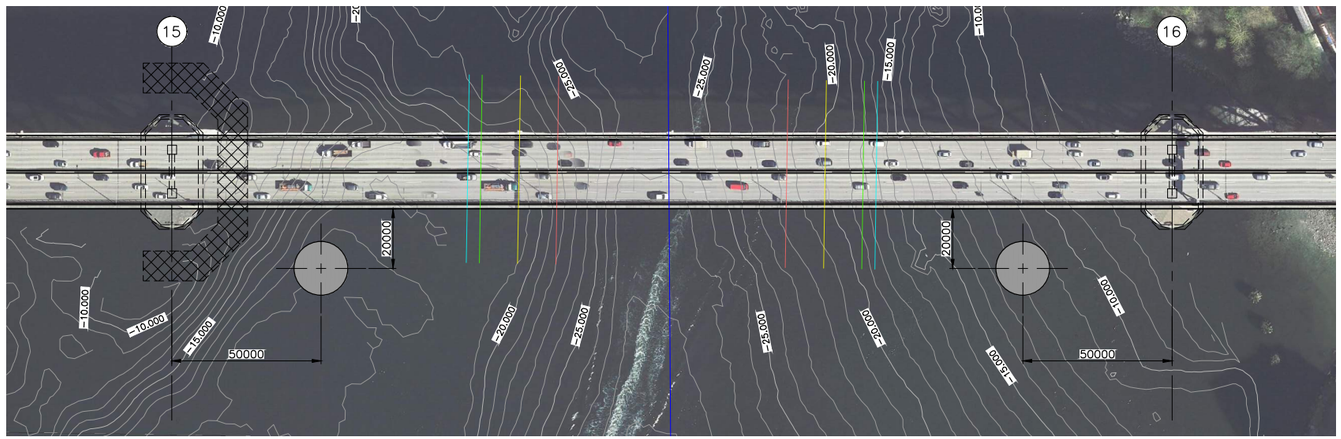
It should be noted that dolphin protection is very directional and dependent on the size (diameter) and location of the dolphins with respect to the bridge structure and vessel transit path. Unlike islands that protect from every direction, dolphins protect only from certain directions where aberrant vessels are blocked or re-directed away from a bridge component due to the dolphin location.



DOLPHIN CONFIGURATION #1
SCALE: 1:1000



DOLPHIN CONFIGURATION #2
SCALE: 1:1000



DOLPHIN CONFIGURATION #3
SCALE: 1:1000

NOTES:

1. ALL ELEVATIONS ARE IN METERS AND REFERENCED TO CHART DATUM.

MMM GROUP

Rev	Date	Description	Init
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.

REVISIONS

BRITISH COLUMBIA | Ministry of Transportation & Infrastructure
South Coast Region

01459 IRONWORKER'S MEMORIAL BRIDGE
VESSEL COLLISION RISK MITIGATION STUDY
DOLPHIN CONFIGURATIONS

PREPARED UNDER THE DIRECTION OF

KEITH HOLMES
ENGINEER OF RECORD
DATE

DESIGNED KH DATE JULY, 2017
CHECKED JJ DATE JULY, 2017
DRAWN SH DATE JULY, 2017
SCALE AS SHOWN
NEGATIVE No.

FILE No.	PROJECT No.	REG.	DRAWING No.
	83118	.	01459–A002

CANCEL PRINTS BEARING PREVIOUS LETTER

11-308-11-(07-08)

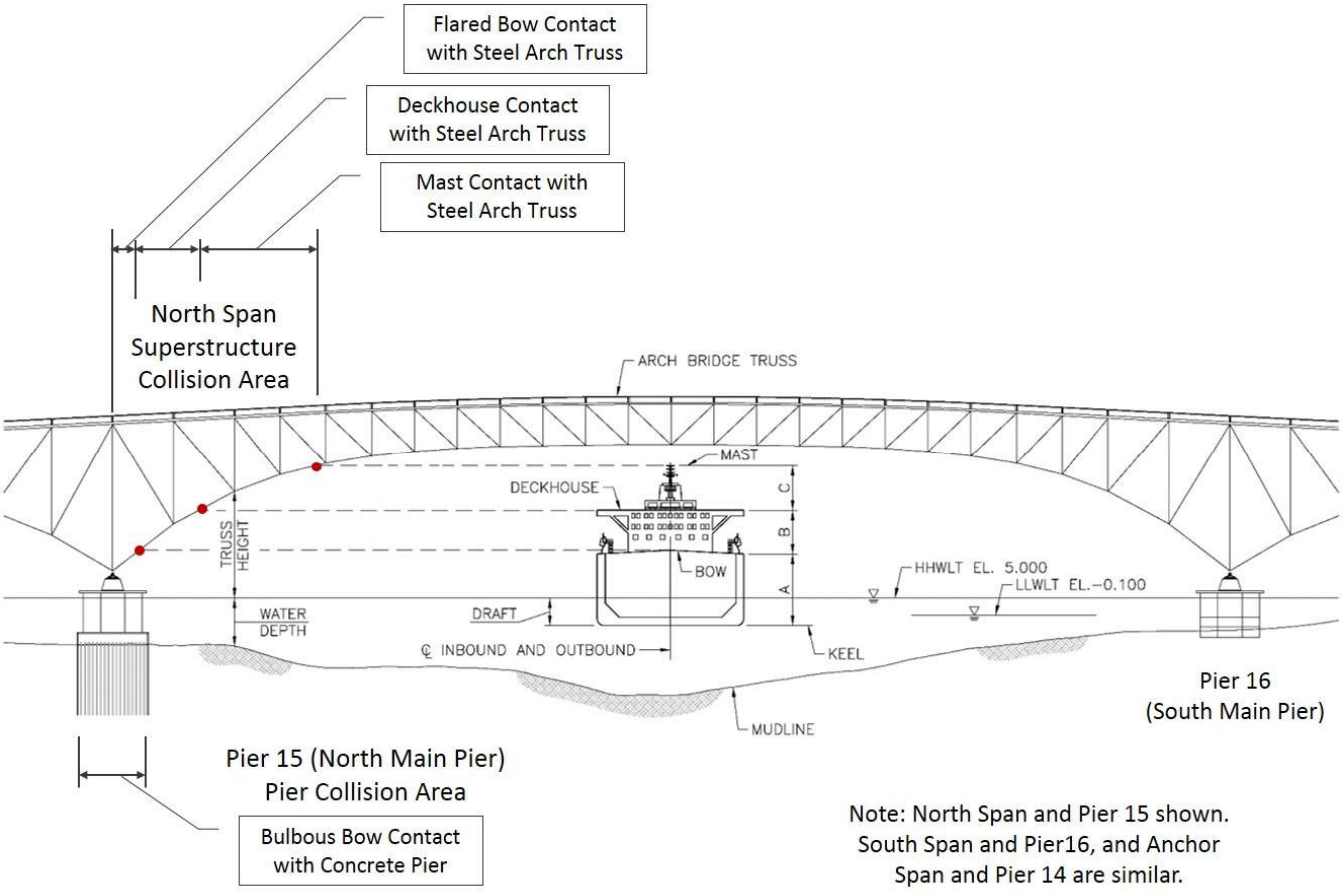


Figure 1: Superstructure (Span) Collision Geometry

3. RISK ASSESSMENT METHODOLOGY

A vessel collision risk assessment was conducted for the three dolphin configurations using the same Method II risk analysis methodology discussed in detail in (**1**). For purposes of the mitigation risk analysis, the annual frequency of collapse (AFC) results for the existing bridge from (**1**) Base Case (Future Vessel Traffic) were compared to the AFC values computed for the bridge with protection alternatives in-place.

The effect of the dolphin alternatives was evaluated by adjusting the various protection factors (PF) and geometric probabilities (PG) in the original base case vessel collision risk model (**1**). The base case model has two analysis sections or modules, one for estimating bridge collapse due to a vessel collision from a ship bow hitting a pier (substructure), and a second module for estimating bridge collapse due to a ship mast, deckhouse, or top of bow hitting the bottom chord of the steel arch span (superstructure).

Protection of the bridge piers by dolphins was modeled by reducing the base case PF values using the methodology in (**4**) and is illustrated schematically in **Figure 2**. The direction of aberrant vessels that could strike the pier was assumed to be normally distributed around the vessel transit path at each pier location. The location and diameter of the dolphins with respect to the bridge piers and one-half of the ship width was used

to develop a "protection zone or area" that was then used to estimate the reduction in PF. The evaluation was conducted for each vessel transit path leg of the risk analysis model, for each pier, for each of the four water levels, and for each vessel category in the design fleet.

Protection of the bridge spans by dolphins was modeled by reducing the base case PG values and is illustrated schematically in **Figure 3**. The direction of aberrant vessels that could strike the span (mast/deckhouse/top of bow impacts) was assumed to be transiting parallel to the vessel transit path and was normally distributed around the centerline of the vessel transit path in accordance with PG requirements in (**2**). The location and diameter of the dolphins with respect to the bridge spans and one-half of the ship width was used to develop a "protection zone or area" that was then used to estimate the reduction in PG. The evaluation was conducted for each transit path leg of the risk analysis model, for each span component, for each of the four water levels, and for each vessel category in the design fleet. The analysis also included refinement of the span components into those components that could be hit by mast collision, deckhouse collision, or top of bow collision. The dolphin protection and the type and location of span impacts varied depending on the vessel category (ship size and loading condition), water level, transit path leg, and dolphin configuration.

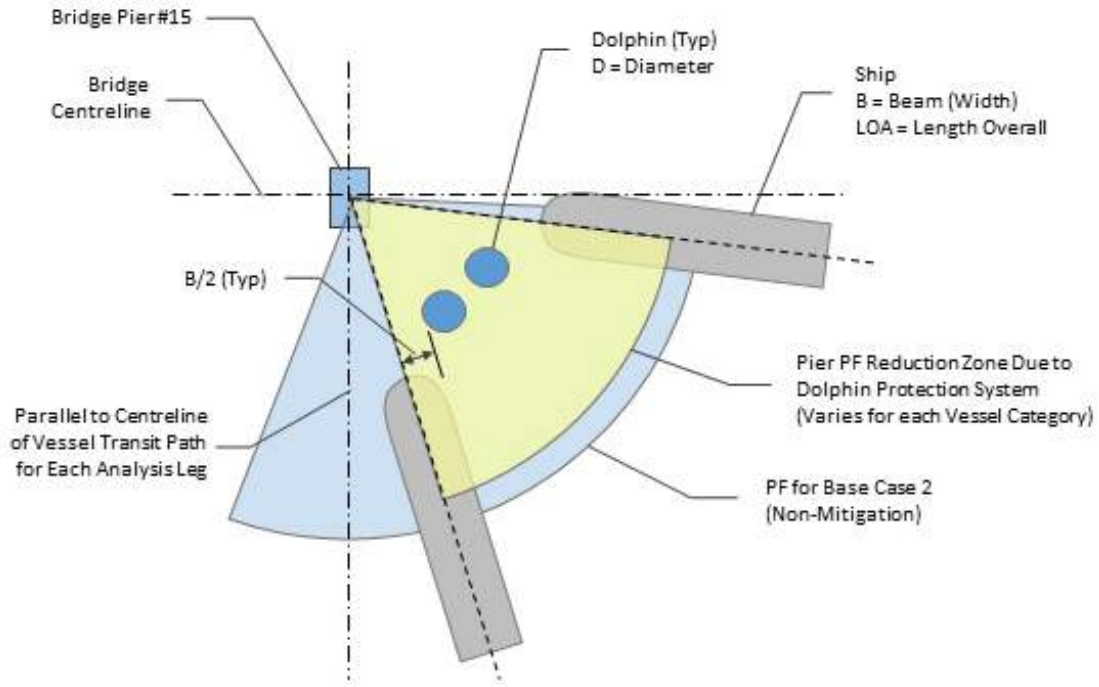
4. RISK ASSESSMENT RESULTS

Based on the risk analysis conducted for the mitigation alternatives, Dolphin Configuration 1 (without any increase in span resistance strength) would reduce the risk of collision and increase the AFC return period from 740 to 10,794 years. This would meet the Class I AFC criteria of 1 in 10,000 years. Dolphin Configuration 2 would increase the AFC return period from 740 to 5,914 years. Dolphin Configuration 3 would increase the AFC return period from 740 to 1,928 years. Both Configurations 2 and 3 are less than the Class I criteria.

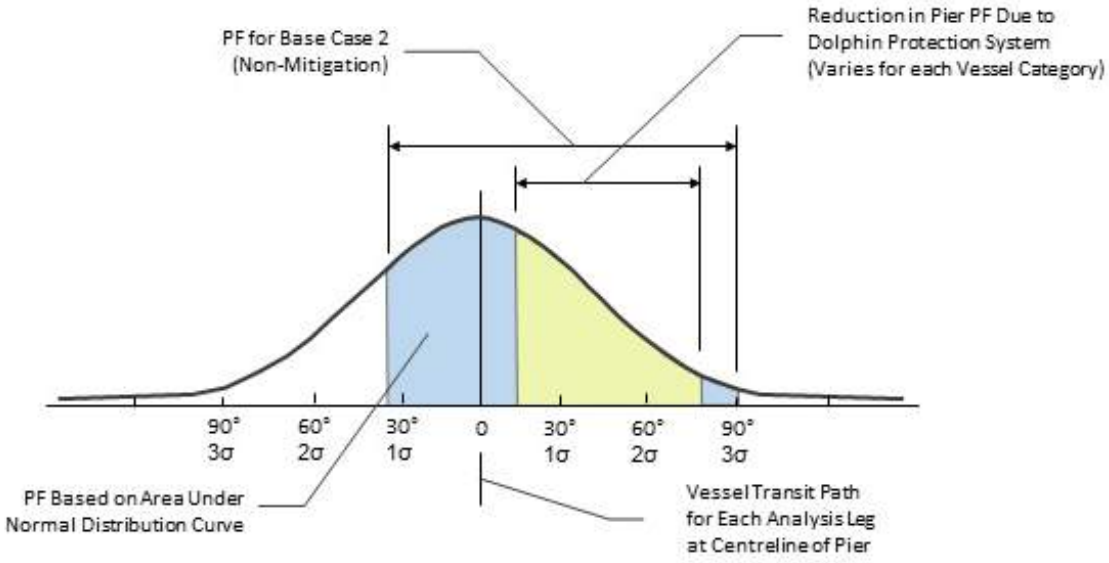
If the dolphins were installed in combination with an increase in span resistance strength from zero to H = 1.0 MN, than Dolphin Configurations 1 and 2 increase the AFC return period to 40,536 and 39,706 years respectively – both significantly exceeding the Class I bridge criteria. However, Dolphin Configuration 3 with span H = 1.0 MN only increases the AFC return period from 740 to 6,645 years (800% decrease in risk) – which is below the Class I criteria.

5. REFERENCES

1. 01459 Ironworkers Memorial Bridge, Vessel Collision Risk Assessment & Mitigation, Final Report by MMM Group Ltd., March 2018.
2. Canadian Highway Bridge Design Code, CHBDC, CAN/CSA-S6-14 with Supplement No. 1 (S6S1-10), Canada Standards Association, Toronto, 2014.
3. LFRD Bridge Design Specifications, 7th Edition. American Association of State Highway and Transportation Officials (AASHTO), Washington, DC, 2014.
4. Guide Specification and Commentary for Vessel Collision Design of Highway Bridges, 2nd Edition, with 2010 Interim Revisions. American Association of State Highway and Transportation Officials (AASHTO), Washington, DC, 2009.



North Main Pier (#15) Inbound Dolphin Protection Plan



Normal Distribution of Vessel Collision Trajectories around Bridge Pier (σ = 30°)

Figure 2: Pier Collision PF Adjustment for Dolphin Protection

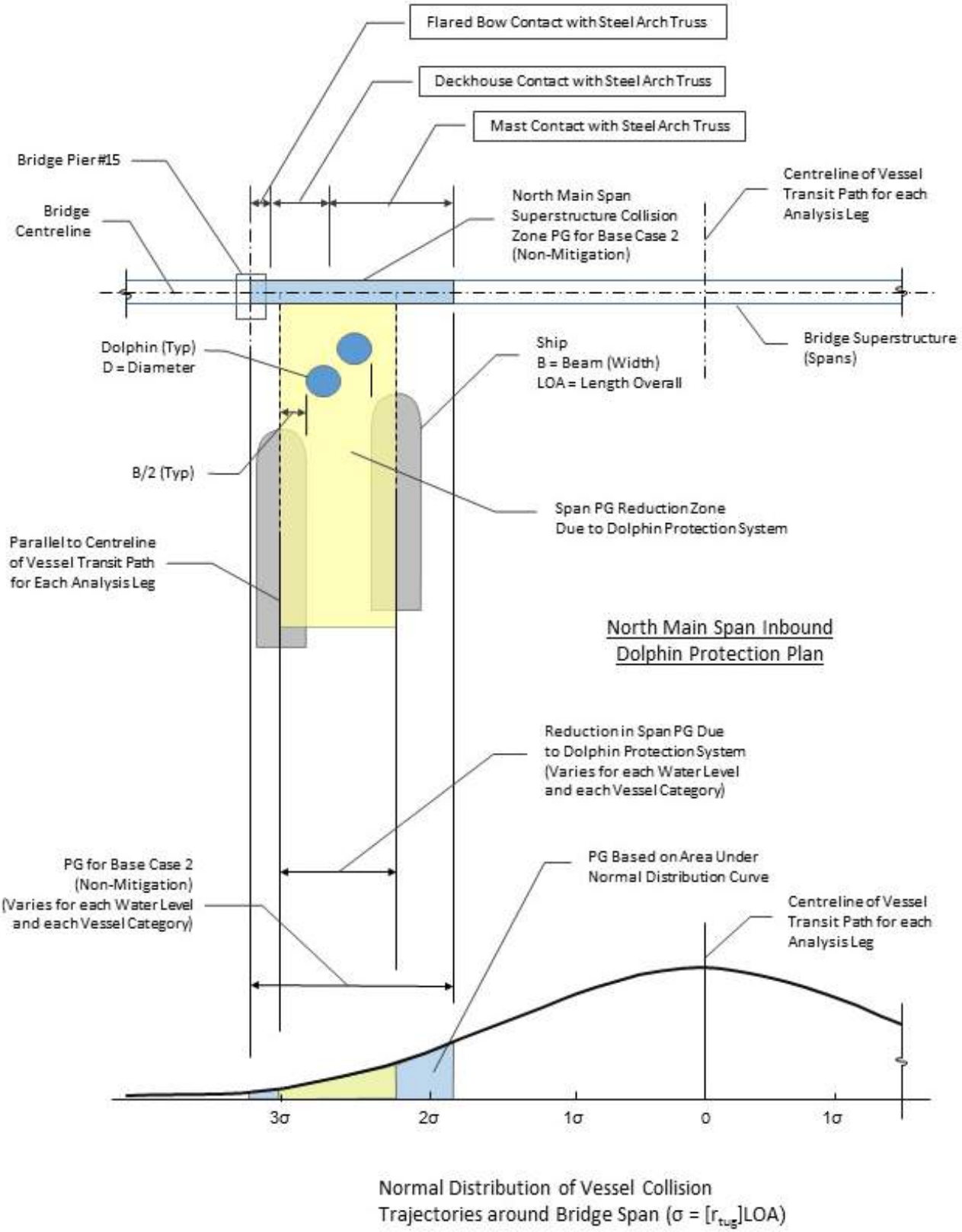


Figure 3: Span Collision PG Adjustment for Dolphin Protection

APPENDIX

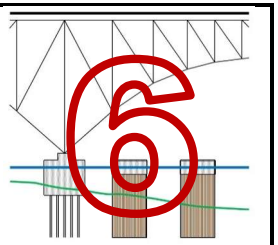
F

COST ESTIMATE TABULATION

01459 Ironworkers Memorial Bridge

Vessel Collision Risk Migitation Measures

Preliminary Cost Estimate



OPTION 1.1: DOLPHIN PROTECTION CONCEPT - 6 SHEET PILE CELLS

Item	Description	Unit	Quantity	Unit Price	Total	Notes
1	**Investigation, Engineering, Permitting, Engagement**					
1.1	Geotechnical Investigation: Sub-Bottom Profiling and Test Holes	LS	1	$500,000	$500,000	2% of Estimated Capital Costs
1.2	Detailed Analytical Confirmation, Design, Contract Documents (geotech, structural, hydrotechnical)	LS	1	$800,000	$800,000	2% of Estimated Capital Costs
1.3	Environmental Permitting	LS	1	$500,000	$500,000	2% of Estimated Capital Costs
	Sub-Total (Investigation, Engineering, Permitting, Engagement):				**$1,800,000**	
2	**Physical Mitigation Measures (Estimated Capital Costs)**					
2.1	Mobilization, Survey Control, Overhead Support	LS	1	$2,500,000	$2,500,000	8% of Estimated Capital Costs
2.2	20m Diameter, 35m Long Sheet Pile Cell (Supply, Transport, Install)	Each Dolphin	6	$1,800,000	$10,800,000	Assumes 15m embedment and 20m projection (the case for north side dolphins). South side dolphins will be shorter but have tensioned vertical anchors. In absence of design info, these costs are considered roughly equivalent.
2.3	Stone Fill (Supply, Transport, Place)	tonne	99,667	$40	$3,986,681	
2.4	Bulk Concrete Fill (Supply, Transport, Place)	m^3	4,954	$2,500	$12,384,158	
2.5	Local Dredging	m^3	7,125	$30	$213,754	
2.6	Scour Protection (Supply, Transport, Place)	m^3	7,125	$250	$1,781,283	Quarry Rock Riprap,1200 minus
2.7	Timber Fender	Each Dolphin	6	$50,000	$300,000	
2.8	Navigation Beacon	Each Dolphin	6	$25,000	$150,000	
	Sub-Total (All Construction Works):				**$32,115,876**	$5,400,000 per Dolphin
3	**Other Costs During Construction**					
3.1	Environmental Mitigation and Compensation	LS	1	$1,000,000	$1,000,000	3% of Estimated Capital Costs
3.2	Engineering and Contract Administration Services during Construction	months	36	$45,000	$1,620,000	5% of Estimated Capital Costs
	Sub-Total (All Construction Works):				**$2,620,000**	
4	**Total**					
	Sub-Total (All Construction Works, Engineering, Approvals)				**$36,535,876**	$6,100,000 per Dolphin
	Contingency:			50%	$18,267,938	
	Total:				**$54,900,000**	$9,200,000 per Dolphin

File Last Saved: 24-Feb-2018

Sheet Printed (Today): 24-Feb-2018

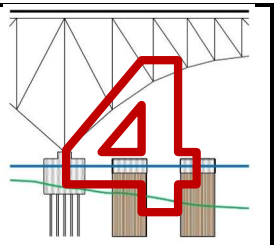
MMM GROUP

Prepared by KH / WS / SC

01459 Ironworkers Memorial Bridge

Vessel Collision Risk Migitation Measures

Preliminary Cost Estimate



OPTION 1.2: DOLPHIN PROTECTION CONCEPT - 4 SHEET PILE CELLS

Item	Description	Unit	Quantity	Unit Price	Total	Notes
1	**Investigation, Engineering, Permitting, Engagement**					
1.1	Geotechnical Investigation: Sub-Bottom Profiling and Test Holes	LS	1	**$300,000**	$300,000	1% of Estimated Capital Costs
1.2	Detailed Analytical Confirmation, Design, Contract Documents (geotech, structural, hydrotechnical)	LS	1	**$500,000**	$500,000	2% of Estimated Capital Costs
1.3	Environmental Permitting	LS	1	$500,000	$500,000	2% of Estimated Capital Costs
	Sub-Total (Investigation, Engineering, Permitting, Engagement):				**$1,300,000**	
2	**Physical Mitigation Measures (Estimated Capital Costs)**					
2.1	Mobilization, Survey Control, Overhead Support	LS	1	**$2,000,000**	$2,000,000	9% of Estimated Capital Costs
2.2	20m Diameter, 35m Long Sheet Pile Cell (Supply, Transport, Install)	Each Dolphin	4	$1,800,000	$7,200,000	Assumes 15m embedment and 20m projection (the case for north side dolphins). South side dolphins will be shorter but have tensioned vertical anchors. In absence of design info, these costs are considered roughly equivalent.
2.3	Stone Fill (Supply, Transport, Place)	tonne	66,445	$40	$2,657,787	
2.4	Bulk Concrete Fill (Supply, Transport, Place)	m^3	3,302	$2,500	$8,256,105	
2.5	Local Dredging	m^3	4,750	$30	$142,503	
2.6	Scour Protection (Supply, Transport, Place)	m^3	4,750	$250	$1,187,522	Quarry Rock Riprap,1200 minus
2.7	Timber Fender	Each Dolphin	4	$50,000	$200,000	
2.8	Navigation Beacon	Each Dolphin	4	$25,000	$100,000	
	Sub-Total (All Construction Works):				**$21,743,918**	$5,400,000 per Dolphin
3	**Other Costs During Construction**					
3.1	Environmental Mitigation and Compensation	LS	1	**$750,000**	$750,000	3% of Estimated Capital Costs
3.2	Engineering and Contract Administration Services during Construction	months	**30**	$45,000	$1,350,000	6% of Estimated Capital Costs
	Sub-Total (All Construction Works):				**$2,100,000**	
4	**Total**					
	Sub-Total (All Construction Works, Engineering, Approvals)				**$25,143,918**	$6,300,000 per Dolphin
	Contingency:			**50%**	$12,571,959	
	Total:				**$37,800,000**	$9,500,000 per Dolphin

File Last Saved: 24-Feb-2018

Sheet Printed (Today): 24-Feb-2018

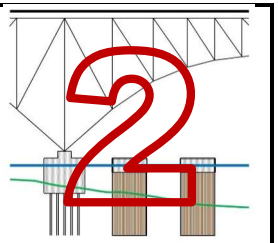
MMM GROUP

Prepared by KH / WS / SC

01459 Ironworkers Memorial Bridge

Vessel Collision Risk Migitation Measures

Preliminary Cost Estimate



OPTION 1.3: DOLPHIN PROTECTION CONCEPT - 2 SHEET PILE CELLS

Item	Description	Unit	Quantity	Unit Price	Total	Notes
1	**Investigation, Engineering, Permitting, Engagement**					
1.1	Geotechnical Investigation: Sub-Bottom Profiling and Test Holes	LS	1	**$300,000**	$300,000	3% of Estimated Capital Costs
1.2	Detailed Analytical Confirmation, Design, Contract Documents (geotech, structural, hydrotechnical)	LS	1	**$500,000**	$500,000	4% of Estimated Capital Costs
1.3	Environmental Permitting	LS	1	$500,000	$500,000	4% of Estimated Capital Costs
	Sub-Total (Investigation, Engineering, Permitting, Engagement):				**$1,300,000**	
2	**Physical Mitigation Measures (Estimated Capital Costs)**					
2.1	Mobilization, Survey Control, Overhead Support	LS	1	**$2,000,000**	$2,000,000	17% of Estimated Capital Costs
2.2	20m Diameter, 35m Long Sheet Pile Cell (Supply, Transport, Install)	Each Dolphin	2	$1,800,000	$3,600,000	Assumes 15m embedment and 20m projection (the case for north side dolphins). South side dolphins will be shorter but have tensioned vertical anchors. In absence of design info, these costs are considered roughly equivalent.
2.3	Stone Fill (Supply, Transport, Place)	tonne	33,222	$40	$1,328,894	
2.4	Bulk Concrete Fill (Supply, Transport, Place)	m^3	1,651	$2,500	$4,128,053	
2.5	Local Dredging	m^3	2,375	$30	$71,251	
2.6	Scour Protection (Supply, Transport, Place)	m^3	2,375	$250	$593,761	Quarry Rock Riprap,1200 minus
2.7	Timber Fender	Each Dolphin	2	$50,000	$100,000	
2.8	Navigation Beacon	Each Dolphin	2	$25,000	$50,000	
	Sub-Total (All Construction Works):				**$11,871,959**	$5,900,000 per Dolphin
3	**Other Costs During Construction**					
3.1	Environmental Mitigation and Compensation	LS	1	**$500,000**	$500,000	4% of Estimated Capital Costs
3.2	Engineering and Contract Administration Services during Construction	months	**24**	$45,000	$1,080,000	9% of Estimated Capital Costs
	Sub-Total (All Construction Works):				**$1,580,000**	
4	**Total**					
	Sub-Total (All Construction Works, Engineering, Approvals)				**$14,751,959**	$7,400,000 per Dolphin
	Contingency:			**50%**	$7,375,979	
	Total:				**$22,200,000**	$11,100,000 per Dolphin

File Last Saved: 24-Feb-2018

Sheet Printed (Today): 24-Feb-2018

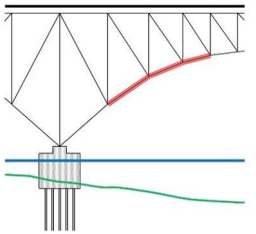
MMM GROUP

Prepared by KH / WS / SC

01459 Ironworkers Memorial Bridge

Vessel Collision Risk Migitation Measures

Preliminary Cost Estimate



OPTION 2: TRUSS FENDER CONCEPT

Item	Description	Unit	Quantity	Unit Price	Total	Notes
1	**Investigation, Engineering, Permitting, Engagement**					
1.1	Geotechnical Investigation: Sub-Bottom Profiling and Test Holes	-	-	-	-	
1.2	Detailed Analytical Confirmation, Design, Contract Documents (structural)	LS	1	$300,000	$300,000	22% of Estimated Capital Costs
1.3	Environmental Permitting	-	-	-	-	
	Sub-Total (Investigation, Engineering, Permitting, Engagement):				**$300,000**	
2	**Physical Mitigation Measures (Estimated Capital Costs)**					
2.1	Mobilization, Survey Control, Overhead Support	LS	1	$200,000	$200,000	15% of Estimated Capital Costs
2.2	Coated Steel Pipe (Supply, Transport)	m	220	$2,000	$440,000	
2.3	Miscellaeous Components (Gussets, Bearings)	%	50%	-	$220,000	
2.4	Galvanized DWIDAG Bars and Hardware (Supply, Transport	m	840	$50	$42,000	
2.5	Marine Crane, Barge and Crew	days	20	$15,000	$300,000	5 days for each of the 4 quadrants
2.6	Erection Crew & Traveler Operator	days	36	$4,800	$172,800	5 man crew + traveler operator
	Sub-Total (All Construction Works):				**$1,374,800**	
3	**Other Costs During Construction**					
3.1	Environmental Mitigation and Compensation	-	-	-	-	
3.2	Engineering and Contract Administration Services during Construction	months	6	$45,000	$270,000	20% of Estimated Capital Costs
	Sub-Total (All Construction Works):				**$270,000**	
4	**Total**					
	Sub-Total (All Construction Works, Engineering, Approvals)				**$1,944,800**	
	Contingency:			**50%**	$972,400	
	Total:				**$3,000,000**	

File Last Saved: 24-Feb-2018

Sheet Printed (Today): 24-Feb-2018

MMM GROUP

Prepared by KH / WS / SC