

Sunshine Coast Fixed Link Planning Study



Prepared for
BC Ministry of Transportation and Infrastructure

BINNIE

205 - 4946 Canada Way
Burnaby, BC V5G 4H7

The Sunshine Coast is located northwest of B.C.'s Lower Mainland on the eastern shore of the Strait of Georgia. It covers an area of approximately 180 kilometres from Gibsons to Lund, with a population base of approximately 49,000. Primary population centres include Powell River, Sechelt and Gibsons.

The Sunshine Coast is accessible only by BC Ferries, water taxi, commercial and charter air service (float/airplane), and private boat or plane. The area is divided into two separate land segments. Highway 101 runs north-south, connecting these two segments via the Earls Cove - Saltery Bay ferry (Route 7) and to the Lower Mainland by the Horseshoe Bay - Langdale ferry (Route 3).

Sunshine Coast Residents and businesses regularly rely on BC Ferries for commuter trips and access to a range of services and facilities on the Lower Mainland, including health/medical services not available on the area, recreational activities, and other services and goods. Tourists and recreational property owners are also key ferry users. In recent years, immediate and long-term challenges facing the B.C. Coastal ferry system have led to service reductions for ferry users, with increased pressure during summer months.

About the Study

The Ministry of Transportation and Infrastructure (the Ministry) issued a Request for Proposals in November 2015 to undertake a study of the feasibility of constructing a fixed link between the Sunshine Coast and the Lower Mainland as an alternative to existing air and ferry services. In February 2016, the Ministry awarded a contract to R.F. Binnie & Associates Ltd.

The purpose of the study is to:

- Assess the costs and benefits of possible future overland connections and bridge crossings between the Sunshine Coast and the Lower Mainland;
- Identify the financial and physical feasibility of constructing a fixed link;
- Undertake a detailed analysis of potential future fixed link scenarios, providing the benefits and impacts of each of the scenarios considered, as compared with the current ferry service.

The study included technical analysis and community and stakeholder engagement. The objectives of the technical analysis are to:

- **Analyze the technical and financial feasibility** as well as the potential customer service, social, environmental, and economic costs and benefits of the various crossing alternatives that have been suggested in the past, along with potential new connection routes.
- **Evaluate the scenarios against the existing ferry service through a Multiple Account Evaluation (MAE)** in accordance with Ministry guidelines. The MAE uses qualitative and quantitative criteria to compare expected benefits and costs of the various scenarios against the existing ferry service (Base Case), and illustrates the trade-offs between the scenarios.
- **Build on the results of previous studies**, with a more comprehensive MAE and new information about potential route scenarios to support an informed discussion about the growing interest in a fixed link connection from the Sunshine Coast to the Lower Mainland.

The objective of the community and stakeholder engagement is to ensure that the technical analysis considers and is informed by the broader community goals, interests and concerns for this area of British Columbia. Engagement took place in three phases, including:

- **Background data collection**, including meetings and interviews with community leaders and subject matter experts to supplement desktop research and assist in developing the draft problem definition statement, potential alignment scenarios and preliminary evaluation criteria.
- **Technical workshops and public open houses** to finalize the project definition statement, confirm the shortlist of fixed link options to be considered, finalize the evaluation criteria and provide feedback on preliminary findings.
- **Ongoing community and First Nations engagement** to keep people informed, maintain open dialogue, follow up on issues identified, and to assist in better understanding non-technical interests that affect the feasibility of potential fixed link options.

Scenario Development

The Ministry's Request for Proposals (RFP) identified four potential fixed link connections, two of which focused on northern connections to Powell River area, and two that focussed on southern connections to the Gibsons/Sechelt area. Stakeholder and community outreach assisted in identifying alternative scenarios and variations, which was used to confirm and refine the four representative scenarios that were analyzed, as summarized in **Figure ES-1** and **Table ES-1**.



FIGURE ES-1: FIXED LINK SCENARIOS REVIEWED

TABLE ES-1: FIXED LINK SCENARIOS REVIEWED

Scenario	Key Features	Cost Estimate
Langdale Road Link	<ul style="list-style-type: none"> • New coastal roadway connecting Port Mellon to Highway 99 near Squamish; • Two-lane highway with passing lanes; • 58 km of extremely difficult new roadway construction (incl. allowance for rock stabilization and significant improvements to Depot Road); • Requires deep cut sections; • Approx. 40 structures for creek/gully crossings; • Replaces Route 3 (Horseshoe Bay – Langdale) ferry service. 	\$2.0 to \$2.5 billion
Langdale Bridge Link	<ul style="list-style-type: none"> • Connects Port Mellon to Highway 99 (near Brunswick Point) via Anvil Island; • Two separate two-lane clear span suspension bridges (incl. cyclist/pedestrian accommodation); • 22 km of new roadway construction (mostly extremely difficult conditions, incl. a new diamond interchange at Highway 99); • Includes a new 14 km roadway from McNab Creek to Port Mellon. • Replaces Route 3 (Horseshoe Bay – Langdale) ferry service. 	\$3.0 to \$3.5 billion
Powell River Road Link	<ul style="list-style-type: none"> • Connects Powell River to Highway 99 (north of Brackendale); • New inland route through mountainous terrain; • Two-lane highway with passing lanes; • 200 km of new roadway construction; • Includes five bridges over creeks and two tunnels (approx. 8.0 km near Mt. Casement and approx. 4.5 km at Mt. Alfred); • Retains both existing Routes 3 and 7 ferry services. 	\$4.5 to \$5.0 billion
Powell River Bridge Link	<ul style="list-style-type: none"> • Connects Earls Cove to Saltery Bay via Nelson Island; • Two separate two-lane clear span suspension bridges (incl. cyclist/pedestrian accommodation); • 19 km of new roadway construction • Replaces Route 7 (Earls Cove – Saltery Bay) ferry service. 	\$3.0 to \$3.5 billion

Ministry design criteria for Rural Arterial Undivided highway were applied for all four of the fixed link scenarios. Key assumptions for planning and costing purposes were:

- Two-lane main roadways, with passing lanes along steep sections;
- Posted speed of 80 km/h, with due consideration to navigational clearances, depths of channels and span lengths for bridge crossings.

Travel Demand Forecasting

The traffic demand forecasting included the review of a 'Base Case' outlook for future auto traffic volumes, assuming that no fixed link is built and that the BC Ferries' current Route 3 and 7 continue to operate. Forecasting for the Base Case assumed average annual traffic growths for Routes 3 and 7, reflecting historic long-run population trends as well as BC Stats' future population projections.

Preliminary vehicle traffic forecasts were developed for each of the four fixed link scenarios based on the following general methodology:

- Estimate overall per-trip costs for the current ferry system. These per-trip costs include: trip travel time (driving time, terminal waiting time, sailing time), vehicle operating costs, and ferry fares.
- Assess the effect of each fixed link scenario on overall per-trip costs: trip travel time, vehicle operating costs, and road/bridge toll rates.
- Forecast the immediate effect on traffic volumes at project opening (assumed to be 2022) and over the longer-term (2040) as a result of future population and traffic growth.

Multiple Account Evaluation

A Multiple Account Evaluation (MAE) of the fixed link scenarios was conducted in accordance with Ministry guidelines. The MAE compares expected quantitative and qualitative benefits and costs of each scenario against the Base Case (existing ferry service), and illustrates trade-offs between the scenarios. As illustrated in **Figure ES-2**, the five standard Ministry evaluation accounts include Financial, Customer Service, Environment, Economic and Socio-Community. The Ministry is also engaging with area First Nations to consider First Nations' Interests. These discussions are on-going, so for the purposes of this report, only publicly available information about First Nations treaty lands and management areas were considered, in addition to any input received from meetings that had been held through to the end of December 2016.



FIGURE ES-2: MULTIPLE ACCOUNT EVALUATION

The criteria, or factors, for each account to be assessed were developed based on Ministry requirements, best practice, and community and stakeholder input received through the engagement process. Scenarios were evaluated using performance criteria typical for roadway projects, and assuming a 25-year life cycle. It is recognized that the life cycle for some of the infrastructure elements would extend well beyond this time frame, and a residual value was applied for these elements at the end of the 25 years. Irrespective of the account, three general types of criteria were evaluated:

- Financially quantifiable revenues and costs;
- Other quantifiable benefits and costs (e.g., travel time and safety);
- Qualitative benefits and costs.

Table ES-2 summarizes the qualitative criteria assessed for the four fixed-link scenarios.

TABLE ES-2: MULTIPLE ACCOUNT EVALUATION RESULTS (SUBJECTIVE CRITERIA)

Criteria	Sunshine Coast Scenarios		Powell River Scenarios	
	Langdale Road Link	Langdale Bridge Link (via Anvil Island)	Powell River Road Link	Powell River Bridge Link (via Nelson Island)
Travel Time Reliability	✓	✓✓	✓✓	✓
Multimodal Accessibility (for bikes and pedestrians)	X	X	---	X
Accessibility to Emergency Services	✓	✓✓	✓	✓
Emergency Evacuation	✓✓	✓	✓	✓
Travel Quality/Experience	X	---	X	---
Safety	X	X	X	X
Population	✓	✓✓	✓✓	✓
Property Requirements	X	X	XX	X
Consistency with Community Policies, Character and Identity	---	X	---	---
Effects on Population-supporting Infrastructure	X	XX	X	X
Visual/Aesthetic Effects	X	---	---	X
Noise Effects	X	X	---	---
Community Severance and Connectivity	✓	✓	✓	✓
Recreation Effects	✓✓	✓	✓✓	✓
Air Quality	X	X	X	---
Freshwater Fish, Wildlife and Habitat	X	---	XX	---
Marine Resources	✓	X	---	X
Parks and Protected Areas	XX	---	XX	---
Effects of the Environment on the Project	XX	X	XX	X
Effects on Private Property Values	✓	✓✓	✓✓	✓
Influence on Tourism and Other Local Business Development	✓	✓✓	✓✓	✓
Natural Resource Development Potential	✓	---	✓✓	---
Marine Navigation Effects	✓✓	✓	---	✓

Legend: --- Neutral ✓ Better ✓✓ Much Better X Worse XX Much Worse

A draft assessment of the qualitative and non-financial quantitative criteria was presented for public and stakeholder feedback (see below). These criteria were refined and finalized in consideration of the public and stakeholder input received.

Stakeholder and Public Engagement

Following is a high-level summary of feedback received from all phases of public and stakeholder engagement, including the three-week public consultation period (October 18 through November 8, 2016) during which open houses were held in five (5) communities and the online feedback form was available for people to comment on the draft study findings.

Study Format/Content

- High level of interest in the study and general sentiment that the study is long overdue.
- General support among stakeholders and the public for the draft Problem Definition Statement, with suggestions to confirm changing demographics on the Sunshine Coast and to consider both the provincial benefits and the regional benefits of a fixed link.
- A number of First Nations and members of the public expressed concerns about potential impacts on aboriginal interests, including route alignments that cross through First Nations' traditional areas and management lands.¹
- The Islands Trust Committee noted that a fixed link across Anvil Island (the Langdale Bridge Link) would run contrary to the Islands Trust Policy Statement, approved by the Province, as well as the Official Community Plans of numerous individual islands.
- While many participants were pleased that the study is happening, several commented that more study would be needed before making a decision whether to proceed. Requested studies included environmental impact assessment and a detailed business case.

Route Options

- General public support for a potential future fixed link, primarily due to anticipated improved travel times, improved community development, and ability to help open up B.C. and address B.C.'s jobs and housing challenges.
- Of those who support a link, the Langdale Bridge Link is the preferred scenario, as illustrated in **Figure ES-3**.
- Reasons for supporting the **Langdale**

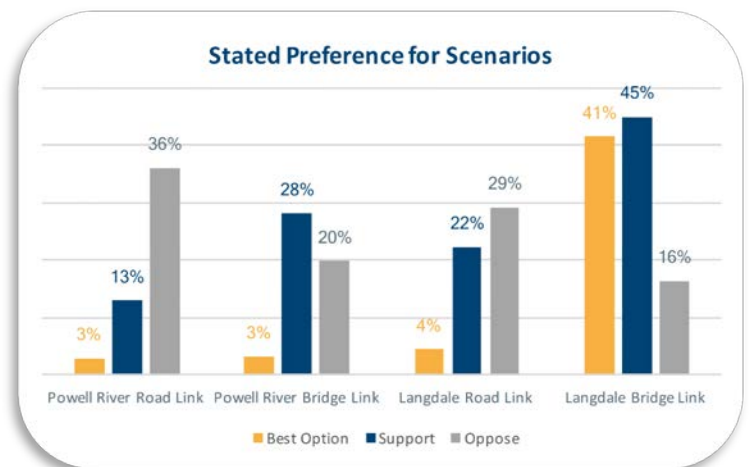


FIGURE ES-3: FIXED LINK SCENARIO PREFERENCES

¹ It is noted that the Ministry continues to engage with First Nations, which may result in changes to the analysis and/or conclusions of this study.

Bridge Link primarily focused on the fact that it is the fastest alternative.

- Reasons for supporting the **Powell River Road Link** primarily focused on the broader economic development potential that this scenario creates. It should be noted, however that many people commented that an additional connection between the lower mainland and the B.C. Interior should not be a provincial priority at this time.
- Support for a **Powell River Bridge Link** primarily focused on the fact that it would remove one ferry, which would provide vastly improved reliability for travellers
- Support for a **Langdale Road Link** primarily focused on lower costs as compared with other scenarios; however, many respondents expressed concern about the additional travel time this scenario would create, as compared with existing ferry service or a Langdale Bridge Link.
- While fewer numbers of consultation participants opposed a fixed link, many of those who did expressed strong concerns about potential community impacts and changes to their way of life.
- Some participants indicated that they would prefer improved ferry service to a fixed link.

Multiple Account Evaluation

- Interest in evaluating the options from the perspective of local benefits and broader provincial benefits.
- Desire for an equally robust analysis of the base case (ferry service), including suppressed demand analysis, commuter vs. economic generating traffic, growth analysis and economic opportunities.

Financial Considerations

- Numerous comments about the importance of considering all costs, including local infrastructure costs associated with increased population or visitor traffic, costs (or avoided costs) of Horseshoe Bay and Langdale terminal upgrades.
- Municipalities and Regional Districts expressed concerns about potential effects on other infrastructure like water and sewer that would come with increased population and tourism.
- Whether for or against a fixed link, many people questioned the additional congestion impacts this scenario would have on Highway 99 and Highway 101 traffic.

Economic and Financial Analysis

As a final stage of analysis, each of the scenarios was also evaluated in terms of their relative attractiveness from an economic benefit cost analysis (BCA) perspective, as measured by Net Present Value (NPV) and Benefit-Cost Ratio (BCR). Both metrics provide information on the financial feasibility of a project, and are summarized in **Table ES-3**.

- For the Powell River Bridge Link, user benefits would be positive, since the bridge would offer convenient and direct access between the Sunshine Coast and the Powell River Regional District. However, given the relatively modest traffic volumes for this link, the net user benefits would be small in comparison to additional costs of construction, maintenance and rehabilitation. As a result, the NPV calculation is negative (minus \$1.7 to \$2.0 billion) and the BCR calculation is small (0.050 to 0.042).

- The Langdale Bridge Link has higher potential user benefits than the Powell River Bridge Link, reflecting its expected higher traffic volumes. However, these user benefits are also small in relation to the additional costs of construction, maintenance and rehabilitation. As a result, the NPV calculation is negative (minus \$1.3 to \$1.6 billion) and the BCR calculation is relatively small (0.255 to 0.215).
- For the two road-based fixed link scenarios, a preliminary BCA found that the net user benefits would be negative. This is because the circuitous nature of the road-based routes adds travel time, vehicle operating costs and additional roadway collisions as compared with current ferry services. As with the bridge link scenarios, the NPVs are negative (minus \$1.5 to \$1.9 billion and minus \$3.1 to \$3.4 billion for the Langdale and Powell River Road Links respectively). Additionally, the BCR calculations are also negative for both the Langdale and Powell River Road Links.

TABLE ES-3: ECONOMIC ANALYSIS SUMMARY – FIXED LINK SCENARIOS REVIEWED

	Powell River Bridge Link	Powell River Road Link	Langdale Bridge Link	Langdale Road Link
Capital and Operations, Maintenance and Rehabilitation Costs	\$2.4 to \$2.8 Billion	\$4.0 to \$4.4 Billion	\$3.0 to \$3.4 Billion	\$2.1 to \$2.5 Billion
Net Present Value (NPV)	-\$1.7 to -\$2.0 Billion	-\$3.1 to -\$3.4 Billion	-\$1.3 to -\$1.6 Billion	-\$1.5 to -\$1.9 Billion
Benefit-Cost Ratio (BCR)	0.050 to 0.042	< 0	0.255 to 0.215	< 0

While no decision has been made with respect to tolling, for this analysis, the BCA calculations as described above are based on a fixed link toll rate equivalent to that of the existing ferry fare. It is noted that during consultation, participants generally supported a toll to help pay for the new crossing; however, suggested toll rates ranged from \$5 to \$30 per trip, which is lower than current ferry rates.

Tolls affect the BCA by adding cost for users, potentially affecting traffic volumes, but also adding financial benefits in the form of government revenues that can be used to fully or partially recover capital costs. When tolls can fully cover a project's capital cost, the project is considered to be self-financing.

Preliminary analysis indicates that only the Langdale Bridge Link has potential to achieve some cost recovery at ferry-equivalent toll rates. The other three scenarios all have potential first-year revenues that are less than one per cent of capital costs, and are assessed as unlikely to be able to achieve full cost recovery. **Table ES-4** summarizes the results of the economic analysis for the Langdale Bridge Link scenario compared to the current ferry service.

TABLE ES-4: ECONOMIC ANALYSIS SUMMARY – LANGDALE BRIDGE LINK

Accounts	Ferry Service (Route 3)	Langdale Bridge Link	Incremental Change
Financial Costs			
Capital Costs (Present Value)	\$ 242	\$ 2,632 to \$ 3,034	\$ 2,390 to \$2,792
O, M & R Costs (Road & Ferry Operations)	\$ 513	\$ 320	-\$ 193
Salvage Value	-\$ 33	-\$ 518 to -\$ 600	-\$ 485 to -\$ 567
Total Financial Cost (\$Capital + O&M + Property)	\$ 722	\$ 2,434 to \$ 2,755	\$ 1,712 to \$2,033
User Costs / Benefits			
Travel Cost (incl. Time and Op. Costs)	\$ 2,187	\$ 1,645	\$ 542
Safety (Collision Cost)			-\$ 105
Total User Cost (\$ Travel Cost + Safety)	\$ 2,187	\$ 1,645	\$ 437
Net Present Value (NPV)			-\$ 1,275 to -\$ 1,596
Benefit — Cost Ratio (BCR)			0.255 to 0.215

Note: Present Value of capital costs are used rather than the cost estimate values due to the discounting of future money spent back to the present.

Conclusions

Acknowledging the limitations of the early level of conceptual engineering undertaken as part of this study, the four fixed link scenarios between the Lower Mainland and the Sunshine Coast appear to be **technically feasible**. However, the extremely challenging construction terrain in the area, including steep rocky terrain, mountain passes, and deep water channels, would result in very high capital costs for all of the scenarios assessed. Consideration of all of the accounts assessed suggests that while there is a high degree of support for the concept of a fixed link, the overall feasibility of such a link is less clear.

From a **financial feasibility** perspective, **none of the options perform strongly**. Preliminary analysis indicates that only the Langdale Bridge Link has potential to achieve some cost recovery at ferry-equivalent toll rates. (Appendix F)

In terms of **economic benefits and costs**, however, **all four of the scenarios have strongly negative Net Present Values (NPVs)**, reflecting the very high provincial capital and operating costs in relation to the potential user benefits. **User benefits are limited** because of modest forecast traffic volumes, as well the additional travel distances associated with three of the scenarios. With regard to the benefit cost ratios (BCRs), the two road-based fixed link scenarios have **BCRs that are negative** because of the circuitous nature of the road routes, while the Langdale and Powell River bridge-based scenarios have **BCRs that are less than 1 (0.25 and 0.05 respectively)**. While the economic benefit cost assessment is based on ferry-equivalent toll rates, sensitivity analysis confirms that, **even with the greater number of travelers associated with a scenario of an un-tolled facility; none of the scenarios would have a positive NPV** (see **Appendix F**). This calculation is prior to consideration of economic development benefits, which are not included in the scope of quantified benefits and costs, but are qualitatively assessed as providing additional longer-run economic benefits.

From a **customer service** perspective, input received as part of the public consultation suggests **general support of a fixed link connection**, with the Langdale Bridge Link as the preferred scenario. Key reasons stated for support for a fixed link include improved travel times, improved community development, addressing B.C.'s jobs and housing challenges, and opening up B.C. It should be noted, however, that consultation participants also expressed concerns about the potential negative effects of a fixed link for cyclists and pedestrians, given that analysis of transit service is outside of the scope of this study.

With respect to **socio-community** considerations, **a number of people opposed a fixed link** out of concern for potential community impacts and changes to their way of life.

Finally, it is recognized that the Sunshine Coast has been used for centuries by numerous First Nations, and that any fixed link alignment likely would traverse through the proximities of First Nations' management areas and potentially through archaeological sites. A number of First Nations and many community leaders and members of the public also expressed concerns about the effects of a fixed link on First Nations traditional and current interests.

Contents

1	Introduction	1
1.1	Project Background and Objectives.....	1
1.2	Previous Studies	2
2	Existing Conditions.....	3
2.1	Overview.....	3
2.2	Regions and Major Centres/Populations.....	3
2.3	Growth Statistics	4
2.4	Transportation.....	5
3	Travel Demand Forecasts	9
3.1	Overview.....	9
3.2	Traffic Outlook - Base Case	10
3.3	Traffic Outlook - Fixed Link Scenarios.....	13
3.4	Traffic Forecast Summary	18
4	Scenario Development (Road & Bridge Links))	19
4.1	Overview.....	19
4.2	Alternative Scenarios Considered	21
4.3	Engineering Design Considerations.....	23
4.4	Langdale Road Link.....	28
4.5	Langdale Bridge Link.....	29
4.6	Powell River Road Link	31
4.7	Powell River Bridge Link	32
5	Cost Estimates.....	34
5.1	Overview.....	34
5.2	Cost Estimate Summaries	37
6	Multiple Account Evaluation Error! Bookmark not defined.	
6.1	Overview.....	39
6.2	Financial Account	40
6.3	Customer Service Account.....	41

6.4	Socio-Community Account	43
6.5	Environmental Account	45
6.6	Economic Development Account	46
6.7	First Nations	47
6.8	MAE Summary	48
7	Conclusion.....	54
8	References	57

Appendices

Appendix A:	Alignment Drawings
Appendix B:	Bridge Crossings Paper
Appendix C:	Environmental Review
Appendix D:	First Nations Areas
Appendix E:	Consultation Summary Report
Appendix F:	Impact of Tolling on Economic/Financial Outlook

Tables

Table 2-1: Regions and Major Centres Populations	3
Table 2-2: Growth Statistics (1991-2015).....	4
Table 2-3: Existing Sunshine Coast Ferry Services (based on 2015 statistics)	8
Table 3-1: BC Ferries Seasonal Variations in Number of Sailings (Existing)	13
Table 3-2: BC Ferries 2015 Sailings, Utilization and Overloads (Annual Totals).....	13
Table 3-3: Traffic Forecast Summary (Average Daily Traffic, Both Directions)	18
Table 4-1: Roadway Design Criteria	27
Table 5-1: Powell River Road Link – Cost Estimate	37
Table 5-2: Powell River Bridge Link (Via Nelson Island) – Cost Estimate	37
Table 5-3: Langdale Road Link – Cost Estimate	38
Table 5-4: Langdale Bridge Link (Via Anvil Island) – Cost Estimate	38
Table 6-1: Economic Analysis summary – Sunshine Coast Scenarios.....	48
Table 6-2: Economic Analysis Summary – Powell River Scenarios	50
Table 6-3: Subjective Criteria Evaluations – Customer Service	51
Table 6-4: Subjective Criteria Evaluations – Socio-Community	52
Table 6-5: Subjective Criteria Evaluations – Environment	52

Table 6-6: Subjective Criteria Evaluations – Economic Development.....	53
Table 6-7: Subjective Criteria Evaluations – First Nations.....	53

Figures

Figure 2-1: Regional Districts Map	4
Figure 2-2: Existing Road Network	6
Figure 2-3: Existing Sunshine Coast Ferry Services	7
Figure 3-1: Fixed Link Scenarios Reviewed.....	10
Figure 3-2: BC Ferries Average Daily Traffic Volumes	11
Figure 3-3: BC Ferries Route 3 Langdale - Mode Splits (Existing).....	11
Figure 3-4: BC Ferries Route 7 Powell River - Mode Splits (Existing)	12
Figure 3-5: Traffic Volume Forecasts – Langdale Road and Bridge Link Scenarios	15
Figure 3-6: Traffic Volume Forecasts – Langdale Road and Bridge Link Scenarios (Origins/Destinations)	16
Figure 3-7: Traffic Volume Forecasts – Powell River Road and Bridge Link Scenarios	17
Figure 3-8: Traffic Volume Forecasts – Powell River Road and Bridge Link Scenarios (Origins/Destinations)	17
Figure 4-1: Fixed Link Scenarios Reviewed.....	20
Figure 4-2: Alternative Scenarios Considered	21
Figure 4-3: Typical Roadway Cross-Section.....	26
Figure 4-4: Langdale Road Link	28
Figure 4-5: Langdale Bridge Link	29
Figure 4-6: Powell River Road Link	31
Figure 4-7: Powell River Bridge Link	32
Figure 6-1: Multiple Account Evaluation	40

Introduction

1.1 Project Background and Objectives

The Sunshine Coast is located northwest of the Lower Mainland on the eastern shore of the Strait of Georgia covers an area of approximately 180 kilometres from Gibsons to Lund, with a population of approximately 49,000. Primary population areas include Powell River, Sechelt and Gibsons.

The Sunshine Coast is accessible only by BC Ferries, water taxi, commercial and charter air service (float/airplane), and private boat or plane. The area is divided into two separate land segments. Highway 101, which runs north-south, connecting these two segments via BC Ferries' Earls Cove - Saltery Bay ferry (Route 7) and to the Lower Mainland by the Horseshoe Bay - Langdale ferry (Route 3).

Sunshine Coast residents and businesses regularly rely on BC Ferries for commuter trips and access to a range of services and facilities on the Lower Mainland, including health/medical services not available in the area, recreational activities and other services and goods. Tourists and recreational property owners are also key ferry users. In recent years, immediate and long-term challenges facing the B.C. Coastal ferry system have led to service reductions for ferry users, with increased pressure during summer months.

With lower growth and economic development as compared with other regions in the Province (despite the area's proximity to the Lower Mainland), and recognizing the recent historical trend of an aging population base, various Sunshine Coast community representatives and residents are increasingly advocating for a cost-effective fixed link connection to the Lower Mainland, with the intent to address access and reliability challenges and support sustainable growth and economic development.

The B.C. Ministry of Transportation and Infrastructure (MOTI) issued a Request for Proposals in November 2015 to undertake a study of the feasibility of constructing a fixed link between the Sunshine Coast and the Lower Mainland as an alternative to existing air and ferry services. In February 2016, MOTI awarded a contract to R.F. Binnie & Associates Ltd.

The purpose of the study is to:

- Assess the costs and benefits of possible future overland connections and bridge crossings between the Sunshine Coast and the Lower Mainland;
- Identify the financial and physical feasibility of constructing a fixed link;
- Undertake a detailed analysis of potential future fixed link scenarios, providing the benefits and impacts of each of the scenarios considered, as compared with the current ferry service.

The study included technical analysis and community and stakeholder engagement. The objectives of this feasibility study are as follows:

- Analyze the technical and financial feasibility as well as the potential customer service, social, environmental, and economic costs and benefits of the various crossing alternatives that have been suggested in the past, along with potential new connection routes.
- Evaluate the scenarios against the existing ferry service through a Multiple Account Evaluation (MAE) in accordance with Ministry guidelines. The MAE uses qualitative and quantitative criteria to compare expected benefits and costs of the various scenarios against the existing ferry service (Base Case), and illustrates the trade-offs between the scenarios. The evaluation considers desktop research, First Nations interests, consultation input, engineering and environmental expertise, and best practice.
- Build on the results of previous studies, with a more comprehensive MAE and new information about potential route scenarios to support an informed discussion about the growing interest in a fixed link connection from the Sunshine Coast to the Lower Mainland.

The objective of the community and stakeholder engagement is to ensure that the technical analysis considers and is informed by the broader community goals, interests and concerns for this area of British Columbia. The engagement sought input and feedback on the draft problem definition, potential alignment scenarios, the MAE evaluation criteria, and preliminary MAE findings. This component of the study is discussed in detail in the Consultation Summary Report (Appendix E). The balance of this report focuses on the technical analysis.

1.2 Previous Studies

The BC Ministry of Transportation and Infrastructure (MOTI) has twice conducted a high-level analysis of potential road connections to and from the Sunshine Coast – one in 1998 and another in 2001.

- The 1998 *“Powell River to Squamish Valley Road Link”* review identified a high-level construction cost estimate and a conceptual alignment; and
- The 2001 *“Conceptual Alignment Study, Sunshine Coast and the Sea to Sky Highway”* identified a conceptual alignment and cost estimate for a fixed link between Port Mellon and Squamish.

Both of the above reviews focused on the technical feasibility of such a connection, and both concluded that the estimated costs and travel times were less desirable compared to the ferry services at the time.

Existing Conditions

2.1 Overview

This section briefly summarizes the existing regional and major centre populations, and recent historical growth for the Powell River, Sunshine Coast, and Squamish-Lillooet Regional Districts. It also provides a summary of the existing transportation facilities providing accessibility/service to and from the Sunshine Coast and Powell River communities. The existing conditions review is based on desktop assessments and data information obtained from BC Statistics, MOTI, and BC Ferries.

2.2 Regions and Major Centres/Populations

The following is a brief summary of the existing regional and major centre populations for the Powell River, Sunshine Coast, and Squamish-Lillooet Regional Districts obtained from BC Stats.

TABLE 2-1: REGIONS AND MAJOR CENTRES POPULATIONS

Powell River Regional District (PRRD); Population: 20,000	
MAJOR CENTRES	POPULATION
Powell River	13,000
Sunshine Coast Regional District (SCRD); Population: 29,000	
MAJOR CENTRES	POPULATION
Sechelt	10,000
Gibsons	4,500
Squamish Lillooet Regional District (SLRD); Population: 40,000	
MAJOR CENTRES	POPULATION
Squamish	18,500
Whistler	10,000
Lillooet	2,500
BC Population: 4.68 million	

2.3 Growth Statistics

As illustrated in the following table, SCRD's population increased an average of 1.3% annually between 1991 and 2015, while PRRD's population was almost unchanged. These growth rates were significantly lower than for the adjacent Squamish-Lillooet Regional District (including Whistler), as well as for the Metro Vancouver area.

TABLE 2-2: GROWTH STATISTICS (1991-2015)

	1991	2015	Average Annual Increase
Sunshine Coast Regional District (SCRD)	21,337	29,177	1.3%
Powell River Regional District (PRRD)	19,623	19,481	–
Total SCRD plus PRRD	40,960	48,658	0.7%
<hr/>			
Other areas:			
• Squamish-Lillooet Regional District	25,069	40,378	2.0%
• Greater Vancouver (Metro Van)	1,647,055	2,513,856	1.8%

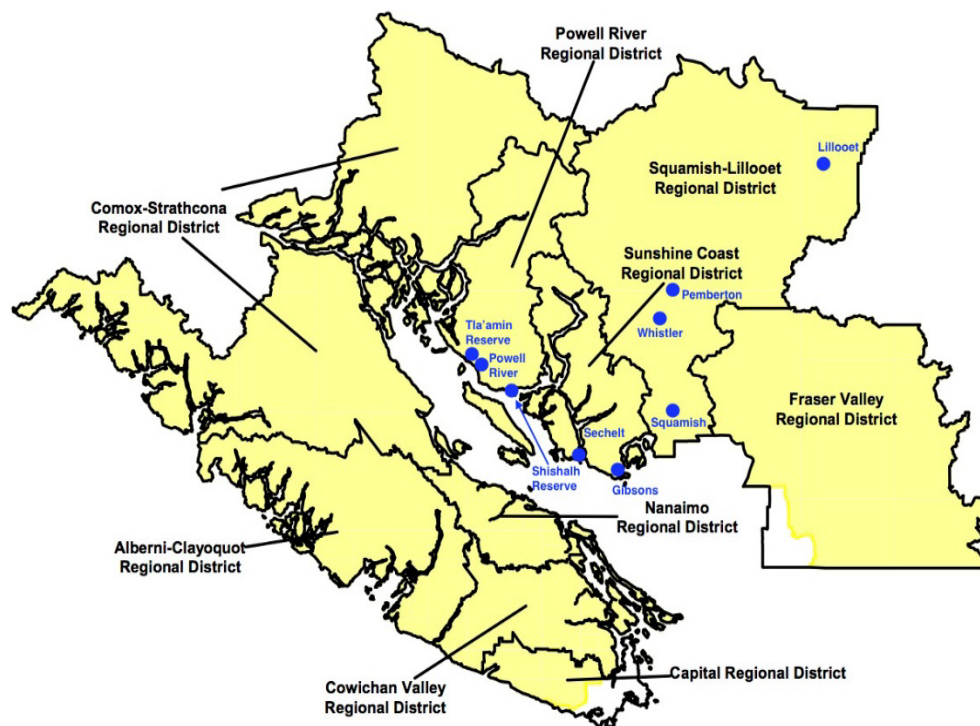


FIGURE 2-1: REGIONAL DISTRICTS MAP

2.4 Transportation

The following provides a brief summary of the existing transportation facilities providing accessibility/service to and from the Sunshine Coast and Powell River communities.

2.4.1 Major Roads

Major roadways currently servicing the Sunshine Coast include:

- **Highway 99**
 - North-south Sea-to-Sky coastal to inland route connects Vancouver to Lillooet, (150 km) with connections to Horseshoe Bay, Squamish, Whistler and Pemberton.
 - Serves 3,900 vehicles per day north of Whistler and 17,500 vehicles per day north of Horseshoe Bay.
 - The existing posted speed along this section of Highway 99 is predominantly 80 km/h.
- **Highway 101**
 - The main north-south thoroughfare on the Sunshine Coast; two-lane rural 159-km long roadway with auxiliary lanes through developed areas. It connects Gibson's to Powell River and points north via ferry link (see below).
 - Serves an average of 1,000 vehicles per day near Powell River and 10,000 vehicles per day near Gibsons.
 - The existing posted speeds along Highway 101 vary, but predominantly comprise of 60 to 80 km/h sections.
- **Port Mellon Highway**
 - Two-lane rural, north-south coastal route from Hopkins Landing to Port Mellon (12 km) and is the primary route to the Howe Sound Pulp and Paper mill at the southern end of the lower Sunshine Coast.
 - Traffic statistics are not available; however, weekday traffic primarily consists of logging trucks and commuters to/from the mill.
 - The existing posted speed along the Port Mellon Highway is 60 km/h.



FIGURE 2-2: EXISTING ROAD NETWORK

2.4.2 Air Services

Existing air services servicing the Sunshine Coast are:

- **Sechelt**
 - Harbour Air – daily service from Porpoise Bay to Vancouver harbour (downtown), YVR, Nanaimo, Whistler, Comox and Victoria
 - Sunshine Coast Air – daily service from Porpoise Bay to Vancouver harbour, Nanaimo and Victoria
 - Fly! Coastal Airlines – provides flights from Sechelt Airport to the Victoria Flying Club (near Victoria International Airport)
- **Powell River**
 - Pacific Coastal Airlines provides service from YVR south terminal
 - Charter service available to Sechelt and Powell River

2.4.3 Ferry Services

The existing BC Ferries routes servicing the Sunshine Coast are:

- **Horseshoe Bay – Langdale (Route 3)**
 - Served by the Queen of Coquitlam, capacity of 360 vehicles.
- **Earls Cove – Saltery Bay (Route 7)**
 - Passage between Sechelt and Powell River via Highway 101; served by the Island Sky, capacity of 125 vehicles.



FIGURE 2-3: EXISTING SUNSHINE COAST FERRY SERVICES

TABLE 2-3: EXISTING SUNSHINE COAST FERRY SERVICES (BASED ON 2015 STATISTICS)

	Horseshoe Bay – Langdale	Earls Cove – Saltery Bay
FREQUENCY	Eight round trips per day (more in summer/long weekends) 6:20 a.m. to 9:45 p.m.	Seven round trips per day (eight on Sundays) 5:30 a.m. to 10:30 p.m.
ANNUAL VOLUMES	1.2 million vehicles (AEQ) 2.5 million passengers	185,000 vehicles (AEQ) 325,000 passengers
ANNUAL UTILIZATION	55% Very high in summer/long weekends – avg.205 vehicles/ trip	29% During summer, avg.46 vehicles/trip
RELIABILITY	77% of sailings occurred within 10 minutes of schedule 17% overloads	95% within 10 minutes of schedule 2% overloads

Travel Demand Forecasts

3.1 Overview

This section first reviews the “Base Case” outlook for future auto traffic volumes, assuming that no fixed link is built and that the BC Ferries’ current Route 3 and Route 7 continue to operate on Highway 101. On BC highways outside urban areas, traffic forecasting is typically carried out using a trend analysis based on past traffic volumes. In the case of the Sunshine Coast Fixed Link (SCFL) Planning Study, this trend analysis was carried out for the two BC Ferries routes serving the Sunshine Coast and Powell River Regional Districts.

The section then goes on to forecast the traffic volumes potentially associated with each of the four fixed link scenarios as identified in the Request for Proposals (RFP) document (see **Figure 3-1**), and how they differ from the Base Case forecasts. Where a fixed link scenario is forecast to lead to an increase in future traffic levels, it is due to two sources:

- *Initially generated traffic* is the traffic that currently wants to travel, but is not doing so because of the differences in the travel characteristics between ferry and fixed link trips. This traffic demand would be released upon opening of the fixed link project, reflecting the reduction in overall travel times and/or the elimination of the current limitations on time of travel associated with ferry service. Historical and current traffic trends on Highway 99 to Squamish, Whistler and Pemberton provide useful insights into the levels of traffic increases associated with each of the fixed link options.
- *Longer-run traffic growth* is the additional traffic growth that would occur over time under each of the fixed link scenarios. This additional traffic results from the greater economic and population growth associated with having a fixed link.

The following traffic forecasts, including the additional traffic associated with each fixed link scenario, consider multiple factors including changes in travel times, vehicle operating costs, ferry/toll rates, and other travel characteristics. Travel time estimates for ferries include terminal waiting times as well as sailing times.

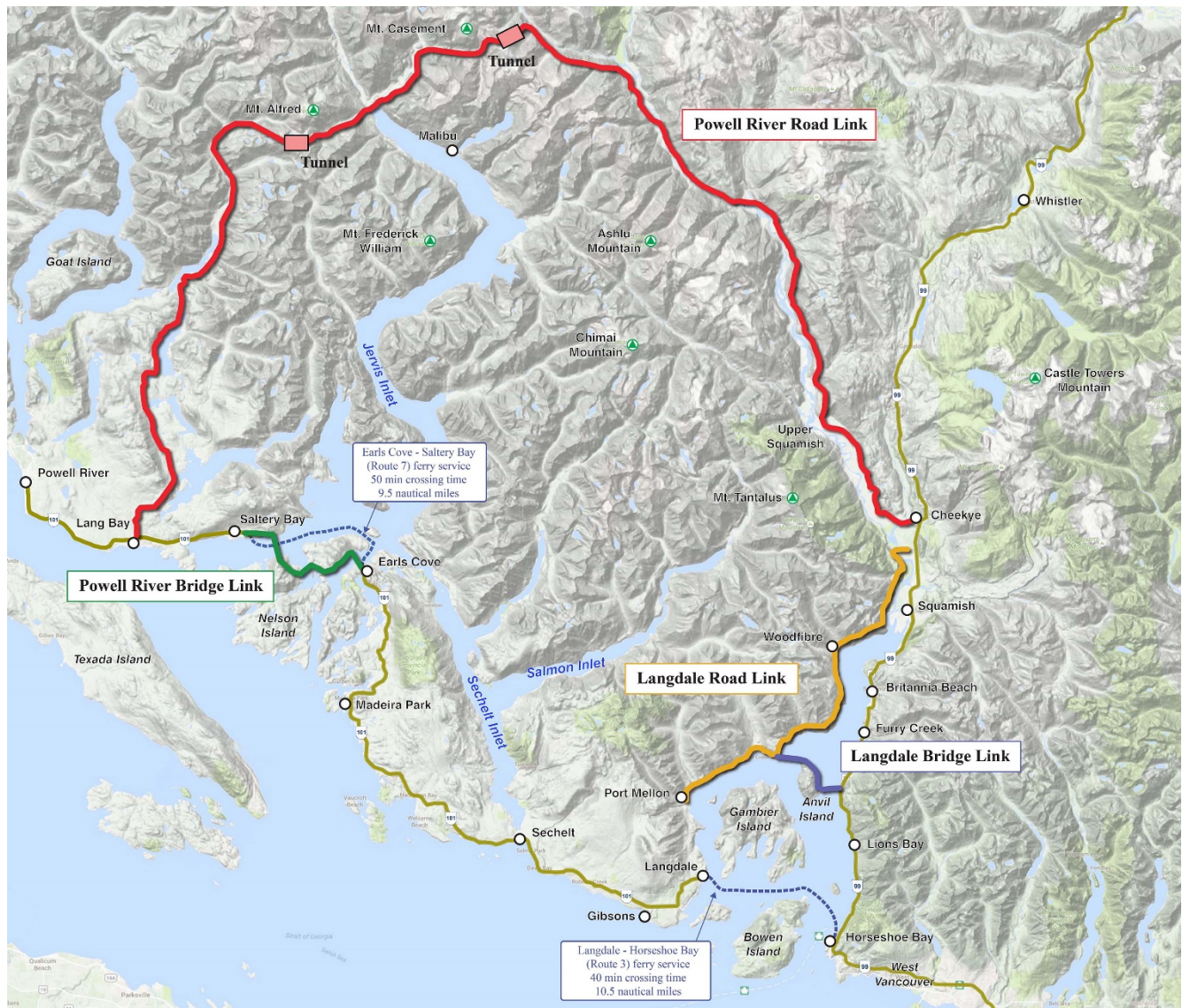


FIGURE 3-1: FIXED LINK SCENARIOS REVIEWED

3.2 Traffic Outlook - Base Case

3.2.1 Annual Ridership

As illustrated in **Figure 3-2**, in 2015 an average of 3,030 vehicles per day (two-way total) travelled on Route 3 (Horseshoe Bay to/from Langdale) in 2015, of which an estimated 2,840 traveled to/from the Sunshine Coast and 190 traveled to/from Powell River. Route 7 (Sunshine Coast to/from Powell River) served an average of 475 vehicles per day, with 190 travelling to/from Horseshoe Bay on Route 3 and 285 to/from the Sunshine Coast.

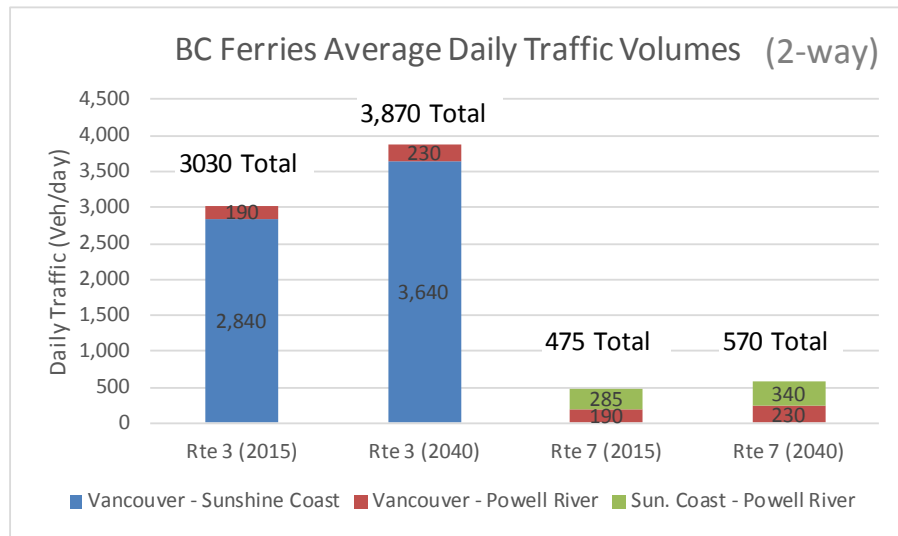
FIGURE 3-2: BC FERRIES AVERAGE DAILY TRAFFIC VOLUMES

Figure 3-2 also illustrates the Base Case outlook for 2040, with continued ferry operations. These volumes represent forecast average annual traffic growth of 1.0% for Route 3 and 0.7% for Route 7 traffic, reflecting historic long-run population trends as well as BC Stats' future population projections.

Figure 3-3 presents the various modes which currently utilize Route 3. Twenty-one percent (21%) of the passengers are foot passengers, with the remaining 79% arriving via vehicular traffic. Of the vehicular traffic, 95% are passenger vehicles with only 3% and 2% being commercial and motorcycle traffic respectively. Less than 1% of the vehicles are buses.

FIGURE 3-3: BC FERRIES ROUTE 3 LANGDALE - MODE SPLITS (EXISTING)

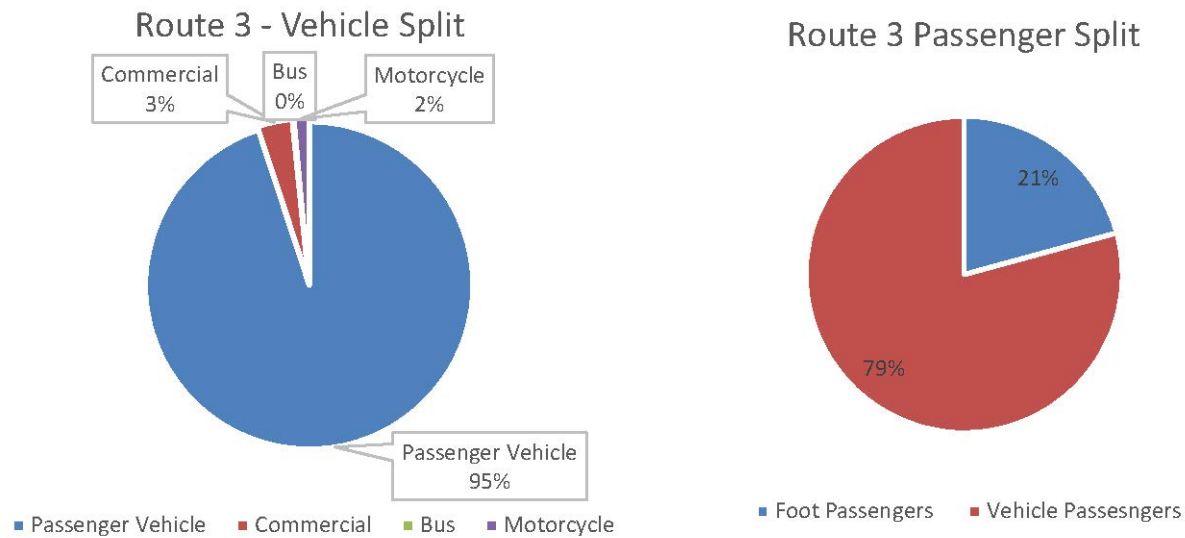
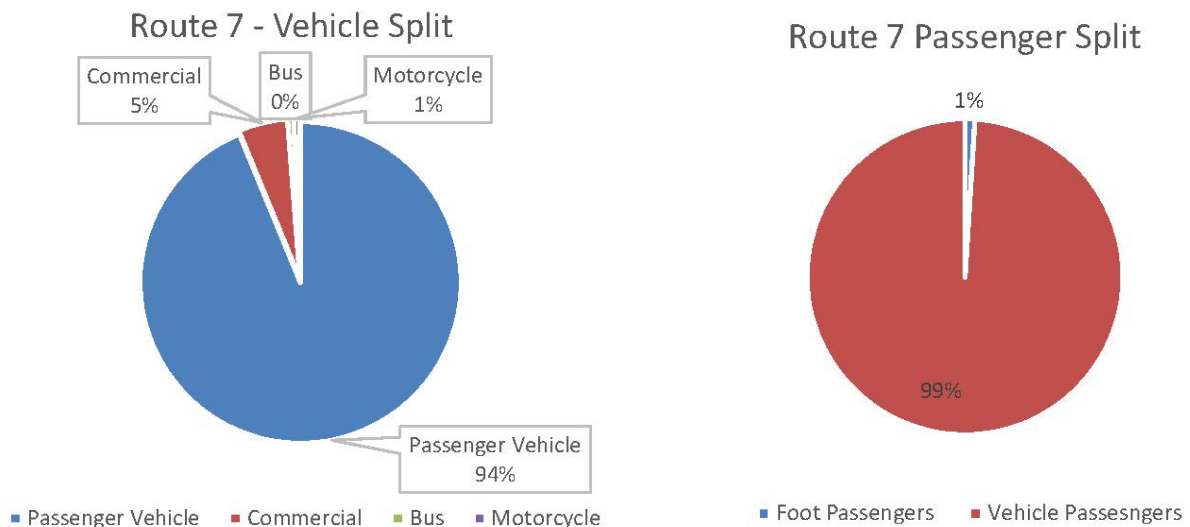


Figure 3-4 presents the various modes which currently utilize Route 7. In this case, only 1% of the passengers are foot passengers, with the remaining 99% arriving via vehicular traffic. Of the vehicular traffic, 94% are passenger vehicles with only 5% and 1% being commercial and motorcycle traffic respectively. Less than 1% of the vehicles are buses.

FIGURE 3-4: BC FERRIES ROUTE 7 POWELL RIVER - MODE SPLITS (EXISTING)



3.2.2 Seasonal/Time-of-Day/Day-of-Week Patterns

As illustrated in **Table 3-1**, the average number of vehicles per sailing is highest during the busy summer season, and lowest during the winter season.

TABLE 3-1: BC FERRIES SEASONAL VARIATIONS IN NUMBER OF SAILINGS (EXISTING)

Route	Vessel	Capacity (# of Vehicles)	Average Daily Trips per Sailing (2015)			
			Winter	Spring	Summer	Fall
3: Horseshoe Bay - Langdale	Queen of Coquitlam	360	155	190	205	170
7: Sechelt – Powell River	Island Sky	125	22	31	46	26

There are also very significant differences in traffic levels by season, by time of day, and by day of week. For example, while Route 3 sailings averaged up to 205 vehicles per ferry (57% of capacity) during the summer, approximately 17% of sailings during the year faced an overload situation (i.e., had to leave vehicles at the terminal). This speaks to the heavily peaked desire for use during weekends and in the summer.

TABLE 3-2: BC FERRIES 2015 SAILINGS, UTILIZATION AND OVERLOADS (ANNUAL TOTALS)

Route	Round Trips	Capacity (AEQ)	Carried (AEQ)	Utilization	Overloads (% trips)	Passengers (#)
3: Horseshoe Bay - Langdale	3,020	2,186,118	1,205,768	55%	17%	2,483,071
7: Sechelt – Powell River	2,542	624,952	185,657	30%	2%	324,841

AEQ: Auto Equivalents

3.3 Traffic Outlook - Fixed Link Scenarios

3.3.1 Methodology Overview

Preliminary vehicle traffic forecasts have been developed for each of the four fixed link scenarios. The methodology is summarized as follows:

- Estimate overall per-trip costs under the current ferry system. These per-trip costs include: (1) trip travel time (driving time, terminal waiting time, sailing time), (2) vehicle operating costs, (3) ferry rates.
- Estimate overall per-trip costs for each scenario, also in terms of: (1) trip travel time, (2) vehicle operating costs, (3) road/bridge toll rates.

- Forecast the immediate (2022) impact on traffic volumes on project opening, as well as the longer-term (2023 – 2040) impact on future population and traffic growth.

Future traffic volumes will depend to some extent on whether each of the fixed links is tolled, and if so at what rate(s). While no decision has been made with respect to tolling, for the purposes of this preliminary analysis it is assumed that each scenario is tolled at ferry-equivalent rates (i.e., toll rate at the same cost as the ferry fare).

3.3.2 Traffic Outlook - Langdale (SCRD) Scenarios

The traffic forecasts for the road and bridge links for the two Langdale (SCRD) scenarios are illustrated in **Figures 3-5 and 3-6**, and are discussed as follows:

Langdale Road Link

- This link would replace Route 3 (Horseshoe Bay-Langdale). It would be used for trips between Metro Vancouver and SCRD/PRRD.
- This route, passing through Squamish, would be circuitous. The overall per-trip user cost between Metro Vancouver and SCRD/PRRD is forecast to increase from the Base Case (Route 3 ferry) because of the additional travel time and vehicle operating costs associated with the extra 120 km of driving.
- Average daily vehicle traffic is forecast as 2,300 in 2022 and 2,980 in 2040 -- lower than the Base Case volumes of 3,300 in 2022 and 3,870 in 2040.

Langdale Bridge Link

- This link would also replace Route 3. It would be used by trips between Metro Vancouver and both the Sunshine Coast and Powell River.
- This route would be much shorter than the Langdale Road Link, but would involve a somewhat greater driving time and distance than the Base Case. However, these additional costs are forecast to be more than offset by the forecast travel times savings (especially when ferry wait times are included), as well as the increased convenience of continuous access rather than being tied to ferry schedules. Thus, volume of trips between North Vancouver and both the Sunshine Coast and Powell River is forecast to increase relative to the Base Case;
- Average daily vehicle traffic is forecast as 5,700 in 2022 and 7,510 in 2040 -- higher than the forecast Base Case volumes 3,300 in 2022 and 3,870 in 2040.

FIGURE 3-5: TRAFFIC VOLUME FORECASTS – LANGDALE ROAD AND BRIDGE LINK SCENARIOS

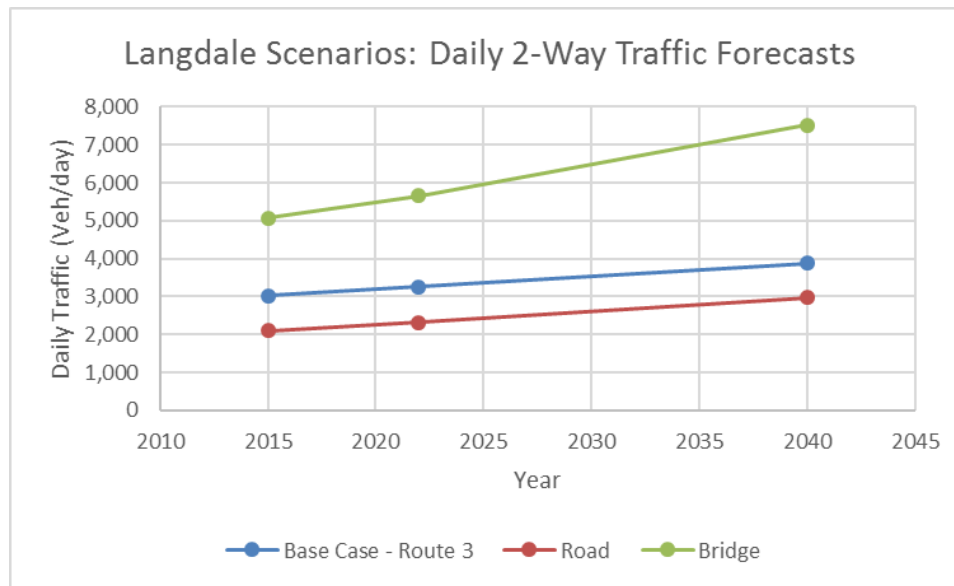
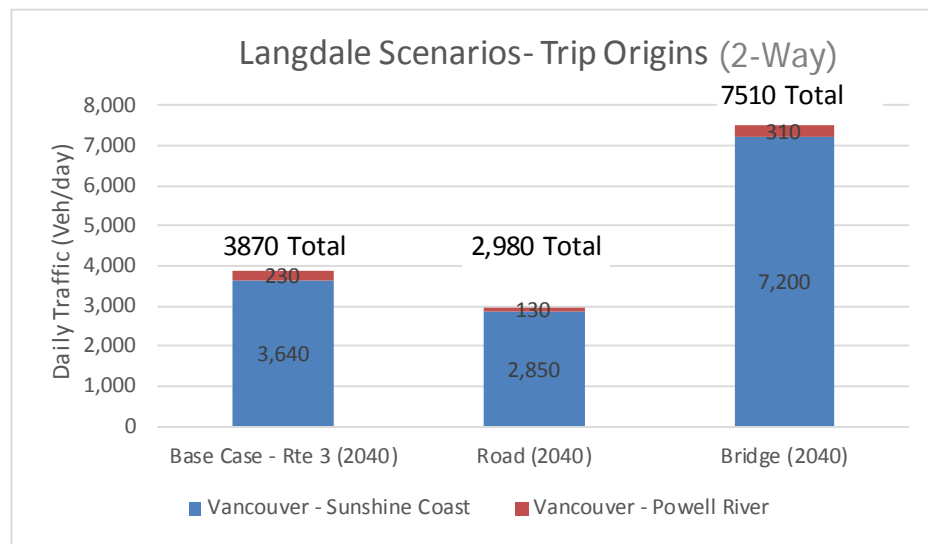


FIGURE 3-6: TRAFFIC VOLUME FORECASTS – LANGDALE ROAD AND BRIDGE LINK SCENARIOS (ORIGINS/DESTINATIONS)



3.3.3 Traffic Outlook - Powell River (PRRD) Scenarios

The traffic forecasts for the road and bridge links for the two Powell River fixed link scenarios are presented in **Figures 3-7 and 3-8**, and are discussed as follows:

Powell River Road Link

- This link would be used for trips between PRRD and Squamish/Metro Vancouver, but would not provide a fixed link to SCRD.
- It would greatly reduce traffic levels on Route 7 and may lead to consideration of the feasibility of continuing to operate this route in its current form. The following traffic forecasts are based on the assumption that Route 7 continues to operate for local Sunshine Coast to Powell River traffic.
- Trips between Powell River and Metro Vancouver are forecast to increase because of the very significant travel time savings (approximately 1.2 hours) over the current two-ferry route. This time saving would more than outweighs the additional vehicle operating costs associated with the trip.
- For trips between Powell River and Metro Vancouver, average daily vehicle traffic on the new road link is forecast to be 310 in 2022 and 380 in 2040 -- higher than the forecast Base Case volumes of 200 in 2022 and 230 in 2040. Although the increase is approximately 50%, the relatively low absolute number of trips reflects the preliminary assumption that the new road is tolled at ferry-equivalent rates.

Powell River Bridge Link

- This link would be used for trips between PRRD and SCRD/Metro Van, as a replacement for Route 7. Through trips from PRRD to Metro Vancouver would continue to access Metro Vancouver from SCRD via the Route 3 ferry.
- Trips to/from Powell River can be expected to increase substantially from the Base Case as a result of increases in local trips between Powell River and Sunshine Coast communities and trips between Metro Vancouver and Powell River (**Figures 3-4 and 3-5**). The total increase could be expected to be from about 500 veh/day (2022) and 570 veh/day (2040) to about 980 veh/day (2022) and 1,170 veh/day (2040) as a result of the time savings (0.9 hours) and cost savings regardless of the longer travel distance (19 km.)

FIGURE 3-7: TRAFFIC VOLUME FORECASTS – POWELL RIVER ROAD AND BRIDGE LINK SCENARIOS

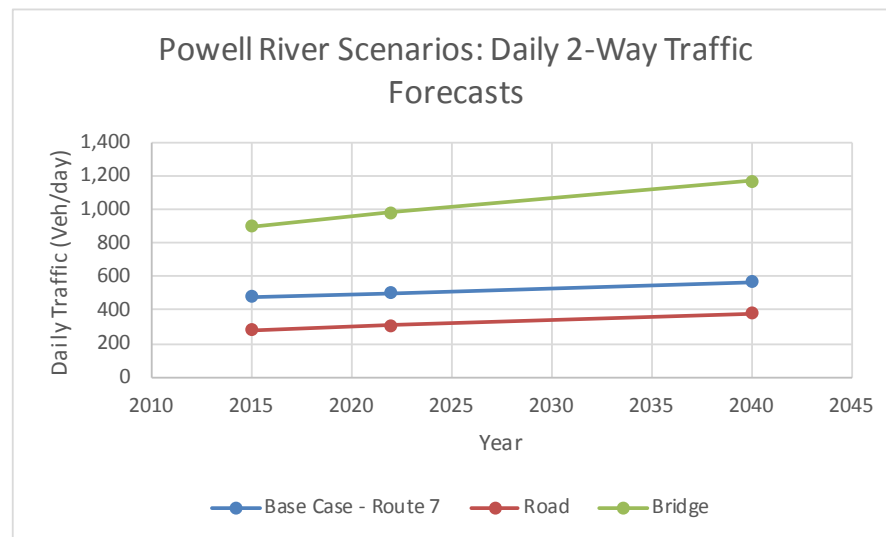
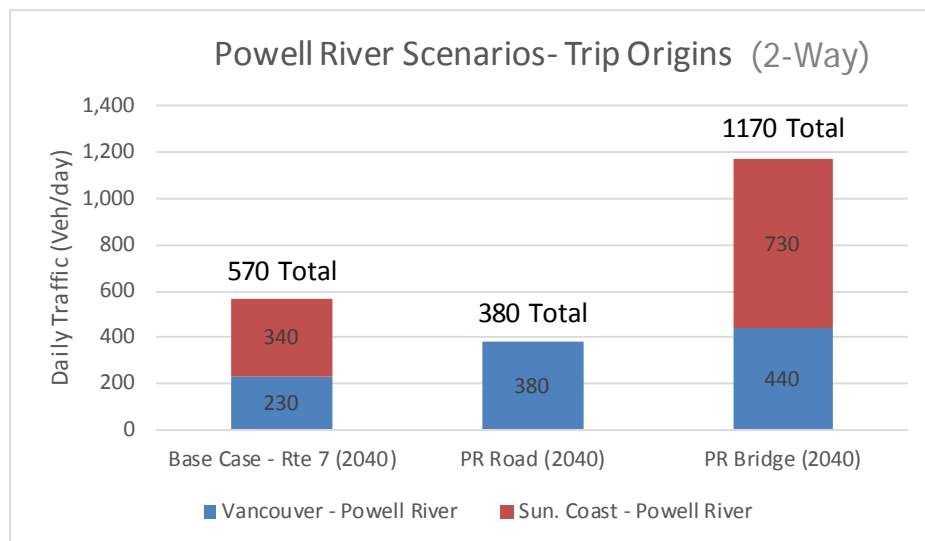


FIGURE 3-8: TRAFFIC VOLUME FORECASTS – POWELL RIVER ROAD AND BRIDGE LINK SCENARIOS (ORIGINS/DESTINATIONS)



3.4 Traffic Forecast Summary

Traffic forecasts for each of the four fixed link scenarios as described above are summarized in **Table 3-3**.

TABLE 3-3: TRAFFIC FORECAST SUMMARY (AVERAGE DAILY TRAFFIC, BOTH DIRECTIONS)

Location	Traffic Volume (Veh/day)	
	2022	2040
Base Case		
Route 3 Ferry Total	3,245	3,870
Route 7 Ferry Total	499	566
Langdale Road Link with Route 7 Ferry Only		
Langdale Road Link Total	2,309	2,973
Route 7 Ferry Total	411	466
Langdale Bridge Link with Route 7 Ferry Only		
Langdale Bridge Link Total	5,655	7,502
Route 7 Ferry Total	569	645
Powell River Road Link with Route 3 & 7 Ferry		
Powell River Road Link Total	308	381
Route 3 Ferry Total	3,046	3,644
Route 7 Ferry Total	299	339
Powell River Bridge Link with Route 3 Ferry Only		
Powell River Bridge Link Total	971	1,175
Route 3 Ferry Total	5,751	7,639

Traffic forecasts will vary depending on the assumptions regarding future ferry service levels and tariffs, as well as the toll rates for each of the four fixed link scenarios. For the purposes of this analysis, the Langdale road and bridge link traffic forecasts are based on the new link replacing Route 3; the Powell River bridge link forecasts are based on the new bridge replacing Route 7; and the Powell River road link is based on continuing Route 7 service concurrent with future demand. In addition, while no decision has been made with respect to possible tolling, for the purposes of this study it is assumed that all of the fixed-link options are tolled at ferry-equivalent rates.

Scenario Development (Road & Bridge Links)

4.1 Overview

The MOTI's Request for Proposals (RFP) included the identification of four scenarios for a fixed link connection to/from the Sunshine Coast – two of which focused on connectivity to/from the Powell River area (road versus bridge link), and the other two which focused on connectivity to/from the Gibsons/Sechelt area (road versus bridge link) and the Lower Mainland. The Powell River scenarios improve connectivity to/from the Lower Mainland, but do not improve connectivity between the Gibsons/Sechelt areas and the Lower Mainland to a real degree. Whereas, the Sunshine Coast (Gibsons/Sechelt) scenarios would also provide improved connectivity between the Powell River area and Lower Mainland by eliminating the need for one of the two existing BC Ferries routes (i.e., Route 3 between Horseshoe Bay and Langdale).

Each of the Sunshine Coast fixed link scenarios represent significant capital investments. Accordingly, the scenarios have been reviewed individually as stand-alone projects for the purposes of this study; although it is noted that this would not necessarily preclude combining some of the scenarios if deemed appropriate.



FIGURE 4-1: FIXED LINK SCENARIOS REVIEWED

4.2 Alternative Scenarios Considered

During the stakeholder consultations and community outreach earlier on in this assignment, feedback was received on alternative scenarios to be considered as part of the study. A brief summary of the key alternative scenarios considered is provided below.

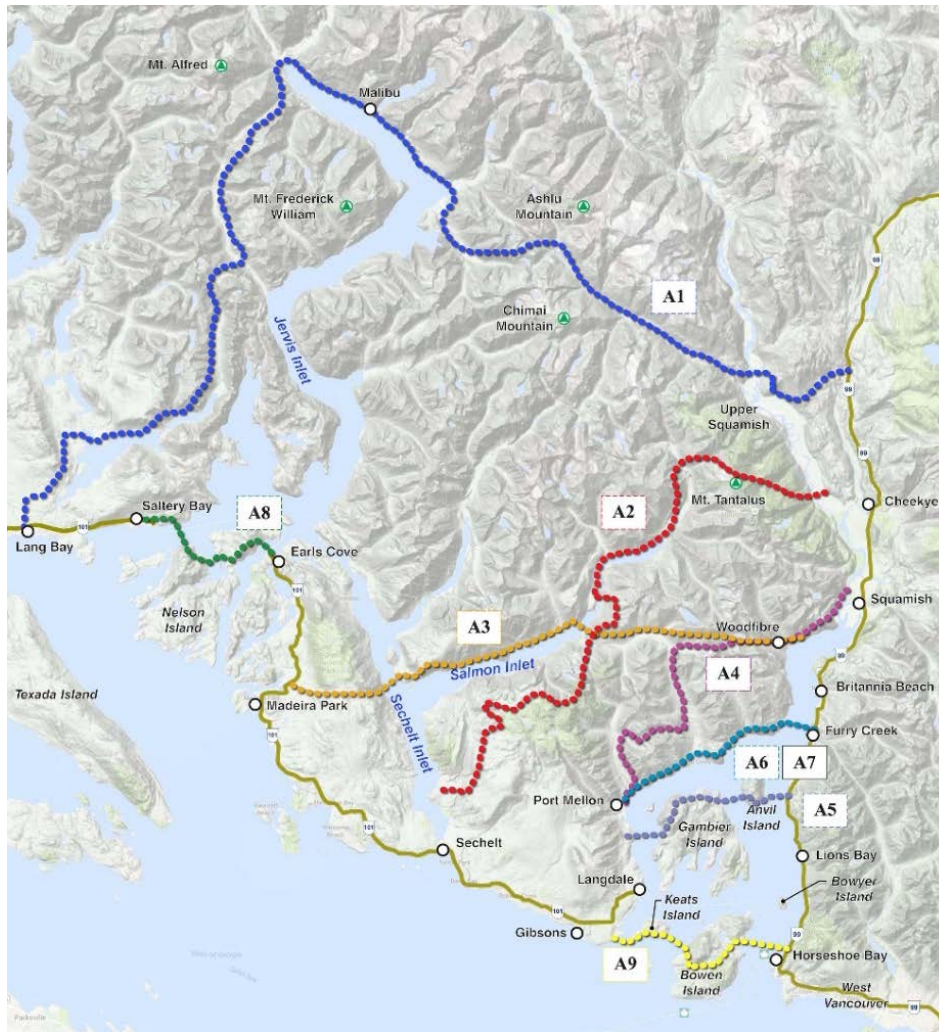


FIGURE 4-2: ALTERNATIVE SCENARIOS CONSIDERED

A1 – Alternate Powell River Road

- Overland route to Powell River, closely follows Jervis Inlet
- A shorter distance, but difficult terrain and a high avalanche risk with the steep slopes adjacent to Jervis Inlet
- Similar cost to the Powell River Road Link

A2 – Alternate Sunshine Coast Road (North)

- Follows a potential bicycle trail from Ashlu River Road to Davis Bay
- Very circuitous and steep grades, cuts through mountainous terrain so likely needs long tunnels
- Unlikely to achieve design standards and higher cost than the Langdale Road Link

A3 – Alternate Sunshine Coast Road (Middle)

- Follow the BC Hydro power line from Woodfibre to Garden Bay
- Steep grades and two major bridges across Salmon Inlet and Sechelt Inlet
- Unlikely to meet design standards and higher cost than the Langdale Road Link

A4 – Alternate Sunshine Coast Road (South)

- Follows the Fortis Gas line from Squamish to Port Mellon
- Longer distance and steeper terrain than the Howe Sound scenario
- Unlikely to achieve design standards and higher cost than the Langdale Road Link

A5 – Sunshine Coast Multi-Bridge Link

- Three bridges, Highway 99 to Anvil Island, Anvil Island to Gambier Island and Gambier Island to Sunshine Coast
- Was originally shown as one of the scenarios in the RFP; however, the Langdale Bridge Link has a cost advantage with one less bridge and no road connection to Gambier Island

A6 – Sunshine Coast Floating Bridge Link

- Single long bridge along the ‘shallower’ part of Howe Sound near Furry Creek and Defence Islands
- Considered as a combined floating bridge and cable-stayed bridge for the navigational channel
- Much more environmental and navigational impacts, higher potential construction risk, along with similar cost to the Langdale Bridge Link

A7 – Sunshine Coast Floating Tunnel Link

- Floating tunnel
- Under consideration in Norway but none constructed; potential construction risk, and cost is expected to be much higher than a bridge

A8 – Powell River Multi-Bridge Link

- Combination bridge and cable ferry (ferry service – Earls Cove to Nelson Island; bridge crossing – Nelson Island to Saltery Bay)
- May create navigational issues for other vessels
- Technical uncertainty (long cable ferry) translates into operational reliability risk
- Limited redundancy, temporary refit relief would be with a tug and barge
- Capacity could become a constraint to access
- The life-cycle cost may be more expensive than the selected Powell River Bridge Link scenario

A9 – Bowen Island Multi-Bridge Link

- Three bridges: Highway 99 to Bowen Island, Bowen Island to Keats Island, and Keats Island to Highway 101
- Potential 4-km long floating bridge and cable-stay bridge for navigational channel between Highway 99 and Bowen Island: new world record length and navigation height for this type of bridge; significant impact to existing channel navigational width; and potential construction and future maintenance risks and very high cost.
- High impacts on islands including private lands on Bowen and Keats Islands

Based on the aforementioned, four fixed link scenarios were further reviewed as described in the following sections of the report.

4.3 Engineering Design Considerations

4.3.1 Bridge Alignment Considerations

Langdale Bridge Link

The route across Howe Sound will require long bridges. The minimum total crossing length is approximately 3 km. The main issues include:

- There is very deep water across most of Howe Sound, with most of the potential routes having over 200 m depth, which is too deep for bridge piers, thus limiting the bridge type options to high cost clear span and floating bridge types;
- Navigation to the Squamish port—and potentially for LNG at Woodfibre—require high navigation clearance, approximately 55 m, and will present ship impact collision risks to in-water

piers and to floating structures. This constraint eliminates some floating bridge options and increases costs for all options due to the required height of the piers.

One potential route across the sound to the north of Anvil Island at Furry Creek would comprise a 3.5 km curved floating bridge with a cable-stayed navigation span on the west end (i.e., Alternative Scenario A6 discussed in **Section 4.2**).

This was not considered a preferred option for the following reasons:

- Floating bridges usually have anchors to the bottom seabed to take lateral loads from wind, waves and current. These waters are too deep for anchors, so another more costly technique will have to be used – putting the bridge on a curved alignment, so that the bridge can resist lateral loads like an arch placed on its side. This would result in the world’s longest bridge of this structure type, which presents numerous technical design and construction challenges that will drive costs up; and
- The navigation channel would be constrained and this option would likely find opposition from the navigation authorities.

There is a shallower bench along a crescent shaped curve across the Sound at Porteau Cove. The depths vary from 50 – 90 m. Theoretically a multispan bridge on deep piers could be built. This was also not considered a preferred option because:

- The bridge would be over 5 km long, and the piers would be among the world’s deepest water piers, resulting in a bridge with much higher capital cost;
- Requirements for ship impact on the tall piers would make them very costly, and would not be practical to design and construct; and
- There would be environmental impacts in construction of the piers that could be significant and would need more detailed studies. Concerns at this time show that some of the impacts are difficult to mitigate, which challenges this option

A three-bridge route was originally proposed in the RFP, from the east side to Anvil Island, from Anvil Island to Gambier Island, and from Gambier Island to the west side (i.e., Alternative Scenario A5 discussed in **Section 4.2**). This was not considered preferable because:

- It added a third bridge of equivalent length and cost, causing this to be a significantly more costly option;
- The south side of Anvil Island is extremely steep and likely not feasible for bridge construction; and
- There are potential land impacts on Gambier Island which the Island Trust has already advocated against.

The preferred route is considered to comprise two suspension bridges crossing from the east side of Howe Sound to Anvil Island, and from Anvil Island to the west side of Howe Sound. The preferred route was chosen because:

- It has the shortest total length of bridges and therefore the lowest capital cost;
- The suspension bridge pylons will be built on shore avoiding ship impact risk, and environmental risks of in-water piers; and
- The bridges will have adequate navigation clearance.

Powell River Bridge Link

The route includes crossing Agamemnon Channel between Earls Cove and Nelson Island, and Jervis Inlet from Nelson Island to Ahlstrom Point near Saltery Bay. The main issues include:

- A long bridge length between Nelson Island and Ahlstrom Point of approximately 2.1 km; and
- Water depths exceed 500 m, limiting options to high cost clear span and floating options.

The bridge between Earls Cove and Nelson Island is about 700 m in length. The bridge could be:

- A cable stay or suspension bridge; and
- A clear span, or have a pylon on Caldwell Island.

The bridge between Nelson Island and Ahlstrom Point is about 2.1 km in length. There are transmission lines crossing the Inlet with a minimum vertical clearance of 49 m. There are two potential bridge types:

- A suspension bridge, which would have a world-record span. There are bridges being studied with spans of 2.3 km, but no bridges have been constructed with spans greater than 2 km, so there would be considerable technical challenges and risks, which will drive up costs.
- A floating bridge on a curved alignment, with a cable stay navigation span on the west side could also be considered. This would also be a world record for this bridge type and would carry technical challenges and risks, which will drive up costs.
- Although there is very little navigation up Jervis Inlet, a detailed study would be required to determine if a small navigation span would be acceptable.

Suspension bridges were chosen for this study for simplicity in conceptual design and cost estimating; however, if a further design phase is undertaken, a detailed study of the bridge types should be undertaken.

A high level review of recently constructed bridges similar to those being considered for the Sunshine Coast was carried out and is included in **Appendix B**.

4.3.2 Navigational Clearances

Determining the required navigation clearances for all of the channels being considered would require a significant study and stakeholder consultations. Based on general industry practice, one should allow for the following required vertical clearances:

- Howe Sound on the west side of Anvil Island – 55 m for vessels navigating to Woodfibre or Squamish;
- Howe Sound on the east side of Anvil Island – 25 to 30 m for recreational vessels;
- Jervis Inlet – 49 m minimum to match the transmission line vertical clearance; and
- Agamemnon Channel – 25 to 30 m for recreational vessels.

4.3.3 Road Cross-section Design Criteria

Figure 4-3 shows the typical roadway cross-section that has been assumed for the various Powell River and Langdale Road link scenarios. Based on the traffic demand forecasts identified in **Section 3** of this report, a basic two-lane roadway cross-section with passing lanes is anticipated to be sufficient in accommodating the travel demands.

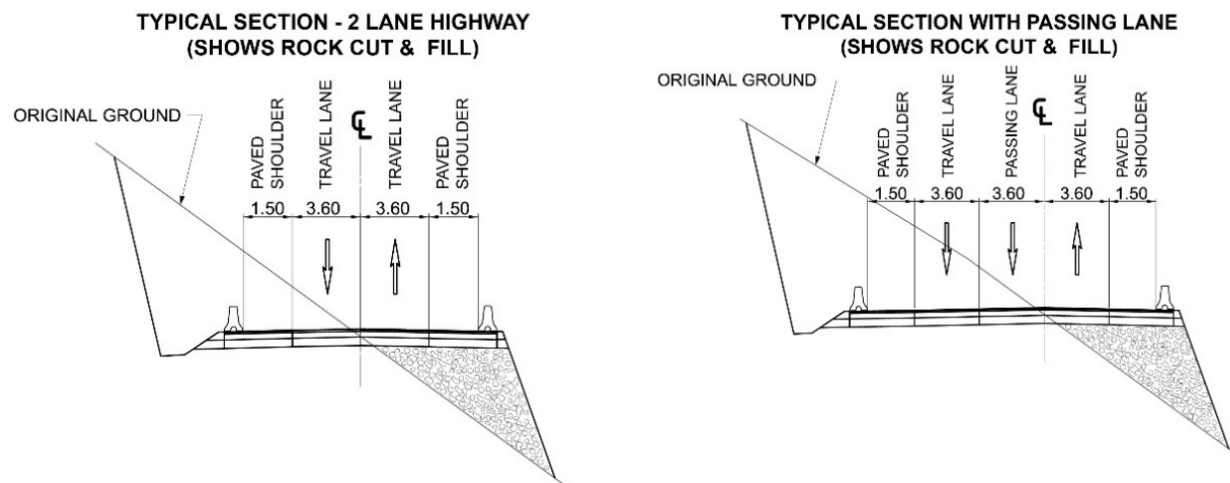


FIGURE 4-3: TYPICAL ROADWAY CROSS-SECTION

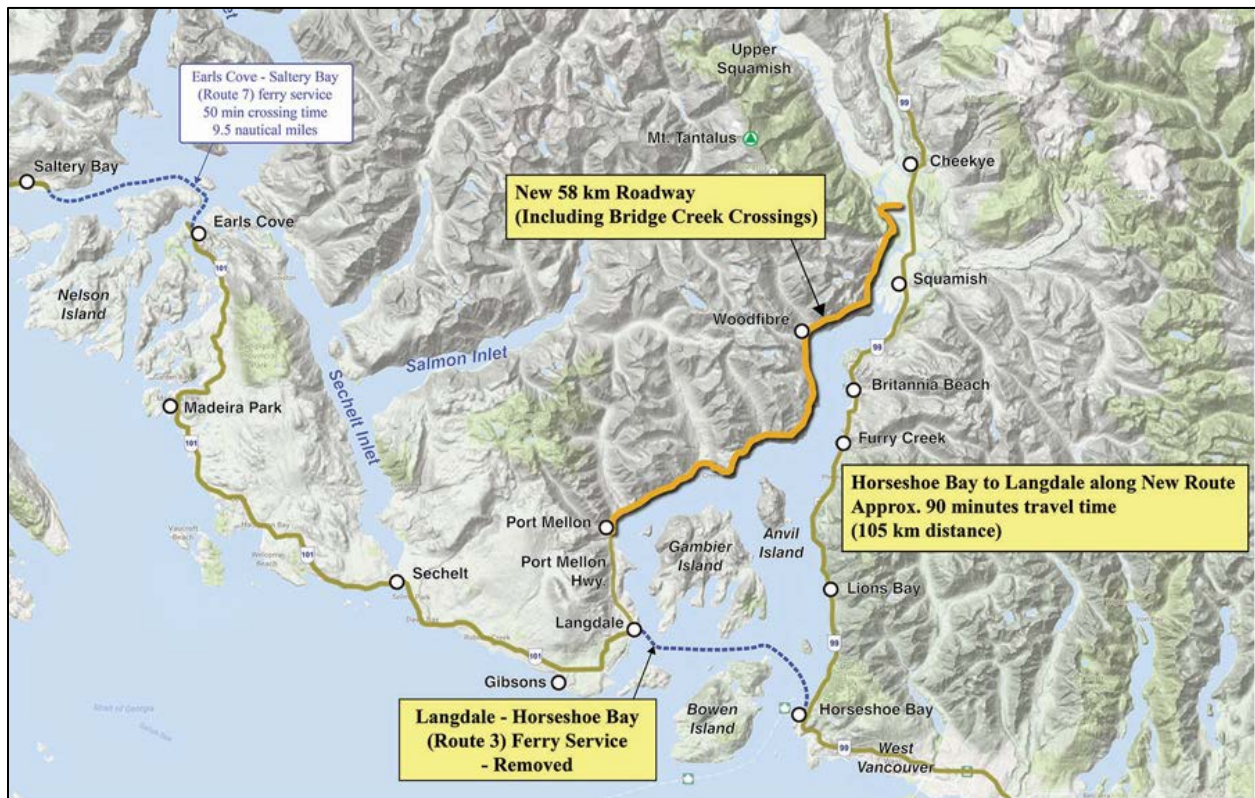
The above typical roadway cross-section is premised on the following design criteria:

TABLE 4-1: ROADWAY DESIGN CRITERIA

Design Element	Proposed Project Criteria	Comments/Notes
Design Classification	RAU	Rural Arterial Undivided roadway
Design/Posted Speed	80 km/h	
Basic # of Lanes	2	One lane per direction, plus 1.2 km long passing lanes on steep grade sections (every 5 km).
Minimum Horizontal Radius	250 m	
Max. Grade	9%	
Lane Width	3.6 m	
Shoulder Width - Outside	1.5 m	1.5 m wide paved shoulder for cycling accommodation.
Clear Zone - Offset Width Recovery Slope (4:1)	8.5 m	Proposed concrete roadside barriers (CRBs) to make the road cross-section more compact in deep cuts and on high embankments.
Design Vehicle	WB-20	20 m long wheel-base tractor-semitrailer

4.4 Langdale Road Link

This scenario connects Port Mellon to Highway 99 (Squamish) with a new coastal road. The two-lane highway, with passing lanes along steep sections, would be 58 km long, and requires deep cut sections at several locations and approximately 5 km of bridges (i.e., over 40 structures) for creek and gully crossings. Travel from Horseshoe Bay to Langdale would take approximately 90 minutes (total distance of 105 km). This scenario retains the existing BC Ferries service to Powell River but eliminates the



Langdale service.

FIGURE 4-4: LANGDALE ROAD LINK

Construction highlights associated with this scenario include:

- Two-lane highway, with passing lanes along steep sections
- Significant rock cuts and fills in several areas
- Approximately 5 km of new widened bridges (i.e. over 40 structures) for creek and gully crossings
- Includes allowance for rock stabilization and significant improvements to Depot Road
- Contingency added for acid rock and slope stabilization
- Contingency added for 'wire mesh' retaining walls and/or short tunnels

Detailed drawings showing the proposed horizontal and vertical alignments for the various scenarios is included in **Appendix A**.

4.5 Langdale Bridge Link

This scenario connects Port Mellon to Highway 99 (near Brunswick Point) via Anvil Island using two separate two-lane suspension bridges, which would include cyclist and pedestrian accommodation, and a new 14 km roadway from McNab Creek to Port Mellon. Travel from Horseshoe Bay to Langdale would take approximately 40 minutes (total distance of approximately 50 km). This scenario retains the existing BC Ferries service to Powell River but eliminates the Langdale service.

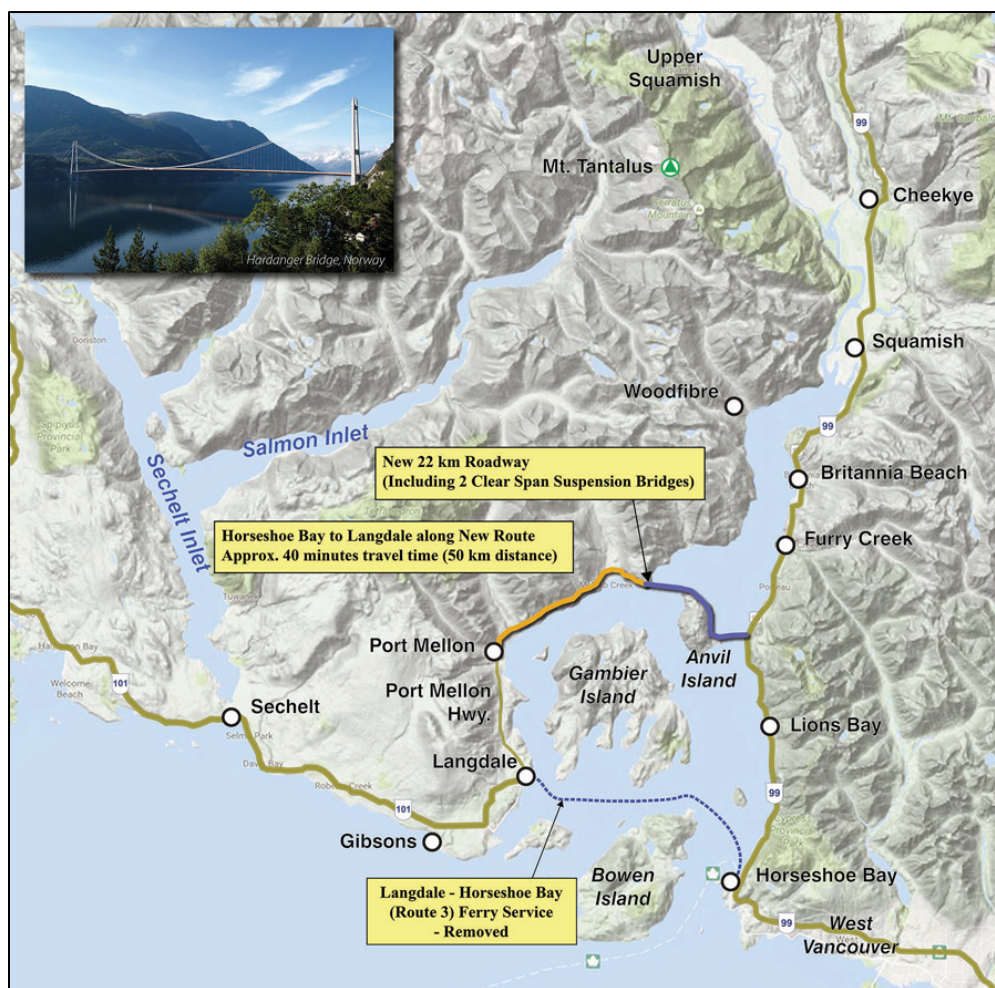


FIGURE 4-5: LANGDALE BRIDGE LINK

Construction highlights associated with this scenario include:

- Two-lane highway, with passing lanes along steep sections

- New interchange at Highway 99
- Bridge – Highway 99 to Anvil Island
 - 1.5 km clear span suspension bridge
 - 60+ m vertical navigational clearance
 - 200+ m deep channel
- Highway construction on north side of Anvil Island (assumes no direct access to/from the island)
 - Significant rock cuts and fills in several areas
- Bridge – Anvil Island to Sunshine Coast
 - 1.5+ km clear span suspension bridge
 - 60+ m vertical navigational clearance
 - 190+ m deep channel
- Highway construction on Sunshine Coast to Port Mellon
 - Significant rock cuts and fills in several areas

4.6 Powell River Road Link

This scenario connects Powell River to Highway 99 (north of Brackendale) with a new inland route through mountainous terrain. The two-lane highway, with passing lanes along steep sections, would be approximately 200 km to Squamish or 250 km to Horseshoe Bay, with approximate travel times of 2.5 or 3.0 hours respectively at 80 km/h. This scenario retains both existing BC Ferries services Routes 3 and 7, with connection to Sechelt/Gibsons as per today.

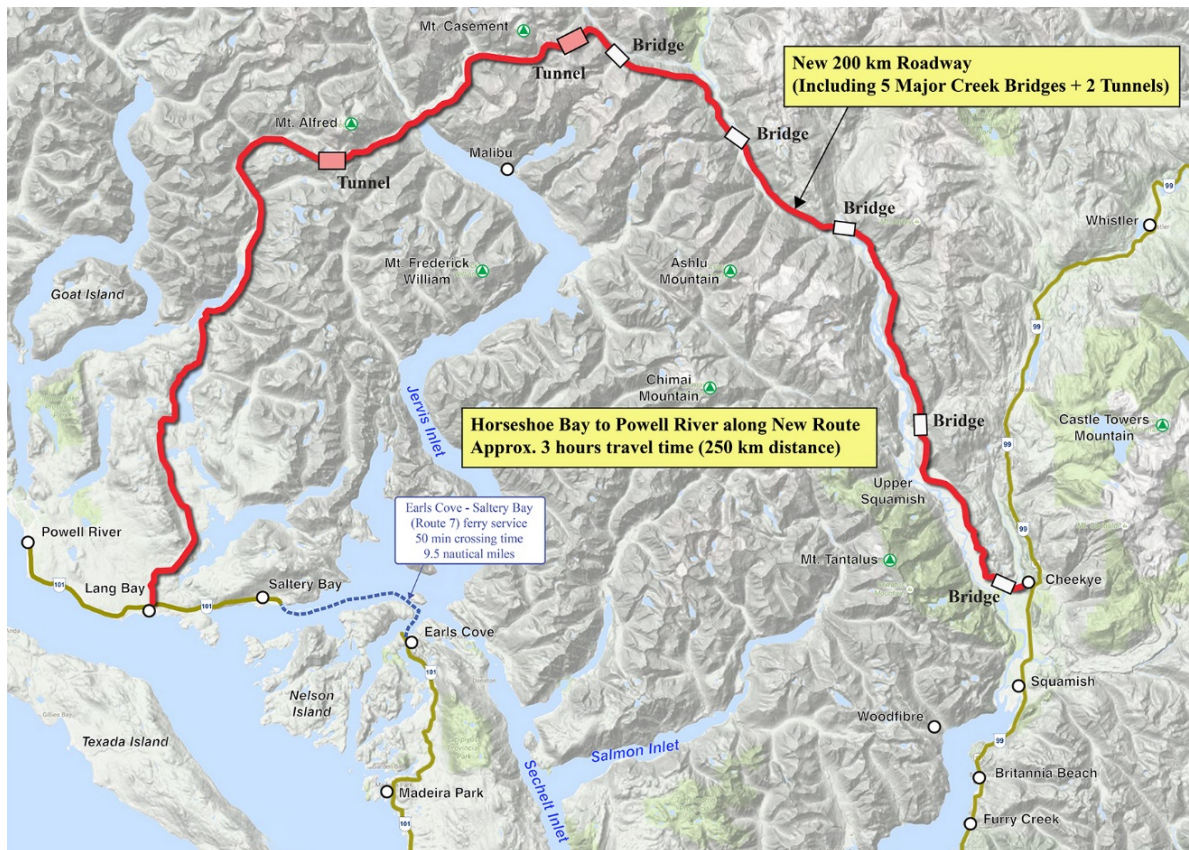


FIGURE 4-6: POWELL RIVER ROAD LINK

Construction highlights associated with this scenario include:

- Two-lane highway, with passing lanes along steep sections;
- Includes five bridges over creeks and two tunnels (approx.. 8.0 km length near Mt. Casement and approx. 4.5 km length at Mt. Alfred);
- Parallels existing logging roads where possible near the eastern portion of the alignment.

4.7 Powell River Bridge Link

This scenario connects Earls Cove to Saltery Bay with two new bridge structures: a suspension bridge from Earls Cove to Nelson Island and another suspension bridge from Nelson Island to Saltery Bay. Each bridge would have two lanes and would accommodate cyclists and pedestrians. In addition, passing lanes would be provided along the steep sections of highway situated on Nelson Island. The new route would be approximately 19 km long, and would take 15 minutes to travel at 80 km/h. This scenario retains the existing BC Ferries service to/from Langdale, but eliminates the Powell River service.



FIGURE 4-7: POWELL RIVER BRIDGE LINK

Construction highlights associated with this scenario include:

- Two-lane highway, with passing lanes along steep sections;
- Bridge – Earls Cove to Nelson Island

- 700 m clear span suspension bridge;
 - 30+ m vertical navigational clearance;
 - 170 m deep channel.
- Requires highway construction on Nelson Island;
- Bridge – Nelson Island to Ahlstrom Point
 - 2.0+ km clear span suspension bridge;
 - 50+ m vertical navigational clearance;
 - 500 m deep channel.
- Requires highway construction to Saltery Bay.

Cost Estimates

5.1 Overview

Plan/profile plots based on a terrain model compiled from Trim Mapping were prepared for each of the four fixed link scenarios. For each scenario, preliminary and very coarse cut and fill quantities were extracted from the model, using the roadway template as summarized in **Table 4-1** to provide a level of context for the estimate.

Sources of information for estimating purposes are as follows:

- 1998 MOTI Study for the Powell River Road Link
- 2001 MOTI Study for the Langdale Road Link
- MOTI Construction and Rehabilitation Cost Guide 2013
- Engineering judgement from the Binnie/Klohn Crippen Berger (KCB) team members
- Input from MOTI based on other projects under consideration, including the Prince Rupert Area Corridor Analysis that includes a roadway through similar terrain along east Tuck Inlet

5.1.1 Unit Rates

A standard approach to cost estimating that is consistent with other similar MOTI projects at this level of study was used. The MOTI Cost Guide shows the following grade construction values for a two-lane Low Volume Road:

- Easy Conditions \$542,000 - \$867,000/km
- Moderate Conditions \$867,000 - \$1,032,000/km
- Difficult Conditions \$1,032,000 - \$2,166,000/km
- Very Difficult Conditions \$2,166,000 - \$3,250,000/km

Following discussion with MOTI and a review of the other recent projects, the conclusion was reached that there are mitigating factors that warrant increasing the cost/km beyond the ranges noted above, including:

- Extremely difficult roadway construction conditions/challenging terrain, and numerous risks and unknowns given the preliminary nature of this study;

- There would be a need for an initial tote road to support the survey, geotechnical investigation and construction access, including temporary bridges at creek crossings;
- Pit development costs;
- Disposal costs for unsuitable material;
- MOTI regional recovery costs;
- Various accommodation.

For the purpose of the cost estimates for this study, the following were used:

- *Easy Conditions (widening an existing road)* \$2,000,000/km
- *Difficult Conditions* \$5,000,000/km
- *Very Difficult Conditions* \$7,000,000/km
- *Extremely Difficult Conditions* \$11,000,000/km

There are a few areas where it was necessary to supplement the MOTI Cost Guide as follows:

- No examples of grade construction similar to the Langdale Road Link along the Howe Sound with such steep rocky terrain.
 - The team used a similar methodology to the MOTI Cost Guide to establish a new category referred to as 'extremely difficult conditions', with a range of costs between \$10M and \$12M/km. For the purpose of this study a value of \$11M/km was used.
- There are very few examples of tunnel construction in North America and no examples for similar 'hard rock' excavation.
 - The team used engineering judgement to establish a \$100M per km cost estimate (which is conservative but realistic to reflect the strict safety criteria in BC for roadway tunnels as opposed to other jurisdictions and/or other users such as mining, railroads, etc).
- The standard value of \$5 K per m² (which is intended for more standard on-shore bridge structures) does not apply for the significant bridge structures required with both the Langdale and Powell River Bridge Link scenarios.
 - The team prepared individual estimates for each of these four bridges based on similar bridge projects located in other parts of the world.
- The following methodology was used for a conservative approach to the numerous creek crossings with the various scenarios:
 - All normal bridge structures assume a cost of \$5 K per m²;

- In addition, an allowance was made for other drainage crossings approximately every kilometre at a cost of \$500 K each.
- The following methodology was used for a conservative approach to account for additional construction costs:
 - 10% of grade and structural construction cost added to account for miscellaneous items such as utility relocation, traffic signals, lighting, minor retaining walls, etc.;
 - 5% of grade and structural construction cost added to account for environmental studies, approvals and mitigation;
 - 2% to 5% of grade construction cost added to account for property acquisition;
 - 40% of grade and structural construction cost added as contingency, which is normal for a conceptual estimate and acceptable based on the conservative methodology of the estimates.

The sum total of all these elements yield the Total **Construction** Cost Estimate.

- Additional project costs – the following methodology was used for a conservative approach:
 - 15% of the total construction cost added to account for project management and construction management;
 - 15% of the total construction cost added to account for survey, design and geotechnical investigation;
 - 10% of the total construction cost added to account for escalation for approximately 5 years.

The sum total of all these elements yield the **Project** Cost Estimate.

5.1.2 Property Impacts

The scenarios generally pass through undeveloped terrain, or along existing roadways where narrow bands of property may be required to allow for the roadway widening. The 2% to 5% of grade and structural construction cost for property acquisition as noted above is considered acceptable based on the preliminary nature of the mapping and design.

5.1.3 Engineering and Supervision

The percentages as noted above for project management, construction management, engineering and escalation are normal for a conceptual estimate and are acceptable based on the conservative methodology of the estimates.

5.1.4 Contingencies

The 40% of grade and structural construction cost for contingency as noted above is normal for a conceptual estimate and acceptable based on the conservative methodology of the estimates.

5.1.5 Accuracy

The Approximate Project Cost Estimate is shown as a range, (+ / –) to the nearest \$250M. This is intended to convey the preliminary nature of the cost estimates and the fact that they are primarily intended to compare between the four scenarios.

5.2 Cost Estimate Summaries

The Project Cost Estimates for each scenario are as follows:

TABLE 5-1: POWELL RIVER ROAD LINK – COST ESTIMATE

Powell River Road Link – Cost Estimate	
Grade Construction	\$1.0 Billion
Tunnel (8 km long)	\$0.8 Billion
Tunnel (4.5 km long)	\$0.4 Billion
<i>Grade and Structural Construction sub-total</i>	<i>\$2.2 Billion</i>
Total Construction Cost (incl. contingency/misc. items)	\$3.5 Billion
Approximate Project Cost Estimate (incl. project mgmt./engineering/escalation)	\$4.5 - \$5.0 Billion

TABLE 5-2: POWELL RIVER BRIDGE LINK (VIA NELSON ISLAND) – COST ESTIMATE

Powell River Bridge Link (via Nelson Island) – Cost Estimate	
Grade Construction	\$0.3 Billion
Bridge – Ahlstrom Point to Nelson Island	\$0.8 Billion
Bridge – Nelson Island to Earls Cove	\$0.3 Billion
<i>Grade and Structural Construction sub-total</i>	<i>\$1.4 Billion</i>
Total Construction Cost (incl. contingency/misc. items)	\$2.2 Billion
Approximate Project Cost Estimate (incl. project mgmt./engineering/escalation)	\$3.0 - \$3.5 Billion

TABLE 5-3: LANGDALE ROAD LINK – COST ESTIMATE

Langdale Road Link – Cost Estimate	
Grade Construction	\$0.7 Billion
Bridges and wire mesh walls	\$0.3 Billion
<i>Grade and Structural Construction sub-total</i>	<i>\$1.0 Billion</i>
Total Construction Cost (incl. contingency/misc. items)	\$1.7 Billion
Approximate Project Cost Estimate (incl. project mgmt./engineering/escalation)	\$2.0 - \$2.5 Billion

TABLE 5-4: LANGDALE BRIDGE LINK (VIA ANVIL ISLAND) – COST ESTIMATE

Langdale Bridge Link (via Anvil Island) – Cost Estimate	
Grade Construction	\$0.4 Billion
Bridge – Sunshine Coast to Anvil Island	\$0.6 Billion
Bridge – Anvil Island to Highway 99	\$0.5 Billion
<i>Grade and Structural Construction sub-total</i>	<i>\$1.5 Billion</i>
Total Construction Cost (incl. contingency/misc. items)	\$2.4 Billion
Approximate Project Cost Estimate (incl. project mgmt./engineering/escalation)	\$3.0 - \$3.5 Billion

6.1 Overview

A Multiple Account Evaluation (MAE) of the scenarios was conducted in accordance with the Ministry's guidelines. The MAE compares expected benefits and impacts of the various scenarios against the Base Case (existing ferry service), and illustrates trade-offs between the scenarios.

The Base Case assumes the following:

- Existing ferry service levels, with capacity changes as required to maintain existing levels if/as demand changes
- Includes full life-cycle analysis of financial considerations (including vessel replacement as needed)
- 25-year life cycle (first 10 years of data provided by BC Ferries)
- For Powell River route scenarios, the Base Case is Earls Cove – Saltery Bay ferry service data
- For Langdale route scenarios, the Base Case is Horseshoe Bay – Langdale ferry service data

As illustrated in **Figure 6-1**, the five standard Ministry evaluation accounts include Financial, Customer Service, Environment, Economic and Socio-Community. The Ministry is also engaging with area First Nations, and these discussions are currently ongoing.

The criteria, or factors, for each account were developed based on Ministry requirements, best practice, and results of consultation and engagement to date. The scenarios have been evaluated based on a number of performance criteria typical for roadway projects over an analysis period of 25 years (but recognizing that the infrastructure life cycle will be beyond this period). The basis for the evaluation for each of the criteria is described in each of the following sections. The criteria can generally be separated into three types: financially quantifiable revenues and costs (e.g. travel time and safety); other quantifiable benefits and costs (e.g. Greenhouse gas emissions); and other subjectively assessed (non-quantified) benefits and impacts.

Quantifiable financial and economic benefits and costs have also been evaluated for each of the four scenarios. Future-year benefits and costs have been discounted to the year 2016, at a rate of 6% annually, in accordance with Ministry guidelines.

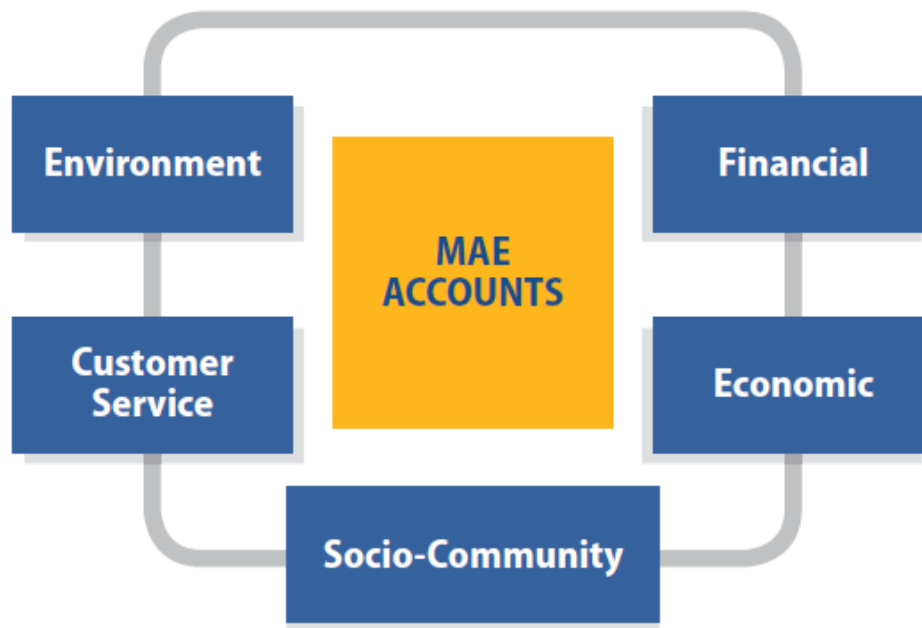


FIGURE 6-1: MULTIPLE ACCOUNT EVALUATION

6.2 Financial Account

6.2.1 Capital Costs

The capital cost estimates for the four scenarios are described in **Section 5.2** of this report. The capital costs for the four fixed link scenarios are the present value (in 2016 dollars, discounted at 6% annually) of the total project capital costs – including planning, property, design, engineering, procurement and construction. Within the economic analysis, the Present Value of the capital costs are used rather than the cost estimate value because the projects will be constructed over a longer period of time, and money amounts spent in the future are discounted to the present. Capital costs for the Base Case (continued ferry operations) also reflect the need for ferry replacements during the 25-year, life-cycle analysis period.

For the Langdale road and bridge scenarios, capital costs are estimated to be \$242 M for the Base Case, \$1,827 to \$2,230 M for the Langdale Road Link and \$2,632 to 3.034 M for the Langdale Bridge Link (**Table 6-1**). For the Powell River scenarios, capital costs are estimated to be \$27 M for the Base Case, \$3,729 to \$4,131 M for the Powell River Road Link and \$2,281 to \$2,683 M for the Powell River Bridge Link (**Table 6-2**). These capital cost estimates are based on completing the works over a six-year period, with completion in 2022 and with the first year of use and benefits occurring in 2023.

6.2.2 Operations, Maintenance and Rehabilitation Costs

For the Langdale scenarios the overall discounted maintenance and rehabilitation costs are expected to amount to \$513M for the Base Case, \$317 M for the Langdale Road Link and \$320 M for the Langdale Bridge Link. The Powell River scenarios are expected to amount to \$198 M for the Base Case, \$251 M for the Powell River Road Link, and \$107 M for the Powell River Bridge Link.

6.2.3 Ferry and Toll Revenues

Ferry and toll revenues have also been forecast for all scenarios. While no decisions have been made with respect to tolling, the analysis presented in **Tables 6-1** and **6-2** is based on the traffic volumes associated with ferry-equivalent toll rates. **Appendix F** also contains a sensitivity analysis of the effect on traffic volumes and economic benefits/costs of having an un-tolled facility.

6.2.4 Salvage Values

Salvage values refer to the remaining value of the various roadway and ferry assets at the end of the 25-year analysis period, reducing the present value of costs of the ferry/fixed link operators. For the Langdale scenarios these amount to -\$33 M for the Base Case, -\$355 to -\$437 M for the Langdale Road Link and -\$518 to -\$600 M for the Langdale Bridge Link. For the case of the Powell River scenarios they amount to -\$33 M for the Base Case, -\$785 to -\$867 M for the Powell River Road Link, and -\$458 to -\$539 M for the Powell River Bridge Link.

6.3 Customer Service Account

6.3.1 Travel Costs

Travel costs have been calculated for the Base Case and for each of the scenarios. These calculations include travel time costs based on measured and expected speeds on the various segments to the Langdale and Powell River destinations, as well as expected vehicle operating costs based on fuel usage. For the Langdale scenarios, travel costs are forecast as \$2,187 M for the Base Case, \$2,585 M for the Langdale Road Link and \$1,645 M for the Langdale Bridge Link. The Powell River scenarios are forecast as \$2,671M for the Base Case \$2,584 M for the Powell River Road Link and \$2,563 M for the Powell River Bridge Link.

6.3.2 Customer Ferry Fares and Toll Costs

Ferry fares and toll costs were also calculated for both the roadways and for the ferry services. While from the ferry/fixed link operators' viewpoints these charges help to reduce project costs, in the consumer benefits accounts they have the effect of adding to the overall trip cost. These costs were used in developing the overall (generalized) trip costs for each of the different options, which were then used for traffic forecasting.

6.3.3 Safety (Collision) Costs

Projections of the number and type of collisions, their costs, and the savings associated with the various scenarios have been made. A series of collision prediction models were set up and calibrated to estimate the collision forecasts over the 25-year life-cycle planning period. The models estimate collisions based on traffic volumes, roadway type, and roadway length for each of the scenarios. Collisions on the ferries themselves are assumed to be negligible.

For the Langdale scenarios, the incremental collision costs as compared to the Base Case are forecast as \$83 M for the Langdale Road Link, and \$105 M for the Langdale Bridge Link. For the Powell River scenarios, incremental safety costs are forecast as \$179 M for the Powell River Road Link, and \$20 M for the Powell River Bridge Link.

6.3.4 Customer Service Subjective Criteria

The results of the customer service subjective (non-quantified) criteria evaluations are presented in **Table 6-3** with a discussion for the ratings provided below.

Travel Time Reliability includes consideration of availability, travel time consistency, and potential for delay due to weather or capacity.

The Langdale Bridge and Powell River Road Links are considered ‘much better’ for the Sunshine Coast and Powell River communities respectively, due to their directness (despite the length of the latter) in serving those communities. The Langdale Road Link is still considered ‘better’ despite its length/travel time to/from the Sunshine Coast, and similarly with the Powell River Bridge Link since both eliminate the requirement for one existing ferry route service.

Multi-modal Accessibility includes consideration of availability and convenience for all modes of travel (including cyclists and pedestrians).

The Powell River Road Link requires retention of both existing ferry route services, which allows maintaining convenient accessibility for cyclists and pedestrians. For the Langdale Road/Bridge and Powell River Bridge Links, one of the ferry route services will be eliminated, making accessibility ‘worse’ for non-motorized modes (particularly pedestrians).

It is noted that all fixed link scenarios would allow for the accommodation of transit, and therefore, all are similar from this perspective.

Accessibility to Emergency Services includes consideration of access to hospitals, availability of emergency responders, as well as cell phone coverage.

The Langdale Bridge Link is considered ‘much better’ for accessibility to emergency services due to its directness in connecting the Sunshine Coast to the Lower Mainland facilities such as Lions Gate Hospital in North Vancouver. The Langdale Road and Powell River Road/Bridge Links are all still considered ‘better’ since they reduce the reliance on at least one existing ferry route service.

Emergency Evacuation includes consideration of capacity to support community evacuation in the event of a major emergency or disaster.

The Langdale Road Link is considered ‘much better’ for emergency evacuation since it is entirely a land route that does not rely on a bridge crossing, and is a relatively short length connection to the Lower Mainland. The Langdale Road and Powell River Road/Bridge Links are all still considered ‘better’ since they reduce the reliance on at least one existing ferry route service.

Travel Quality/Experience includes consideration of availability of amenities, such as food services and washrooms, driver comfort and stress/fatigue, Sunshine Coast viewsapes, and driver experience.

Both the Langdale Bridge and Powell River Bridge Links involve crossing bodies of water (i.e., similar to the existing ferry services) and shorter distances as compared to the land-based scenarios; therefore, both retain the experience of enjoying Sunshine Coast viewsapes with better driver comfort. The land-based routes, Langdale Road and Powell River Road Links, are considered ‘worse’ from a travel quality/experience perspective.

Safety includes accident rates, types, and severity of collisions based on Ministry statistics for roadway types.

All of the Langdale Road/Bridge and Powell River Road/Bridge Links are considered a higher risk for vehicle collisions as compared to the existing ferry services; therefore, they are rated ‘worse’.

The Powell River Road Link will have long tunnels, which would require significant additional safety equipment/personnel if dangerous goods were to be allowed on the route. Therefore, it is assumed that the transport of dangerous goods would not be permitted on the route.

6.4 Socio-Community Account

The results of the Socio-Community subjective criteria evaluations are presented in **Table 6-4** with a discussion for the ratings provided below.

Population includes consideration of potential to support population growth.

The Langdale Bridge and Powell River Road Links are considered ‘much better’ for improving accessibility to/from the Sunshine Coast and Powell River communities respectively, thereby correspondingly supporting population growth. The Langdale Road and Powell River Bridge Links are still considered ‘better’ since both eliminate the requirement for one existing ferry route service, and therefore improve accessibility in support of population growth.

Property Requirements include consideration of impacts to private property or otherwise designated crown lands for roadway development.

The Powell River Road Link is a very long route alignment that traverses through the greatest number of private and crown- designated legal lots; therefore, it is rated as ‘much worse’ from a property

requirements perspective. The Langdale Road/Bridge and Powell River Bridge Links traverse through far fewer legal lots, though they will still impact properties. Thus, they are correspondingly rated as ‘worse’.

Consistency with Community Policies, Character and Identity includes consideration of potential to support the realization of the vision of Official Community Plans and related neighbourhood and transportation plans.

The Langdale Bridge Link is rated as ‘worse’ since it may be viewed as contravening the *Island Trust Act* for which the objective is ‘preserving and protecting the Trust Area’. This is due to impacts on Anvil Island which is part of the Trust Area. The Langdale Road and Powell River Road/Bridge Links do not appear to be at odds with any of the Sunshine Coast (Gibsons and Sechelt) and/or Powell River Official Community Plans; therefore, they are rated as ‘neutral’ in terms of consistency with community policies.

Effects on Population-supporting Infrastructure includes consideration of potential requirement for increased investment in local roads, sewers, potable water supply, waste handling, and other utilities as a result of increased population and temporary visitors.

The Langdale Bridge Link is expected to generate the most traffic and potential growth due to its route directness to/from the Sunshine Coast. It is expected to have the greatest impacts on population-supporting infrastructure—particularly for the Gibsons and Sechelt areas. Thus, the Langdale Bridge Link is rated ‘much worse’ in this respect. The Langdale Road and Powell River Road/Bridge Links are rated ‘worse’ due to anticipated lower traffic generation and corresponding effects on population-supporting infrastructure.

Visual/Aesthetic Effects include consideration of changes in viewsapes through communities as a result of new roads and bridges.

The Langdale Road and Powell River Bridge Links will be constructed through some currently pristine areas that will be viewed by nearby communities. Therefore, they are rated as ‘worse’ from a visual/aesthetics perspective. On the other hand, the Langdale Bridge and Powell River Road Links either have less impacts on currently pristine areas or will not be in view of nearby communities, and thus are rated as ‘neutral’.

Noise Effects include consideration of noise levels through communities as a result of new roads and bridges, and/or increased traffic volumes, as well as the elimination of ferries and terminals and associated traffic impacts.

While both the Langdale Road and Bridge Links eliminate an existing ferry route service (which would benefit Sunshine Coast residents by removing ferry traffic noise), they are anticipated to generate more overall traffic. This increase in traffic would increase traffic noise effects on those communities along Highway 99, north of Horseshoe Bay. Therefore, these option links are rated as ‘worse’ from a noise perspective.

On the other hand, the Powell River Road and Bridge Links are anticipated to generate less traffic and thus are rated as ‘neutral’ in terms of noise effects.

Community Severance and Connectivity includes consideration of changes in community accessibility and connectivity between local communities.

All of the Langdale Road/Bridge and Powell River Road/Bridge Links are considered as improving accessibility and connectivity between local communities, without any negative effects of severing communities traversed by the road/bridge alignments. Therefore, these four options are rated as 'better' from a community connectivity perspective.

Recreation Effects include consideration of changes in recreation potential resulting from increased access to back country areas.

The Langdale Road and Powell River Road Links both provide improved accessibility to back country areas for potential recreational purposes; therefore, both are rated as 'much better' from a recreational effects perspective. The Langdale Bridge and Powell River Bridge Links provide potential back country access to a lesser degree, and thus are only rated as 'better' for such recreational effects.

6.5 Environmental Account

The results of the environmental subjective criteria evaluations are presented in **Table 6-5** with a discussion for the ratings provided below. A 'desktop' environmental review of the various scenarios was also carried out and included in **Appendix C**.

Air Quality includes consideration of potential changes in criteria air contaminants and greenhouse gases as a result of increased vehicle traffic and decreased ferry traffic.

The Powell River Bridge Link is anticipated to generate the least amount of traffic (and corresponding greenhouse gases). As it replaces an existing ferry route service, it is given a 'neutral' rating from the perspective of air quality. On the other hand, although both the Langdale Road and Bridge Links will also replace an existing ferry route service, they are, nonetheless, anticipated to generate significantly more traffic; therefore, they are rated 'worse'. The Powell River Road Link retains both existing ferry route services, but is anticipated to generate less traffic than the Langdale Road and Bridge Links. With the ferry services retained, it too is rated 'worse' for air quality.

Freshwater Fish, Wildlife and Habitat includes consideration of potential effects on these biophysical resources as a result of new roadways and vehicle use.

The Powell River Road Link is a very long land route with many freshwater river and creek crossings. It is rated 'much worse' in terms of impacts to freshwater fish, wildlife, and habitat. While the Langdale Road Link is also a land route, it is significantly shorter and has fewer crossings over freshwater creeks; therefore, it is correspondingly given a 'worse' rating. The Langdale Bridge and Powell River Bridge Links both cross over a marine body and have the least impact on freshwater tributaries and associated habitats; they are rated as 'neutral'.

Marine Resources considers potential effects on marine life and habitat as a result of changes in ferry service, as well as new bridge crossing over marine areas.

The Langdale Road Link eliminates an existing ferry route service and does not involve any new marine body bridge crossing; therefore, it is rated 'better' from a marine resources perspective. On the other hand, while the Langdale Bridge and Powell River Bridge Links both eliminate an existing ferry route,

they nonetheless require new marine body crossings and so are both rated as ‘worse’. Finally, while the Powell River Road Link is a land route, it still relies on retention of the existing ferry route services; therefore, nothing changes from a marine resources perspective.

Parks and Protected Areas include consideration of physical effects on these designated areas as a result of new roadways.

The Langdale Road and Powell River Road Links both traverse through areas designated as Provincial Park or other similar protected areas; therefore, they are rated ‘much worse’ in this respect. On the other hand, the Langdale Bridge and Powell River Bridge Links do not traverse through any known Provincial Parks.

Effects of the Environment on the Project include consideration of factors such as climate change and extreme weather events.

The Powell River Road and Langdale Road Links are expected to be susceptible to climate change and extreme weather events due to their proposed alignments located through very rugged and mountainous terrain. Correspondingly, they have been rated as ‘much worse’ with respect to effects of the environment. The Langdale Bridge and Powell River Bridge Links represent shorter route connections and have been rated ‘worse’.

6.6 Economic Development Account

The results of the Economic Development subjective criteria evaluations are presented in **Table 6-6** with a discussion for the ratings provided below.

Effects on Private Property Values include consideration of increased value commensurate with increased accessibility.

The Langdale Bridge and Powell River Road Links are considered ‘much better’ for improving accessibility to/from the Sunshine Coast and Powell River communities respectively, thereby correspondingly potentially increasing private property values. The Langdale Road and Powell River Bridge Links are still considered ‘better’ since both eliminate the requirement for one existing ferry route service, and thus improve accessibility.

Influence on Tourism and Other Local Business Development includes consideration of increased economic development and potential for increased tourism. With such growth one can anticipate higher travel demand volumes, improved access to goods and services, and improved access to back country tourism areas.

The Langdale Bridge Link is considered ‘much better’ for generating higher travel demand volumes due to its route directness to/from the Sunshine Coast and, correspondingly, its resultant influence on tourism and other local business development. The Powell River Road Link is also considered to be ‘much better’ from the perspective of the Powell River community; it also improves tourists’ access to back country areas. The Langdale Road and Powell River Bridge Links are still considered ‘better’ since

both eliminate the requirement for one existing ferry route service, and therefore improve overall accessibility.

Natural Resource Development Potential includes consideration of improved road access to back country areas.

The Powell River Road Link opens up vast areas of back country for potential natural resource development; therefore, it is rated ‘much better’ in this respect. The Langdale Road Link potentially opens up some areas closer to the coast, although not as vast as with the latter option. Thus, it is rated ‘better’.

The Powell River Bridge Link simply replaces one of the existing ferry services and therefore, provides minimal benefits with regard to natural resource development.

Marine Navigation Effects include consideration of economic implications of increases or decreases in vessel traffic and/or increases or decreases in impediments to marine travel (e.g., new bridge piers or reduced ferry crossing conflicts for other vessels).

The Langdale Road Link eliminates one existing ferry route and does not require any bridge crossings over waterways; therefore, it is considered ‘much better’ with respect to marine navigation effects. The Powell River Road Link would still rely on both of the existing ferry services and so is rated ‘neutral’ in this regard. The Langdale Bridge and Powell River Bridge Links both eliminate one existing ferry route service, but require new bridge crossings over waterways; therefore, they are rated only as ‘better’.

6.7 First Nations

The results of the First Nations subjective criteria evaluations are presented in **Table 6-7** with a discussion for the ratings provided below. A summary of some of the key First Nations interest areas is also included in **Appendix D**. Note that MOTI continues to engage with First Nations, and because these discussions are on-going, this may result in changes to the analysis and/or conclusions of this study.

Aboriginal Rights include consideration of publicly available information with respect to overlap with First Nations’ land claims, tenure or known sacred or conservancy/wildland areas.

The Powell River Road Link traverses through a significant number of Squamish Nation and Sechelt First Nation conservation, wildlife/wildland, cultural, and reserve areas; thus, it is rated ‘much worse’ in this respect. Similarly, the Langdale Road Link traverses through a number of Squamish Nation wildlife and cultural areas, and is also rated ‘much worse’. The Langdale Bridge Link appears to traverse through only a portion of the Squamish First Nation’s wildlife area, while the Powell River Bridge Link traverses through the Sechelt First Nation’s cultural area; therefore, both are rated as ‘worse’.

Archaeological Resources include consideration of overlap with areas of known or high potential for archaeological and heritage sites.

All of the Langdale Road/Bridge and Powell River Road/Bridge Links traverse through the proximities of archaeological sites, with a greater potential number of direct impacts associated with the Powell River Road Link. Therefore, the Powell River Road Link is rated as ‘much worse’ in this respect, while all of the other links are rated as ‘worse’.

Economic and Land Development will include confirmation with First Nations regarding any other interests or concerns. These discussions are ongoing.

6.8 MAE Summary

Utilizing the financial information from **Sections 6.2** and **6.3** above, two key economic indicators can be calculated: the Net Present Value (NPV), and the Benefit/Cost Ratio (BCR). Both indicators, but in particular the Net Present Value, are important to the Provincial Government in their financial analysis and decision making. The Net Present Value identifies the difference in benefits over costs, or the additional benefit that can be expected by a project. The benefit/cost ratio presents the proportional difference of benefits over costs. Typically, what is desired are positive Net Present Values and Benefit/Cost ratios greater than 1.0. The key indicators, and the information leading to the key indicators are presented in **Table 6-1** for the Sunshine Coast scenarios and **Table 6-2** for the Powell River scenarios.

TABLE 6-1: ECONOMIC ANALYSIS SUMMARY – SUNSHINE COAST SCENARIOS

Accounts	Base Case Route 3	Langdale Road Link	Incremental Change	Langdale Bridge Link	Incremental Change
FINANCIAL COSTS					
Capital Costs (Present Value)	\$ 242	\$ 1,827 to \$ 2,230	\$ 1,585 to \$ 1,988	\$ 2,632 to \$ 3,034	\$ 2,390 to \$ 2,792
O, M & R Costs (Road & Ferry Operations)	\$ 513	\$ 317	-\$ 197	\$ 320	-\$ 193
Salvage Value	-\$ 33	-\$ 355 to -\$ 437	-\$ 322 to -\$ 403	-\$ 518 to -\$ 600	-\$ 485 to -\$ 567
Total Financial Cost (\$Capital + O&M + Property)	\$ 722	\$ 1,789 to \$ 2,110	\$ 1,067 to \$1,388	\$ 2,434 to \$ 2,755	\$ 1,712 to \$ 2,033
USER COSTS/BENEFITS					
Travel Cost (incl. Time and Op. Costs)	\$ 2,187	\$ 2,585	-\$ 398	\$ 1,645	\$ 542
Safety (Collision Cost)			-\$ 83		-\$ 105
Total User Cost (\$ Travel Cost + Safety)	\$ 2,187	\$ 2,585	-\$ 481	\$ 1,645	\$ 437

Net Present Value (NPV)			-\$ 1,548 to -\$ 1,868		-\$ 1,275 to -\$ 1,596
Benefit — Cost Ratio (BCR)			< 0		0.255 to 0.215

Notes:

- 1) Base Case is Route 3 Horseshoe Bay – Langdale ferry service.
- 2) Present Value of capital costs are used rather than the cost estimate values due to the discounting of future money spent back to the present.
- 3) Negative BCR (< 0) due to the user costs being greater than the Base Case ferry service.

For the **Langdale Road Link**, the additional financial costs to the Province (ferry and road operations combined, relative to continued ferry operations) is estimated as having a present value of \$1,067 to \$1,388 million. For users of the new road, the “generalized cost” (travel time + vehicle operating costs) of taking the circuitous coastal road route through Squamish would actually be higher than the current cost of travelling by ferry, resulting in “negative benefits” (additional user costs) of \$481 million in relation to the current Route 3 ferry service. Thus, the Net Present Value (NPV) of the project (benefits minus costs) is estimated as minus \$1.5 to \$1.9 billion – the \$1,067 to \$1,388 million in additional provincial financial costs, plus the \$481 million in additional user costs – and the benefit cost ratio is estimated as negative or less than zero.

For the **Langdale Bridge Link**, the additional financial cost to the Province is estimated to have a present value of \$1,712 to \$2,033 million. In terms of user benefits, the “generalized costs” for travellers would be lower than for current ferry services, reflecting the reduced travel times and increased flexibility. User benefits (reduced user costs) are estimated as having a present value of \$437 million. Comparing benefits to costs, the Net Present Value of the project (benefits minus costs) is estimated as minus \$1.3 to \$1.6 billion, and the benefit cost ratio is estimated as 0.255 to 0.215.

This preliminary benefit cost analysis (BCA) is based on a number of key initial assumptions -- including for example, the assumption that a new Langdale fixed link would be tolled at ferry-equivalent rates. BCA findings will vary depending on this and other individual assumptions. Accordingly, a high-level analysis has been undertaken of the sensitivity of the BCA results to a toll-free facility for all scenarios, as discussed in **Appendix F**. Even assuming no tolls, both Langdale scenarios still have negative Net Present Values and Benefits Cost Ratios of less than 1.0.

These results are also before considering the potential longer-run economic development benefits associated with each scenario, which are assessed qualitatively in **Table 6-6**.

The same calculations are made for the Powell River scenarios with the results tabulated in **Table 6-2**.

TABLE 6-2: ECONOMIC ANALYSIS SUMMARY – POWELL RIVER SCENARIOS

Accounts	Base Case	Powell River Road Link	Incremental Change	Powell River Bridge Link	Incremental Change
FINANCIAL COSTS					
Capital Costs (Present Value)	\$ 27	\$ 3,729 to \$ 4,131	\$ 3,702 to \$ 4,104	\$ 2,281 to \$ 2,683	\$ 2,253 to \$ 2,656
O, M & R Costs (Road & Ferry Operations)	\$ 198	\$ 251	\$ 53	\$ 107	-\$ 91
Salvage Value	-\$ 33	-\$ 785 to -\$ 867	-\$ 752 to -\$ 834	-\$ 458 to -\$ 539	-\$ 425 to -\$ 506
Total Financial Cost (\$Capital + O&M + Property)	\$ 192	\$ 3,195 to \$ 3,516	\$ 3,003 to \$ 3,323	\$ 1,930 to \$ 2,251	\$ 1,738 to \$ 2,058
USER COSTS/BENEFITS					
Travel Cost (incl. Time and Op. Costs)	\$ 2,671	\$ 2,584	\$ 87	\$ 2,563	\$ 108
Safety (Collision Cost)			-\$ 179		-\$ 20
Total User Cost (\$ Travel Cost + Safety)	\$ 2,671	\$ 2,584	-\$ 92	\$ 2,563	\$ 87
Net Present Value (NPV)			-\$ 3,095 to -\$ 3,415		-\$ 1,650 to -\$ 1,971
Benefit — Cost Ratio (BCR)			< 0		0.050 to 0.042

Notes:

- 1) Base Case is Route 7 Earls Cove – Saltery Bay ferry service.
- 2) Present Value of capital costs are used rather than the cost estimate values due to the discounting of future money spent back to the present.
- 3) Negative BCR (< 0) due to the user costs being greater than the Base Case ferry service.

For the **Powell River Road Link**, the additional financial costs to the Province (ferry and road operations combined, relative to the base case of continued ferry operations only) is estimated as having a present value cost of \$3,003 to \$3,323 million. For users of the new road, the “generalized cost” (travel time + vehicle operating costs) of taking the interior highway route (through Squamish to Jervis Inlet, and then on to Powell River) would actually be higher than the current cost of travelling by ferry, given the circuitous nature of the trip -- resulting in “negative benefits” (additional costs) of \$92 million in relation to the current ferry services. Thus, the Net Present Value (NPV) of the project (benefits minus costs) is estimated as minus \$3.1 to \$3.4 billion – the \$3,003 to \$3,323 million in additional provincial financial

costs, plus the \$92 million in additional user costs – and the benefit cost ratio is estimated as negative or less than zero.

For the **Powell River Bridge Link**, the additional financial cost to the Province is estimated to have a present value cost of \$1,738 to \$2,058 million. In terms of user benefits, the “generalized costs” for travellers would be lower than the current ferry service, primarily due to the reduced travel times for users. Direct user benefits (reduced travel costs) are estimated as having a present value of \$87 million, reflecting the relatively modest traffic volumes forecast for the new bridge. The Net Present Value of the project (benefits minus costs) is estimated as minus \$1.7 to \$2.0 billion, and the benefit cost ratio is estimated as 0.050 to 0.042.

Again, this preliminary benefit cost analysis (BCA) is based on a number of key initial assumptions -- including for example the assumption that a new Powell River fixed link would be tolled at ferry-equivalent rates. As further discussed in **Appendix F**, even assuming no tolls, both scenarios still have negative Net Present Values and Benefits Cost Ratios of less than 1.0. In addition, these results are before considering the potential longer-run economic development benefits associated with each scenario, which are assessed qualitatively in **Table 6-6**.

The following **Tables 6-3** through to **6-7** provide summaries of the subjective MAE accounts and criteria for the various Sunshine Coast and Powell River Road/Bridge Link scenarios.

TABLE 6-3: SUBJECTIVE CRITERIA EVALUATIONS – CUSTOMER SERVICE

Criteria	Sunshine Coast Scenarios		Powell River Scenarios	
	Langdale Road Link	Langdale Bridge Link (via Anvil Island)	Powell River Road Link	Powell River Bridge Link (via Nelson Island)
Travel Time Reliability	✓	✓✓	✓✓	✓
Multimodal Accessibility (for bikes and pedestrians)	✗	✗	---	✗
Accessibility to Emergency Services	✓	✓✓	✓	✓
Emergency Evacuation	✓✓	✓	✓	✓
Travel Quality/Experience	✗	---	✗	---
Safety	✗	✗	✗	✗
Legend: --- Neutral ✓ Better ✓✓ Much Better ✗ Worse ✗✗ Much Worse				

TABLE 6-4: SUBJECTIVE CRITERIA EVALUATIONS – SOCIO-COMMUNITY

Criteria	Sunshine Coast Scenarios		Powell River Scenarios	
	Langdale Road Link	Langdale Bridge Link (via Anvil Island)	Powell River Road Link	Powell River Bridge Link (via Nelson Island)
Population	✓	✓✓	✓✓	✓
Property Requirements	X	X	XX	X
Consistency with Community Policies, Character and Identity	---	X	---	---
Effects on Population-supporting Infrastructure	X	XX	X	X
Visual/Aesthetic Effects	X	---	---	X
Noise Effects	X	X	---	---
Community Severance and Connectivity	✓	✓	✓	✓
Recreation Effects	✓✓	✓	✓✓	✓
Legend: --- Neutral ✓ Better ✓✓ Much Better X Worse X X Much Worse				

TABLE 6-5: SUBJECTIVE CRITERIA EVALUATIONS – ENVIRONMENT

Criteria	Sunshine Coast Scenarios		Powell River Scenarios	
	Langdale Road Link	Langdale Bridge Link (via Anvil Island)	Powell River Road Link	Powell River Bridge Link (via Nelson Island)
Air Quality	X	X	X	---
Freshwater Fish, Wildlife & Habitat	X	---	XX	---
Marine Resources	✓	X	---	X
Parks and Protected Areas	XX	---	XX	---
Effects of the Environment on the Project	XX	X	XX	X
Legend: --- Neutral ✓ Better ✓✓ Much Better X Worse X X Much Worse				

28.00 in

TABLE 6-6: SUBJECTIVE CRITERIA EVALUATIONS – ECONOMIC DEVELOPMENT

Criteria	Sunshine Coast Scenarios		Powell River Scenarios	
	Langdale Road Link	Langdale Bridge Link (via Anvil Island)	Powell River Road Link	Powell River Bridge Link (via Nelson Island)
Effects on Private Property Values	✓	✓✓	✓✓	✓
Influence on Tourism and Other Local Business Development	✓	✓✓	✓✓	✓
Natural Resource Development Potential	✓	---	✓✓	---
Marine Navigation Effects	✓✓	✓	---	✓
Legend: --- Neutral ✓ Better ✓✓ Much Better X Worse X X Much Worse				

Consideration	Sunshine Coast Scenarios			Powell River Scenarios	
	Langdale Road Link	Langdale Bridge Link (via Anvil Island)		Powell River Road Link	Powell River Bridge Link (via Nelson Island)
Aboriginal Rights	XX	X		XX	X
Archaeological Resources	X	X		XX	X
Economic and Land Development	Discussions underway				
Legend: — — — Neutral ✓ Better ✓ ✓ Much Better X Worse X X Much Worse					

TABLE 6-7: SUBJECTIVE CRITERIA EVALUATIONS – FIRST NATIONS

Conclusion

This report was developed using Ministry guidelines and best practices for an MAE, desktop research, consultation input, and engineering, economic and environmental expertise. Given the high level of interest and concern in a Sunshine Coast fixed link, the Ministry engaged with First Nations, stakeholders and the public to assist in studying the relative merits of the potential crossing scenarios.

The objectives of this report were to:

- Assess the costs and benefits of possible future overland connections and bridge crossings between the Sunshine Coast and the Lower Mainland as compared with existing ferry service;
- Identify the financial and technical feasibility of constructing a fixed link, and;
- Provide information to inform the Ministry's decision on whether there is merit for further analysis of a fixed link from the Sunshine Coast to the Lower Mainland.

Based on the early level of conceptual engineering undertaken as part of this study, a fixed link between the Lower Mainland and the Sunshine Coast appears to be technically feasible; however, the extremely challenging construction terrain in the area, including steep rocky terrain, mountain passes, and deep water channels, would result in very high capital costs for all of the scenarios assessed. Additionally, consideration of all of the accounts assessed suggests that while there is a high degree of support for the concept of a fixed link, the overall feasibility of such a link is less clear.

The main focus of this study by the Province has been on seeking cost-effective alternatives to the two existing ferry services. Accordingly, the baseline economic and financial assessments are based on tolling the new fixed link(s) at ferry-equivalent rates. Based on this approach, a preliminary economic benefit-cost analysis has been performed, along with a preliminary financial analysis, for each scenario.

From an economic benefit-cost perspective, the **two road-based fixed links** are both assessed as having a **negative benefit cost ratio**, primarily because of the circuitous nature of the road routes in relation to existing ferry services. Overall, travel costs for road users are forecast to increase relative to existing ferry services, due to the additional travel time and vehicle operating costs associated with the longer routes.

On the other hand, both of the **bridge-based fixed links** would have positive user benefits, because of the travel time savings and convenience associated with the new bridge(s). However, these benefits are assessed as being significantly less than the additional costs to the Province in constructing and operating the new bridge, even after allowing for potential savings from ferry service level adjustments. For the **Powell River bridge link**, the **ratio of user benefits to provincial costs is 0.042 to 0.050**,

reflecting the modest volume forecasts for the new bridge. For the **Langdale Bridge Link**, the ratio of user benefits to costs is somewhat higher because of the higher traffic levels, and is **0.215 to 0.255**.

All four of the scenarios have strongly negative Net Present Values (NPVs), reflecting the very high provincial capital and operating costs in relation to the potential user benefits. User benefits are limited because of modest forecast traffic volumes, as well the additional travel distances associated with three of the scenarios. While the economic benefit cost assessment is based on ferry-equivalent toll rates, sensitivity analysis confirms that, **even with the greater number of travelers associated with a scenario of an un-tolled facility; none of the scenarios would have a positive NPV.**

In addition to the user benefits underlying the initial benefit cost analysis, all of the four scenarios have potential resource and other economic development benefits that would improve their economic outlook. These are not included in the scope of quantified benefits and costs, but are qualitatively assessed as providing longer-run economic benefits.

The preceding economic and financial analysis is of a preliminary nature, consistent with the broad scope of this initial study. More detailed analysis would need to be undertaken in giving further consideration to any of the four scenarios.

The input received as part of the stakeholder and community engagement suggests that from a customer service perspective, there is general support for a fixed link connection, with the Langdale Bridge Link as the preferred scenario. Key reasons stated for support for a fixed link include improved travel times, improved community development, addressing B.C.'s jobs and housing challenges, and opening up B.C. It should be noted; however, that consultation participants also expressed concerns about the potential negative effects of a fixed link for cyclists and pedestrians, given that analysis of transit service was outside of the scope of this study. Some participants indicated that they would prefer improved ferry service to a fixed link. With regard to toll rates, some participants were comfortable with the concept of a ferry-equivalent toll rate; however, most participants' suggested toll rate was generally much lower – typically in the range of \$5 to \$30 per one-way trip, versus the current ferry rates (car plus two passengers) of approximately \$40-45 per one-way trip.

Additionally, with respect to socio-community considerations, while smaller numbers opposed a fixed link, many of those who did expressed strong concerns about potential community impacts and changes to their way of life. Also, whether for or against a fixed link, many people questioned the additional congestion impacts this scenario would have on Highway 99 and Highway 101 traffic, analysis of which is outside the scope of this assignment. And, while many participants were pleased to see a detailed study take place, several commented that more study would be needed before making a decision whether to proceed. Requested studies included environmental impact assessment and a detailed business case.

It also must be noted that the Islands Trust Committee has advised that a fixed link across Anvil Island would run contrary to the Islands Trust Policy Statement, approved by the Province, as well as the Official Community Plans of numerous individual islands. Municipalities and Regional Districts expressed concerns about potential effects on other infrastructure —like water and sewer—that would come with increased population and tourism.

Finally, it is recognized that the Sunshine Coast has been used for centuries by numerous First Nations, and that any fixed link alignment likely would traverse through the proximities of First Nations' management areas and potentially through archaeological sites. A number of First Nations and many community leaders and members of the public also expressed concerns about the effects of a fixed link on First Nations traditional and current interests.

References

- Powell River to Squamish Valley Road Link*. BC Ministry of Transportation and Infrastructure. 1998.
- Conceptual Alignment Study, Sunshine Coast and the Sea to Sky Highway*. BC Ministry of Transportation and Infrastructure. 2001.
- Construction and Rehabilitation Cost Guide*. BC Ministry of Transportation and Infrastructure. 2013.
- BC Supplement to TAC Geometric Design Guide*. BC Ministry of Transportation and Infrastructure. 2007.
- Canadian Hydrographic Service Nautical Charts – Howe Sound*. Canadian Ministry of Fisheries and Oceans. 2005.
- Canadian Hydrographic Service Nautical Charts – Jervis Inlet*. Canadian Ministry of Fisheries and Oceans. 1996.
- BC Statistics website* - Population forecasts for BC municipal areas and regional districts, 2017 through 2041, as of December 2016.
- Annual Reports to the British Columbia Ferries Commissioner*, British Columbia Ferry Services Inc. (Years 2003 – 2004 to 2015 – 2016 utilized).
- Traffic Count Information from the Ministry of Transportation website:*
<http://www.th.gov.bc.ca/trafficdata/index.html>
- Smart Plan, Gibsons Official Community Plan*, Town of Gibsons, March 2015.
- Vision Plan for Sechelt, District of Sechelt*, June 2007.
- District of Sechelt Official Community Plan Bylaw No. 492*, District of Sechelt, June 2010.
- City of Powell River Sustainable Official Community Plan Bylaw No. 2370*, City of Powell River, 2014.
- City of Powell River Integrated Community Sustainability Plan*, City of Powell River, August 2015.
- District of Squamish Official Community Plan Bylaw No. 2100*, District of Squamish, 2009 Consolidated November 2015.
- Demographic Study Sunshine Coast*, Sechelt and District Chamber of Commerce
- Electoral Area C, Official Community Plan, By-law No. 467, 2012*. April 2013.
- Electoral Area B, Official Community Plan, By-law No. 465, 2012*. March 2013.

Powell River Regional District Transportation Plan

BC Ferry Corporation and Fiscal Fairness for Ferry-Dependent Communities – Executive Summary.
January 2013.

The Case for the Coastal Connector. Powell River Chamber of Commerce.

Agreement on Land Use Planning, between the Squamish First Nation and the Province of British Columbia. BC Ministry of Agriculture and Lands. 2007.

Tsleil-Waututh Nation Stewardship Policy. Tsleil-Waututh Nation – Burrard Indian Band.

Tla’Amin Land Use Plan, Tla’Amin First Nation, March 2010.

Shishalh Nation Lands and Resources Decision-Making Policy. Shishalh First Nation.

A Strategic Land Use Plan for the shishalh Nation. Sechelt Indian Band. June 2007.

APPENDIX A
ALIGNMENT DRAWINGS

APPENDIX B
BRIDGE CROSSINGS PAPER

APPENDIX C
ENVIRONMENTAL REVIEW

APPENDIX D
FIRST NATIONS AREAS

APPENDIX E
CONSULTATION SUMMARY REPORT

APPENDIX F
IMPACT OF TOLLING ON ECONOMIC/FINANCIAL OUTLOOK

Appendix F - Impact of Tolling on Economic/Financial Outlook

Impact of Tolling on Economic Benefit-Cost Analysis

The Multiple Account evaluation in the main report includes an economic benefit-cost analysis (BCA) of the four fixed-link scenarios. In accordance with Ministry BCA guidelines, all benefits and costs have been estimated on a multi-year basis, with future benefits and costs evaluated on a Net Present Value basis, using a 6% annual discount rate.

The economic BCA has considered a wide range of economic costs and benefits, both financial and non-financial. Financial considerations include the costs of constructing and operating the fixed link over its life-cycle, relative to the costs of ferry operations. Non-financial economic considerations include (for example) the travel time and convenience associated with each of the fixed link scenarios relative to the existing ferry services, as well as the relative costs of collisions. The benefit-cost analysis takes all of these factors into account.

While no decision has been made with respect to tolling, the baseline assumption for this analysis has been that each option is tolled at ferry-equivalent rates (i.e. similar to ferry fare levels). In an untolled scenario, user benefits (and BCA results) would be increased for the Langdale Bridge and Powell River Bridge options, because of the greater number of people using and benefitting from the new bridge. However, for the Langdale Road and Power River Road options, the user per-trip costs (driving distance, travel time, collision risks) would be higher than the equivalent costs for the existing ferry service -- resulting in a negative per-trip benefit. For the highway options, the increased traffic in the untolled scenario would also increase the size of the total negative benefits, further worsening the BCA results.

As illustrated in **Table F-1**, the impact on the BCA of assuming a “no-toll” framework is modest, with the Net Present Value continuing to be negative for all scenarios. The most promising option from an economic BCA perspective is the Langdale Bridge scenario, with the Net Present Value of -\$1,080 to -\$1,400M and a benefit cost ratio of 0.371 to 0.312 under the un-tolled scenario. While the untolled bridge options provide greater user benefits than the tolled options, these additional benefits come at a larger financial cost to the Provincial taxpayer, since there are no toll revenues to help offset bridge construction and operating costs.

TABLE F-1: IMPACT OF TOLLING ON ECONOMIC BENEFIT-COST RESULTS

Item	Langdale Highway		Langdale Bridge		Powell River Highway		Powell River Bridge	
	Toll	No Toll	Toll	No Toll	Toll	No Toll	Toll	No Toll
PV Benefits	-\$481	-\$505	\$437	\$635	-\$92	-\$462	\$87	\$117
PV Costs	\$1,070 to \$1,390	\$1,070 to \$1,390	\$1,710 to \$2,030	\$1,710 to \$2,030	\$3,000 to \$3,300	\$3,000 to \$3,300	\$1,740 to \$2,060	\$1,740 to \$2,060
NPV (Benefits – Costs)	-\$1,540 to -\$1,870	-\$1,570 to -\$1,890	-\$1,280 to -\$1,600	-\$1,080 to -\$1,400	-\$3,100 to -\$3,420	-\$3,460 to -\$3,790	-\$1,660 to -\$1,970	-\$1,620 to -\$1,940
Benefit Cost Ratio	< 0	< 0	0.255 to 0.215	0.371 to 0.312	< 0	< 0	0.050 to 0.042	0.067 to 0.057

Note: Negative BCR (< 0) due to the user costs being greater than the Base Case ferry service.

Financial Analysis – Potential for Cost Recovery through Tolling

Another way to evaluate the four scenarios is to address the narrower question of each scenario's potential to be self-financing through tolling. This study is not a tolling study, and no decision has been made whether a new fixed link would be tolled, pending further consideration of the results of this study. However, the study has undertaken a preliminary initial assessment of the potential for each of the fixed-link scenarios to recover its financial costs through tolling.

As illustrated in **Table F-2**, the Sunshine Coast (Langdale) Bridge Link, via Anvil Island, is the only scenario assessed as having sufficient potential toll revenues (relative to capital costs) to be considered a possible candidate for cost recovery through tolls. The other three scenarios all have potential first-year revenues that are less than 1% of capital costs, and are not good candidates in this regard.

TABLE F-2: POTENTIAL FOR PROJECT COST RECOVERY THROUGH TOLLING

	Sunshine Coast (Langdale) Scenarios		Powell River Scenarios	
	Road Link	Bridge Link	Road Link	Bridge Link
Project Costs				
Construction Costs (2016 dollars)	\$2.0 - \$2.5 billion	\$3.0 - \$3.5 billion	\$4.5 - \$5.0 billion	\$3.0 - \$3.5 billion
Total Project Costs at opening in 2025 (nominal dollars)²	\$3.2 billion	\$4.6 billion	\$6.8 billion	\$3.9 billion
First-Year Revenue Potential	<\$30 million	approx. \$80 M	<\$40 million	<\$25 million
First-Year Revenue Potential, relative to Project Costs	< 1%	1.8%	< 1%	< 1%
Potential for cost recovery through tolling	None	Very low	None	None

For the Sunshine Coast (Langdale) Bridge Link scenario, a preliminary multi-year financial forecasting analysis has also been performed. Based on toll rates being set at similar levels to ferry rates, and also assuming future traffic growth and toll rate increases, the Langdale Bridge scenario is assessed as having at least some potential for cost recovery over a long-term tolling period. The preliminary analysis also indicates that, at toll rates significantly lower than current ferry rates, the potential for the Langdale Bridge Link to be self-financing is extremely low.

Significant additional analysis, including detailed traffic and revenue studies, would be required to further investigate and confirm this preliminary assessment.

² Mid-range of construction cost estimates, plus 5% allowance for other costs, inflated to nominal dollars @ 2% annually, plus interest during construction @ 4.5% (assuming construction mid-point 3 years prior to opening). **Note:** First-year revenue potential is based on ferry-equivalent toll rates, and the volume forecasts associated with those rates.