Final Report

Highway 97 Quesnel Transportation Study

Phase 1 - Existing Conditions

September 2016

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HIGHWAY 97 Quesnel Transportation Study
Phase 1 – Existing Conditions

Final Report

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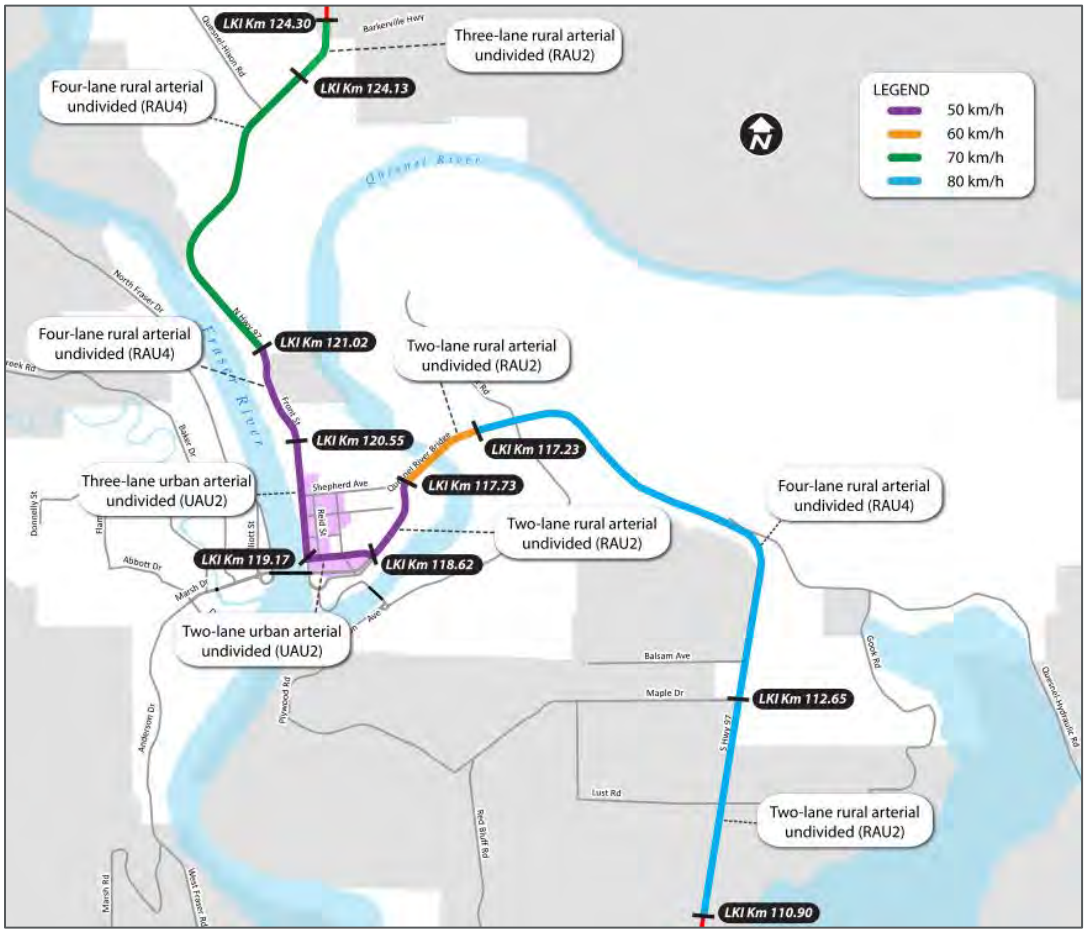
EXECUTIVE SUMMARY

The BC Ministry of Transportation and Infrastructure (MoTI) retained Urban Systems (Urban) to undertake an existing conditions corridor review for Highway 97 through the City of Quesnel. The purpose of this study was to develop a holistic understanding of the existing conditions for Highway 97 as it is aligned between Quartz Road and Highway 26 / Barkerville Highway over a length of 13.9 kilometres (LKI Segment 1146 km 110.9 to km 124.3). The study corridor, shown in Figure ES-1, was separated into four study segments to reflect the changing highway design elements as it passes through Quesnel including cross-section and speed. The highway study segments are ordered as follows:

- **Segment A** - South Quesnel Commercial: Quartz Road to Dragon Hill Road
- **Segment B** - North Star Interchange: Dragon Hill Road to West of the Quesnel River Bridge
- **Segment C** -Downtown Quesnel: West of Quesnel River Bridge to Spears Street
- **Segment D** -Two Mile Flats: Spears Street to North of Highway 26 Junction

Figure ES-1: Key Highway 97 Characteristics (LKI Segment 1146, Km 110.9 to Km 124.3)



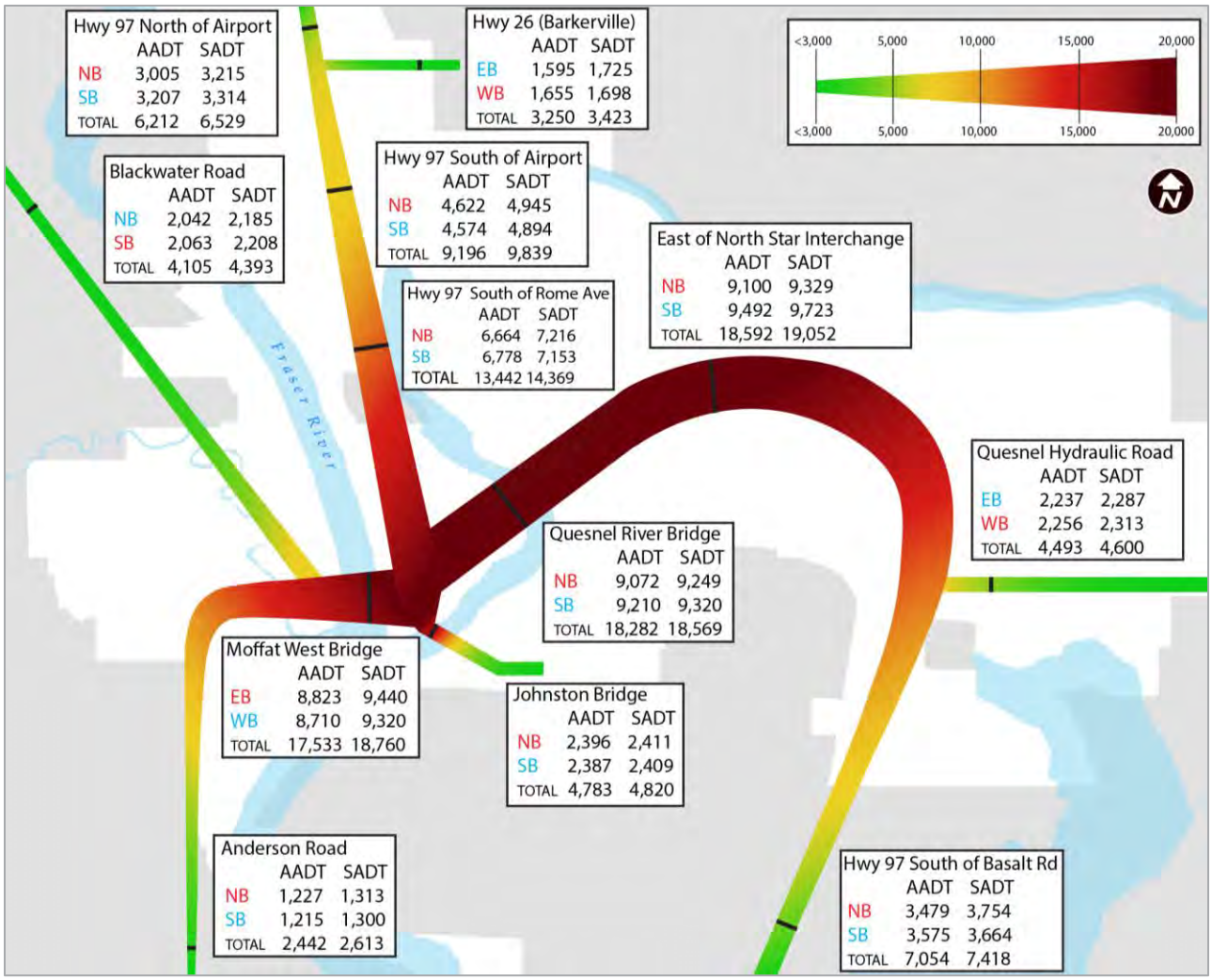
This existing conditions study represents the first phase of the MoTI project lifecycle planning process and focuses on developing a thorough understanding of current conditions on the Highway 97 study segment. Phase 2 will consist of developing an Improvement Strategy that will include an assessment of

future highway conditions and the generation of concept options. The following summarizes the key results and findings of this existing conditions assessment.

Highway Traffic Characteristics

Traffic Volumes – The Annual Average Daily Traffic (AADT) and Summer Average Daily Traffic (SADT) volumes are summarized and illustrated in Figure ES-2. As illustrated, traffic volumes increase significantly along the urban section of Highway 97 through the downtown of Quesnel and across the Moffat West Bridge to a maximum of approximately 19,000 veh/day, and reducing to approximately 3,000 to 7,500 veh/day at the north and south entry / exit points of the study area

Figure ES-2: AADT and SADT Volumes along Highway 97 and Adjoining Study Area



Traffic Growth - The historical traffic volumes were found to have reduced for a period after 2008 until 2014 where recent data suggests an upward traffic growth trend. Given the local economic conditions are strongly tied to forestry and natural resource industries, further assessment of growth rates is needed in the next phase of the study to conduct the future conditions assessment.

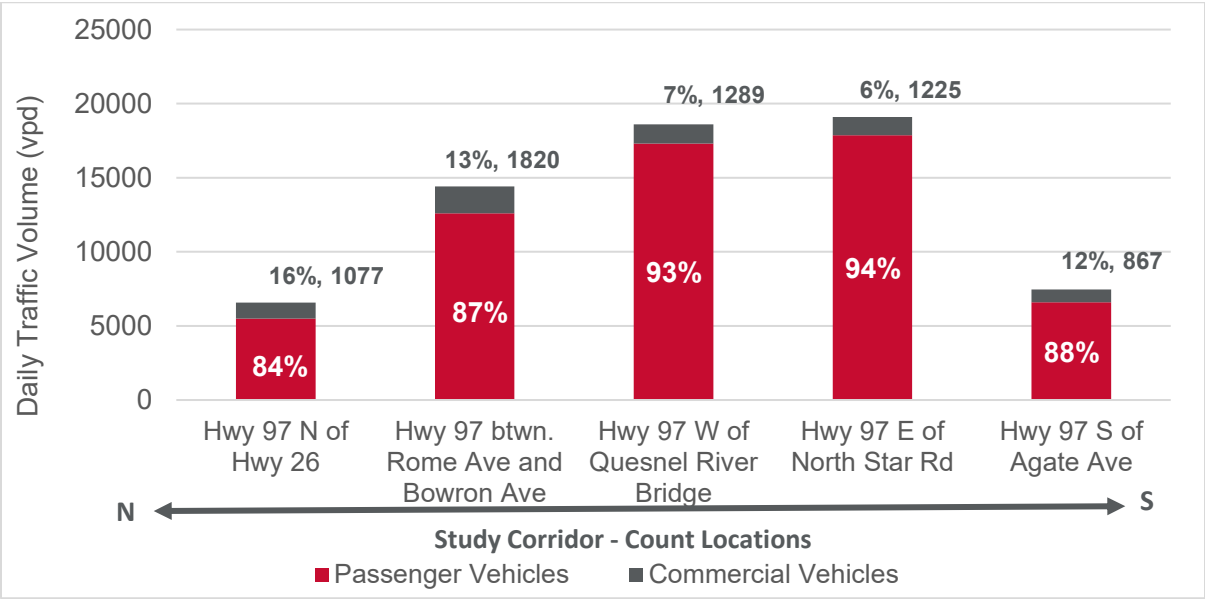
Traffic Profiles - The daily traffic profiles were analyzed and indicated that traffic steadily increases from about 6 AM to 9 AM and continues to climb through the middle of day and eventually reach an afternoon peak around 5 PM before decreasing. Generally, the traffic profiles indicate that trips are being made constantly throughout the work day and are less reflective of morning and evening commute-based trips typically observed in larger communities.

Traffic Seasonality - Highway 97 traffic counts were obtained in the months of August of 2015, October of 2015, and January of 2016 and the Coefficient of Variation (CoV) was calculated to understand the intensity of seasonal traffic variations. The largest calculated CoV was 7.4% for the count location on Highway 97 east of North Star Road. Thus, the seasonality of traffic volumes through the study area may be characterized as being consistent.

Travel Time Survey – A travel time survey was completed during data collection with three timed trials of travelling the corridor in both the northbound and southbound directions in the AM, Mid-Day, and PM peak periods. The time to travel the study corridor northbound in the AM peak period was 13 minutes and 17 seconds and 13 minutes and 24 seconds in the PM peak period. The average speed to travel the full length of the corridor including stops was between 59 and 62 km/h for all timed trials. The time spent at a stop (i.e. red light) varied between 29 seconds and 46 seconds in total for the full length of the corridor.

Commercial Traffic – Generally, passenger vehicle traffic comprises the largest portion of vehicles on the highway, whereas commercial vehicles account for a fraction of the traffic. Figure ES-3 illustrates the overall composition of average weekday traffic volumes (two-way) at the ATR count stations for the month of August. The count stations at Rome Avenue, Quesnel River Bridge, and North Star Road recorded the highest volumes and the largest share of heavy commercial vehicles in comparison to the count stations at the north and south ends of the study area.

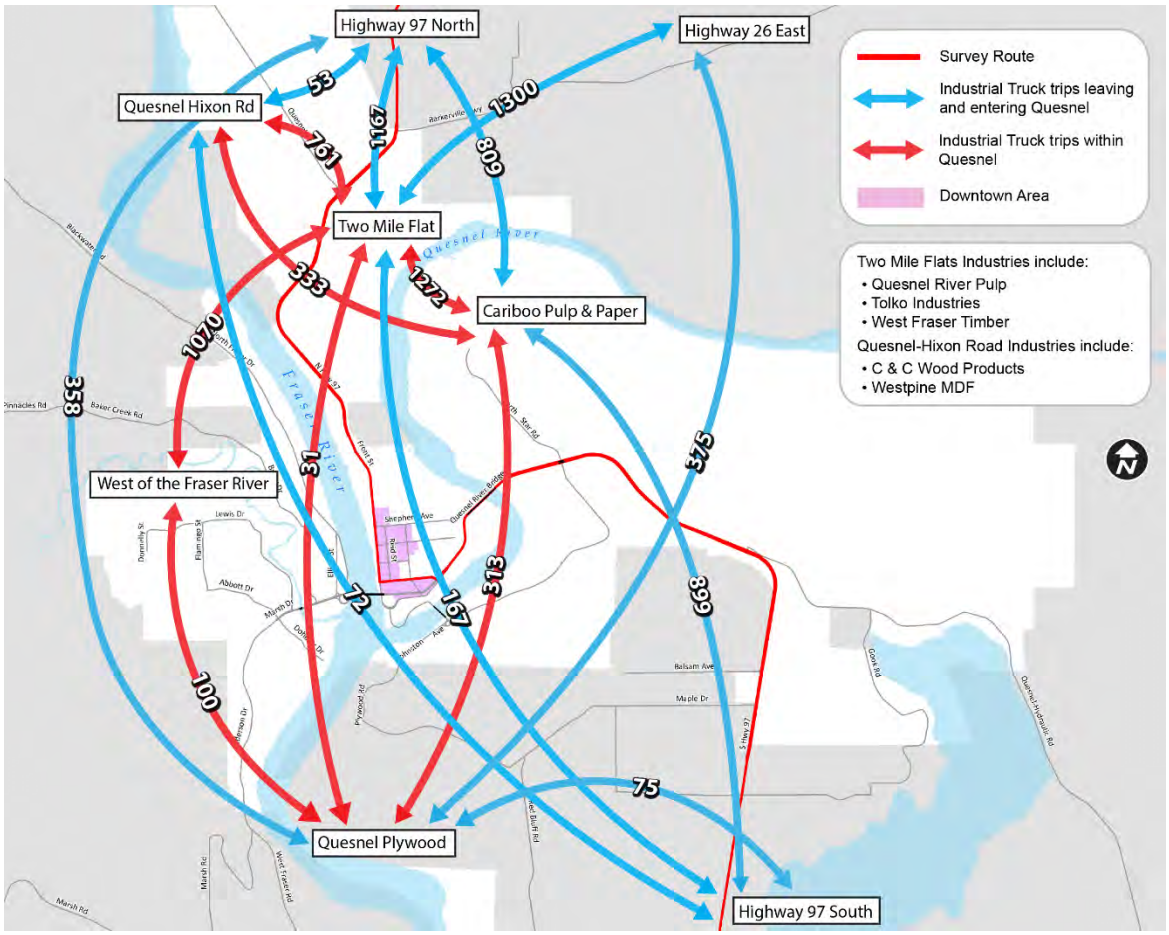
Figure ES-3: Vehicle Classification by Location – Average Weekday in August



Industry Truck Traffic – Seven of the major mill operations were surveyed for monthly truck trip generation statistics in November and December of 2015. Figure ES-4 illustrates the average monthly truck traffic volumes generated by the seven mills surveyed. The truck travel survey findings were compared to those collected in the *Traffic Profile Report, Highway 97 Quesnel* completed in 2011.

In the 2011 study, the truck survey findings found that limited truck traffic passes through Quesnel and a heavy concentration of truck traffic moves between the North Star Interchange and the Two Mile Flats areas of the City. The 2016 survey findings found similar results and confirmed that most truck traffic originates or is destined to locations within Quesnel. In 2011, most of the lumber that was delivered to Quesnel for processing came from West Quesnel and North of Quesnel. In comparison, the 2016 survey found most lumber was delivered to Quesnel from east on Highway 26.

Figure ES-4: Average Monthly Truck Traffic (2014-2015, Excludes Trucks with Raw Log Loads)



Transportation of Dangerous Goods - The transportation of dangerous goods (TDG) is permitted on Highway 97 by the Commercial Vehicle Safety and Enforcement (CVSE) agency. The CVSE provided data for seven (7) days during the month of February and the analysis found the two dominant types of dangerous goods are Gasoline (49%) and Diesel Fuel (41%), followed by corrosive liquids (6%), alcohols (1%), batteries (1%), flammable liquids (1%), and aviation fuel (1%).

Origin-Destination Survey - An origin-destination (OD) survey was undertaken to understand the local and regional travel patterns of traffic in the Quesnel area and were compared with the origin-destination findings collected in the *Traffic Profile Report, Highway 97 Quesnel* completed in 2011. The results of the 2011 survey found that 70 – 80% of traffic on Highway 97 originates or is destined to within the City of Quesnel. In comparison, the 2016 survey results found the percentage of local traffic is higher with approximately 90% of highway traffic either originating or is destined to within the City of Quesnel. Overall, these findings confirm the majority of traffic travelling on Highway 97 in Quesnel is local traffic with only a small portion accounting for highway pass-through traffic.

Reliability

The reliability of Highway 97 was reviewed using data provided by the DriveBC, which stores all messages that are released through the DriveBC website. The data was filtered to obtain a total of 80 reliability events between 2005 and 2012. Of these 80 events, 40 involved closure of the highway, 14 involved closure of lanes, and 23 events involved single lane alternating traffic conditions. Other key findings include:

- The months of November, December, and June exhibit the highest frequency of reliability events
- Vehicle collisions account for 43% of traffic pattern changes, followed by vehicle incidents (20%), maintenance and construction activities (11%), hydroelectric lines down (7%), and other various causes.
- More than half (53%) of highway closures are less than 3 hours in length, 40% of closures are between the duration of 3 and 9 hours in length, and the remaining 7% of closures are greater than 10 hours in duration.

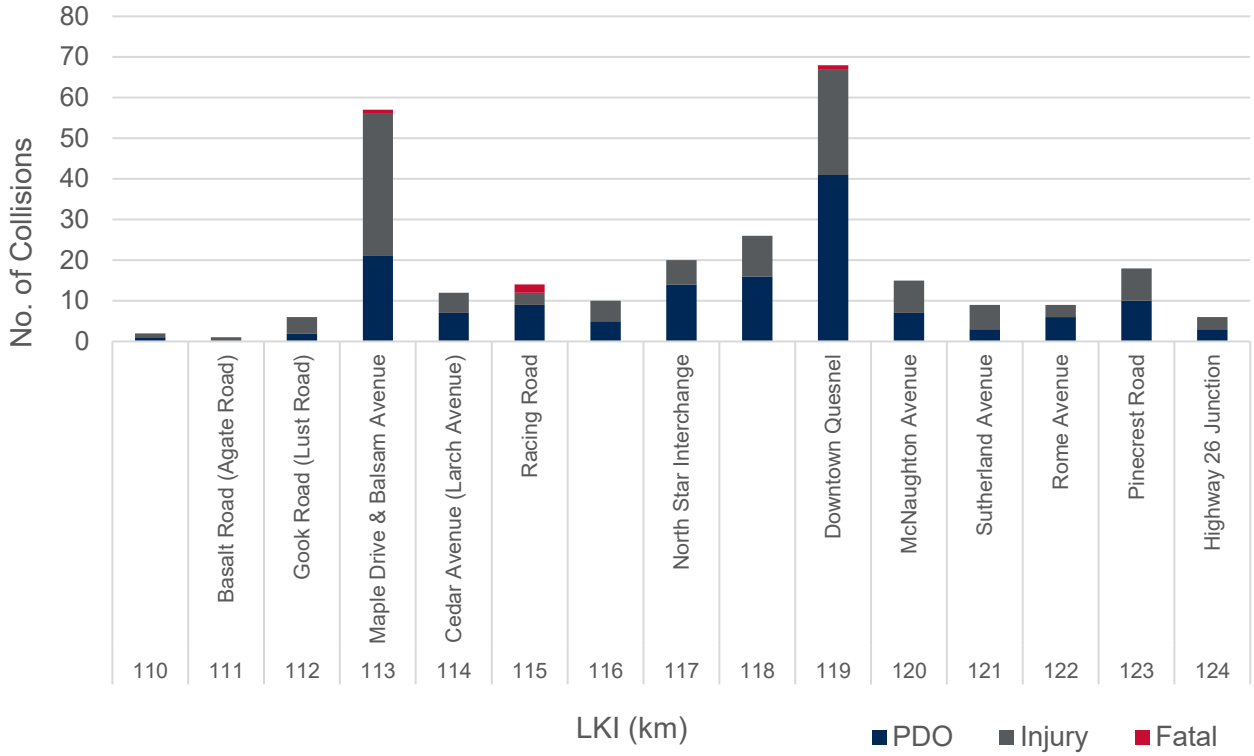
Mobility Performance

The traffic operations for each study intersection were analyzed using traffic capacity analysis software and according to the Highway Capacity Manual (HCM) 2010 manual. The results of the traffic capacity analysis indicate the overall mobility conditions along Highway 97 are good. Acceptable levels of service ranging from A to C are common along the southern and northern highway study segments. Increasing delays are observed along the highway and side-street movements in the urban downtown area of Quesnel. More specifically, the side street movements at the pedestrian half signals at McNaughton Avenue and Shepherd Avenue both experience an LOS 'E'. Similarly, the side-street movements at the intersections of St. Laurent Avenue, Reid Street, and McLean Street experience LOS 'D'. The intersection of McLean Street and Moffat Bridge recorded a LOS `F` performance in the PM peak.

Safety Performance

A historical collision assessment of the Highway 97 study area was conducted using data from MoTI`s Collision Information System (CIS) to obtain a detailed understanding of the highway's safety performance. Figure ES-5 illustrates the spread of collisions across the Highway 97 study corridor over 1 kilometre segments and provides a good illustration of where collisions are occurring.

Figure ES-5: Historical Collisions by 1 Km Segments on Highway 97



While the full collision analysis is provided in Section 6 of this report, the key findings of the safety performance assessment are highlighted as follows:

- Maple Drive, Cedar Avenue, Kinchant Street, McLean Street, Front Street and St. Laurent Street recorded the highest frequency of collisions, resulting in collision rates higher than both the provincial average and critical collision rates.
- Cedar Avenue and Racing Road (Dragon Hill Road) recorded a CSI value above the provincial average, indicating there is a high safety risk at this intersection
- The Racing Road (Dragon Hill Road) / Highway 97 intersection is a high risk location and confirmed that two fatal collisions have occurred under existing conditions
- The segments of Highway 97 from Maple Drive to Juniper Road (LKI km 113 to km 114), Racing Road to McNaughton Avenue (LKI km 115 to km 120), and from Pinecrest Road to Highway 26 (LKI km 123 to km 124) have collision rates higher than the provincial and critical collision rates.

Geometric and Asset Conditions

Highway Geometry - A high-level review of the current highway geometry was completed in accordance with the Transportation Association of Canada's "Geometric Design Guidelines for Canadian Roads" (1999) and the Ministry of Transportation's "BC Supplement to TAC Geometric Design Guide", (2007). A number of discrepancies were identified at specific locations and in general across the corridor. These are described in detail in Section 8 of this report. Overall, the corridor reflects various standards and

design criteria that have evolved over time. These varied standards have created an inconsistent corridor and driving experience for the travelling public.

Pavement Conditions - In 2015, approximately 20 kilometres of Highway 97 within the Quesnel area underwent resurfacing to extend the lifespan of the highway's road surface and structure. Also in 2015, the 4-laning of Highway 97 between Quartz Road and Dragon Lake began construction. Prior to these resurfacing projects, the pavement conditions along the Highway 97 study corridor were assessed using a Roadway Pavement Management System (RPMS), which uses the Pavement Condition Rating (PCR) system to rate the condition of pavement. The PCR report found that pavement within the study section of Highway 97 alignment is in good condition with sound pavement structure. However, there were three areas of low PCR rating which included the pavement south of Gook Road, near the creek crossing at ±LKI 113.32, and west of the Quesnel River Bridge

Structure Conditions – The structure conditions of the North Star Overpass, Quesnel River Bridge and the Quesnel Overhead were reviewed using the inspection reports that are provided by MoTI`s Bridge Management Information System (BMIS). The Bridge Condition Inspection (BCI) Rating, described in Section 9.2 of this report, provides an overall rating of the condition of each of these bridges. The result of this review found the following:

- **The North Star Overpass** was constructed in 1980 and the most recent inspection report rated the structure with an adjusted BCI of 1.91, indicating the structure is in relatively good condition.
- **The Quesnel River Bridge No. 1569** was constructed in 1961 and has an adjusted BCI rating of 2.27, indicating the structure is in good to fair condition. The inspection report identified a few urgent items needing maintenance attention. Further, there is a history of comments and continual maintenance of the bridge components is required.
- **The Quesnel Overhead No. 01641** was constructed in 1961 and has an adjusted BCI rating of 3.2, indicating the structure is moving from fair to poor condition. The most recent inspection report identified urgent items needing maintenance attention. More importantly, rehabilitation of the structure in the near future will become a priority as the deck is in very poor condition and a new deck is required. Multiple challenges exist to replace the deck considering the cantilevered structure type, location over the CN Railway, and traffic management during rehabilitation.

Problem Definition and Next Steps

Overall, the current alignment of Highway 97 is constrained through the downtown of Quesnel, which poses challenges identified in this existing conditions review for future horizons. These challenges are summarized in the following problem definition statement, organized by the four highway study segments:

Segment A - South Quesnel Commercial (LKI km 110.9 to km 115.1)

The South Quesnel Commercial area of Highway 97 experiences road safety performance challenges and geometric challenges at a number of intersections along this study segment. High collision rates were observed at the intersections of Maple Drive and Cedar Avenue, and a high collision severity rate was observed at the Racing Road (Dragon Hill Road) intersection. The highway frontage roads provide minimal vehicle queuing storage at highway intersections and inhibits trucks from making turning movements without over-tracking into adjacent lanes and the road shoulder.

Segment B - North Star Interchange (LKI km 115.1 to km 117.7)

Highway 97 across the Quesnel River Bridge and Quesnel Overhead experiences higher than average vehicle collisions and the narrow two-lane cross-section does not completely adhere to MoTI's current design guidelines. The Quesnel Overhead structure requires rehabilitation or replacement given a number of challenging circumstances to conduct rehabilitation with the existing structure design and location. In addition, the sidewalks on both structures are constrained by the railings and curb roadside barrier that inhibit pedestrian and bicycle usage. The off ramps to Valhalla Road and Dragon Hill Road do not meet existing highway design standards. Lastly, directional signage on North Star Road requires upgrades to improve wayfinding effectiveness.

Segment C - Downtown Quesnel (LKI km 117.7 to km 121.0)

The Downtown Quesnel area of Highway 97 experiences high collision rates at a number of intersections including at Kinchant Street, McLean Street, Front Street, and St. Laurent Avenue. There are a few mobility performance challenges for side-street movements on approaches to Highway 97 including vehicles leaving the hospital onto Front Street (Highway 97). There is a horizontal curve design to a minimum 90 meter radius just west of the Quesnel Overhead No. 01641 (LKI km 117.9) in which there is evidence some vehicles may be going off pavement. Lastly, a pedestrian and cycle connection from Downtown to the Two Mile Flats area is a strong desire of the City.

Segment D - Two Mile Flats (LKI km 121.0 to km 124.3)

In this Two Mile Flats segment, the Highway 97 alignment comes close to the CN Rail alignment and the rail base abuts the highway shoulder, resulting in an increased risk of vehicle impacts to the railway base and slope. At the intersection of Brownmiller Road, there is a risk of heavy vehicles tracking off pavement as they make northbound right turns around a sharp curve onto Brownmiller Road. Access management is also needed to better define permitted turning movements onto and off the highway to local businesses. Lastly, the Highway 97 / Highway 26 (Barkerville) intersection experiences a high collision severity rating indicating a road safety issue at this location.

Next Steps

The results of this Highway 97 Quesnel Phase 1 – Existing Conditions study indicate the presence of a number of existing transportation challenges on the corridor relating to mobility, safety, highway geometry, active transportation, and structure and pavement conditions. Thus, it is recommended that the findings of this existing conditions study be carried forward into the Phase 2 - Improvement Strategy for the study corridor. This improvement strategy should consist of a future highway performance assessment to understand future corridor conditions and challenges over short, medium, and long-term horizons. Other study components should include economic, structural, environmental, geotechnical, and utility constraints reviews along the study corridor that will inform the generation of conceptual design improvements and their evaluation using a multiple account evaluation (MAE) framework.

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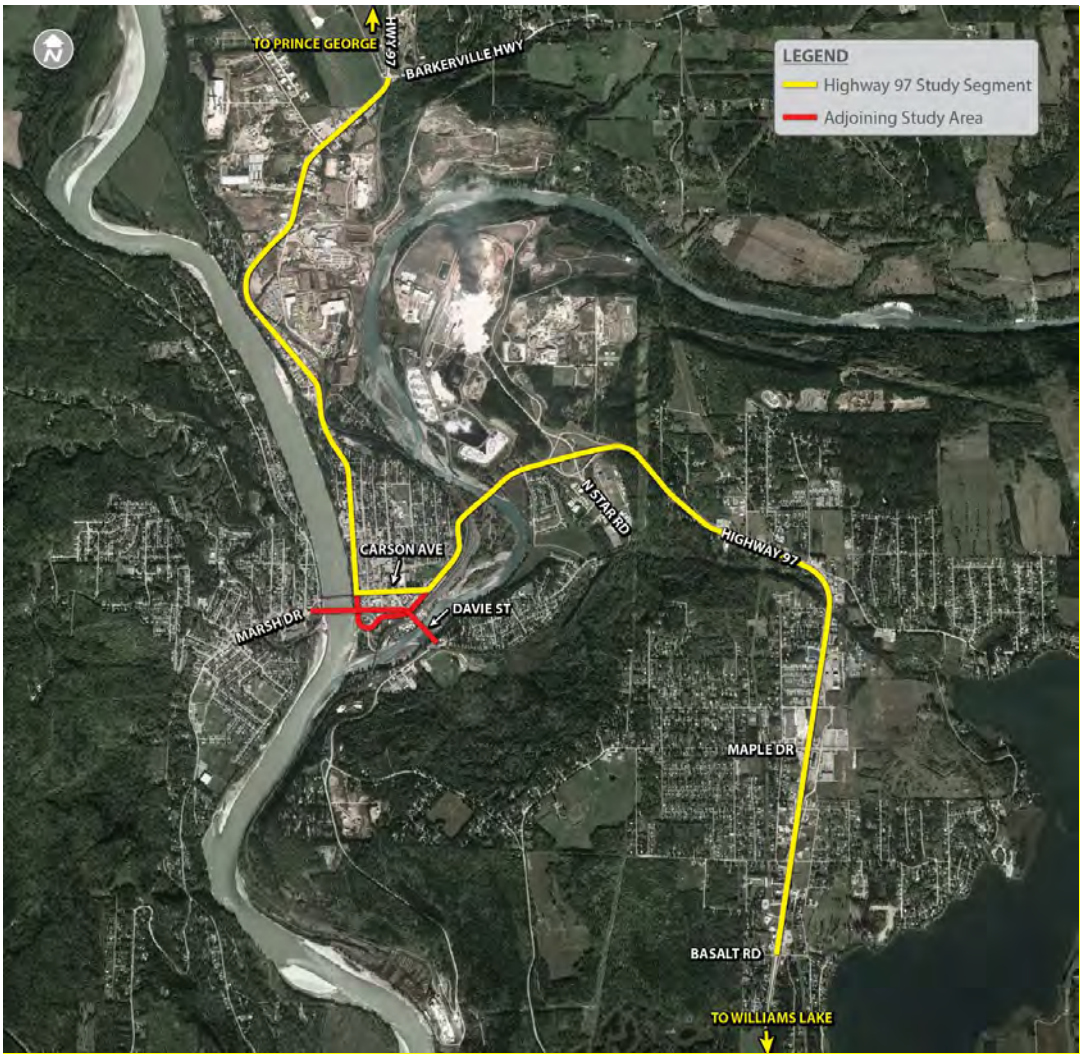
1.0 INTRODUCTION

The BC Ministry of Transportation and Infrastructure (MoTI) retained Urban Systems (Urban) to undertake an existing conditions corridor review for Highway 97 through the City of Quesnel. The purpose of this study is to develop a holistic understanding of the existing conditions for Highway 97 as it is aligned between Quartz Road and Highway 26 / Barkerville Highway (LKI Segment 1146 km 110.9 to km 124.3). The overall study segment length is 13.9 kilometres. The study area for this existing conditions study is shown in Figure 1.1 with the main alignment for Highway 97 and the adjoining study area highlighted as illustrated.

Figure 1.1: Highway 97 (Quesnel) Study Area



Highway 97 is a major provincial transportation corridor in British Columbia's interior providing connectivity as far south as the U.S. Border in Osoyoos to as far north as the Alaska U.S. Border along the Alaska Highway. The highway passes through many communities and will continue to play a key role in opening BC's north to economic development in the province's natural resource sector. More

specifically, the province is currently experiencing significant investment and expansions in the industries of Liquefied Natural Gas (LNG), forestry, oil and gas, mining, and supporting industries.

From a regional perspective, Highway 97 continues south through the communities of Williams Lake, 100 Mile House and eventually Cache Creek, where Highway 97 intersects with Highway 1. To the north, Highway 97 passes through mostly undeveloped land until it reaches the larger community of Prince George where Highway 97 intersects with Highway 26.

Overall, this existing conditions study forms the first piece of a larger planning study, which will include further study and analysis of short, medium and long-term improvements options. This report establishes the existing conditions for the Highway 97 study area and is split into nine core study components, ordered as follows:

- Background Information
- Highway Characteristics
- Data Collection
- Mobility Performance
- Safety Performance
- Reliability Performance
- Geometric Review
- Existing Asset Condition Review
- Problem Definition Statement

This report concludes with a problem definition statement which summarizes all transportation issues observed from the existing conditions assessment. In addition, the conclusion outlines the next steps of the project lifecycle process which will involve the development of a detailed Improvement Strategy for the Highway 97 study corridor.

2.0 BACKGROUND INFORMATION

2.1 Previous Studies

Highway 97 through Quesnel has been studied multiple times by the MoTI to understand different and varying issues on the highway corridor. These previous studies have focused on existing conditions performance, the development of immediate improvement options, and the development of long-term corridor solutions. The following previous studies completed by MoTI will be referenced in the next phase of the planning study and will be used as a starting point for developing corridor infrastructure solutions.

The Highway 97 Corridor Management Plan: Cache Creek to Mackenzie Junction which produced a Performance Analysis Report was completed in 1998 by the MoTI project committee. The purpose of this report was to develop a standardized evaluation of the Highway 97N corridor performance. This analysis was the foundation of the Highway 97 Corridor Management Strategy and the subsequent Quesnel Highway 97 Local Improvement Study, which would guide future improvements to the corridor.

The performance analysis included a highway feature analysis, a traffic analysis, an operational analysis, a safety analysis, and a reliability analysis. With exception of structural analysis, the extensive plan documented all current and potential issues with the corridor, using the current highway standards at the time. Some recommendations included this report were identifying highway access concerns, possible catastrophic slide areas, and safety feature deficits pertaining to signage, illumination, barriers, pedestrians, wildlife, and drainage.

The Quesnel Highway 97 Local Improvement Study was completed in 1998 by Reid Crowther with the purpose of developing a functional plan of immediate improvements to extend the life and capacity Highway 97 until the long-term plan of a connector is implemented. This study was completed as a supplement to the Corridor Management Plan completed for Highway 97 around the same time.

The study area extended between the North Star Interchange and the Highway 26 junction north of the City and included analysis of traffic capacity, collisions, and involved public consultation over three open houses. Upon establishing the existing conditions at the time the study was completed, the option generation process identified 40 different improvements at 17 separate locations. These options were subsequently assessed using a multiple account evaluation (MAE) process to develop a list of 11 recommended improvements including conceptual designs and cost estimates totaling approximately $530,000 (1998 estimate).

The Quesnel North-South Industrial Connector Feasibility Study was completed in 2004 by Urban Systems to determine the economic and technical feasibility of constructing a north-south industrial traffic connector. The study was prepared in in the period of significant pine beetle infestation when the forest industry's approach was to conduct rapid harvesting of infected areas to preserve uninfected areas and limit further infestation. Two crossing locations of the Quesnel River were identified between the Cariboo Pulp and Paper Mill located on the south side of the river and the Slocan Mill on the north side. A multiple account evaluation was conducted for each option, which found the north crossing location was preferable mainly due to fewer constraints. The study's recommendations included conducting further preliminary design work to confirm physical conditions and constraints, initiating further discussion with the industry property owners, and investigating methods to permit only truck use of the connector.

The Cariboo Connector Technical Analysis Report, Highway 97, Cache Creek to Sintich Road was completed in 2009 by the Southern Interior Region Planning Group of MoTI to understand existing traffic, mobility, safety, and infrastructure performance and deficiencies between Cache Creek and Sinitch. The report segmented the study area into four sections with Highway 97 through Quesnel reviewed in the Williams Lake to Quesnel section.

The traffic conditions review included an assessment of the existing traffic volumes, profiles, and traffic forecasts. The mobility performance included a traffic capacity assessment using Highway Capacity Software (HCS 2000) of highway approaches at key intersections throughout Quesnel and the study area. The highway movements through Quesnel were found to have sufficient capacity despite some worsening levels of service in the downtown area. The safety analysis reviewed collisions over a five year period between 2003 and 2007 and a few intersections exhibited collision rates above the provincial critical rates. The pavement condition review found the majority of the highway segment between William`s Lake and Quesnel was rated as moderate to good. The bridge condition analysis found the Quesnel River Bridge and the Quesnel O/H bridge over the railway were suffering from varying degrees of damage and deterioration.

The Highway 97N Quesnel Hydraulic Options Evaluation Study was completed in 2009 by ISL Engineering and Land Services to investigate existing traffic operations and to identify solutions to enhance mobility and safety along this section of Highway 97N. The traffic problems investigated by this study are primarily due to the proximity of the Valhalla Road, Dragon Hill Road and Juniper Road frontage roads to Highway 97N. Problems arise at the intersections that bisect the frontage roads and the highway, leaving little queuing room for vehicles approaching the highway. Specifically, these intersections of concern are at Quesnel Hydraulic, Racing Road, and Cedar/Larch Avenue, where the proximity of intersections is a mobility or safety issue. Furthermore, traffic on Quesnel Hydraulic Road accessing Hwy 97N experiences delays both at the highway and due to conflicts at the Valhalla Road frontage road intersection, which is exacerbated by the short storage length at the Hwy 97 intersection.

The study considered eight access management options to improve mobility and safety of the network. The common recommendations to all options were:

- Closure of the Juniper Road right-in, right-out due to high collision rate and reduced highway mobility.
- Closure of the Valhalla Road right-out, with safe access restored via Racing Road.
- Dragon Hill Road off-ramp retained as it reduces the number of vehicles at the Racing Road intersection.

Additionally, a traffic signal was warranted on Hwy 97 at either Hydraulic Road or Racing Road. For a signalized intersection at Hydraulic Road, two options were evaluated. They included the closure of the southern leg of the intersections at Racing Road or Quesnel Hydraulic Road. Due to the several advantages it offered, a roundabout was also included at Hydraulic Road where it intersects with the Valhalla Road. The report presented the findings of the conceptual planning stage and the short listed options that would be subject to further evaluation and refinement at the functional design stage.

A Traffic Profile Report, Highway 97 Quesnel was completed in 2012 by Urban Systems to collect and analyze traffic data along Highway 97 to support future mobility and business case planning. The purpose of the study was to develop an understanding of Highway 97's current traffic profile and to gain insights on the type and volume of vehicles which would potentially use a bypass route. Traffic data was collected in the form of manual counts and 24 hour automatic traffic recorder (ATR) counts. Further, an origin-destination survey was undertaken by recording license plate numbers simultaneously at five key locations.

A few key findings were obtained from the data analysis, with particular relevance to heavy truck traffic. The analysis found that much of the truck traffic that leaves Quesnel originates from within the urban boundaries of Quesnel and there is a high interdependency of truck traffic between the various industrial wood processing businesses. Cariboo Pulp and Paper and the Two Mile Flat areas were found to be the major traffic generators with a significant amount of truck traffic travelling between these two areas. In addition, the study found approximately 1,200, to 1,800 vehicles per day pass through Quesnel on Highway 97, whereas up to 20,000 vehicles per day use Highway 97 on the downtown segments.

The study explored three alternate truck route options, described as short, medium, and long route options. The short option involves a potential bypass route around the downtown area and would attract approximately 10,000 trucks per month. The medium option involves a potential bypass around the downtown and most of the Two Mile Flat areas and would also attract approximately 10,000 truck per month. Both the short and medium options would provide relatively direct connections to service the primary truck traffic route within Quesnel. The long option involves a potential bypass route around much of Quesnel starting at the North Star Interchange; however, this option would likely provide less benefit to truck traffic with an estimated usage of 2,500 trucks per month.

A Technical Memorandum: East-West Connector Quesnel – Mobility Benefits was most recently completed in 2014 by Urban Systems with the purpose of completing a Multiple Account Evaluation to be incorporated within an economic business cases assessing the feasibility of a potential east-west connector between Blackwater Road and Two Mile Flats. The study sourced information from previous studies including the *Traffic Profile Report, Highway 97 Quesnel (Urban Systems)*, and from a travel time study completed by ND LEA in 2003 for the same connector. The study found a potential east-west connector at the stated location would provide substantial mobility benefits; however, these benefits would apply mainly for truck and vehicle traffic originating and destined to Blackwater Road.

3.0 HIGHWAY CHARACTERISTICS

3.1 Network Description

The main Highway 97 corridor varies in character, function, speed, and cross-section over its 13.9 kilometre study length and is classified as a Major Arterial roadway in the City of Quesnel's OCP. The study area extends from just south of the Highway 97 / Quartz Road intersection (LKI km 110.9) northwards into the area characterized by highway commercial service land uses. Highway 97 continues north past the Birchwood Estates, South Hill Neighbourhood, and Red Bluff areas and through the North Star Road interchange. Highway 97 continues across the two-lane Quesnel River Bridge into the downtown area and makes a 90 degree turn onto Carson Avenue (Highway 97) for four city blocks. Highway 97 makes another 90 degree turn and leaves the downtown area into the Two Mile Flat area, parallel to the Fraser River. The study segment ends at the intersection of Highway 97 / Highway 26 (Barkerville Highway) at LKI km 124.30.

In addition to the main Highway 97 corridor, a few major roadways and bridges integrate with Highway 97 in the downtown area of Quesnel. After Highway 97 makes a 90 degree turn in the northbound direction onto Carson Avenue, the roadway continues west intersecting with three downtown intersections before crossing the Fraser River over the Moffat Bridge to West Quesnel. As Highway 97 passes through the downtown on Carson Avenue and makes a 90 degree turn in the southbound direction on Front Street, the roadway continues under the Moffat Bridge and intersects with Johnston Bridge Loop and Davie Street. The Johnston Bridge Loop crosses the Johnston Bridge over the Quesnel River providing access to the Johnston Residential Neighbourhood.

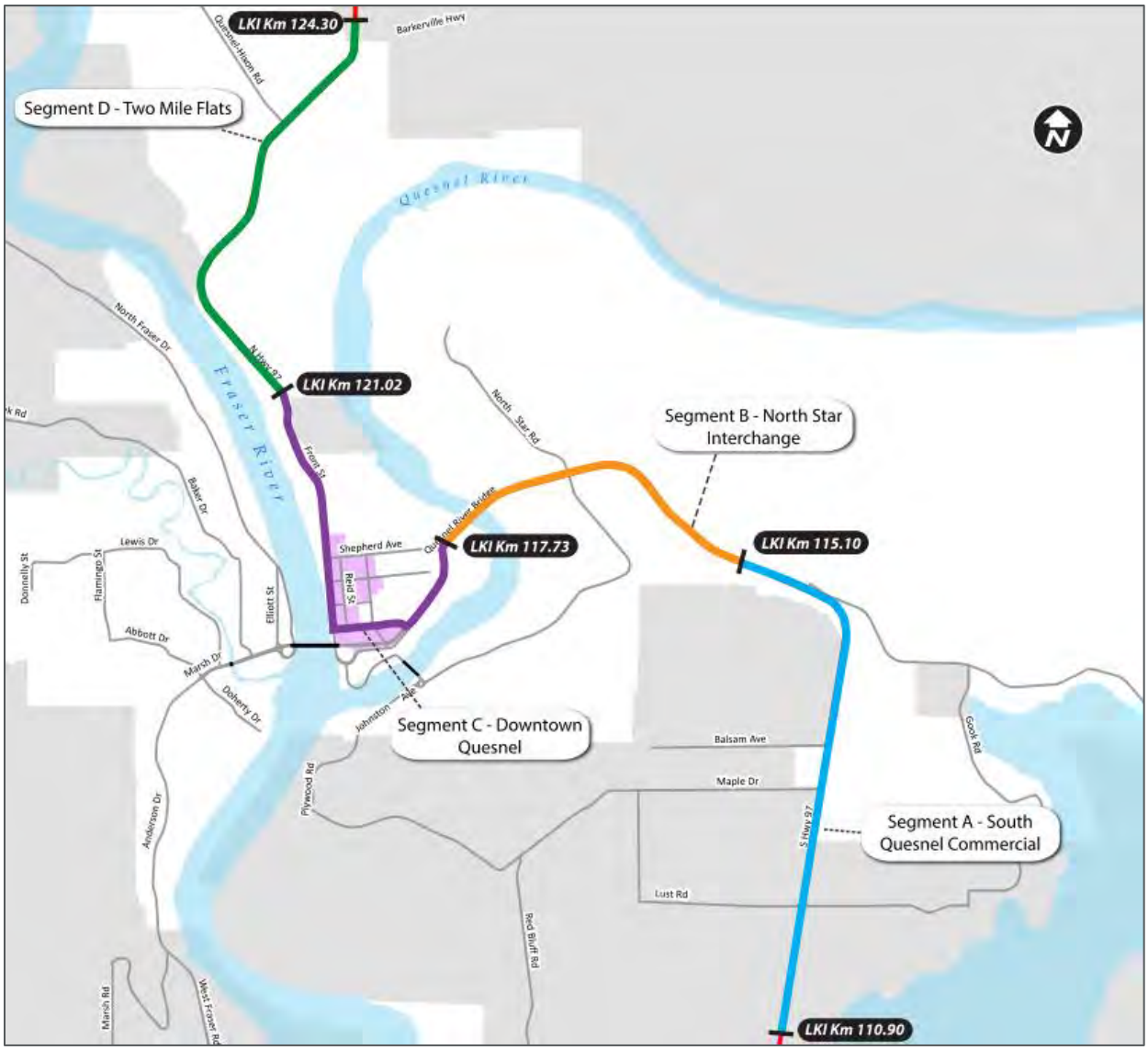
The main Highway 97 study corridor spans 13.9 kilometres in length and intersects with a total of 8 signalized intersections, 3 pedestrian half-signalized intersections, and 27 unsignalized intersections. As part of the data collection and mobility analysis documented in Sections 4.0 and 5.0 of this report respectively, all 8 signalized and 3 pedestrian half-signalized intersections were assessed, along with 17 major unsignalized intersections. Traffic data was not collected at the remaining unsignalized intersections which were considered minor in terms of their interface between Highway 97 and the local road network.

3.1.1 STUDY CORRIDOR

Highway 97 is an important provincial transportation corridor and provides access to dozens of communities both north and south of Quesnel. The study corridor was separated into four study segments to reflect the changing highway design elements as it passes through Quesnel. The highway study segments are illustrated in Figure 3.1 and are ordered as follows:

- **Segment A** - South Quesnel Commercial: Quartz Road to Dragon Hill Road
- **Segment B** - North Star Interchange: Dragon Hill Road to West of the Quesnel River Bridge
- **Segment C** - Downtown Quesnel: West of Quesnel River Bridge to Spears Street
- **Segment D** - Two Mile Flats: Spears Street to North of Highway 26 Junction

Figure 3.1: Study Segments of Highway 97 Corridor



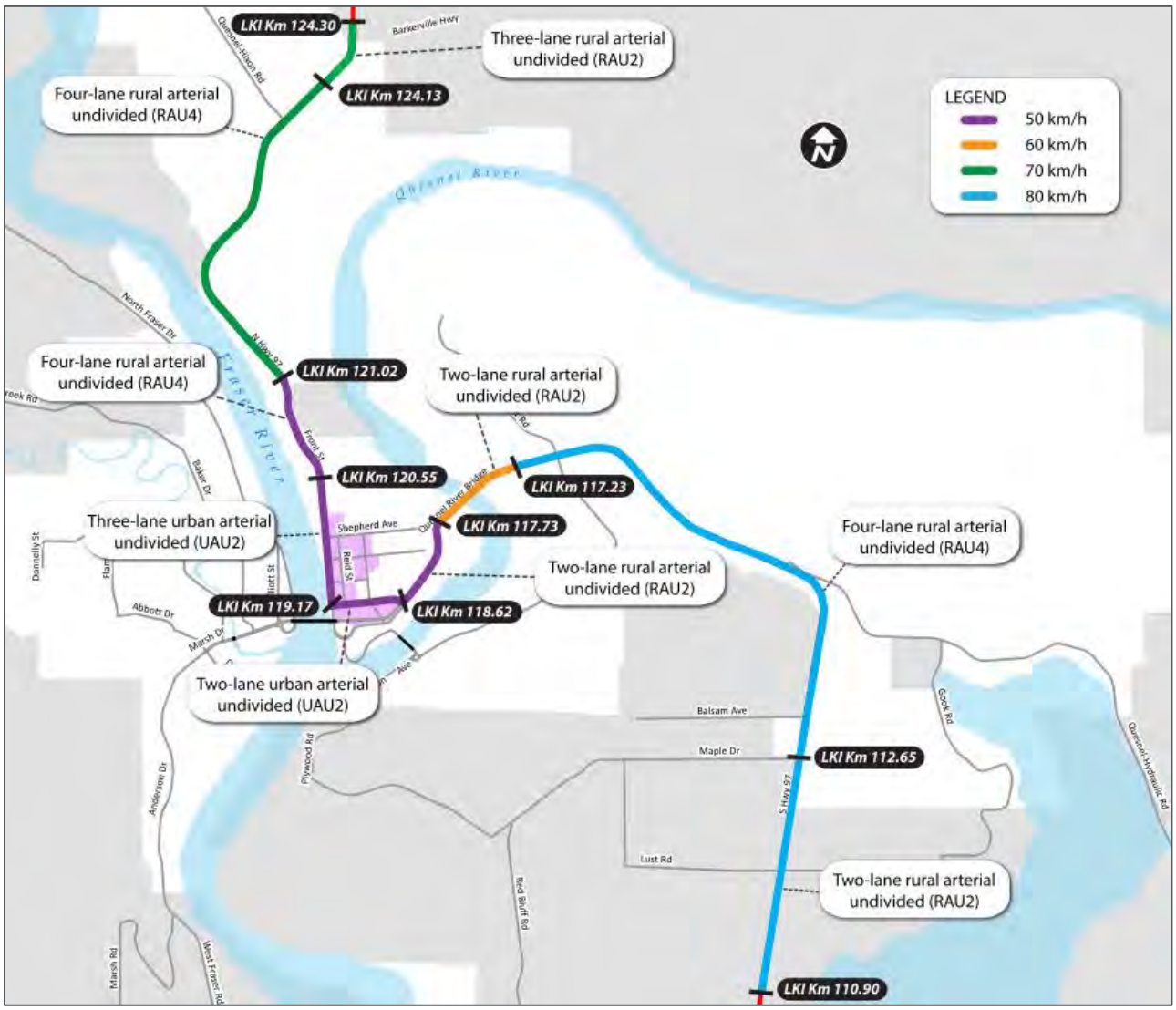
Developing the Problem Definition Statement

The organization of the Highway 97 corridor into these four study segments serves as the foundation for developing the problem definition statement. The four study segments capture distinctive elements that change for each segment, which consists of changes to the cross-section laning, surrounding land use, posted speeds, accesses, and other elements. While the key findings presented in this report are structured based on the technical review components, the findings are transformed into the problem definition statement in Section 10.0 with respect to the four highway segments.

3.1.2 MAJOR NETWORK FEATURES

The main features and connections of Highway 97 were reviewed with respect to the study segments. Figure 3.2 illustrates the important design and travel speed elements of the corridor. There are four posted speed zones throughout the study corridor, which closely relate to the study segments defined in Section 3.1.1. Starting at the southern end of the corridor, Highway 97 is a two-lane rural arterial highway with a posted speed of 80 km/h. The highway expands to a four-lane cross-section at Maple Drive until the Quesnel River Bridge, where it narrows back to a two-lane cross-section. The posted speed reduces first to 60 km/h over the bridge and then to 50 km/h through the downtown. Along Front Street, the Highway cross-section expands to three travel lanes. Further north, Highway 97 returns to a four-lane cross-section at Spears Road and the posted speed increases to 70 km/h.

Figure 3.2: Key Highway 97 Characteristics (LKI Segment 1146, Km 110.9 to Km 124.3)



3.1.3 MAJOR NETWORK CONNECTIONS

Some of the major and noteworthy connections with Highway 97 are described as follows with respect to the study segments. These are locations where Highway 97 intersects with other regional connections or with local roads which serve a unique land use or purpose.

Segment A – South Quesnel Commercial:

- **Highway 97 / Quesnel Hydraulic Road intersection** is an important rural regional connection with Quesnel Hydraulic Road and provides access to a large area of rural properties along its approximate 46 kilometre length extending outside the City of Quesnel. As such, Quesnel Hydraulic Road is classified as a Municipal Arterial under the City of Quesnel's OCP. In addition, Quesnel Hydraulic Road serves much of the South Hill neighbourhood, concentrating traffic along the frontage road approach to the intersection with Highway 97. Left turn auxiliary lanes are provided on the Highway 97 approaches to the four-legged intersection, which are stop controlled on the minor approaches.

- **Highway 97 / Maple Drive Intersection** is a noteworthy connection with Highway 97 as Maple Drive provides the only secondary road connection from the South Quesnel Commercial area to the Johnston Neighbourhood and Quesnel's downtown. Maple Drive also connects to Red Bluff Road, which runs south of Quesnel paralleling Highway 97 until it intersects with the highway south of the study area. Further, Maple Drive is classified as a Commercial roadway in the City's OCP as it services some of the large commercial stores in the area and a hotel. The four-legged intersection is signalized and both left and right auxiliary lanes are provided on each approach.

Segment B – North Star Interchange:

- **Highway 97 / North Star Road Interchange** is a partial Parclo A interchange design providing an important connection to forestry processing and industrial land uses north of the interchange and to the Carson and Johnston residential neighbourhoods south of the interchange. North Star Road is classified as a Collector type roadway in the City's OCP.

Segment C – Downtown Quesnel:

- **Highway 97 South of Sutherland Avenue** signifies a change in cross-section as Highway 97 enters the downtown core of Quesnel. Highway 97 transitions from a four-lane rural undivided cross-section to a three-lane urban undivided cross-section with two travel lanes provided for the southbound direction and travel lane for the northbound direction. A sidewalk is provided continuously on the east side of Highway 97 as it enters the downtown.

- **Highway 97 (Front Street) / Carson Avenue** is an important intersection whereby Highway 97 makes a 90 degree turn onto Carson Avenue and crosses through Quesnel's downtown core. The three-legged intersection is signalized and the inner southbound travel lane becomes a left turn only lane, which is subsequently dropped south of the intersection. The current configuration serves the primary southbound left and westbound right high volume turning movements.

- **Highway 97 (Carson Avenue) / Moffat Bridge Approach** is an important intersection whereby Highway 97 makes a second 90 degree turn exiting the downtown core of Quesnel. While Highway 97 maintains its Major Arterial classification through the change in alignment, the Moffat Bridge Approach is classified as a Municipal Arterial roadway. The four-legged intersection is signalized and left turn auxiliary lanes are provided on the Moffat Bridge approach and Highway 97 approach. The westbound right turn movement has a free flow control with an unusual yield control on the receiving lane for the northbound movement, which was most likely configured due to the volume usage of each movement.

Segment D – Two Mile Flats:

- **Highway 97 / Highway 26 (Barkerville Highway) intersection** is an important regional junction providing access to Highway 26 and to the Quesnel Regional Airport. Highway 26 is a relatively short highway at approximately 82 kilometres long and provides access to rural properties, the community of Wells, and ends at the famous gold rush town of Barkerville. The town of Barkerville has now become a tourist attraction and draws a number of visitors travelling by car and by bus along Highway 26, most of which enter and leave from Highway 97. The intersection has a two-way stop control with free flow given to Highway 97 movements. Auxiliary turning lanes are provided on each approach except for the eastbound movement leaving the Quesnel Regional Airport.

- **Highway 97 / Quesnel-Hixon (Finning) Road intersection** is a significant rural road connection serving both local and regional purposes. Quesnel-Hixon Road is classified as a Municipal Arterial roadway and this intersection is one of three major intersections in the Three and Two Mile Flat areas which serves both forestry and logging industrial land uses. In addition, Quesnel Quesnel-Hixon Road travels north parallel to Highway 97 for approximately 33 kilometres proving access to numerous rural properties. People who live and work along this road and travel towards Quesnel or further south are concentrated to access Highway 97 at this intersection. This intersection is signalized with auxiliary left, through, and right turning lanes on all approaches.

- **Highway 97 / Pinecrest-Hilltop Road intersection** is the second of three major intersections in the Three and Two Mile Flat areas which serves both forestry and logging industrial land uses. Pinecrest Hilltop Road is classified as a Collector roadway and has a two-way stop control configuration for its approaches onto Highway 97. Left and right auxiliary lanes are provided on the highway's northbound approach with only a left auxiliary lane provided on the southbound approach.

- **Highway 97 / Rome Avenue intersection** is the third of three major intersections in the Two Mile Flats area which serves both forestry and logging industrial land uses. Rome Avenue is classified as a Collector roadway and forms a three-legged signalized intersection with Highway 97. Auxiliary left and right turning lanes are provided along Highway 97 with a single shared turning movement lane on the minor Rome Avenue approach.

3.2 Existing Land Use

3.2.1 Existing Land Use Plans

The City of Quesnel's Official Community Plan (OCP) was completed for the City of Quesnel and adopted by City Council in 2007. The OCP provides the objectives and policies for the community of Quesnel and sets out the land-use management strategy for future growth. Given Highway 97 passes through the core of the community, the OCP includes objectives and policies which have significance to the highway corridor and must be considered with future planning.

Overall, the City of Quesnel's OCP recognizes the importance of the Highway 97 corridor and promotes compatible land uses along the highway, such as highway service commercial and light industrial. The City of Quesnel also has seven Development Permit Areas (DPAs), of which five abut the Highway 97 corridor:

1. Highway Frontage DPA
2. South Quesnel Highway Commercial DPA
3. Downtown DPA
4. Multi-Family DPA
5. Water Corridor DPA

The most relevant to this study are the Highway Frontage DPA, South Quesnel Highway Commercial DPA and Downtown DPA, which have detailed design guidelines applicable to all types of development within the highway corridor and Quesnel's downtown core along Highway 97.

With respect to land use planning, the City's objectives and policies support highway service commercial areas with development focused around nodes. Elongated strip development is discouraged and the OCP policies encourage landscaping, screening, and buffering to present an attractive appearance to motorists on Highway 97. Further, the OCP states the City will work with MoTI to achieve good access management.

The OCP's policies with respect to Transportation are supportive of planning future roads and highways to improve mobility across the City. Further, the transportation policies identify the importance of continuing to work with MoTI to find a truck route which will promote safety and efficiency for the surrounding road and highway network.

Cariboo Regional District - Quesnel Fringe Area Official Community Plan (OCP): A small portion of the study area to the south of the City of Quesnel boundary is located within the Cariboo Regional District – 'Quesnel Fringe Area'. The Quesnel Fringe Area OCP shows several properties in this section of the Highway 97 corridor as located in the 'Highway 97 Corridor Development Permit Area (DPA).' The purpose of the Highway 97 Corridor DPA is to ensure that new development contributes to a positive first impression of the community by maintaining a high development standard for the entry point to the City from the South.

This portion of the study area appears to have a large amount of vacant land with some potential for future highway commercial and light industrial development. These features of the Cariboo Regional District – Quesnel Fringe Area OCP are well aligned with the City of Quesnel OCP and South Quesnel Highway Commercial DPA.

3.2.2 HIGHWAY 97 LAND USE CONDITIONS

Highway 97 has a number of important functions within the City of Quesnel. The Highway transects the City and provides the primary access into and out of Quesnel from the north and south, and it is one of the City's main streets in the downtown; Carson Avenue (East-West) and Front Street (North-South). Additionally, Highway 97 provides direct access to North Quesnel, acting as an industrial corridor in Two Mile Flats area.

Land uses and anticipated developments within the study area are discussed according to the four highway study segments previously defined. It should be noted the section of the corridor between Quartz Road and Maple Drive is located in Electoral Area A of the CRD. Land use planning in this section of the Highway is outside of the City of Quesnel boundaries, and guided by the Cariboo Regional District Quesnel Fridge OCP. The remainder of the corridor between Maple Drive and the Barkerville Highway is located within the City of Quesnel boundaries.

Segment A – Quesnel South Commercial:

Highway 97 transitions from a two to four-lane segment flanked by primarily light industrial uses and highway commercial services with a number of vacant properties, and residential uses interspersed throughout. Travelling north from Quartz Road, to Maple Drive the road widens from two to four lanes and the land use transitions into big box retail and highway commercial. Major development at the intersection of Highway 97 and Maple Drive includes a Sandman Hotel, Extra Foods, several gas stations, and a mall.

There appears to be some potential for future development along this segment. According to the City of Quesnel OCP and the CRD Quesnel Fringe Area OCP much of the commercial land fronting the highway is currently vacant and designated for 'Highway Commercial' and 'Highway Service Commercial" uses, which can include retail, office, tourist accommodations, as well as compatible light industrial uses. The City anticipates there will continue to be pressure to permit increased commercial development in the area between Maple Drive and Cedar Avenue.

This area is part of the 'Highway 97 Corridor Development Permit Area' in the CRD Quesnel Fringe Area OCP, which contains the stated objective, "to ensure that new development contributes to a positive first impression of the community by maintaining a high development standard." The development of an RV warehousing site is proposed in the CRD Quesnel Fringe Area at the existing Chemo RV development. Closer to Maple Drive there appear to be a couple of sites already under construction, these fall under the South Quesnel Highway Commercial DPA in the City of Quesnel OCP, which provides similar requirements for new development as the CRD Highway 97 Corridor DPA.

From Maple Drive to the North Star Interchange, Highway 97 continues as a four-lane highway. This segment contains a mixture of highway commercial uses, such as motels, strip malls, big box stores, auto parts and gas stations, as well as several residential properties. Development is still sparsely distributed with a number of vacant properties adjacent the Highway corridor. The majority of buildings along this segment are single storied, and off-street parking is provided throughout this segment. Some development is anticipated on vacant properties including at the corner of Racing Road and Valhalla Road where a bowling alley / laser tag facility is being proposed.

Segment B – North Star Interchange:

Leading up to the Quesnel River Bridge is the North Star Interchange, which provides access to the College of New Caledonia to the south and Cariboo Pulp and Paper to the north. Beyond the North Star Interchange leading up to the Quesnel River Bridge is the Carson Neighbourhood, which contains about 100 single family units along the river south of the Highway.

The City of Quesnel OCP shows a number of designations for this stretch of highway with significant portions dedicated to 'Natural Environment', 'Parks and Recreation', 'Institutional' and 'Light Industrial.' There is currently a significant amount of vacant land in this area, notably the light industrial designated lands adjacent to the highway just prior to the Quesnel River Bridge. There is also a large amount of land designated and zoned highway and service commercial between Racing Road and the North Star Road Interchange that remains undeveloped.

Several properties in this area are also subject to the South Quesnel Highway Commercial DPA in the City of Quesnel OCP. The objective of the South Quesnel Highway Commercial DPA is to promote redevelopment that creates a strong first impression of Quesnel for motorists arriving from the south by encouraging a high standard of development, uses that do not negatively impact existing adjacent uses, and uses that provide for safe and effective access.

Segment C – Downtown Quesnel

Approaching the Quesnel River Bridge, the highway narrows to two lanes with on-street parking and continues as a two-lane segment into downtown Quesnel along Carson Avenue, which functions as one of Quesnel's downtown main streets. This segment contains a mixture of auto oriented commercial uses that directly abut the Highway. The commercial uses in this segment are set back and accessed directly from the highway. Businesses in the area include gas stations, car dealerships, building supplies, small scale retail and a motel. The majority of buildings along this segment are single storeyed.

Minimal change is anticipated in this central portion as there are few vacant sites available. The majority of the area is designated 'Downtown' and 'Civic Precinct,' with a large area designated light industrial along the Quesnel River. These designations allow for a wide variety of light industrial, commercial, retail and civic uses. Both the 'Downtown' and 'Civic Precinct' designations encourage infill and redevelopment in this area; although only a limited amount of this growth is expected to occur in the near future. Parts of this section of the Highway 97 corridor also fall under the Downtown DPA and Water Corridor DPA. The Downtown DPA seeks to promote a vibrant downtown and the Water Corridor DPA seeks to minimize the impact of development on natural areas along the Quesnel and Fraser River.

Approaching the Fraser River, Highway 97 turns 90 degrees right to become Front Street and widens back to three lanes; two lanes southbound one lane northbound. In this section Highway 97 runs adjacent to the Fraser River and several sections are flanked directly by the River and parkland to the west. Other land use include a broad mix of commercial (grocery stores, motels, restaurants, coffee shops), residential (single and multi-family), and institutional (seniors care, G.R. Baker Memorial Hospital) uses, as well as vacant redevelopment lots throughout. Many buildings along this segment have multiple stories with retail uses at grade and offices or residential uses on upper floors; off-street parking is generally provided throughout this segment.

The majority of the area is designated 'Downtown' with a large area designated 'Institutional' (G.R. Baker Memorial Hospital). There is also a limited amount of medium-density residential housing along the Quesnel River near the hospital. These lands allow for a wide variety of commercial, and retail uses alongside residential areas and the hospital. The 'Downtown' designation encourages a high standard of development along the east side of Front Street. The OCP also contains policies promoting a greater diversity of active transportation in the area potentially increasing pedestrian traffic along the highway in this area.

The City is active in developing policies and programs to encourage multi-residential development in the downtown area. A modest amount of new development / redevelopment is anticipated on vacant properties in the north end of the segment; although only a limited amount of this growth is expected to occur in the near future.

Segment D - Two Mile Flats:

Highway 97 transitions from a three to four-lane segment flanked by a mix of commercial, industrial, and heavy industrial uses, as well as vacant properties and forested lands. The road remains at three lanes until it reaches Sutherland Avenue at which point it expands to four. The initial portion of this section of Highway 97 is abutted by mostly single-family residential development, then heading north from Heinzelman Road to Rome Avenue the uses change to service and business commercial. From Rome Avenue to the Barkerville Highway, Highway 97 runs parallel to the railway and several large sawmills to the east and some more service commercial uses on the west flank. This section of the road has a fair amount of vacant land and several large lumber storage yards next to the Highway.

Many properties adjacent to Highway 97 in this section fall under the Highway Frontage Development Permit Area (DPA). The City's OCP designates this area as mostly Heavy Industrial and Service Commercial, but the Highway Frontage DPA encourages service commercial and light industrial uses in this area to provide a positive 'first impression' to visitors and residents alike.

The area further north outside of the Highway 97 study area is again located in the CRD Quesnel Fringe Area. The land abutting both east and west sides of Highway 97 through the CRD is designated for industrial uses and is currently undeveloped. The CRD also has land near the airport that is zoned for light industrial and can accommodate new development. On the west side of the Fraser River, there is a possible New Gold mining project that would be located in the Blackwater area. The proposed access to this site would use the Kluskus Forest Road and connect with Vanderhoof. Given this proposed access and the early stage of planning, it is difficult to understand what impacts the mine could potentially have on Highway 97.

3.3 Multi-Modal Review

The City of Quesnel is currently undertaking an active transportation planning process which involves a review and development of future improvements to the City's bicycle, pedestrian, trail, and transit network. This plan is intended to build on the existing OCP, the Bicycle Network Plan (1997), and the Integrated Community Sustainability Plan, which will include specific project improvements and enhancements to the existing network. Maps of the existing trail, sidewalk, and transit networks were developed and used for this multi-modal review; however, this study is in its early stages and improvements have not yet been identified.

Previously, the City's OCP (2007) outlined Council's objectives and policies around multi-modal transportation, which encourage the expansion of multi-modal networks across the City. The Bicycle Network Plan provided guidance for short-term improvements; however, none of the improvements identified in the previous plan currently have significant relevance to Highway 97. Thus, future improvements to the City's existing and future multi-modal network needs were reviewed based on the OCP's objectives and policies.

Sidewalks exist along Highway 97 primarily in the downtown urban area of Quesnel. Sidewalks are provided on both sides of Highway 97 (along Carson Avenue) from Kinchant Street to Front Street, and from Front Street to Gordon Avenue. Sidewalks which are provided on only one side the road are also located in the downtown along Carson Avenue between Highway 97 and Kinchant Street, and between Gordon Avenue and Sutherland Avenue. Paved shoulders are provided for the remaining segments of Highway 97 north of Sutherland Avenue and south of Carson Avenue for multi-modal use. The Council's policies for future improvements to the sidewalk network include:

- Investigating a pathway connection between the downtown residential area and the industrial area in the north area (Two Mile Flats) of the City;
- Investigate options for pedestrian access across Highway 97, particularly near the Quesnel Hydraulic Road intersection;
- Integrating the sidewalk network with pathways and trails;
- Improve the width and approaches on sidewalks for improved wheelchair accessibility;
- Require sidewalks in new development.

Since the OCP was completed, a pedestrian underpass was installed at the intersection of Dragon Hill Road and Highway 97 to provide a pedestrian access across the highway. A pathway connection from the downtown residential area and the Two Mile Flats area has yet to be implemented. This connection would be closely aligned with Highway 97 given the land use and CN railway constraints north of Sutherland Avenue. The narrow nature of the highway corridor and rail right of way make this very challenging without collaboration. Lastly, the City has indicated the asphalt sidewalk extending south from the Quesnel River Bridge has deteriorated and is in need of upgrade. The City also expressed safety concerns for pedestrians using this route and has indicated a need for better separation between pedestrians and vehicles.

Trails are an important part of the City's multi-modal network and are used for transportation and recreational trips. The City's trails come into interaction with Highway 97 in a few areas across the City. The City maintains a significant riverfront trail network, which runs adjacent to the Fraser River and Quesnel River surrounding the downtown Quesnel core. The riverfront trail forms a loop around the downtown, which includes a crossing of Highway 97 at McNaughton Avenue. This crossing is supported by a pedestrian half signal, which when activated, temporarily stops traffic along Highway 97 for trail users to cross the highway. In addition, a pedestrian bridge crosses the Fraser River and trail users are guided to cross Highway 97 at the signalized intersection with Front Street.

The riverfront trail also comes into interaction with Highway 97 at the Quesnel Overhead No. 01641, where the trail travels adjacent to Highway 97 along the south side of the bridge. On the north side of the Quesnel Overhead, the trail comes to a fork and users can either continue along the riverfront trail on the floodplains, or continue across the south side of the Quesnel River Bridge on the Campus Connector trail. The Campus Connector trail runs parallel to Highway 97 until the North Star Interchange where it diverts and subsequently runs along North Star Road until the Quesnel District Arts and Recreation Centre. From there, the Campus Connector trail becomes the Bryce Trail, which travels uphill through a forested area until it comes out onto Dragon Hill Road. As previously mentioned, the Bryce Trail connects across Highway 97 using a recently constructed underpass at the Dragon Hill Road / Highway 97 intersection. From there, the trail continues along Valhalla Road (frontage road to Highway 97) and then onto Quesnel Hydraulic Road.

Upon reviewing the OCP, no significant future trail network improvements which would impact the Highway 97 corridor were identified.

Transit services mainly West Quesnel, Downtown Quesnel, the Johnston Subdivision, and South Quesnel and partially uses Highway 97. In the downtown area, transit routes are provided along Front Street (Highway 97) between McNaughton Avenue and Carson Avenue, and continue further south over the Johnston Bridge on the municipal road network. No transit route operates along Highway 97 between the Front Street intersection and the North Star Interchange. Transit vehicles re-enter Highway 97 at the North Star Interchange and travel southwards until Racing Road, where the route diverts onto the frontage roads towards Maple Drive. From Maple Drive, Handydart service is provided south of Quesnel along Highway 97.

The OCP's objectives and policies for the future of public transit include continued modifications and expansions of public transit to meet the community's needs. In addition, the City will continue to work closely with BC Transit and give consideration to the transit needs of all age groups.

4.0 DATA COLLECTION

4.1 Traffic Characteristics

Traffic count data was obtained at many study locations along the Highway 97 corridor through Quesnel. As part of this study, a comprehensive traffic data collection plan was implemented and included turning movement counts (TMCs) at 28 key study intersections and automatic tube record counts (ATRs) at nine locations. Creative Transportation Solutions (CTS) was retained to obtain the majority of the TMC data in August of 2015 with spot counts completed in October of 2015. The ATR counts were obtained in both August and October of 2015.

1) Turning Movement Counts

The TMCs include a total of 7 hours of data for each intersection, which captured data for the morning, mid-day, and evening peak periods. The full TMC dataset is available in spreadsheet format. Two (2) hours of data were obtained in both the morning (7:00 AM to 9:00 AM) and mid-day periods (11:00 AM to 1:00 PM), and three (3) hours of data were obtained in the evening period (3:00 PM to 6:00 PM) to discern the respective peak traffic hours. The TMC data classifies vehicles by passenger cars, heavy vehicles, and medium size trucks (including RVs and transit vehicles). The TMC data was collected for the following locations:

Intersections along Highway 97:

- Highway 97 / Highway 26 (Barkerville Hwy)
- Highway 97 / Quesnel-Hixon Road
- Highway 97 / Brownmiller Road (Pinecrest Road)
- Highway 97 / Rome Avenue
- Highway 97 / McNaughton Avenue
- Highway 97 / Shepherd Avenue
- Highway 97 / St. Laurent Avenue
- Highway 97 (Front St) / Carson Avenue
- Carson Avenue Hwy 97) / Reid Street
- Carson Avenue (Hwy 97) / McLean Street
- Carson Avenue (Hwy 97) / Kinchant Street
- Carson Avenue (Hwy 97) / Moffat Bridge Approach
- North Star Road / Highway 97 NB Ramps
- North Star Road / Highway 97 SB Ramps
- Highway 97 / Racing Road
- Highway 97 / Quesnel Hydraulic Road
- Highway 97 / Juniper Road
- Highway 97 / Cedar Avenue
- Highway 97 / Balsam Avenue
- Highway 97 / Maple Avenue
- Highway 97 / Gook Road
- Highway 97 / Basalt Road

Other Adjacent Study Intersections:

- Front Street / Johnston Bridge Loop
- Front Street / Johnston Avenue
- Davie Street / Moffat Bridge Approach
- McLean Street / Moffat Bridge Approach
- Elliot Street and Marsh Drive
- Juniper Road / Highway 97 Access

2) Automatic Tube Recorded Counts

The ATR counts were conducted over seven (7) day periods to understand the variability in traffic patterns between weekdays and weekends. The full ATR dataset is available in spreadsheet format. The ATR counts collected in October of 2015 were also aligned with the Bluetooth origin-destination survey (discussed later in section 4.2 of this report). The ATR data was collected in one hour periods for both northbound and southbound directions of travel and includes a detailed classification of vehicles

according the classification scheme provided by the Federal Highway Administration. The ATR data was collected for the following locations:

ATR Locations along Highway 97:

- Highway 97 north of Highway 26
- Highway 97 between Rome Avenue and Bowron Avenue
- Highway 97 west of Quesnel River Bridge
- Highway 97 east of North Star Road
- Highway 97 south of Agate Avenue

Other ATR Study Locations:

- Highway 26 east of Highway 97
- Moffat Bridge at Marsh Drive
- Johnston Bridge at Davie Street
- Quesnel-Hydraulic Road west of Quesnel River Bridge

3) Historical Turning Movement Counts

In addition to the traffic volumes collected over the summer and fall of 2015, MoTI provided historical TMC data from 2005 to 2014 for inclusion in this existing conditions study. Most of the historical TMC data was obtained at signalized intersections where volumes could be downloaded. This data was primarily used to determine historical traffic growth.

4) Travel Time Survey

A travel time survey was conducted on August 13, 2015 during the August count period. The survey was conducted during the AM, Mid-Day, and PM peak hour periods between both the north end of the study area near Highway 26, and the south end of the study area near Quartz Road. Three (3) survey trials were conducted for the AM and Mid-Day peak periods and five (5) survey trials were conducted for the PM peak period. The full travel time survey data results are also available in spreadsheet format.

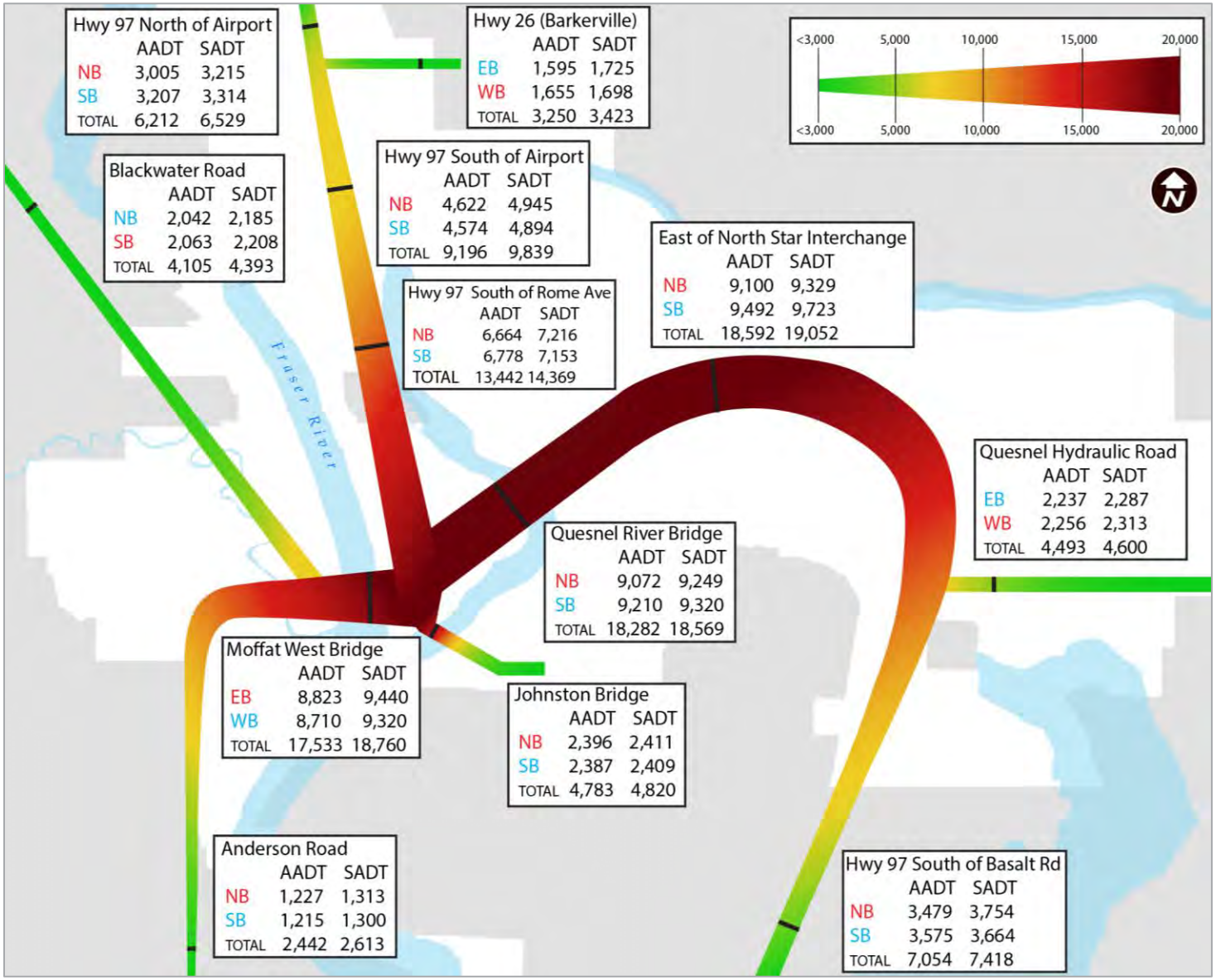
4.1.1 AADT and SADT Traffic Volumes

The Annual Average Daily Traffic (AADT) and Summer Average Daily Traffic (SADT) volumes are summarized and illustrated in Figure 4.1 on the following page. As illustrated, traffic volumes increase significantly along the urban section of Highway 97 through the downtown of Quesnel and across the Moffat West Bridge to a maximum of approximately 19,000 veh/day, and reducing to approximately 3,000 to 7,500 veh/day at the north and south entry / exit points of the study area

4.1.2 Peak Hour Traffic volumes

The AM and PM peak hour turning movement volumes at each of the 28 key study intersections are illustrated in Figure 4.2 to Figure 4.4. These peak hour volumes are based on the summer traffic counts collected in 2015 and adjusted using the MoTI seasonal factors to obtain typical day peak hour volumes.

Figure 4.1: AADT and SADT Volumes along Highway 97 and Adjoining Study Area



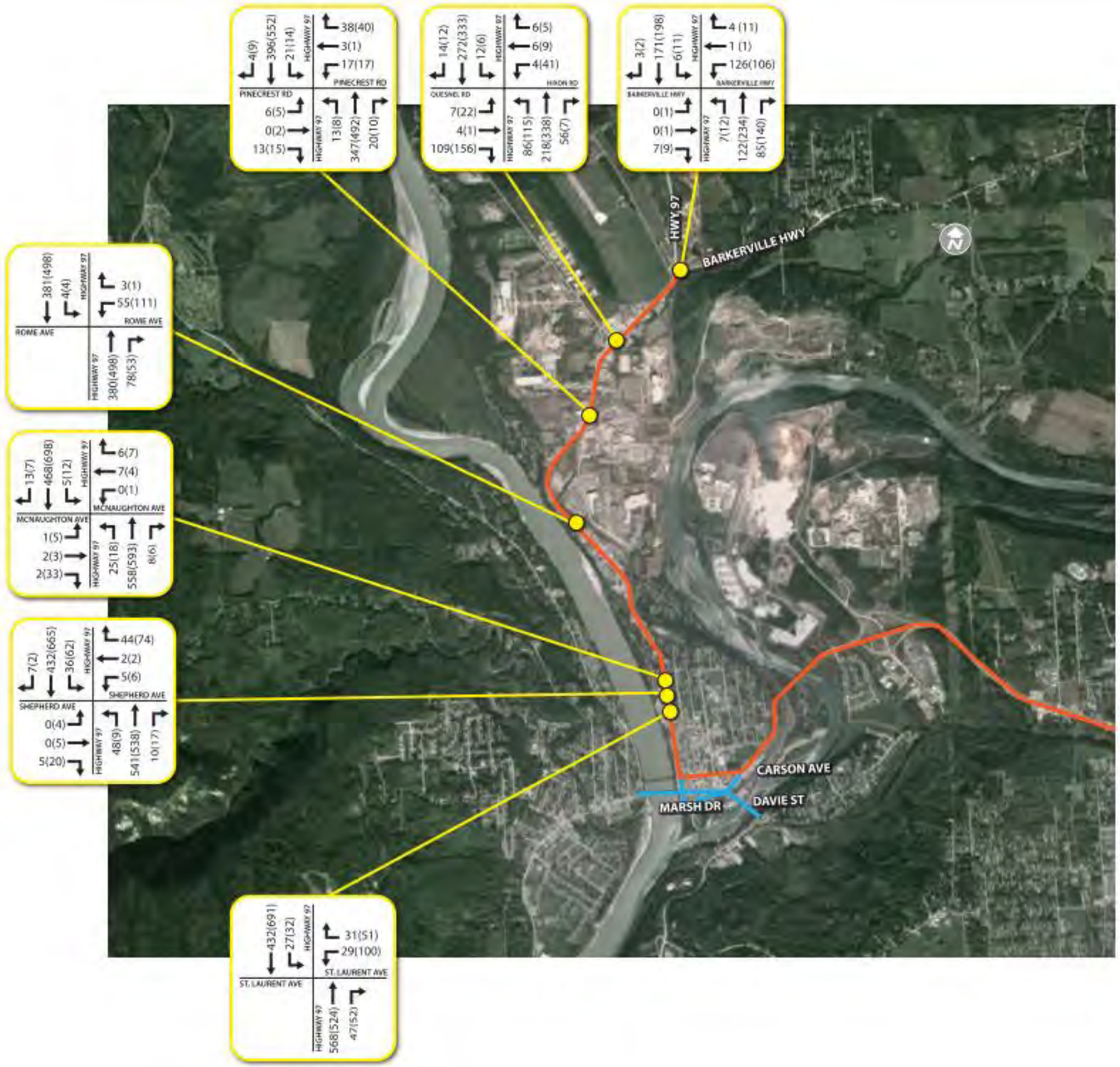


Figure 4.2: Existing 2015 AM and PM Peak Hour Turning Volumes – Typical Day (1 of 3)

URBAN systems

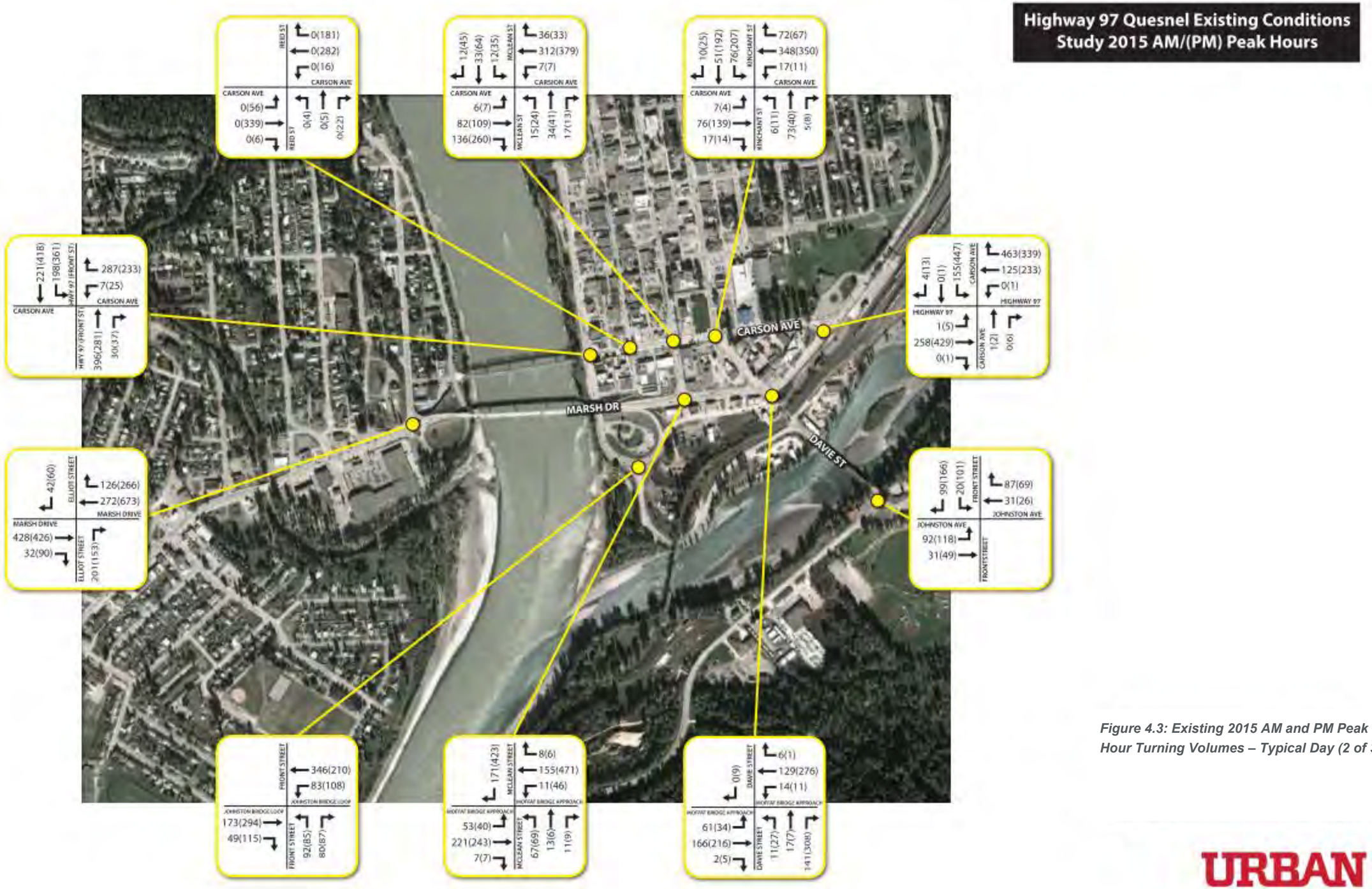


Figure 4.3: Existing 2015 AM and PM Peak Hour Turning Volumes – Typical Day (2 of 3)

URBAN systems

Highway 97 Quesnel Existing Conditions Study 2015 AM/(PM) Peak Hours

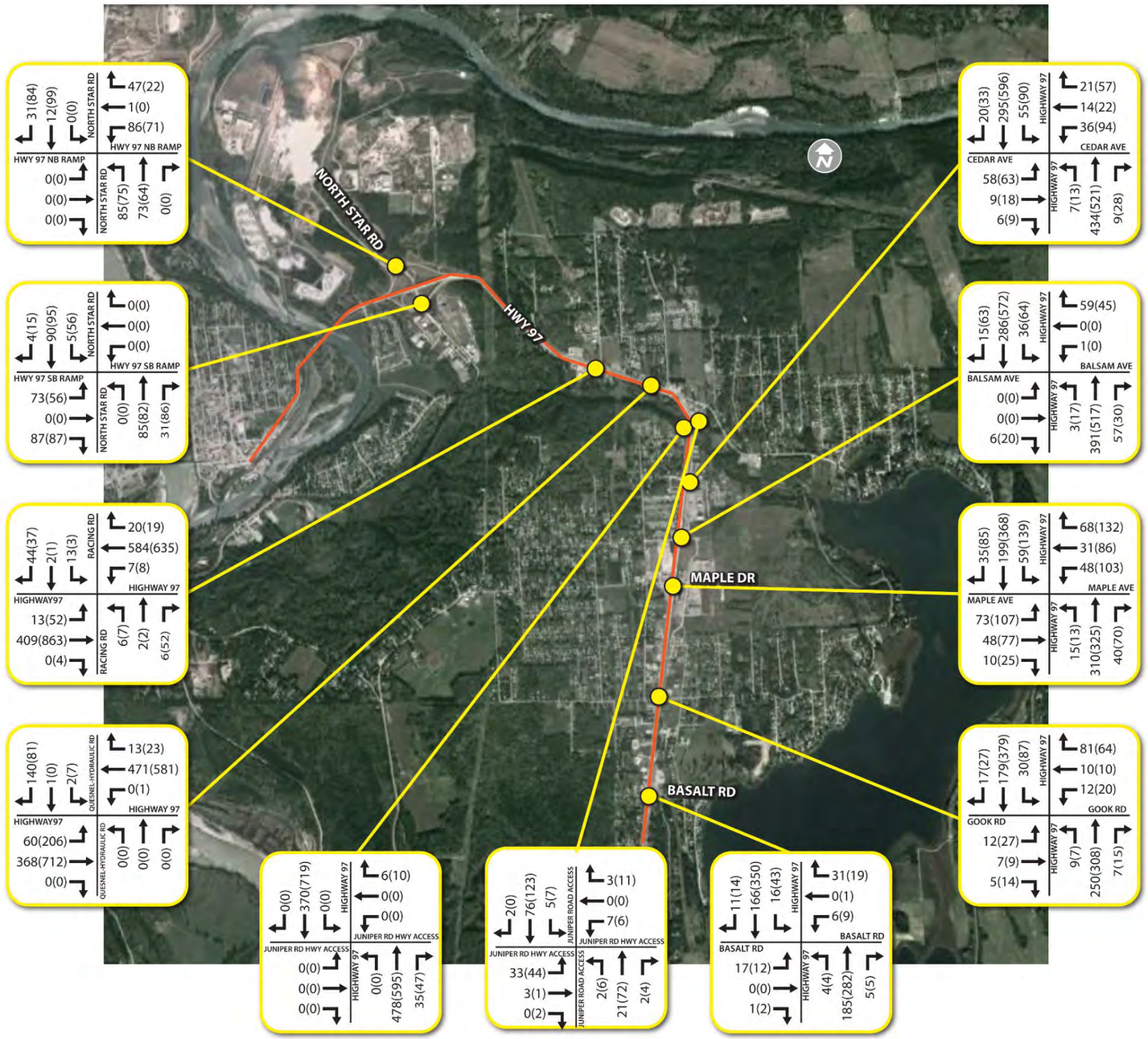


Figure 4.4 Existing 2015 AM and PM Peak Hour Turning Volumes – Typical Day (3 of 3) 2)

URBAN systems

Traffic Volume Findings Comparison to 2011 Traffic Profile Study

The AADT and SADT traffic volumes estimated from the recent 2015 ATR count data were compared with the AADT and SADT traffic volumes estimated in the *Traffic Profile Report, Highway 97 Quesnel* completed in 2011. The objective of this comparison was to understand how traffic patterns may or may not have changed in the five year period since the 2011 study was completed. Table 4.1 summarizes the comparison of AADT and SADT volumes at similar traffic count locations and the percent growth relative to the 2016 Highway 97 Quesnel Corridor Review. It should be noted that the AADT and SADT volumes for both studies are based on a short ATR counts and are an estimation only. In addition, the "percent change" in volumes does not provide an accurate representation of overall traffic volume growth along the corridor.

Table 4.1: AADT and SADT Volume Comparison to 2011 Study Findings

Count Location on Highway 97 /	AADT Volumes		AADT % Change	SADT Volumes		SADT % Change
	2011 Study	2016 Study		2011 Study	2016 Study	
South of Highway 26	8,000	9,200	15%	8,600	9,800	14%
South of Rome Ave	15,800	13,400	-15%	15,800	14,400	-9%
Moffat Bridge	17,000	17,500	3%	18,000	18,800	4%
West of Quesnel River	20,000	18,300	-9%	22,000	18,600	-15%
East of North Star I/C	17,000	18,600	9%	17,900	19,100	7%
South of Basalt Rd.	6,700	7,000	4%	7,100	7,400	4%

The comparison of both AADT and SADT volumes for the 2011 and current 2016 study results indicate there were some increases and decreases in volumes on certain segments of Highway 97. Specifically, the section of Highway 97 south of Rome and the section West of Quesnel River saw the largest decreases in traffic volumes while the section south of Highway 25 saw the largest increase in traffic volumes. These results may partially reflect the closure of the Canfor sawmill in 2014.

4.1.3 Highway Usage Profiles

The highway traffic profiles were prepared and studied to understand the typical traffic flows, peaks, and dips experienced by highway users on a typical weekday and weekend. Each traffic profile is based on the five ATR count data locations obtained along Highway 97, and the figures demonstrate how daily traffic patterns differ depending on the location where the data was obtained along the highway. The profiles for northbound and southbound weekday traffic travelling along Highway 97 are shown in Figure 4.5 and Figure 4.6 respectively.

In the northbound direction of travel, traffic volumes steadily increase from about 6 AM reaching the first peak around 9 AM. Interestingly, the morning peak traffic volumes do not taper off after the AM peak and they continue to climb through the middle of day and eventually reach their afternoon peak around 5 PM. In the southbound direction, traffic volumes increase rapidly around 830 AM and after peaking, begin to slowly taper off throughout the rest of the day.

The ATR counts located at the north and south perimeters of the study area indicate traffic slowly increases through the morning and afternoon, and slowly decreases through the evening with little variability. This long mid-day peak is typically observed on rural highways where regional trips are occurring. The ATR counts located through Quesnel indicate some variability to traffic volumes through the day. Generally, both traffic profiles illustrate that trips are being made constantly throughout the work day and are less reflective of morning and evening commute-based trips typically observed in larger communities.

An additional observation worth noting is the difference in traffic volumes measured between the northbound and southbound directions of travel. The traffic profile curves indicate volumes are slightly greater for traffic travelling northbound than in the southbound direction. When comparing Figure 4.5 and Figure 4.6, this directional volume difference is most observed for the internal traffic count stations located south of Rome Avenue, west of the Quesnel River Bridge, and east of North Star Road. In addition, there is no other route where southbound traffic could be diverted and result in the direction volume difference. Thus, the potential source of higher northbound volumes could be attributed to traffic entering the Highway from the North Star interchange and arriving in the Two Mile Flats area. A truck traffic survey was conducted with the major industries in Quesnel and the results of that survey are discussed in Section 4.2 of this report. Based on the traffic volumes alone, there is not enough information to indicate the slightly higher northbound volumes are a result of truck traffic.

Figure 4.5: Highway 97 Northbound Weekday Traffic Profile

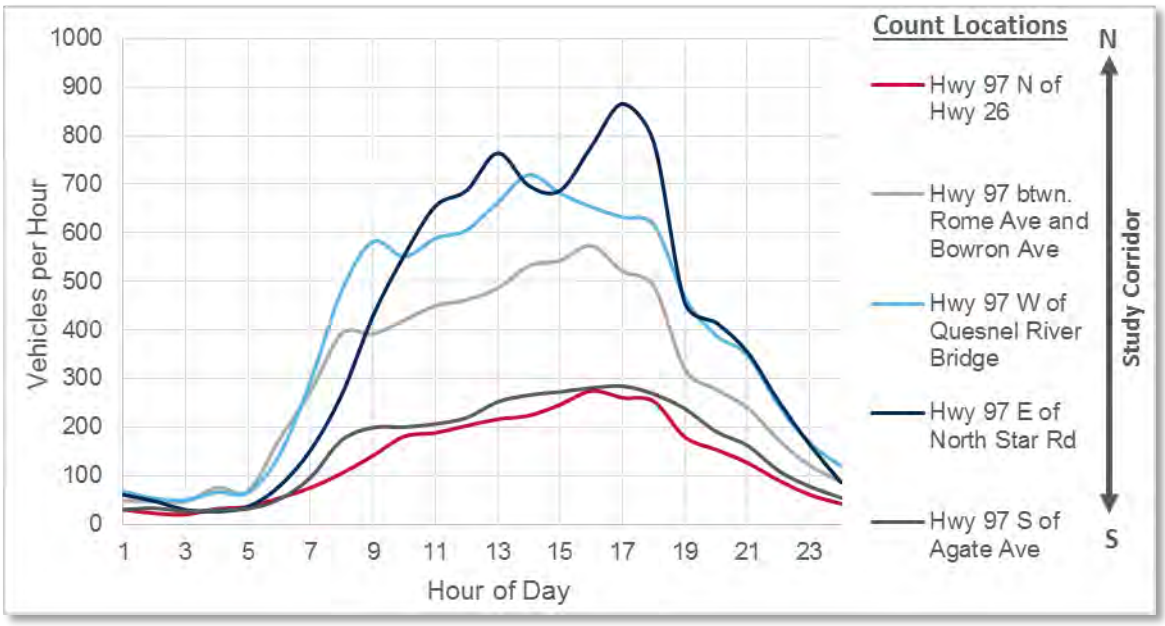
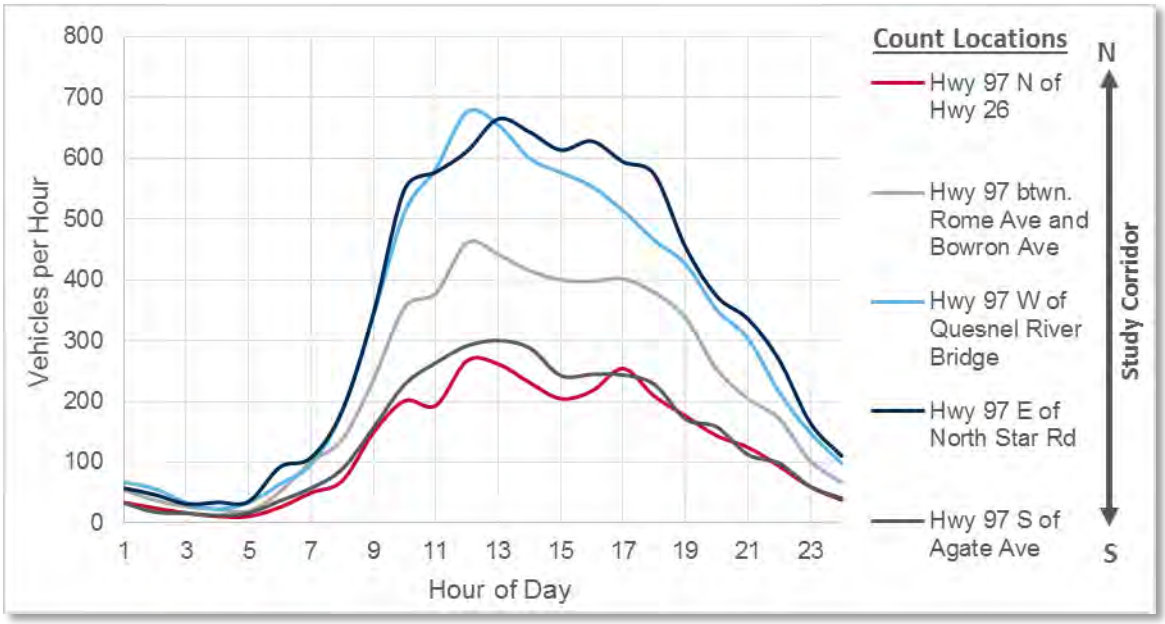


Figure 4.6: Highway 97 Southbound Weekday Traffic Profile



The profiles for northbound and southbound weekend traffic travelling along Highway 97 are shown in Figure 4.7 and Figure 4.8, respectively.

In the northbound direction of travel, the traffic profile demonstrates a spot increase of traffic in the early morning hours, followed by a steady increase to peak traffic in the middle of the day, varying based on the ATR count location. Traffic volumes then decrease steadily through the afternoon and evening. In the southbound direction of travel, traffic volumes experience a similar increase through the morning hours, peaking in the middle of the day, and decreasing thereafter into the afternoon and evening. Both the northbound and southbound traffic profiles reflect typical weekend traffic patterns which tend to consist primarily of shopping, recreational, and leisure based trips.

Figure 4.7 Highway 97 Northbound Weekend Traffic Profile

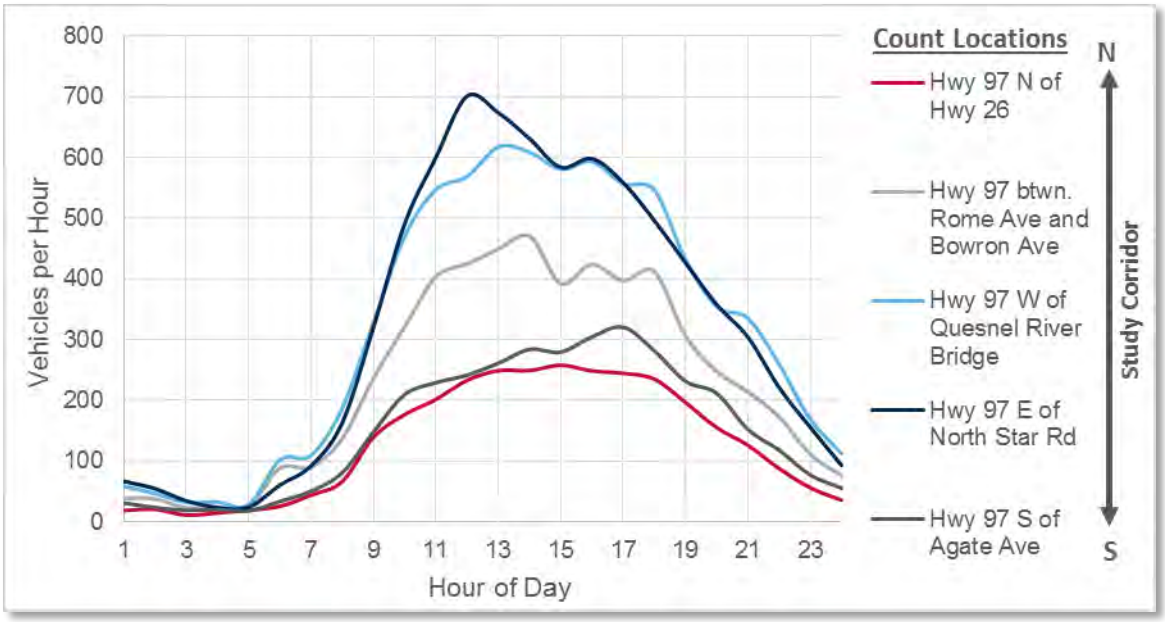
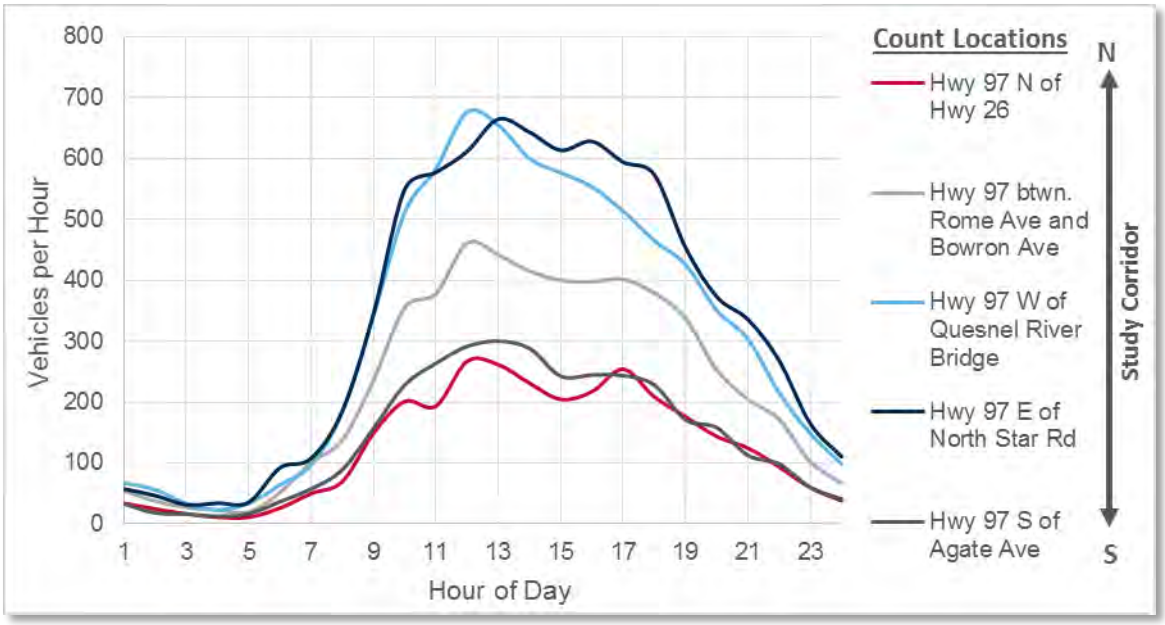


Figure 4.8 Highway 97 Southbound Weekend Traffic Profile

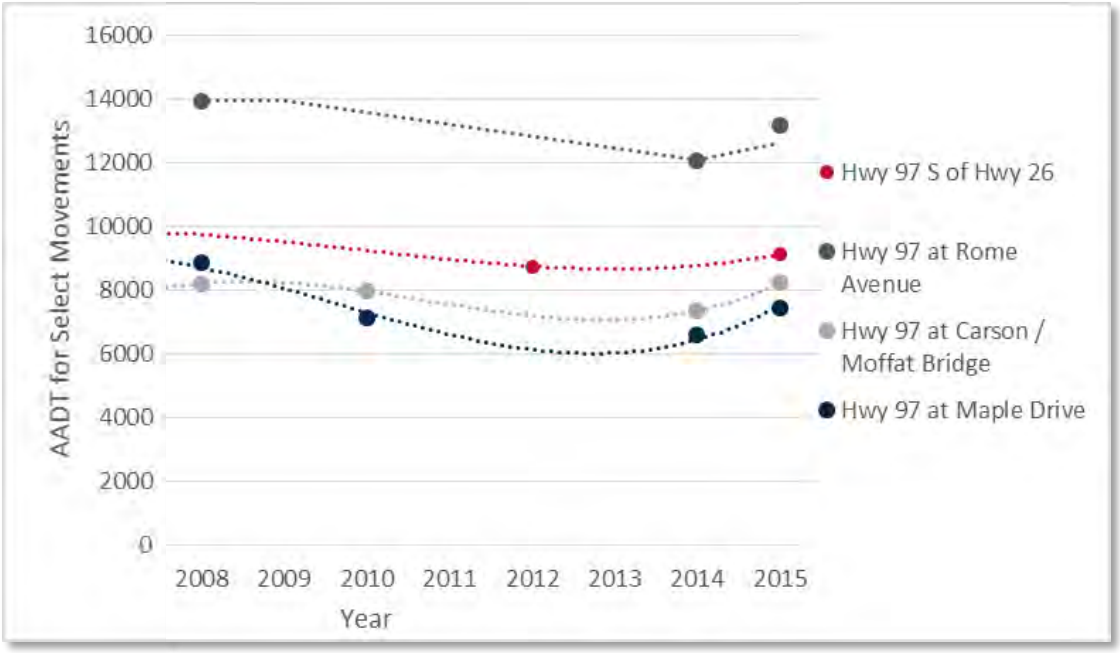


4.1.4 HISTORICAL TRAFFIC GROWTH

Historical traffic growth patterns were calculated based on available traffic data obtained from four signalized intersections in Quesnel that correspond to the four study segments. Figure 4.9 illustrates the estimated AADT traffic volumes as they have changed since 2008 where data was available. Traffic volumes slightly lowered following 2008 until 2014 where recent data suggests an upward traffic growth trend.

When the traffic growth is calculated over the long term from 2008 to 2015, the number of years in between and the relatively flat volumes suggest a growth rate of -0.6% on average, which is close to zero growth. However, when growth is calculated over the short term between 2014 and 2015, the significant increase in 2015 volumes suggests a growth of 8.8% on average.

Figure 4.9: Historical Traffic Count Volumes along Highway 97



While future growth forecasts make take into consideration these historical growth rates, any forecasts should also consider population forecast data, industry forecast data, and any other relevant information which may be used to establish appropriate future growth assumptions.

4.1.5 TRAFFIC SEASONALITY

The traffic counts were obtained in the months of August of 2015, October of 2015, and January of 2016 and were compared to understand some of the seasonal changes observed in traffic along the Highway 97 corridor. Figure 4.10 depicts the average two-way weekday traffic volumes obtained at the ATR count stations in each of these months. Winter traffic counts could only be obtained at three locations near Rome Avenue, the Quesnel River Bridge, and the North Star Road.

In general, the seasonal changes in traffic indicate lower volumes are observed in the fall than in the summer, and volumes in the winter are lower than in the fall. The exception to this observation are the winter counts collected between Rome Avenue and Bowron Avenue, which are higher than the fall counts by approximately 500 vehicles over the day. However, it is noted that each of these counts are based on a small sample size and traffic conditions can change depending on a number of factors.

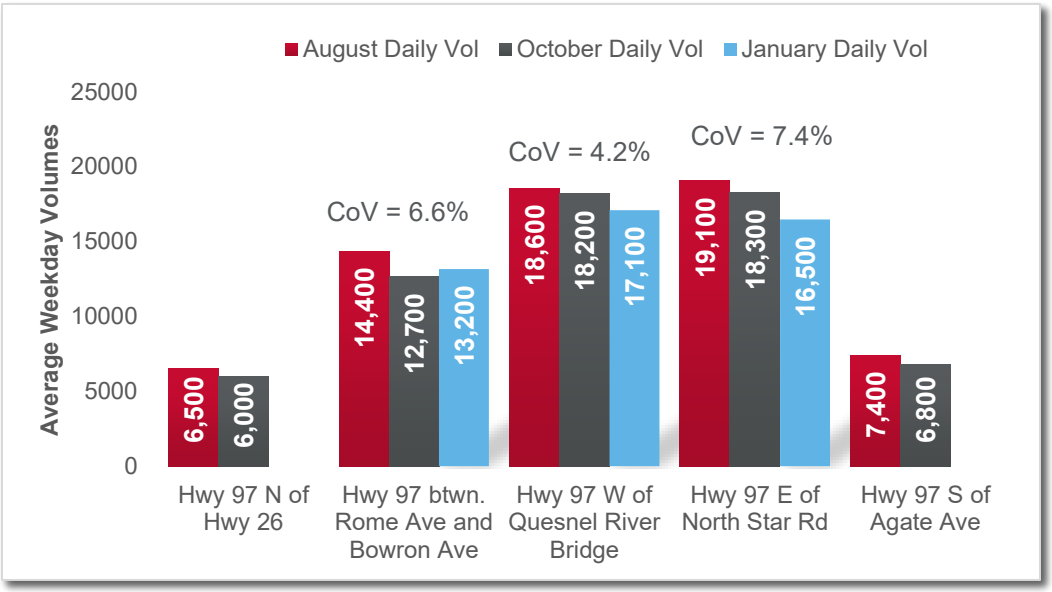
The MoTI defines seasonality as the increase and decrease in traffic volumes throughout the year, which typically reflect increased volumes in the summer and lower volumes in the winter. Seasonality is quantified by the Coefficient of Variation (CoV), which is simply the standard deviation of recorded volumes at a location divided by the mean of volumes for the same location. Using the CoV, the seasonality of count locations is categorized as either:

- Consistent: CoV < 15%
- Seasonal: 15% < CoV < 33%
- Highly Seasonal: CoV > 33%

The CoV was calculated for the three count locations where volumes were obtained in the summer, fall, and winter and is also shown in *Figure 4.10*. The largest calculated CoV was 7.4% for the count location on Highway 97 east of North Star Road. Thus, the seasonality of traffic volumes through the study area may be characterized as being consistent. In comparison, the seasonality for the nearest permanent count station on Highway 97 at Marguerite (P-41-2NS), which is located approximately 45 kilometers south of the study area, was found to be seasonal.

These findings indicate the traffic volumes on Highway 97 in the Quesnel study area are more consistent and reflect higher proportions of commuter traffic; whereas the traffic volumes outside of the Quesnel area indicate higher volumes in the summer and low to moderate proportions of commuter traffic.

Figure 4.10: Seasonal Variation between August and October Traffic Volumes



4.1.6 VEHICLE CLASSIFICATION

Vehicle classification data was captured in the ATR counts conducted during the August and October count periods. The vehicle classification data can be categorized in up to thirteen (13) standard categories, known as the US Federal Highway Administration Vehicle Classification Scheme, which sorts vehicles by size, ranging from passenger vehicles to multi-trail trucks with seven or more axles. However, to understand the overall composition of traffic on Highway 97, these thirteen categories may be summed into two core categories, which are passenger vehicle traffic and commercial vehicle traffic.

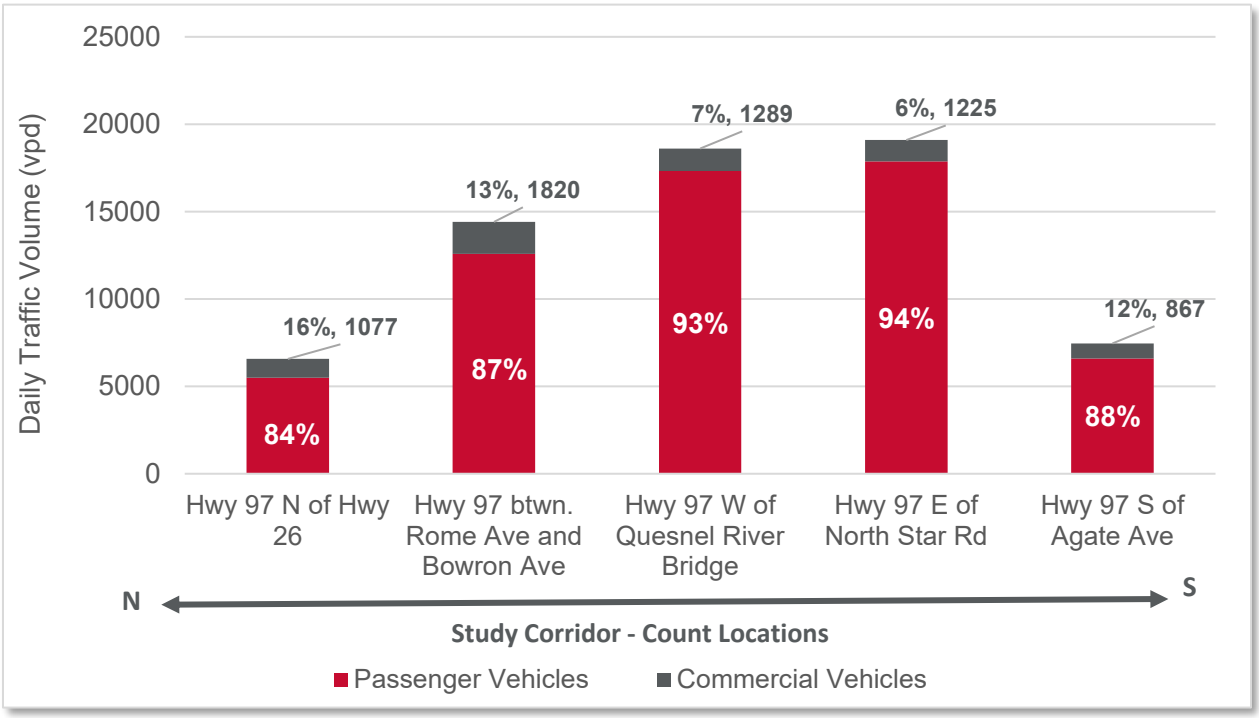
Passenger vehicle traffic typically comprises the largest portion of vehicles on the road, whereas commercial vehicles typically account for a fraction of the traffic on most roadways. Figure 4.11 and

Figure 4.12 illustrate the overall composition of average weekday traffic volumes (two-way) at the ATR count stations during the August and October counts, respectively.

As previously noted in the highway usage profiles, the count stations at Quesnel River Bridge and the North Star Interchange recorded the highest volume of vehicles per day and had the lowest percentage share of commercial traffic. In the summer, commercial traffic accounted for approximately 1,250 vehicles per day at these locations. Conversely, the ATR count stations at the north and south ends of the study area (North of Highway 26 and South of Agate Avenue) recorded the lowest volume of vehicles per day and had relatively high shares of commercial traffic. However, these two stations recorded the lowest volume of commercial traffic with approximately 1,100 vpd recorded at the Highway 26 location and approximately 900 vpd recorded at the Basalt Road location.

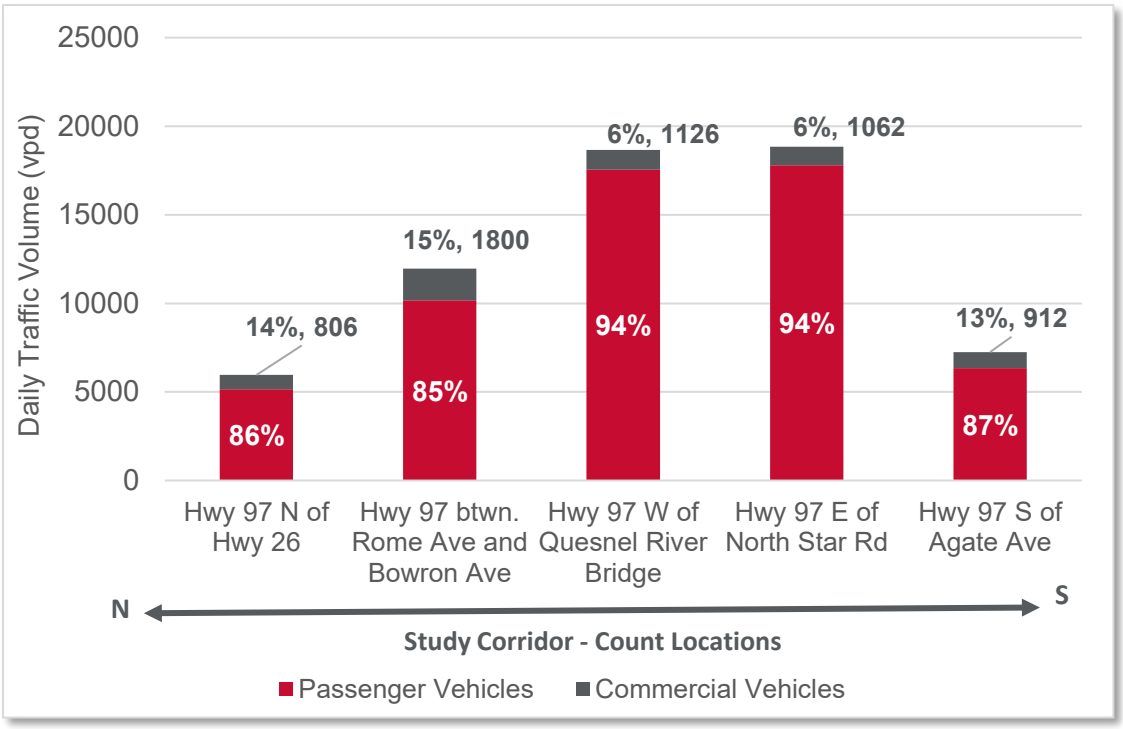
The ATR count station located between Rome Avenue and Bowron Avenue recorded volumes that could be considered the mid-point of volumes along the Highway 97 corridor. This station recorded the highest percentage share of commercial traffic and also the highest volume of commercial vehicles at approximately 1,800 vehicles per day.

Figure 4.11: Vehicle Classification by Location – Average Weekday in August



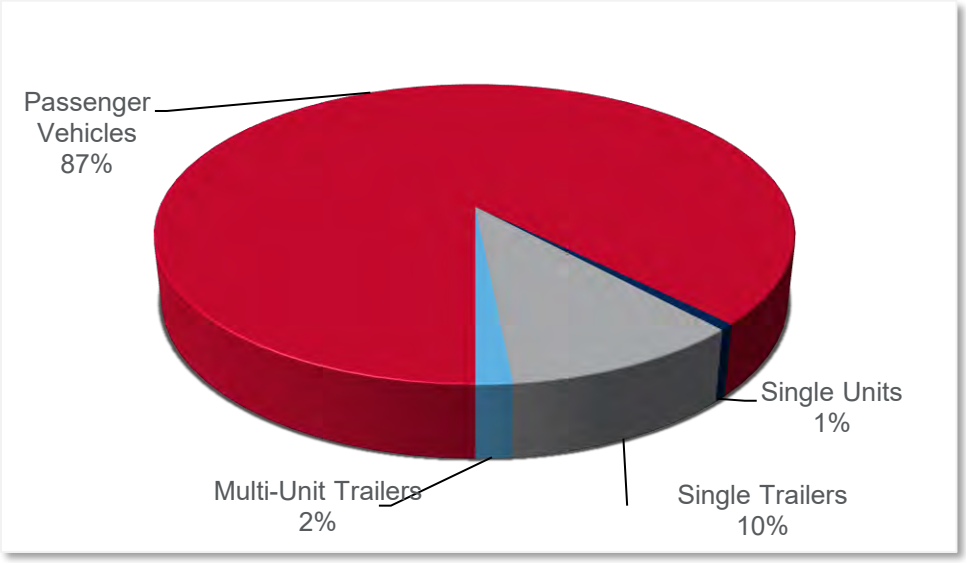
The classification results observed from the summer traffic count had close similarity to the classification results observed in the fall traffic count data, and the same observations apply.

Figure 4.12: Vehicle Classification by Location – Average Weekday in October



The traffic data obtained at the count station located between Rome Avenue and Bowron was analyzed further given the high volume and percentage of commercial traffic observed at this count station. As depicted in Figure 4.13, the majority of commercial traffic consists of single-trailer trucks (10%), followed by multi-unit trailer trucks (2%), and single unit trucks (1%). Similar results were observed for the classification data obtained during the October traffic counts.

Figure 4.13: Average Weekday Classification of Commercial Traffic – South of Rome Avenue



4.1.7 TRAVEL TIME SURVEY

The travel time survey provides an understanding of the duration of time it takes for a vehicle to traverse the study area in both the northbound and southbound directions of travel. As previously noted, three (3) trials were conducted for the AM and Mid-Day peak periods and five trials were conducted for the PM peak period. In addition to travel time, the survey provides information on average speed (km/h), duration of time when the vehicle was stopped (s), and the number of stops. Table 4.2 summarizes the average measurements for travel time, speed, and stopping time for each peak period.

The travel time results indicate travel during the morning peak hours is the fastest with respect to the mid-day and evening peak hours, with recordings of 797 seconds (13 minutes and 17 seconds) in the northbound direction and 765 seconds (12 minutes and 45 seconds) in the southbound direction. However, travel time during the mid-day and evening peak hours is only greater by a few more seconds. One notable observation is the travel times recorded in the northbound direction are all longer in duration than travel in the southbound direction. As noted before, this is likely due to higher traffic volumes observed travelling northbound than in the southbound direction.

Table 4.2: Corridor Travel Time Survey Results

Time Trial Measurements	Northbound			Southbound		
	AM Peak	MID-Day Peak	PM Peak	AM Peak	MID-Day Peak	PM-Peak
Average Travel Time (min:sec)	13:17	13:26	13:24	12:45	13:10	12:47
Average Speed (km/h)	60	59	59	62	60	62
Stopping Time (s)	30	29	46	39	35	39

The average speed was obtained from the time trials for each peak hour period for a vehicle to traverse the study segment. The average recording for speed was observed between 59 and 62 km/h. However, the highway design and land use context changes significantly along this segment and vehicles will travel faster along more rural segments than slower urban segments. The time trials are depicted on distance versus time graphs in Figure 4.14 and Figure 4.15 for the respective northbound and southbound travel directions of the PM peak period.

The steeper the slope of the curve, the faster the vehicle is travelling along that section of highway, and conversely, the flatter the slope of the curve, the slower the vehicle is travelling. As traffic enters from south of Agate Avenue heading northbound, vehicles slow down through the south highway commercial where traffic signals exist at Maple Avenue and Cedar Avenue. From Cedar Avenue, vehicles travel at a higher speed as they travel towards the downtown past the North Star Interchange and across the Quesnel River Bridge. Vehicle speeds decrease notably through the downtown as shown by the time trial curves on both northbound and southbound figures. By Rome Avenue, vehicles are travelling at increasing speeds as they travel northbound out of the study area. A similar pattern can be observed in the opposite direction of travel for southbound traffic.

Figure 4.14: Highway 97 Northbound Time Trials – PM Peak

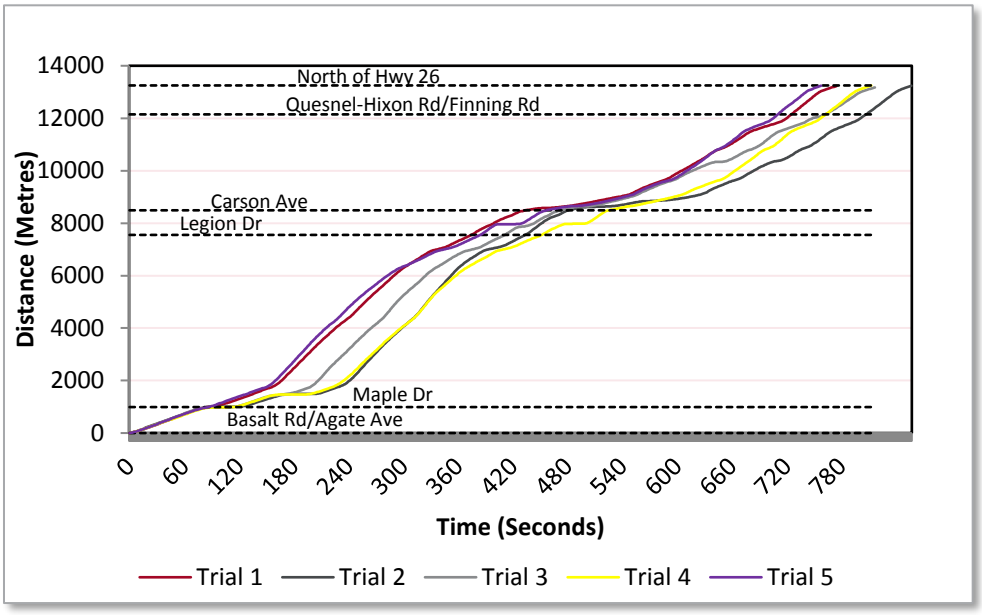
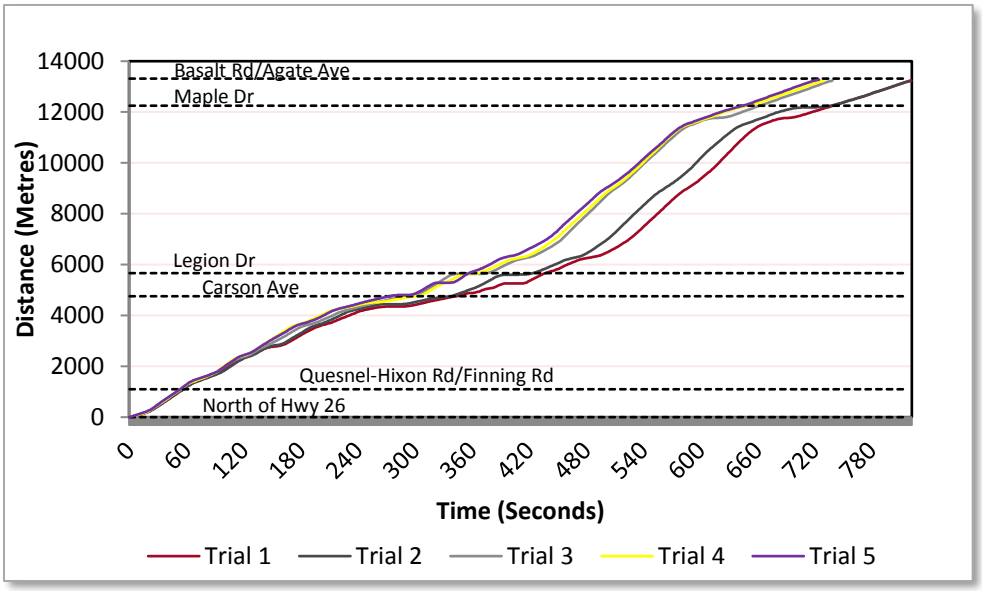


Figure 4.15: Highway 97 Southbound Time Trials – AM Peak



4.2 Truck Traffic Survey

Commercial truck traffic using Highway 97 through Quesnel is significantly tied to the wood product industry, including timber, pulp and paper mills. Although rail transportation handles much of the finished products produced by these mills for transport to regional destinations, trucks are still heavily used for the transportations of raw materials, chemicals, and wood by-products to and from mills within Quesnel.

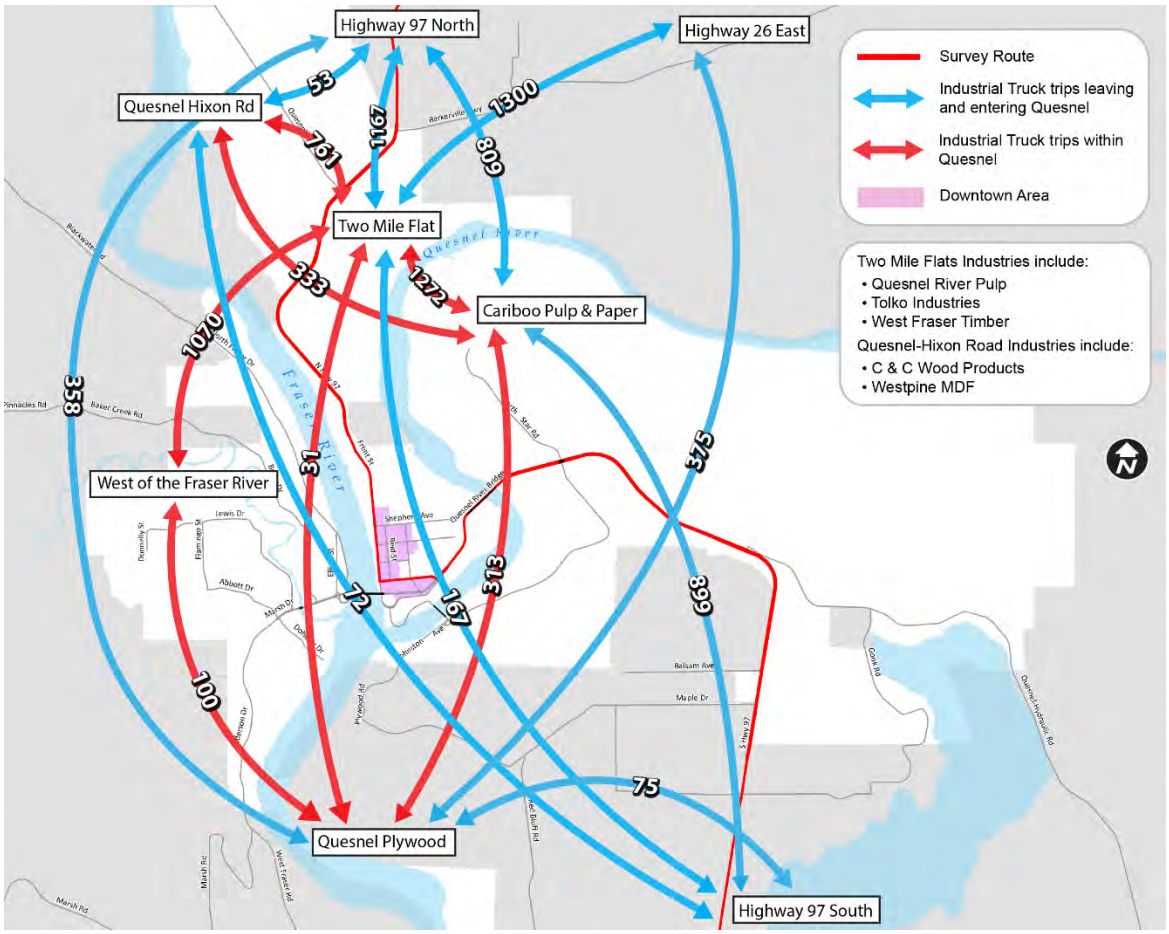
Seven main mill operations were surveyed for monthly truck trip generation statistics in November and December of 2015. The industries surveyed include West Fraser, Tolko, Quesnel River Pulp, Cariboo Pulp, Quesnel Plywood, C&C Wood Products and Westpine MDF. Each industry operations was

requested to provide monthly inbound and outbound truck load information for the period between September 2014 and November, 2015.

Figure 4.16 illustrates the average monthly truck traffic volumes generated by the aforementioned industries operating within Quesnel. The patterns highlighted in blue represent truck loads entering and leaving Quesnel and the patterns highlighted in red represent truck loads moving within the City.

The volumes were averaged over a year between December 2014 and November 2015. Truck traffic travelling between Two Mile Flats and Cariboo Pulp and Paper accounts for the highest volume of truck trips per month moving within the City, accounting for 1,272 truck loads per month. Truck traffic travelling between Two Mile Flats and east on Highway 26 accounts for the highest volume of truck trips entering and leaving Quesnel, accounting for 1,300 truck loads per month. Other main truck traffic patterns include trips from Cariboo Pulp to the south of Quesnel and to the north of Quesnel, from Two Mile Flats to Quesnel-Hixon Road and West Quesnel, from Cariboo Pulp & Paper to Quesnel Hixon Road, from Quesnel Plywood to Cariboo Pulp & Paper, and from Quesnel Plywood to north of Quesnel.

Figure 4.16: Average Monthly Truck Traffic (2014-2015, Excludes Trucks with Raw Log Loads)



Truck Survey Findings Comparison to 2011 Traffic Profile Study

The truck travel survey findings were compared to those collected in the *Traffic Profile Report, Highway 97 Quesnel* completed in 2011. The objective of this comparison was to understand how truck travel patterns may or may not have changed in the five year period since the 2011 study was completed.

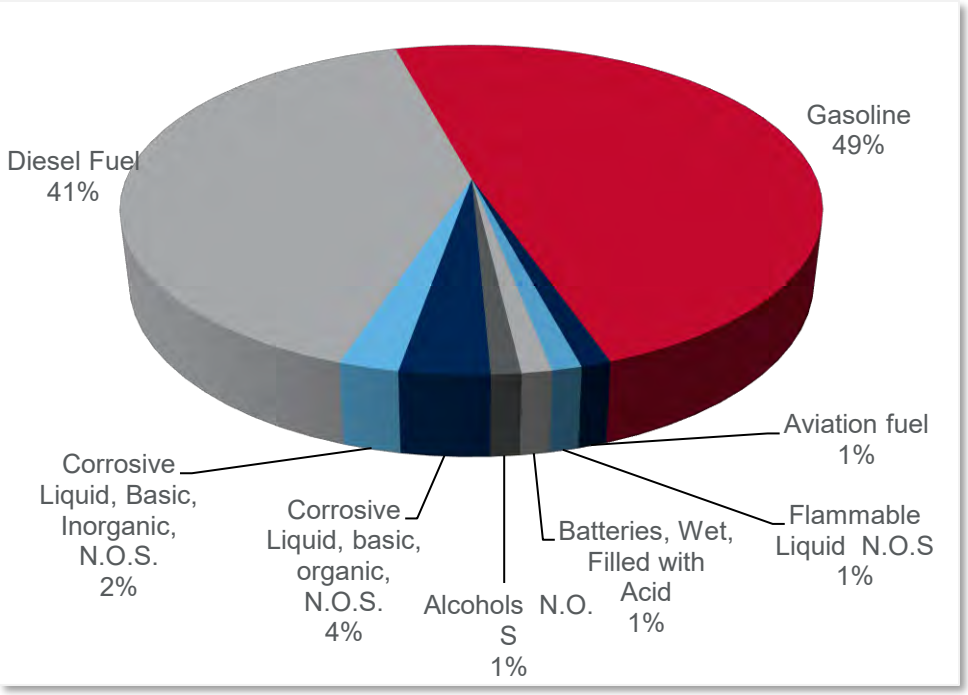
In the 2011 study, the truck survey findings found that limited truck traffic passes through Quesnel and a heavy concentration of truck traffic moves between the North Star Interchange and the Two Mile Flats areas of the City. The 2016 survey findings found similar results and confirmed that most truck traffic originates or is destined to locations within Quesnel. In 2011, most of the lumber that was delivered to Quesnel for processing came from West Quesnel and North of Quesnel. In comparison, the 2016 survey found most lumber was delivered to Quesnel from east on Highway 26. This change in truck travel patterns highlights the dynamics of the forestry industry and its fundamental need to draw lumber and materials from different areas across the Cariboo region for production and export (mainly via railway).

4.3 Transportation of Dangerous Goods

The transportation of dangerous goods (TDG) is permitted on Highway 97 and is regulated by the Commercial Vehicle Safety and Enforcement (CVSE) agency. The CVSE obtains general data on the type and amount of dangerous goods travelling along BC highways when commercial vehicles stop at weigh scales for regular inspections. TDG data was provided for the month of February, 2016 from the Quesnel Weigh Scale station located at 3870 Highway 97 North, just south of the Highway 26 junction. It is important to note that the data does not discern between traffic travelling northbound or southbound; however, it may be appropriate to assume some of the trucks carrying dangerous goods pass either partially of fully through the City of Quesnel on Highway 97.

Figure 4.17 summarizes the type and percentage split of dangerous goods in transportation through the Quesnel weigh scale station over 7 days (during an 8.75 hrs shift each day) in the month of February. 2016. In total, 86 trucks carrying dangerous goods passed through the Quesnel weigh scale during this period. The two dominant types of dangerous goods are Gasoline (49%) and Diesel Fuel (41%), which account for a total of 90% of all dangerous goods observed in this time period. The remaining minority of dangerous goods consists of corrosive liquids (6%), alcohols (1%), batteries (1%), flammable liquids (1%) and aviation fuel (1%).

Figure 4.17: Monthly Summary of Transportation of Dangerous Goods – February, 2016



4.4 Origin-Destination Characteristics

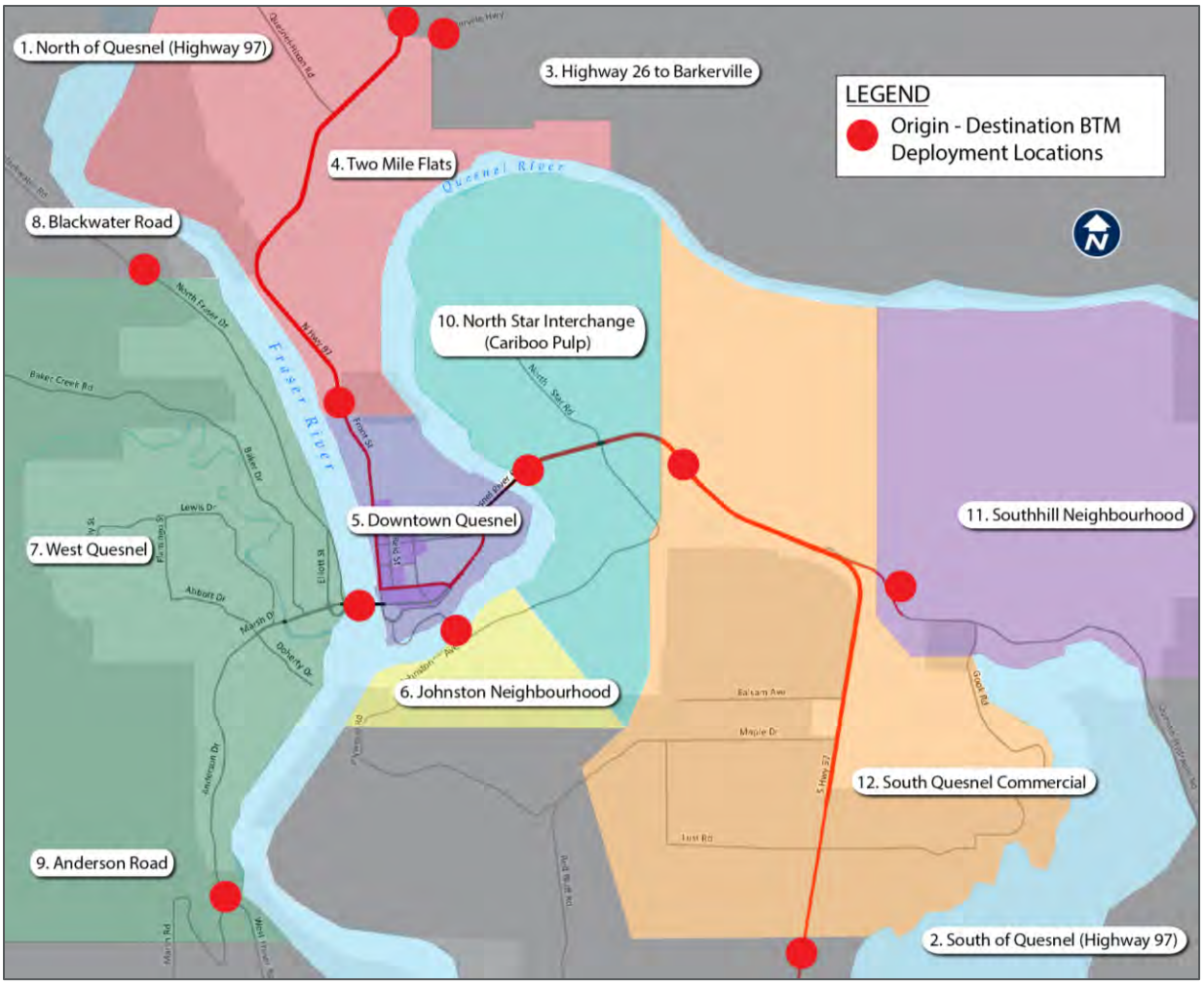
4.4.1 Survey Methodology

An origin-destination (OD) survey was undertaken to understand both the local travel patterns of traffic within Quesnel, and the regional travel patterns of traffic passing into and through Quesnel along Highway 97. A previous OD survey was conducted in 2011 with the findings documented in the *Traffic Profile Report Highway 97 Quesnel* (Urban Systems). The 2011 OD survey obtained travel pattern findings by collecting data using a license plate survey at five locations. For this current study's OD survey, the travel pattern findings were obtained by collecting data using Bluetooth Traffic Monitor (BTM) units.

TPA North America Inc. was retained by Urban Systems for this assignment to conduct the Bluetooth survey using Bluetooth technology. The BTM units were deployed for two (2) weeks between October 4th and October 17th, 2015 and collected data over 24 hours each day. The BTM units detect and record the random identification codes of Bluetooth devices in vehicles as they pass the BTM unit. A single trip pattern is recorded when a vehicle passes two or more BTM units with the same Bluetooth device identification code. Once all the data was collected, TPA North America processed the data to remove double counting of trip patterns and other 'noise' in the data.

The BTM units were mounted onto select street light poles adjacent to Highway 97 to determine the patterns of traffic entering and leaving specific 'zones' in Quesnel. The location of each BTM unit and the zones for which traffic patterns could be quantified are illustrated in Figure 4.18: Location of BTM Units and Traffic Pattern Zones on the following page.

Figure 4.18: Location of BTM Units and Traffic Pattern Zones



4.4.2 ORIGIN-DESTINATION FINDINGS

Figure 4.19 to Figure 4.26 illustrates the OD findings for eight origin-destination zones over an average weekday 24 hour period. These eight zones were highlighted through the study process as significant origin and destination areas of interest. The full set of origin-destination data for the remaining travel patterns is provided in **Appendix A**.

Reading the Origin-Destination Graphics

For example, Figure 4.19 summarizes the amount of traffic which entered Quesnel from Zone 1 - 'North of Quesnel', and illustrates what amount of that traffic is destined to the other 'Zones' in the study area. The percentages reflect the dark blue fill in each of the pie charts, which represents the share of traffic which left the origin-destination zone and ended in each of the zones.

Observations

The following observations were drawn based on the findings from the OD survey.

General Observations

- The distribution of traffic leaving each of the zones is nearly identical to the traffic arriving in each of the zones. For example, 17% of traffic leaving downtown Quesnel (Zone 5) arrives in the South Quesnel Commercial area (Zone 12), and the traffic leaving from the South Commercial Area to downtown Quesnel is 17% or very close. These travel pattern similarities for each zone are expected for the 24-hour period over which the data was collected and averaged. The full origin-destination data is provided in **Appendix A** and documents this similarity.

Zone 1 and 2 – Traffic from/to North and South of Quesnel

- Limited traffic passes through Quesnel without first stopping in the City;
- Whether drivers are entering Quesnel from the north or south on Highway 97, the largest share of traffic is destined to the South Quesnel Commercial Zone 12.
- Other major destinations for traffic entering Quesnel from the north and south are the Two Mile Flats (Zone 4) and Downtown Quesnel (Zone 5).

Zone 3 – Traffic from/to Highway 26 (Barkerville)

- The majority of traffic entering Quesnel from Highway 26 is destined to the Two Mile Flats area (35%), followed by Downtown Quesnel (27%), the South Quesnel Commercial area (11%), and West Quesnel (10%).
- Only 4% of traffic leaving/entering Highway 26 is destined to an area North of Quesnel and less than 1% is destined to an area South of Quesnel.

Zone 4 – Traffic from/to Two Mile Flats

- Traffic leaving and entering Two Mile Flats is primarily destined to Downtown Quesnel (31%), to areas north and south of Quesnel (11% each), to the South Quesnel Commercial zone (15%), and to West Quesnel (14%).
- The share of traffic from Two Mile Flats destined north and south of Quesnel accounts for a total of 22%, which represents there is a higher volume of regional-based trips leaving and entering the Two Mile Flats area.

Zone 5 – Traffic from/to Downtown Quesnel

- The majority of traffic (approximately 84%) which originates in Downtown Quesnel is destined to other internal zones within Quesnel.
- The main destinations for traffic leaving the downtown are West Quesnel (25%), Two Mile Flats (20%), South Quesnel Commercial (17%), and North Star Interchange (13%).

Zone 8 – Traffic from/to Blackwater Road

- The majority of traffic entering Quesnel from Blackwater Road is destined to Downtown Quesnel (37%), Two Mile Flats (23%), South Quesnel Commercial area (13%), and West Quesnel (10%).

Zone 9 – Traffic from/to Anderson Road

- The majority of traffic entering Quesnel from Anderson Road is destined to West Quesnel (85%) with the remaining trips destined to Downtown Quesnel (8%) and the remaining 7% to all other areas.

Zone 11 – Southhill Neighbourhood

- The majority of traffic entering Quesnel from the Southhill Neighbourhood (Quesnel-Hydraulic Road) area is destined to the South Quesnel Commercial area (54%), followed by Downtown Quesnel (21%), West Quesnel (10%), and the remainder to all other zones.

Origin-Destination Findings Comparison to 2011 Traffic Profile Study

The origin-destination survey findings were compared to those collected in the *Traffic Profile Report, Highway 97 Quesnel* completed in 2011. The objective of this comparison was to understand how general traffic travel patterns may or may not have changed in the five year period since the 2011 study was completed.

In 2011, the origin destination survey was conducted using a different methodology from the 2016 study by collecting licence plate numbers manually at various stations across the City during the AM, Mid-Day, and PM peak hours on a typical weekday. The results of the 2011 survey found that 70 – 80% of traffic on Highway 97 originates or is destined to within the City of Quesnel. In comparison, the 2016 survey results found the percentage of local traffic is higher with approximately 90% of highway traffic either originating or is destined to within the City of Quesnel. Overall, these findings confirm the majority of traffic travelling on Highway 97 in Quesnel is local traffic with only a small portion accounts for pass-through traffic.

Figure 4.19: Average Weekday OD Findings for Zone 1 – North of Quesnel (Highway 97)

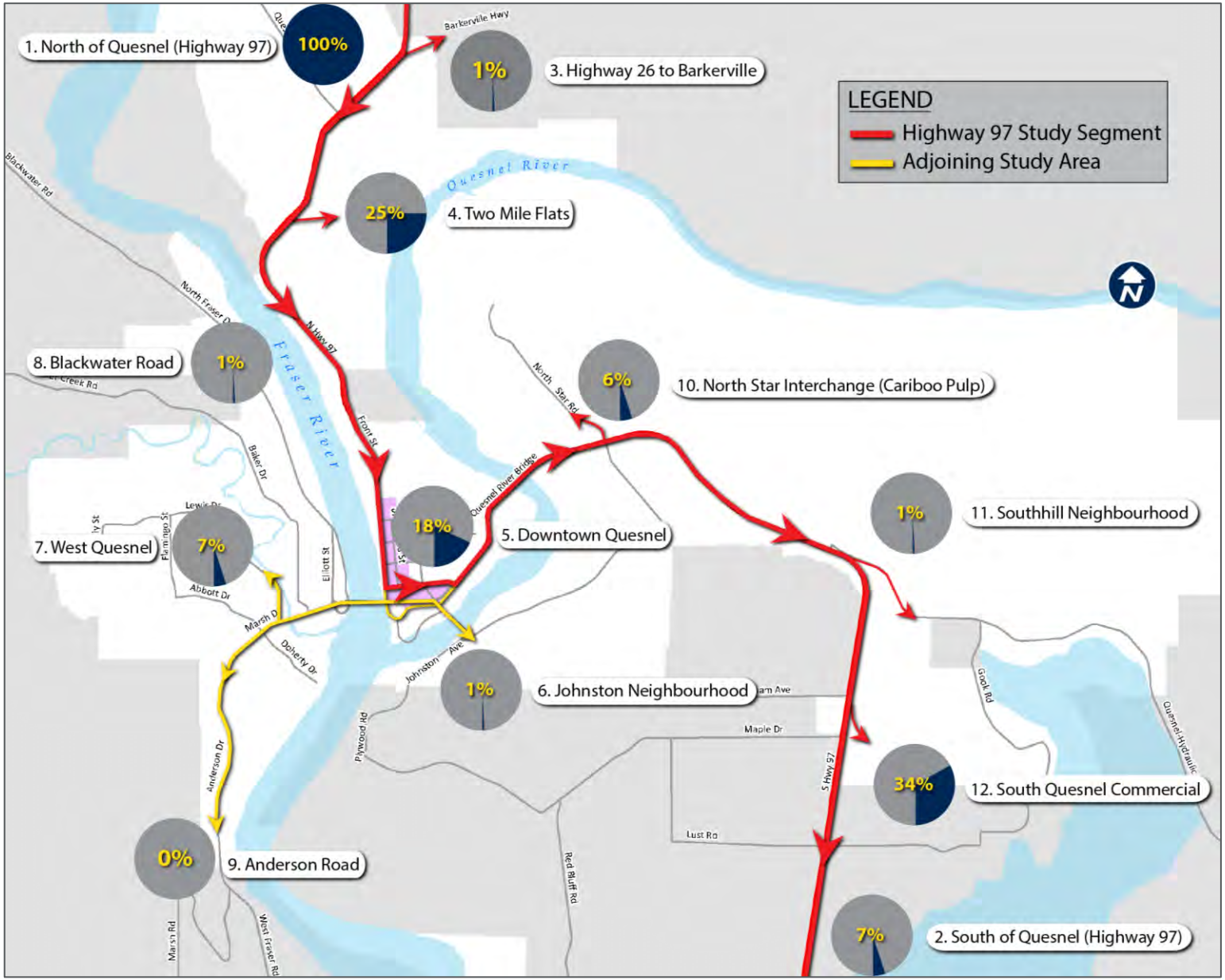


Figure 4.20: Average Weekday OD Findings for Zone 2 - South of Quesnel (Highway 97)

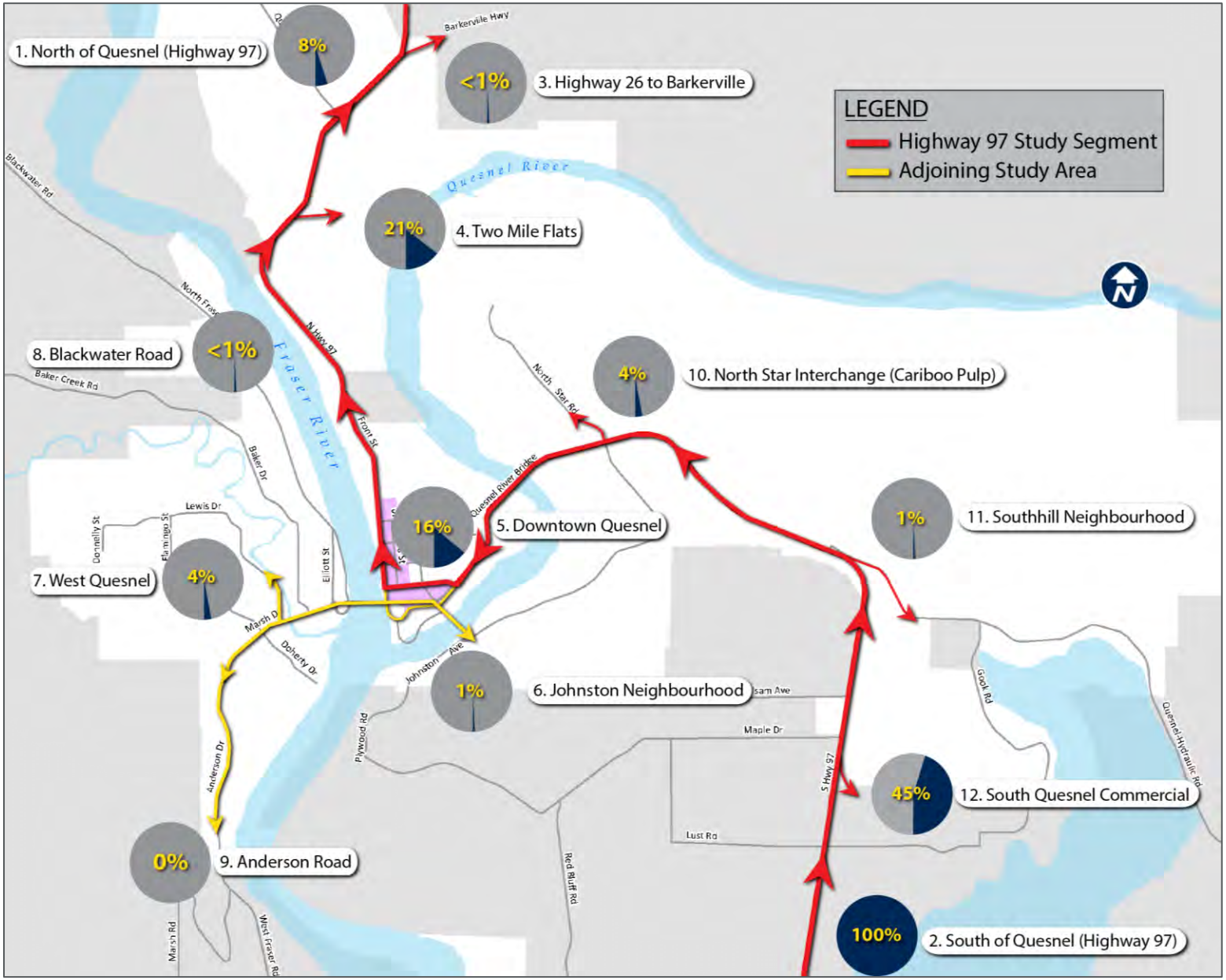


Figure 4.21: Average Weekday OD Findings for Zone 3 – Highway 26 to Barkerville

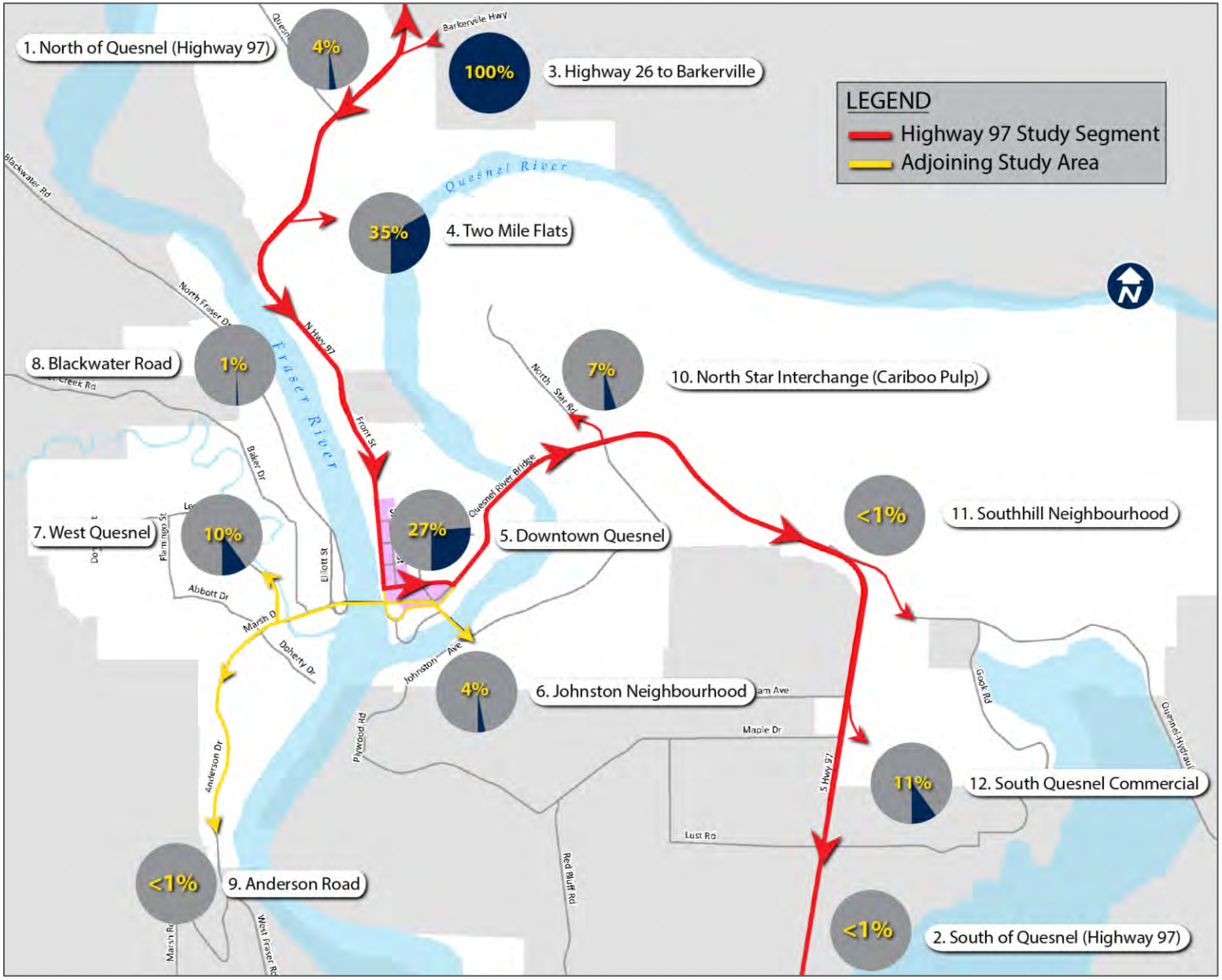


Figure 4.22: Average Weekday OD Findings for Zone 4 – Two Mile Flats

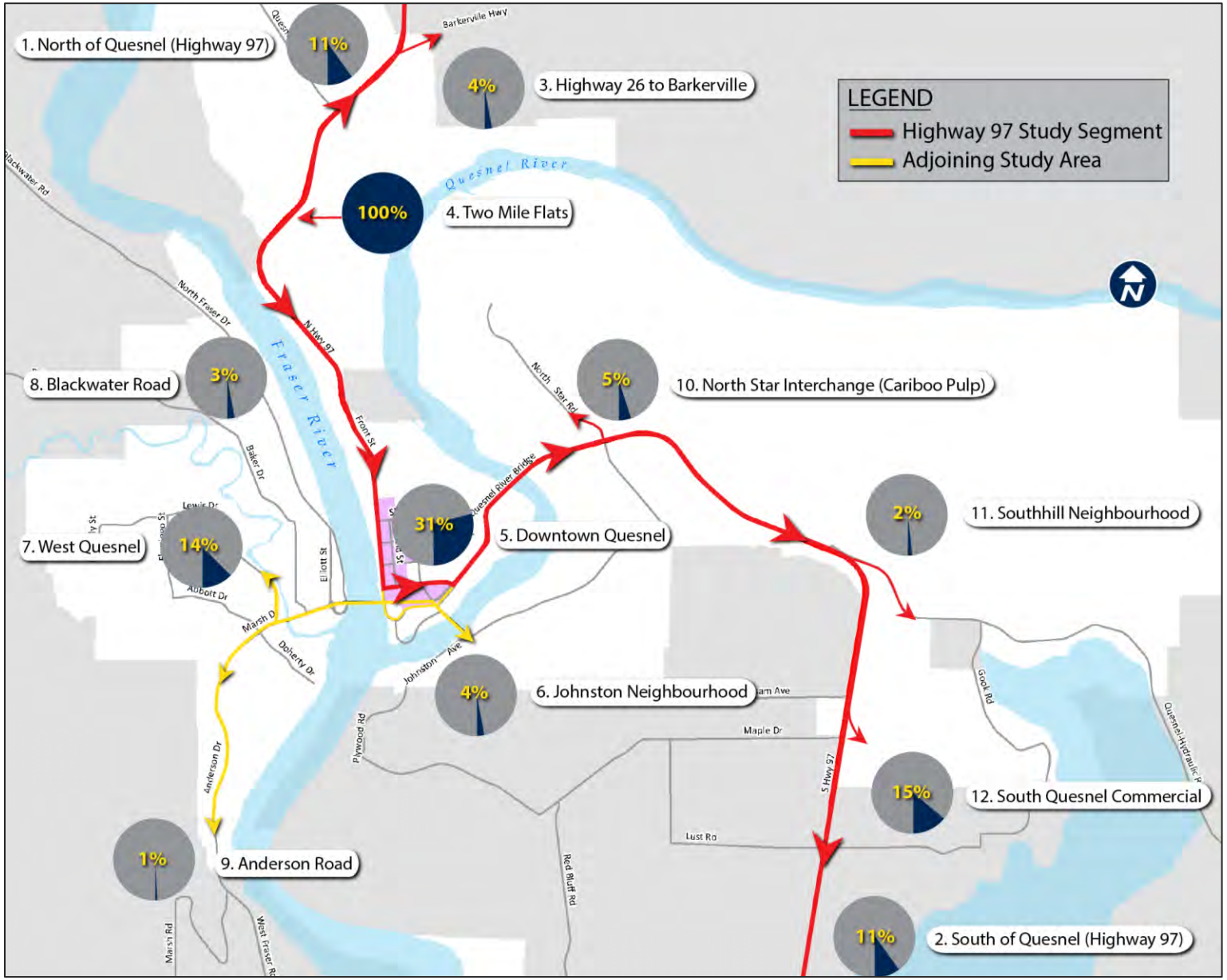


Figure 4.23: Average Weekday OD Findings for Zone 5 - Downtown Quesnel

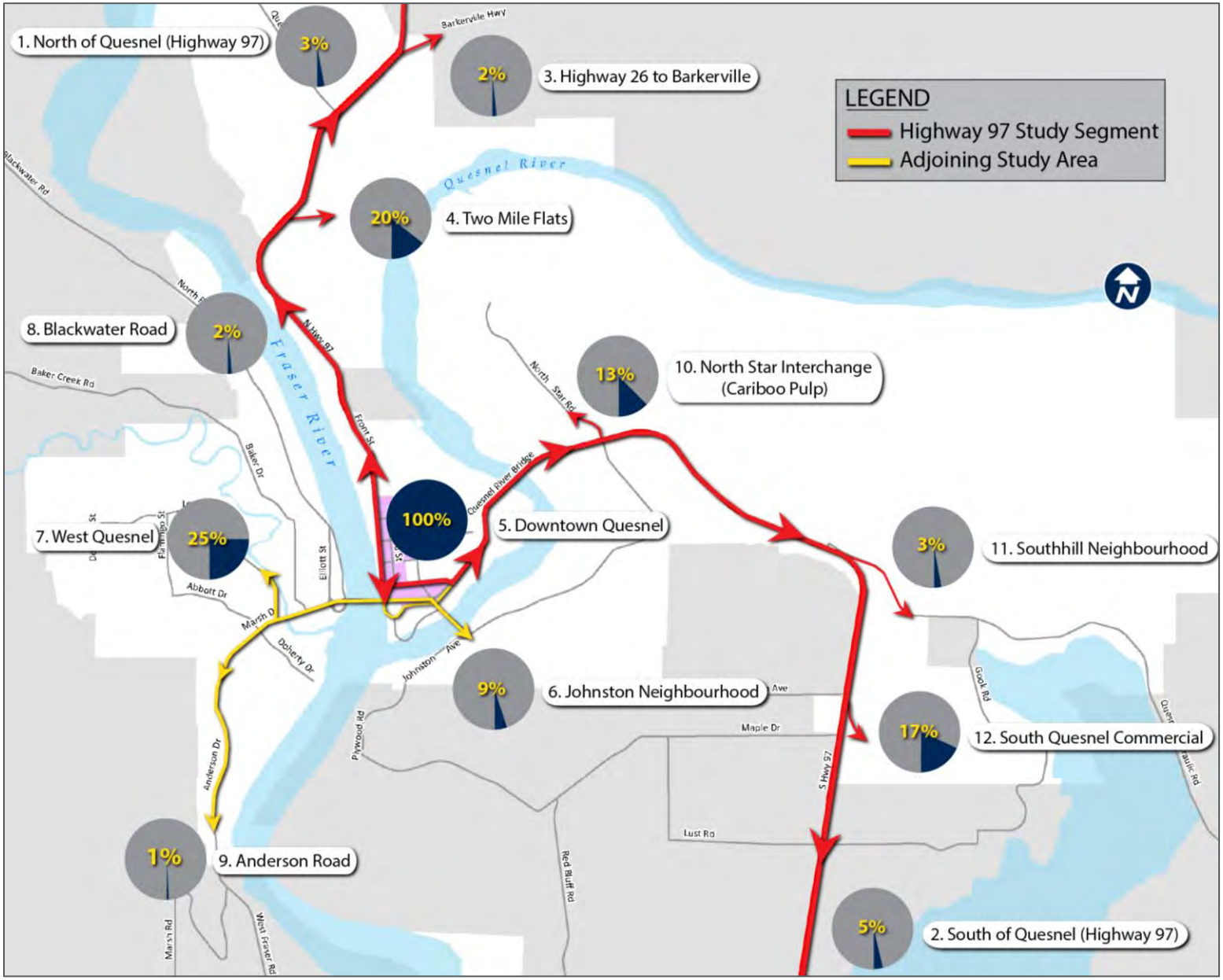


Figure 4.24: Average Weekday OD Findings for Zone 8 – Blackwater Road

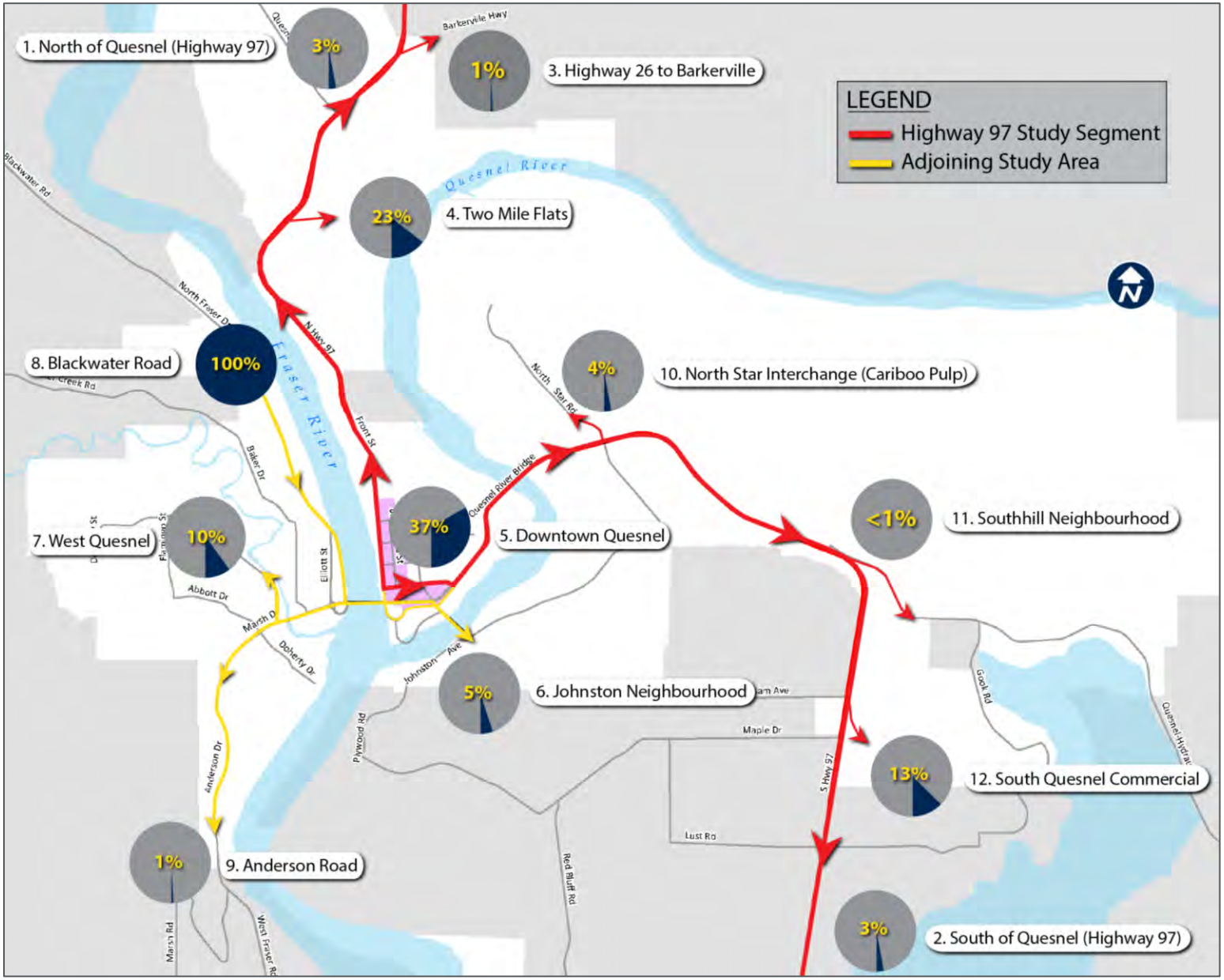


Figure 4.25: Average Weekday OD Findings for Zone 9 – Anderson Road

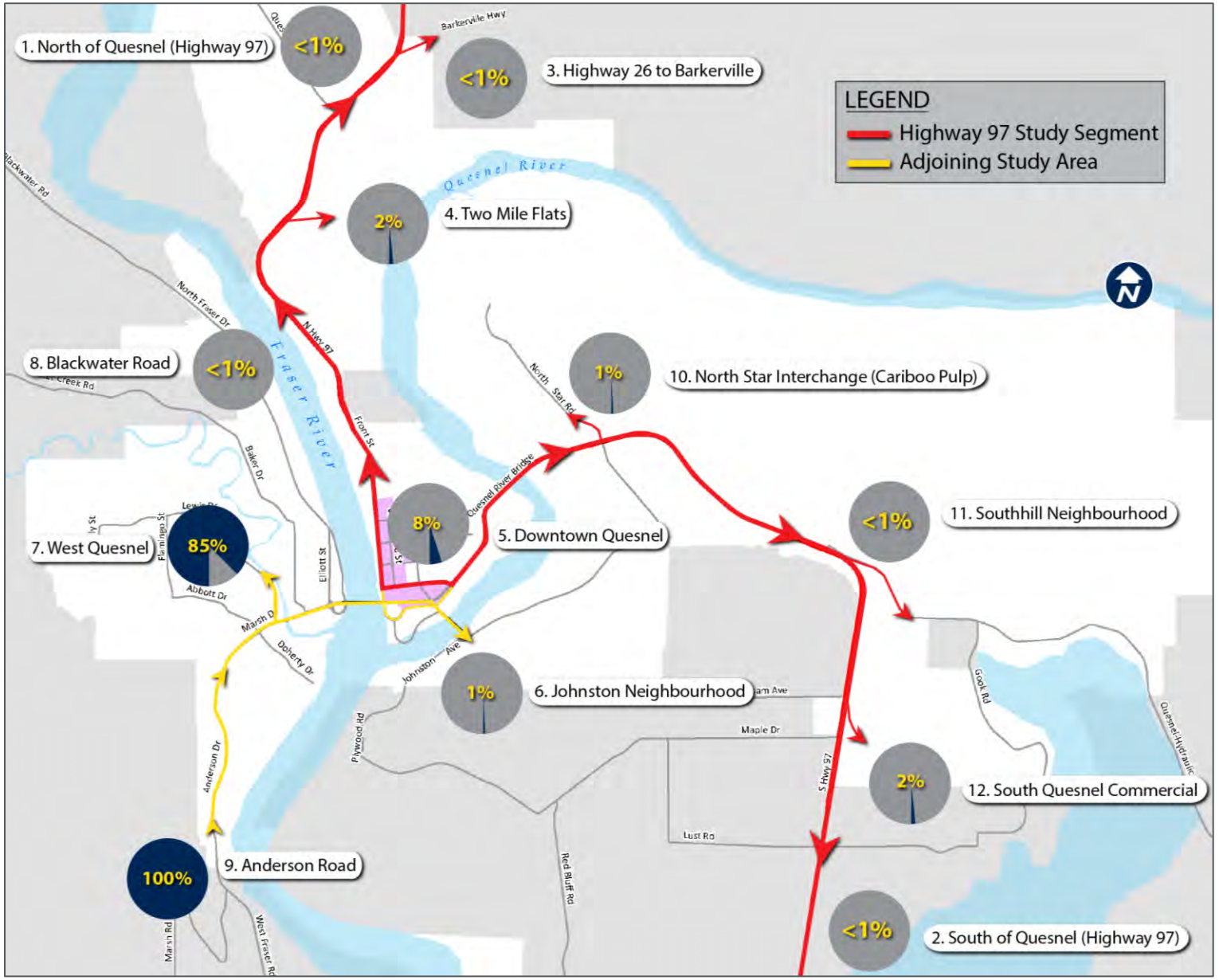
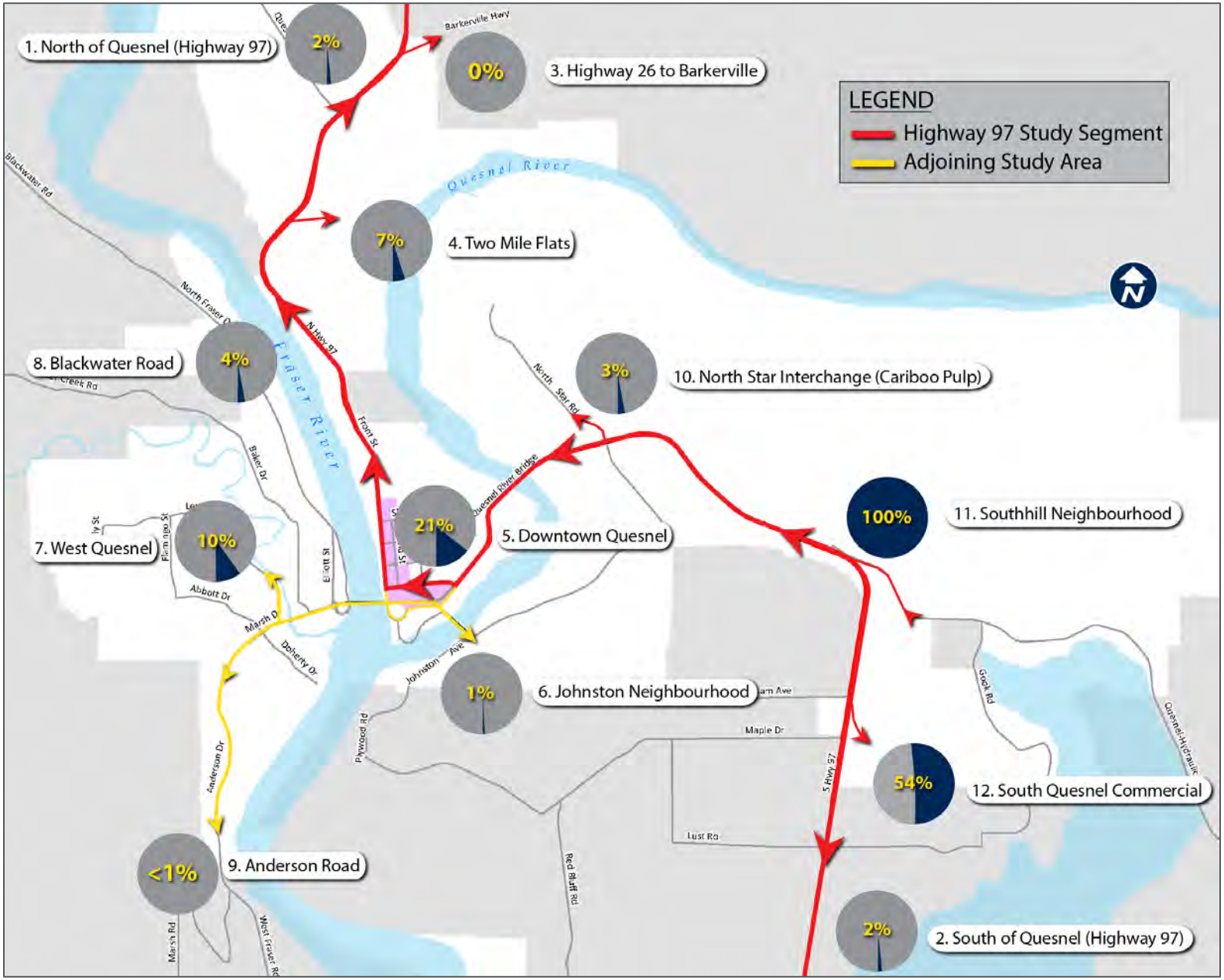


Figure 4.26: Average Weekday OD Findings for Zone 11 – Southhill Neighbourhood (Quesnel-Hydraulic Rd)



5.0 MOBILITY PERFORMANCE

The traffic operations for each study intersection were analyzed using traffic capacity analysis software and according to the Highway Capacity Manual (HCM) 2010 manual. Stop controlled and signalized intersections were assessed using Synchro 8 software and the single roundabout in the study area was assessed using Sidra 6.1 software. Using both capacity analysis software, the mobility performance is determined based on key output parameters, most notably including the volume-to-capacity (v/c) ratio, the level of service (LOS) for the overall intersection and critical movement, and delay which is measured in seconds.

5.1 Network Assessment Parameters

At signalised intersections, the v/c ratio is used as a measurement of the traffic congestion for a particular traffic lane or lane group or entire intersection. Generally, values up to 0.85 are considered acceptable for the intersection and up to 0.90 for individual lanes or lane groups. A v/c ratio of 1.0 or greater indicates that the traffic operation is over-capacity. The traffic level of service (LOS) indicator ranges from the ideal LOS A condition to the LOS F condition. Further, the LOS indicator is directly related to the average delay experienced by drivers for turning movements and overall intersection. The six levels of service and the corresponding delay thresholds are illustrated in Table 5.1.

Table 5.1: Mobility Level of Service Parameters

Level of Service (LOS)	Control Delay (s)			
	Two-Way Stop Control	All-Way Stop Control	Roundabout	Signal
A	0-10			0-10
B	>10-15			>10-20
C	>15-25			>20-35
D	>25-35			>35-55
E	>35-50			>55-80
F*	>50			>80

If V/C Ratio >1.0, Resulting LOS is 'F'

It should be noted that the asterisk symbol (*) is used throughout the network performance summary tables and denotes an approximation of the intersection LOS for two-way stop control intersections based on the average intersection delay. HCM 2010 does not calculate an overall intersection LOS for two-way stop control intersections as the overall delay is typically biased by the zero delay free-flow through movements. Thus, the LOS of movements on the stop controlled approaches should be monitored more carefully.

5.2 Existing 2015 Performance Conditions

The 2015 existing mobility performance results are summarized in Table 5.2 and reflect the normalized AM and PM peak hour periods provided previously in Figure 4.3 and Figure 4.4, respectively. The AM and PM peak hour volumes were normalized to obtain typical day traffic conditions by applying MoTI seasonal factors to the summer traffic volumes collected in August of 2015. The LOS results provided for intersections and critical movements are colour coded according to the scale described in the previous section of this report. The mobility performance results also reflect current signal timing plans in implementation at each study intersection operated by MoTI. Detailed Synchro 8, SimTraffic 8 and Sidra 6.1 reports are provided in **Appendix B.** While signalized intersections in the downtown were recently re-timed in 2014, there is opportunity to optimize the signal timings for better performance at all signalized intersections.

The results of the traffic capacity analysis indicate the overall mobility conditions along Highway 97 are good. Acceptable levels of service ranging from A to C are common along the southern and northern highway study segments. Increasing delays are observed along the highway and side-street movements in the urban downtown area of Quesnel.

More specifically, the side street movements at the pedestrian half signals at McNaughton Avenue and Shepherd Avenue both experience an LOS 'E'. Similarly, the side-street movements at the intersections of St. Laurent Avenue, Reid Street, and McLean Street experience LOS 'D'. Despite these lowering levels of service on side-street movements, the traffic model indicates highway movements operate at acceptable levels. Further, the volume to capacity ratio indicates sufficient capacity exists on the side-street movements, meaning vehicle queues are clearing each of these intersections in one cycle.

The intersection of McLean Street and Moffat Bridge recorded the lowest LOS performance of all intersections in the PM peak only. A LOS 'F' was recorded for the northbound side-street stop controlled approach and a value of 1.69 was recorded for the v/c ratio. It appears a moderate number of vehicles (84 vph) make a northbound left towards West Quesnel and are unable to find sufficient gaps in cross-street traffic on Moffat Bridge Approach. Given the surrounding land use context, it appears the vehicles using this approach are coming from the businesses located on the north side of Legion Drive or from the Johnston Neighbourhood heading towards West Quesnel. A site visit was undertaken on March 9, 2016 at 12:30 pm to observe site conditions. While this site visit did not take place during the PM peak hour for which these results represent, the field observers did not note any major queuing or vehicle delays.

In addition, anecdotal evidence suggests the intersection of Carson Avenue / Kinchant Street (Davie Street) is experiencing significant queueing a delays on the westbound through approach (on Carson Avenue) and the southbound left-through approach (on Kinchant Street). This location was also observed during the site visit on March 9, 2016 at 12:30 pm. The observers noted queues of up to 10 vehicles in length formed on each approach; however, the queues cleared within a single green phase. Again, these observation reflect traffic volumes during the mid-day peak period and not during the typically higher traffic pm peak hour period.

Table 5.2: 2015 Existing Conditions Mobility Performance Results

Control	Intersection Name	Overall Intersection				Critical Movement					
		AM		PM		AM			PM		
		LOS	Delay	LOS	Delay	Mvmt.*	LOS	V/C	Mvmt.*	LOS	V/C
STOP	Highway 97 / Highway 26 (Barkerville Hwy)	A*	3.3	A*	3.4	WBLT	B	0.22	WBLT	C	0.29
	Highway 97 / Quesnel-Hixon Road	A	3.7	A	5.6	SBT	A	0.16	WBL	B	0.21
STOP	Highway 97 / Brownmiller Road (Pinecrest Road)	A*	1.4	A*	1.3	EBLTR	B	0.08	WBLTR	B	0.10
	Highway 97 / Rome Avenue	A	4.6	A	7.3	WBLR	B	0.44	WBLR	C	0.77
STOP	Highway 97 / McNaughton Avenue	A*	1.1	A*	2	EBLTR	D	0.11	EBLTR	E	0.34
STOP	Highway 97 / Shepherd Avenue	A*	2	A*	3.1	WBR	B	0.14	EBLTR	E	0.31
	Highway 97 / St. Laurent Avenue	A	5.8	A	7.4	NBTR	A	0.55	WBL	D	0.68
	Highway 97 (Front Street) / Carson Avenue	B	17.4	A	5.4	NBTR	C	0.86	SBL	A	0.54
STOP	Front Street / Johnston Bridge Loop	A*	4.1	A*	4.1	NBL	C	0.28	NBL	C	0.27
	Front Street / Johnston Avenue	A	5.6	A	6.9	WBTR	A	0.15	SBLR	A	0.31
	Carson Avenue (Hwy 97) / Reid Street	-	-	A	3.0	-	-		NBLTR	D	0.50
STOP	Carson Avenue (Hwy 97) / McLean Street	A*	3.7	A*	6.5	SBTL	C	0.22	SBLT	D	0.51
	Carson Avenue (Hwy 97) / Kinchant Street	B	13.3	B	17.1	NBTR	C	0.59	SBL	C	0.60
	Carson Avenue (Hwy 97) /Moffat Bridge Approach	A	7.5	B	17.6	WBR	A	0.59	SBLTR	C	0.83
STOP	Davie Street / Moffat Bridge Approach	A*	4.5	A*	6.3	NBR	B	0.20	NBR	B	0.49

Control	Intersection Name	Overall Intersection				Critical Movement					
		AM		PM		AM			PM		
		LOS	Delay	LOS	Delay	Mvmt.*	LOS	V/C	Mvmt.*	LOS	V/C
STOP	McLean Street / Moffat Bridge Approach - Marsh Drive	A*	5.7	E*	49.4	NBLTR	C	0.29	NBLTR	F	1.69
STOP	Elliot Street / Marsh Drive	A*	2.5	A*	1.6	NBR	B	0.31	NBR	B	0.26
STOP	North Star Road / Highway 97 NB Ramps	A*	6	A*	4.6	WBLT	B	0.20	WBLT	B	0.15
STOP	North Star Road / Highway 97 SB Ramps	A*	8	A*	8.6	SBLT	B	0.20	SBLT	B	0.31
STOP	Highway 97 / Racing Road	A*	1	A*	1.2	SBLTR	B	0.11	NBLTR	B	0.12
STOP	Highway 97 / Quesnel Hydraulic Road	A*	2.2	A*	1.9	SBLTR	B	0.26	EBL	A	0.23
STOP	Highway 97 / Juniper Road	A*	0.2	A*	0.2	WBR	B	0.02	WBR	B	0.04
STOP	Juniper Road Hwy Access / Juniper Road	A*	7.6	A*	8.4	SBLTR	A	0.12	SBLTR	A	0.20
	Highway 97 / Cedar Avenue	A	9	A	9.4	NBT	A	0.29	WBL	C	0.49
STOP	Highway 97 / Balsam Avenue	A*	1.4	A*	1.3	WBR	B	0.10	SBL	A	0.08
	Highway 97 / Maple Avenue	B	15.2	B	16.9	NBT	B	0.34	WBT	C	0.45
STOP	Highway 97 / Gook Road	A*	3.3	A*	4	WBLTR	B	0.19	WBLTR	C	0.29
STOP	Highway 97 / Basalt Road	A*	2.2	A*	1.6	WBLTR	B	0.09	WBLTR	B	0.08

* Movement direction corresponds to geographic north.

5.2.1 Comparison to Travel Time Survey

In addition to the intersection mobility performance results, the corridor was assessed in SimTraffic 8 to verify that the mobility results obtained are consistent with local field conditions. Both the 2015 AM and

PM peak traffic models were run through SimTraffic separately over five (5) runs to obtain averaged results. The detailed reports for these SimTraffic runs are provided in **Appendix B**.

Within the SimTraffic model, the Arterial Report was generated, which estimates the average travel time and arterial speed for a vehicle to travel northbound and southbound from the study limits north of Highway 26 and south at Quartz Road. The average travel time and speed results generated by the SimTraffic model are compared in the following Table 5.3 with the results of the travel time survey previously summarized in Section 4.1.7.

Table 5.3: Comparison of SimTraffic Model and Field Survey Travel Time Results

Measure	Method for Comparison	Northbound		Southbound	
		AM Peak	PM Peak	AM Peak	PM Peak
Average Travel Time (min:sec)	SimTraffic Model Results	**13:48**	**14:12**	**14:01**	**14:46**
	Field Survey (August, 2015)	13:17	13:24	12:45	12:47
Average Speed (km/h)	SimTraffic Model Results	**59**	**57**	**58**	**55**
	Field Survey (August, 2015)	60	59	62	62

In general, the travel time results from the SimTraffic Model runs were fractionally longer than those obtained through the field surveys conducted in August 2015. In the northbound direction during the AM peak hour, the field surveys measured an average travel time duration of 13 minutes, 17 seconds, less than the SimTraffic travel time duration of 13 minutes, 48 seconds for a vehicle to travel from Quartz Road to Highway 26. Thus, the averaged SimTraffic Model travel time result was 31 seconds longer than the field survey. Similar results were obtained for the northbound direction in the PM peak hour, and for the southbound direction in the AM and PM peak hours.

Overall, the travel time and average speed results provided for both the SimTraffic model and field survey methods are within close proximity to each other. When compared with the field survey, the SimTraffic model results may be considered slightly conservative. Laslty, the similarity of both sets of results provides confirmation that the SimTraffic Model and the underlying Synchro Model inputs and parameters are calibrated to local conditions, as based on the field travel time survey completed in August, 2015.

6.0 SAFETY PERFORMANCE

A historical collision assessment was completed for the full length of the Highway 97 study area through Quesnel to obtain a detailed understanding of the highway's safety performance. The safety data sourced for this assessment was obtained from BC MoTI's Collision Information System (CIS) database. The CIS database is derived from MV104 police reports, which generally reflects more serious collisions since police officers attended each incident. The collision data analyzed in this assessment extends from January 1st, 2010 to December 31st, 2014.

From the study's southern end t Quartz Road to its northern end at the junction of Highway 26, the collision assessment examined collision patterns, collision rates, and the severity index of the highway.

6.1 Collision Patterns

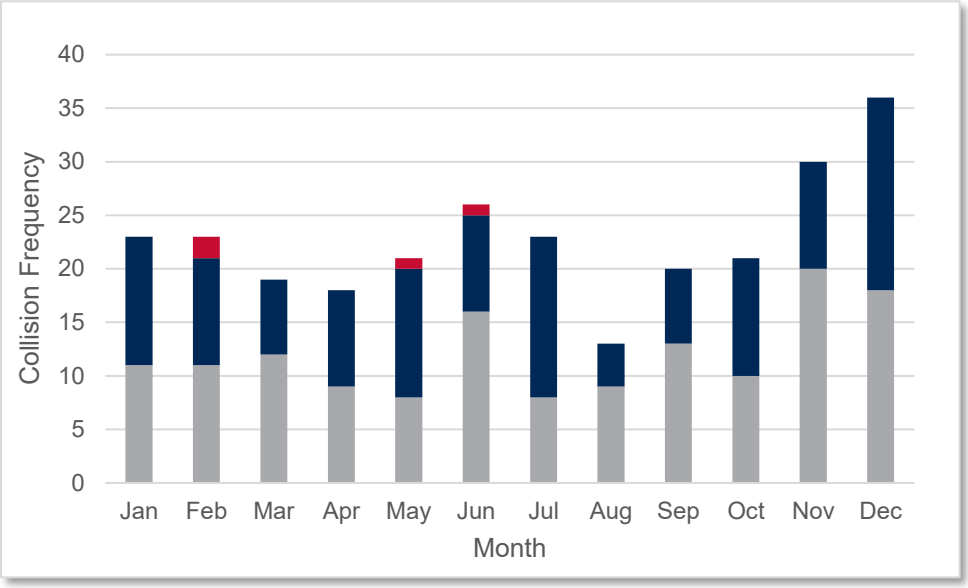
The total collisions recorded over the five year period from 2010 to 2014 for the Highway 97 corridor (LKI Segment 1146 km 110.9 to km 124.3) is summarized Table 6.1. The collisions recorded with a severity involving personal injury account for a relatively high rate of 45.4% of all collisions with incidents involving property damage accounting for 53.1% of all collisions. By year, the rate of collisions is relatively steady and fluctuates from a low of 46 collisions reported in 2014 to a high of 64 collisions reported in 2011.

Table 6.1: Five Year Historical Collision Data and Severity (2010 to 2014)

Collision Date	Fatal	Personal injury	Property damage only	Grand Total
2010	2	26	31	59
2011	1	30	33	64
2012		24	24	48
2013		27	29	56
2014	1	17	28	46
Grand Total	**4 (1.5%)**	**124 (45.4%)**	**145 (53.1%)**	**273**

The collision data was analyzed to identify temporal patterns and trends which may give insight into problem areas for improvement. *Figure 6.1* illustrates the five year collision data seasonally by month. The spring and fall months experience the fewest collisions with peaking occurring in the summer months and in the winter months. These trends are considered fairly typical for a community in BC's Interior as traffic volumes are at their highest in the summer during tourism season; and, winter conditions in November, December, January, and February bring slippery conditions to the roadways, both factors of which contribute to higher collision rates.

Figure 6.1: Five Year Historical Collision Data by Month (2010 to 2014)



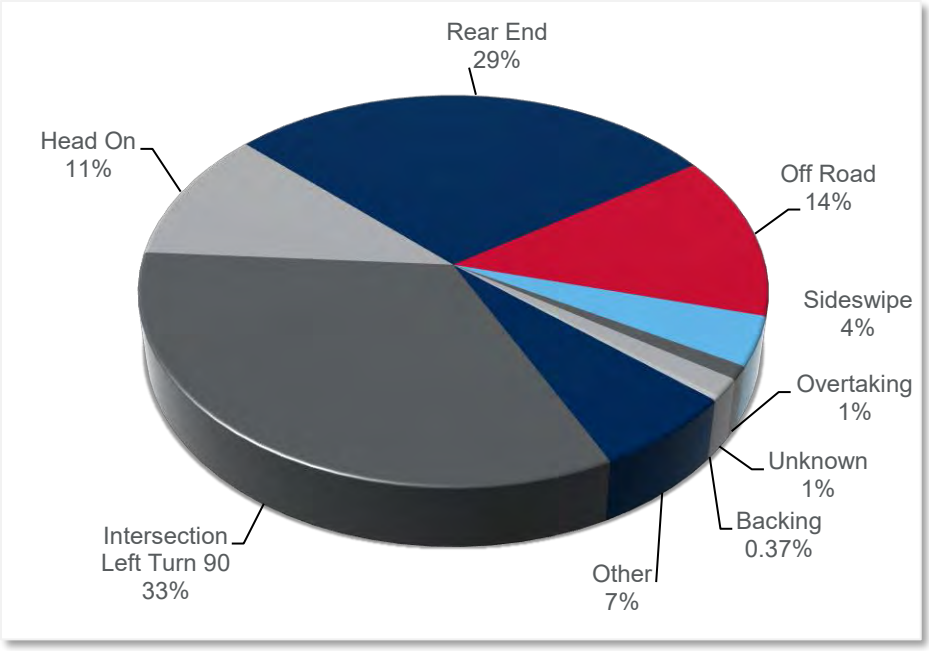
The type of collisions was reviewed to determine which collision configurations were the most and least common among the five year historical data, as illustrated in Figure 6.2. Surprisingly, 'Intersection Left Turn 90' configurations, otherwise known as side impact collisions were the most common accounting for 33% of all collisions. Since this configuration type typically reflects higher severity collisions, this collision type was explored further and the following was observed:

- Three out of the four total fatal collisions over five years of data occurred when the incident configuration was recorded as an 'Intersection Left Turn 90'.
- 52% of the collisions recorded as an 'Intersection Left Turn 90' type involved personal injury to the occupants of the vehicle(s).
- 45% of the collisions recorded as an 'Intersection Left Turn 90' type involved property damage to the vehicle(s).

As the leading collision configuration type with the majority of collisions involving injury to occupants, left turn side-impact collisions at intersections should be considered a priority collision type for addressing.

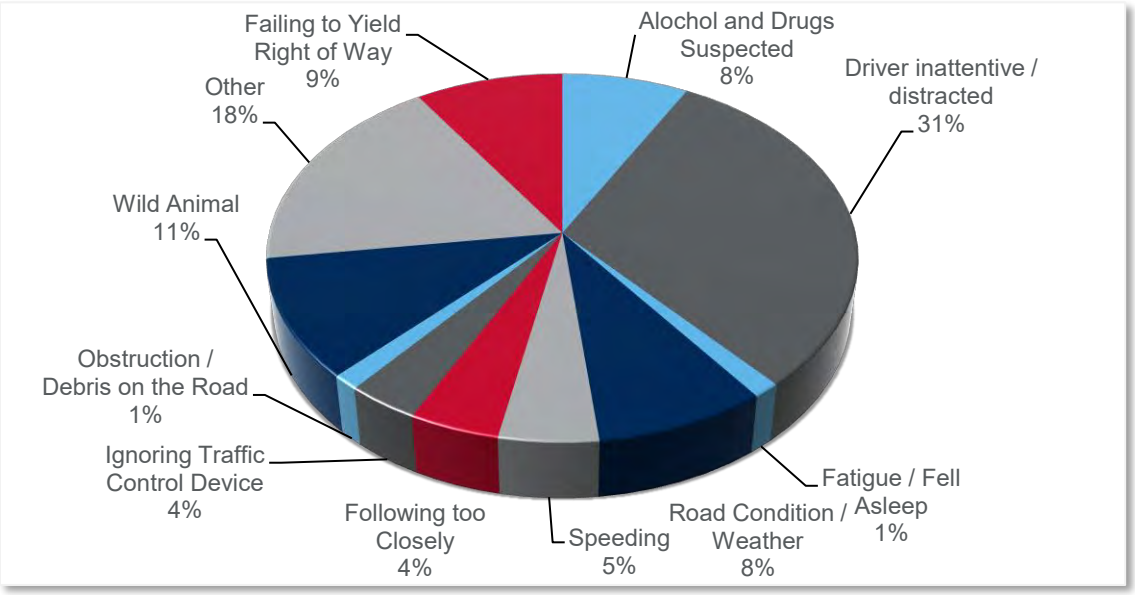
Additional collision configuration charts for key intersections are provided in **Appendix C**. These key intersections correspond with those whose collision rates and/or collision severity rating are higher than the provincial average, as discussed in Section 6.2 of this report.

Figure 6.2: Collisions by Configuration Type (2010 to 2014)



The primary contributing factors of the collisions recorded throughout the Highway 97 study corridor are illustrated in Figure 6.3. As depicted, drivers who were inattentive or distracted were the leading factor contributing to collisions along the study corridor, followed by various factors within the 'other' category, and then collisions involving wild animals and failing to yield right of way.

Figure 6.3: Primary Contributing Factors to Historical Collisions (2010 to 2014)

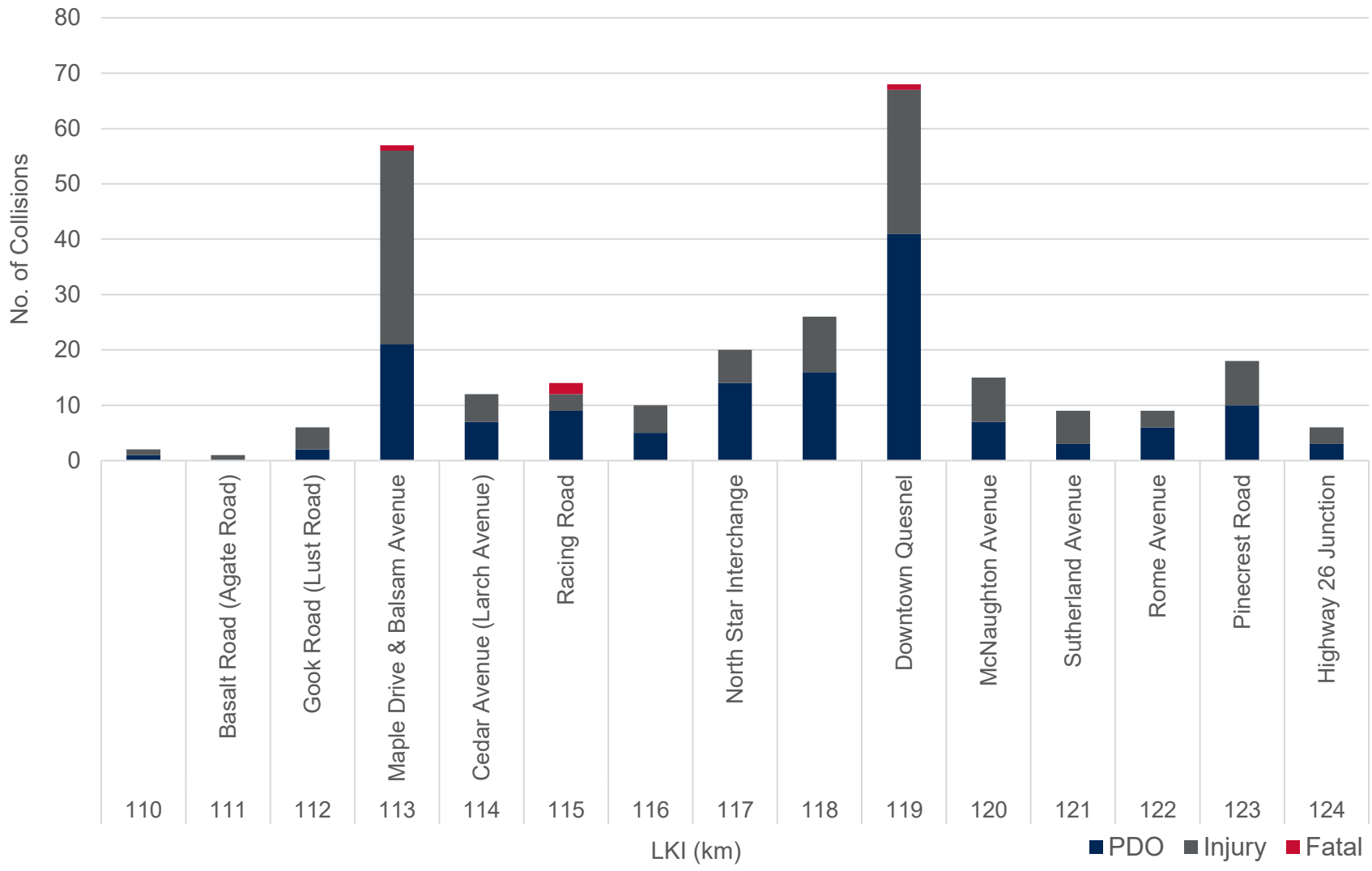


Additional charts depicting the primary contributing factors to collisions at intersections are provided in **Appendix C.** These key intersections correspond with those whose collision rates and/or collision severity rating are higher than the provincial average, as listed in Section 6.2 of this report.

Further, the historical collision data was analyzed across 1 kilometre segments of the corridor to determine where collisions are occurring the most and least frequently. Figure 6.4 illustrates a high number of collisions occurs on Highway 97 in the southern highway-service commercial area at the intersections of Maple Drive and Balsam Avenue. Of the collisions occurring in this area, three collisions involved fatalities. Two of the fatal collisions occurred at the intersection of Dragon Hill Road (Racing Road) and Highway 97. The third fatal collision occurred mid-block between the intersections of Maple Drive and Balsam Avenue.

Further, a high number of collisions are observed in the downtown and urban area of Quesnel on Highway 97. Of the collisions occurring in the downtown, one collision involved a fatality. This fatal collision in specific occurred mid-block on Front Street between the intersections of St. Laurent Avenue and Shepherd Avenue.

Figure 6.4: Historical Collisions by 1 Km Study Area Segments - Histogram (2010 to 2014)



6.2 Intersection Safety

A safety assessment of the study intersections was conducted to develop an understanding of which study intersections experience higher than average collision and severity rates. To establish the safety performance indicators for this assessment, the collision rate and collision severity index (CSI) were calculated and compared to provincial benchmarks for similar facilities. The CSI provides a clear indicator of the types of collisions which occur along the study corridor. The index applies higher emphasis on personal injury and fatality collisions by adding weights and highlighting the consequences of collisions at specific locations. The CSI is calculated using the formula provided below:

CSI = ((100 X # Fatal Collisions) + (10 X # Injury Collisions) + # PDO Collisions)) / Total Collisions

The BC MoTI CIS database was used to calculate typical performance indicators along the corridor at major intersections and compared to provincial benchmarks for similar facilities using AADT volumes at each intersection. A summary of the key safety performance indicators and corresponding provincial averages are presented in Table 6.2 on the following page. It should be noted that only recorded collisions that are categorised as occurring "At Intersection" are included within the intersection assessment.

Key Findings:

The analysis of historical collision data at the study intersections demonstrates Maple Drive, Cedar Avenue, Kinchant Street, McLean Street, Front Street and St. Laurent Street recorded the highest frequency of collisions, resulting in collision rates higher than both the provincial average and critical collision rates. Further, the intersection of Cedar Avenue and Racing Road (Dragon Hill Road) recorded a CSI value above the provincial average, indicating there is a high safety risk at this intersection. The City of Quesnel indicates the Racing Road / Highway 97 intersection, which serves a few businesses including Aroma Foods, is a high risk location and confirmed that two fatal collisions have occurred under existing conditions.

These aforementioned intersections of concern were reviewed with the 'Provincial Collision Prone Locations (CPLs) 2009-2013 Collision Data' list, provided by MoTI. The CPLs are identified through a preliminary system safety level performance analysis (or network screening exercise), which represent intersections which have a high potential for safety improvement and are based on MoTI's CIS database. Using the Level 1 Criteria, five CPLs were identified along the study segment between Quartz Road and Highway 26 / Barkerville Highway (LKI Segment 1146 km 110.9 to km 124.3), as summarized in Table 6.3. These five locations match with the intersections identified in this report, confirming these locations have a high potential for safety improvements.

Table 6.2 Highway 97 Study Intersection Safety Performance (2010 to 2014)

Intersection	LKI	Road Class	Total	PDO	Injury	Fatal	Collision Rate (col/MVK)	Critical Collision Rate	Avg Collision Rate	CSI	Prov Avg. CSI
Basalt Road / Agate Road	111.3	RAU2	3	2	1	0	0.21	0.45	0.16	4.00	6.89
Gook Road / Lust Road	112.1	RAU2	3	1	2	0	0.16	0.34	0.16	7.00	7.21
Maple Drive	113	RAU4	28	12	16	0	**0.97**	0.34	0.19	6.14	6.54
Balsam Avenue	113.3	RAU4	2	1	1	0	0.08	0.37	0.20	5.50	7.03
Cedar Avenue / Larch Avenue	113.8	RAU4	16	5	11	0	**0.53**	0.34	0.19	**7.19**	6.54
Juniper Street Access	114.2	RAU4	3	2	1	0	0.10	0.34	0.19	4.00	6.54
Quesnel Hydraulic Road	114.7	RAU4	6	3	3	0	0.18	0.33	0.19	5.50	6.54
Racing Road / Dragon Hill Road	115.1	RAU4	5	1	2	2	0.14	0.32	0.19	**44.20**	6.54
Carson Avenue	118.6	RAU2	7	4	3	0	0.25	0.31	0.16	4.86	6.58
Davie Street / Kinchant Street	118.9	UAU2	10	8	2	0	**0.35**	0.24	0.12	2.80	7.59
McLean Street	119	UAU2	11	9	2	0	**0.52**	0.33	0.16	2.64	5.62
Reid Street	119.1	UAU2	2	1	1	0	0.10	0.34	0.16	5.50	6.21
Front Street	119.2	UAU2	15	8	7	0	**0.49**	0.24	0.12	5.20	7.59
St. Laurent Avenue	119.5	UAU2	8	5	3	0	**0.27**	0.24	0.12	4.38	7.59
Shepherd Avenue	119.7	UAU2	6	4	2	0	0.19	0.24	0.12	4.00	7.59
McNaughton Avenue	119.9	UAU2	3	1	2	0	0.10	0.24	0.12	7.00	7.59
Rome Avenue	121.6	RAU4	2	1	1	0	0.08	0.37	0.20	5.50	7.03
Pinecrest Road / Brownmiller Road	122.7	RAU4	2	1	1	0	0.08	0.37	0.20	5.50	7.03
Quesnel Hixon Road / Finning Road	123.5	RAU4	6	3	3	0	0.26	0.37	0.20	5.50	7.03
Highway 26 / Airport Road	124.3	RAU2	4	1	3	0	0.25	0.43	0.16	**7.75**	6.89

Table 6.3 Summary of Provincial Collision Prone Locations along Highway 97 (2009 – 2013)

Segment	LKI Km	LKI Landmark (Intersection)	Composite Index	Composite Index Rank	SWAR Ratio	SWAR Ratio Rank
1146	113	MAPLE DR	30346	125	1.89	78
1146	119.2	HWY 97 TURNS RIGHT ONTO FRONT ST	24061	144	2.59	34
1146	119	MCLEAN ST	19312	157	2.08	63
1146	119.5	ST LAURENT AVE	13487	165	1.45	111
1146	118.9	DAVIE ST/KINCHANT ST	11381	167	1.23	135

6.3 Segment Safety

The segment safety analysis involved an examination of the collision rate and severity index of the Highway 97 corridor in one kilometre segments. The historical records from this segment of Highway 97 were compared with provincial averages from similar road classifications to evaluate the relative safety performance of the highway segments. Figure 6.5 and Figure 6.6 on the following pages illustrate the collision data for the collision rate and severity index over one kilometre segments, respectively. The roadway characteristics are also presented for reference purposes.

Key Findings: As illustrated in Figure 6.5 the collision rate is higher than both the provincial average and critical collision rates for the following locations along Highway 97:

- From Maple Drive to Juniper Road (km 113 to km 114)
- From Racing Road to McNaughton Avenue (km 115 to km 120)
- From Pinecrest Road to Highway 26 (km 123 to km 124)

From a five-year total of 273 collisions along the whole study corridor, 213 collisions occurred in these above noted segments. Further, collision severity exceeds the provincial severity averages for the segments from LKI km 111 to 112, and from km 115 to 116.

These aforementioned segments of concern were reviewed with the 'Provincial Collision Prone Sections (CPSs) 2009-2013 Collision Data' list, provided by MoTI. The CPSs are identified through a preliminary system safety level performance analysis (or network screening exercise), which represent highway segments of at least one (1) kilometre in length which have a high potential for safety improvement and are based on MoTI's CIS database. Using the Level 1 Criteria, one (1) CPS was identified along the study segment between Quartz Road and Highway 26 / Barkerville Highway (LKI Segment 1146 km 110.9 to km 124.3), as summarized in Table 6.4. This section falls within the section of concern from Racing Road to McNaughton Avenue and confirms it has a high potential for safety improvements.

Table 6.4: Summary of Provincial Collision Prone Sections along Highway 97 (2009 – 2013)

Segment	LKI Km	Length	Closest Major LKI Landmark	Composite Index	Composite Index Rank	SWAR Ratio	SWAR Ratio Rank
1146	116.8 to 117.7	1.0	QUESNEL RIVER BRIDGE 1569 (S END) at 117.5	47065	43	3.20	26

Figure 6.5: Highway 97 Collision Rates and Characteristics (LKI km 110.9 to 124.3)

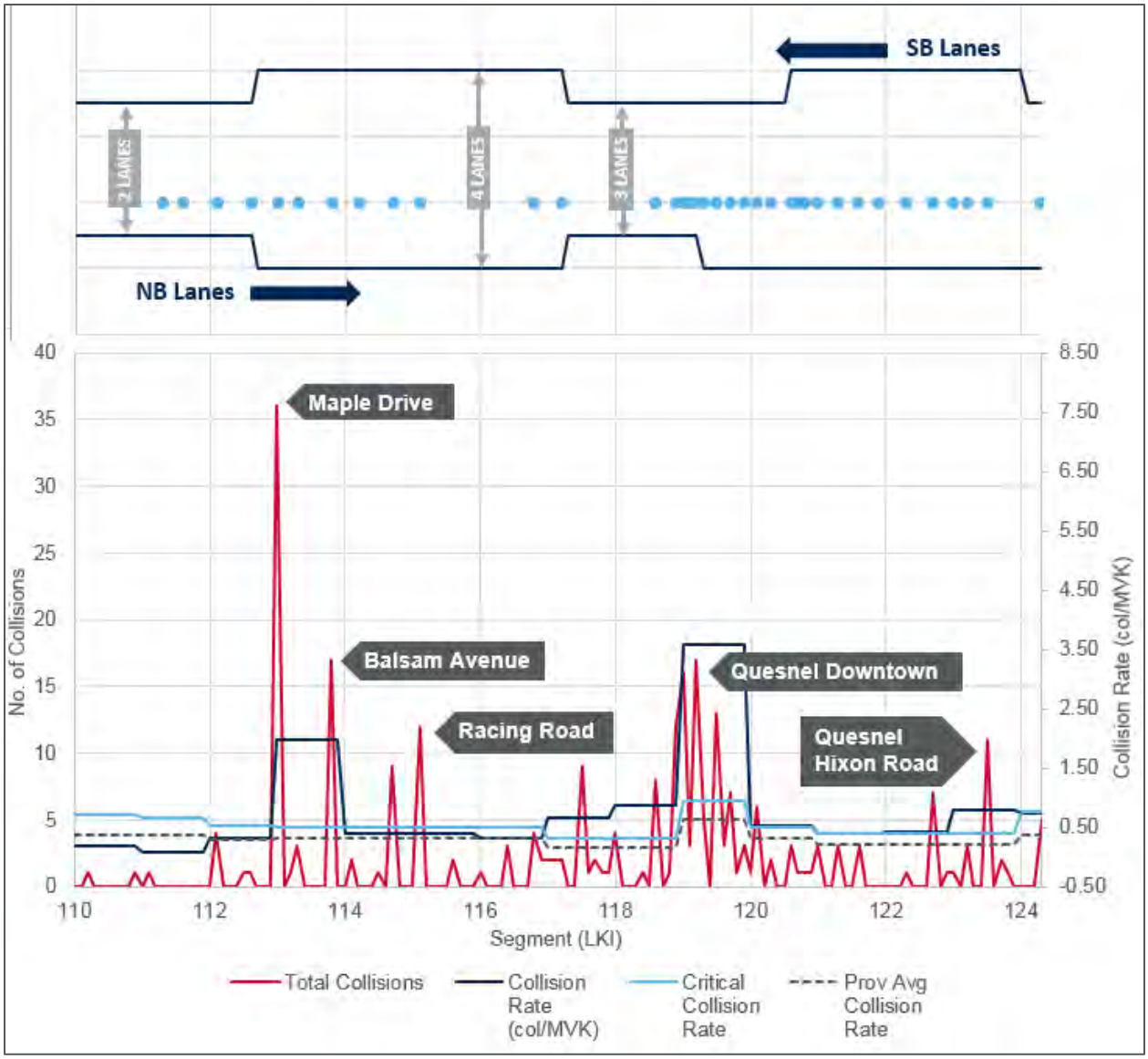
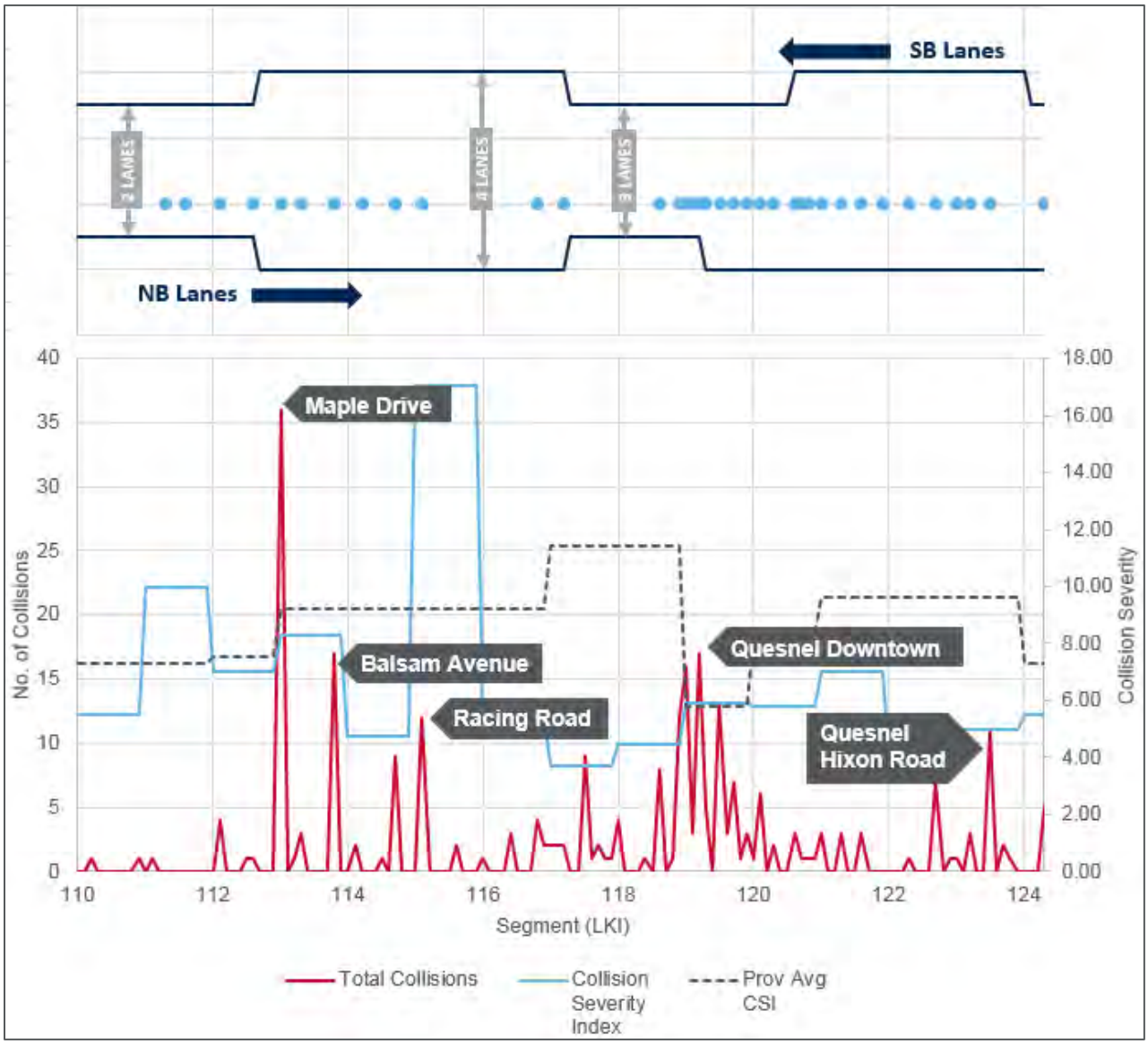


Figure 6.6: Highway 97 Collision Severity and Characteristics (LKI km 110.9 to 124.3)



7.0 RELIABILITY PERFORMANCE

Highway reliability describes a highway's capability to maintain safe and drivable conditions between major access points under all types of weather, emergency, and related conditions that it may be subjected to. One of the key measures for assessing highway reliability is analyzing the duration and frequency of when a highway is closed. Closures may occur for a number of reasons, most often due to vehicle collisions and incidents, poor weather conditions, avalanche control, and vehicle collisions.

Closures and delays to a highway can have a significant economic impact on communities, especially those with limited travel route options. Not only do closures and delays effect an impact on the driving public, they impact the delivery of goods and services that support these communities. In addition, poor reliability can be a significant concern with respect to the timely delivery of emergency services and can contribute increased risks for impacted communities. For these reasons, mitigating the frequency and duration of closures is important to supporting safe and thriving communities.

Highway 97 is an important north-south route for the communities of Quesnel and William's Lake as it is the only connection between these communities and the provincial highway network (either to the north at Prince George or to the south at Cache Creek). To better understand reliability along this corridor, DriveBC data was provided by MoTI for an eight year period between 2005 and 2012 for analysis. Some of the more important attributes used in this reliability review include the type and frequency of traffic pattern changes by date and time, cause of the traffic pattern change, and the duration of closures.

7.1 DriveBC Data

DriveBC is a web-based messaging system operated by MoTI to provide the public with up-to-date information on roadway driving conditions. The data package is comprehensive where every message provided through the DriveBC website is recorded along with many attributes. Before analyzing the reliability data, the data was screened to remove multiple messages recorded for singular events and to remove events where there were no resulting delays or closures to the highway. The screening process also involved removing events which occurred outside of the study area. After screening, there were a total of 80 reliability events recorded between June 7, 2005 and June 29, 2012 in the DriveBC data. Given the recorded data begins and ends mid-year, the data shown for 2005 and 2012 represents only partial years and thus skews the results presented in the following figures for 2005 and 2012.

The dataset sorts highway reliability events into three traffic pattern change categories, which include highway closure events (40 events), lane closure events (14 events), and single lane alternating traffic events (23 events). The frequency of these three main traffic pattern changes by year is shown in Figure 7.1. The data indicates the number of reliability events occurring along the highway vary by year, with the most events recorded in 2010 and the fewest events recorded in 2006 where a full year of data exists.

The same categorization of traffic pattern changes is represented seasonally by month in Figure 7.2. In this perspective, reliability events occur less frequently in the summer and early fall months, totalling about 2-4 events in July, August, September, and October over the eight year study period. The months of November, December, and June exhibit the highest frequency of reliability events. For November and December, further analysis indicates the high event frequency was mostly a result of vehicle collisions

and incidents, likely due to worsening winter travel conditions. For June, the high event frequency was a result of a combination of causes including downed hydro lines, maintenance activities and vehicle incidents.

Figure 7.1: Frequency of Highway 97 Reliability Events by Year (DriveBC Data 2005 – 2012, partial years)

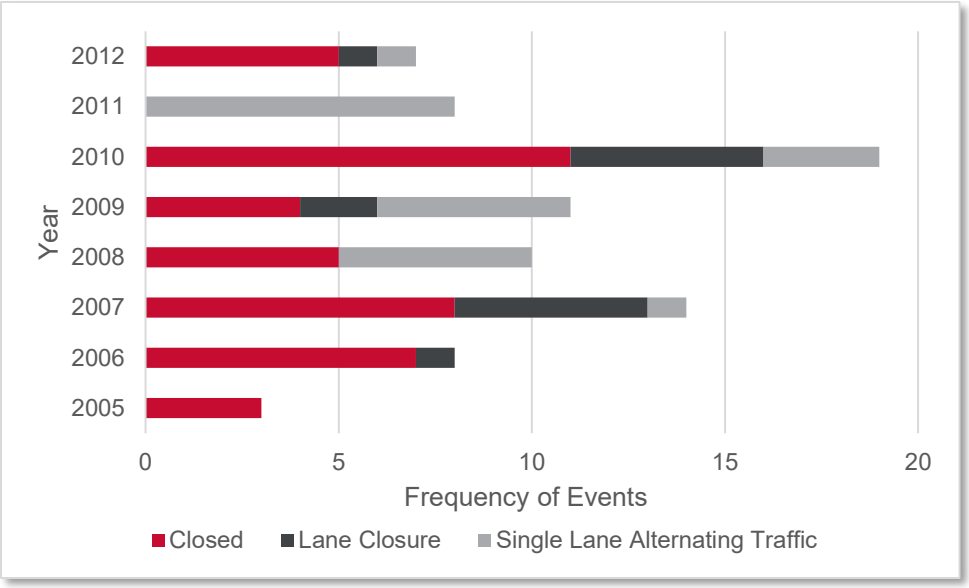
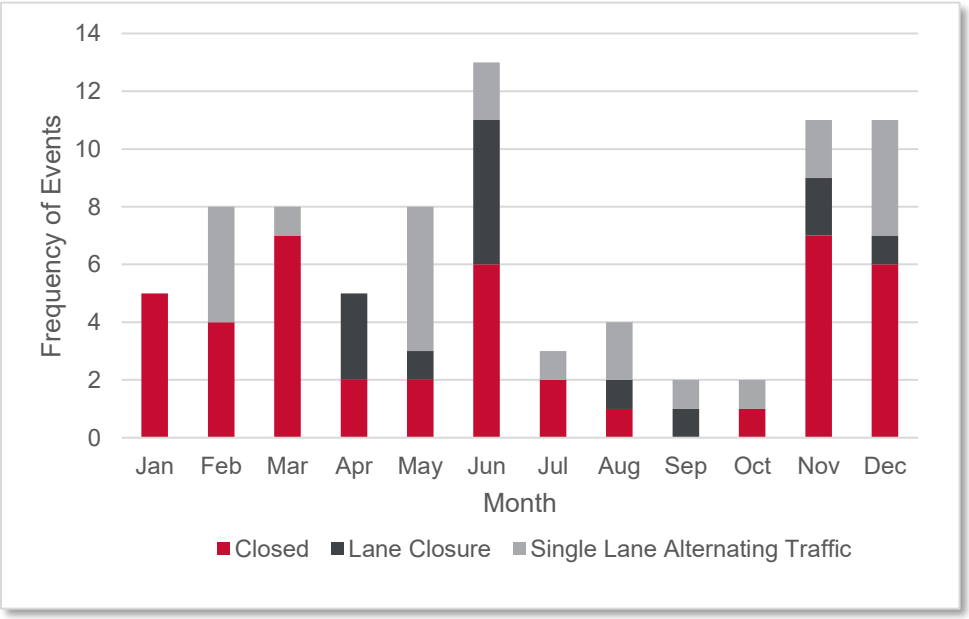


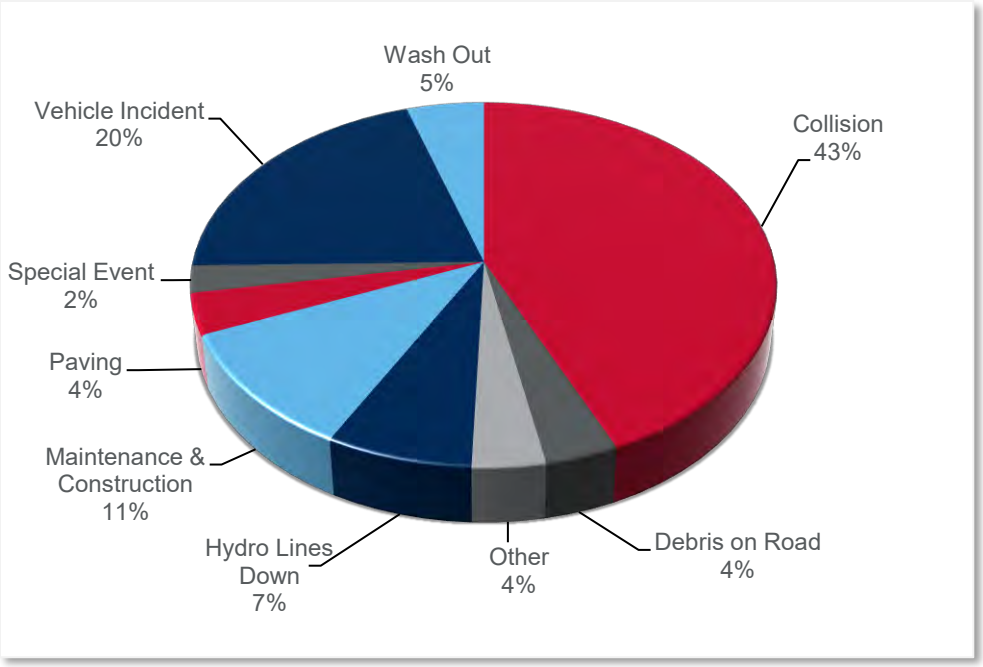
Figure 7.2: Frequency of Highway 97 Reliability Events by Month (DriveBC Data 2005 – 2012, partial years)



As illustrated in Figure 7.3, there are a few causes which result in the three traffic pattern changes described. The complete breakdown of the causes for reliability events is shown in Figure 7.3. Vehicle

collisions account for 43% of traffic pattern changes, the highest of all other causes. Of the 52 reliability events caused by vehicle collisions, 36 (or 69%) of these collisions resulted in complete highway closures, followed by 14 (or 27%) of these collisions resulting in single lane alternating traffic changes. Vehicle incidents are the second highest cause of traffic pattern changes accounting for 20% of all reliability events. Maintenance and construction activities are the third highest cause of traffic pattern changes accounting for 11% of reliability events observed along the study segment. Other causes included wash outs, paving, downed hydro lines, clearing debris from the roadway, and special events.

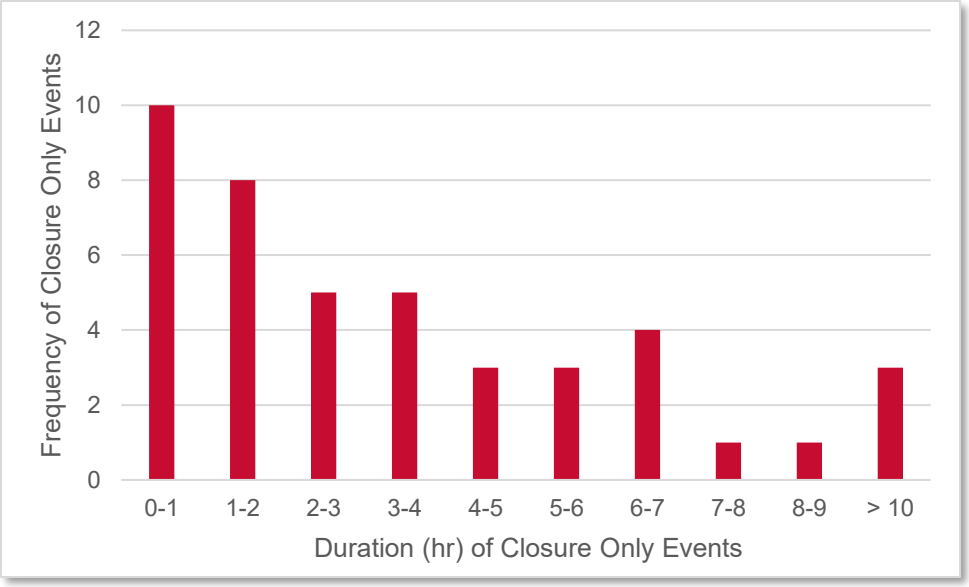
Figure 7.3: Causes of Highway 97 Reliability Events (DriveBC Data 2005 – 2012, partial years)



The duration of highway reliability events was analyzed, with the duration of closure only events depicted in Figure 7.4. Lane closures and single lane alternating traffic pattern changes are not included in the data as the duration of these events was observed to be typically much longer (e.g. ongoing maintenance activities), and these events have a less severe impact on reliability than full highway closure events.

The DriveBC data indicates more than half (53%) of highway closures are less than 3 hours in length, 40% of closures are between the duration of 3 and 9 hours in length, and the remaining 7% of closures are greater than 10 hours in duration. As noted previously, the majority of highway closures are a result of vehicle collisions and incidents.

Figure 7.4: Duration of Highway Closure Events (DriveBC Data 2005 – 2012, partial years)



8.0 GEOMETRIC REVIEW

The Highway 97 alignment and function changes primarily from a regional based 80 km/h rural arterial highway to a 50km/h speed urban arterial highway within the downtown area of Quesnel into a 70km/h commercial section.

A high-level review of the current highway geometry was completed in accordance with the Transportation Association of Canada's "Geometric Design Guidelines for Canadian Roads" (1999) and the Ministry of Transportation's "BC Supplement to TAC Geometric Design Guide", (2007).

While both urban and rural roadway standards exist along this segment of Highway 97, there exists a few discrepancies with the standard of the highway. Using the available LiDAR cadastral and survey information provided by the Ministry of Transportation and Infrastructure, a desktop review was completed to assess the existing highway horizontal alignments and minimum sight distances at intersections.

Upon reviewing the cadastral and survey information, USL identified the following issues that do not adhere completely to current MoTI Design guidelines.

General Comments:

- The clear zone does not exist for large sections of the 80km/h section of highway. Utility poles impact the clear zone area. Large commercial and highway signage, and some lamp standards no not have frangible bases or structure.
- Utility poles impact numerous intersections in the southern section of corridor.
- The frontage road network in southern section is discontinuous and negatively impacts most of the intersections with the highway corridor.
- Numerous intersections have barrier installed to discourage turning movements and relate to the frontage road issues previously noted. These barrier sections are placed at unexpected locations and are a potential hazard to traffic and large vehicle movements. Raised islands should be reviewed for these issues.
- There are a few accesses and intersections in which the throat space to the frontage / backage roads is very short and provides limited storage room for vehicles entering and exiting Highway 97.
- There are a number of public and private accesses on highway 97 that would benefit from access management strategies to minimize redundant accesses and maintain efficient traffic flow on the highway. In addition, the City has raised concern with access onto Lear Road, Keis Avenue and Hilltop Road located in the Two Mile Flats area, and should be the subject of further review.
- The CN Railway is aligned and spaced closely with the northern section of the highway corridor. Some of these sections may do not meet the standards for railway clearance.
- The transportation of oversize loads and the MoTI (DS15001) WB-24 tacking model would be very difficult within the urban section. The urban section is inconsistent with the overall Highway 97 corridor due to the right angle corners and stop conditions.

LKI 111.34 Intersection at Basalt Road and Agate Road: The frontage roads (Jade and Jasper Roads) are in close proximity to the highway (approximately 30 meters from center of Highway 97 to center of Frontage Road intersections) and causes the following problems:

- There is minimal storage on Basalt Road and Agate Road at the intersection, with space for approximately one passenger vehicle. Any additional vehicles queued to enter Jasper Road and Jade Road could impede vehicle movements exiting from the highway.
- It causes larger vehicles to track outside the lane when entering or exiting the highway.
- Given the above items of note, the AM and PM peak hour volumes are comparatively low with minimal vehicle queues forming.

LKI 111.63 Right In/Right Out Intersection at Flint Road and Arbutus Road:

- There is a speed differential issue with northbound vehicles accelerating to 80 km/h from the Basalt Road intersection and conflicting with vehicles decelerating to make a right turn exit onto Flint Road. The distance between intersections is 275m and the posted speed is 80km/h. There are no acceleration or deceleration lanes and tapers between the two intersections in the northbound direction. To add the required tapers and parallel lanes for a RAU2 highway would have the tapers overlapping with those in the southbound direction.
- There is no deceleration lane for vehicles making a southbound right onto Arbutus Road or an acceleration lane for vehicles making a right turn exit from Arbutus Road onto Highway 97 southbound.
- These issues could be resolved by closing the right in /right out accesses at Arbutus Road and Flint Road and providing a complete intersection with the correct acceleration and deceleration lane components at Basalt Road and Agate Road intersection.

LKI 112.09 Intersection at Lust Road and Gook Road: The frontage roads (Jade and Chew Roads) are in close proximity to the highway (approximately 35 meters from center of Highway 97 to center of Frontage Road intersections) and causes the following problems:

- There is no storage on Lust Road and Gook Road at the intersection, one vehicle will impede movements to Jade Road and Chew Road from the highway.
- It causes larger vehicles to track outside the lane when entering or exiting the highway.
- Left turn storage lengths are the minimum of 30m, with Gook Road accessing Dragon Lake and the subdivisions in the area. The storage requirements should be reviewed.

LKI 113.32 Right In/Right Out Intersection to Juniper Road: Juniper Road is located in close proximity to the highway (approximately 30 meters from center of Highway 97 to center of Frontage Road intersections). There is a 50m direct taper from the highway to a yield sign, this would allow for one vehicle in storage. The design of the island does not prevent left turn movements from the highway and there is some evidence that this movement is being made. With nearby intersections located within approximately 400-500 meters with direct access to Juniper and Valhalla frontage roads, the need for this access should be reviewed in further detail.

LKI 115.11 Intersection at Racing Road/Dragon Hill Road: This intersection has a new pedestrian underpass which has a luminaire set low at path level on the west side and on the highway grade on the east side. The island on the west side has a post top luminaire, due to the

power line in the vicinity. The poor lighting from the short height post top luminaire combined with the low elevation of the path luminaire would provide very poor lighting. There are other options for the post top luminaire that would be worth reviewing.

LKI 115.28 Northbound off ramp to Valhalla Road: This off ramp to Valhalla Road is located immediately north of the Racing Road / Dragon Hill Road intersection and does not meet any design standards. No signage is provided on the highway, no taper and a stop sign at the north end of a very short ramp. The ramp lines up with the wrong lane of Valhalla Road, which at night would place headlights in a confusing location. Sight distance to the off ramp and Valhalla Road is very short. This off ramp should be reviewed in further detail.

LKI 115.59 Southbound off ramp to Dragon Hill Road cul-de-sac: Similar to the northbound off ramp to Valhalla Road, no highway signage is provided on the highway for this southbound off ramp to Dragon Hill Road. Further, no taper is provided and allows for high speed exit on a very short ramp into the wrong lane of low speed Dragon Hill Road. This off ramp should be reviewed.

LKI 116.44 Northbound off ramp to North Star Road: The exit nose area of this off ramp appears to have had issues due to the oversized W-54 signage currently in use. The exit does meet current standards and the barrier flare west of nose is substandard.

LKI 116.80 North Star Road loop ramp to Highway 97 southbound: Previous site visits confirmed vehicles avoid or miss the loop ramp and turn across traffic at southbound on ramp to head south. Signage exists but is small and not to current standard. Upgrading the existing sub-standard signage to the current standard should be considered.

LKI 117.48 to 117.69 Quesnel River Bridge No.1569: The Quesnel River Bridge has narrow 3.35 meter lanes, which is very tight for commercial vehicles. The typical corridor cross-section consists of 3.6 meter travel lanes and 2.5 meter shoulders. This would allow for traffic to flow if there was a breakdown in one direction.

LKI 117.80 to 117.85 Quesnel Overhead No. 01641: The Quesnel Overhead has narrow 3.3 meter lanes, which is very tight for commercial vehicles. The corridor standard is for a 3.6m lane and 2.5m shoulder. This would allow for traffic to flow if there was a breakdown in one direction.

LKI 117.94 highway curve is a minimum standard of 90m, however the shoulder is very narrow or nonexistent and there is evidence of commercial vehicles tracking off pavement into the lawn adjacent to the highway. Sight distance on southbound lane is restricted by trees encroaching over shoulder.

LKI 122.45 to 122.55: The railway grade is tight with the highway and no curb roadside barrier is provided for separation and safety of vehicles travelling the corridor. Consideration for curb roadside barrier should be reviewed further.

LKI 122.74 Brownmiller Road: The northbound right turn from Highway 97 onto Brownmiller Road southbound involves a tight 19m radius curve. The curve requires commercial vehicles, such as WB-20 to track off pavement and to utilize the opposite lane to make the maneuver. Barriers have been placed to direct vehicles, however these have been impacted by the turning movements and are moved out of position.

The corridor reflects various standards and design criteria that have evolved over time. These varied standards have created an inconsistent corridor and driving experience for the travelling public.

9.0 EXISTING ASSET CONDITION REVIEW

9.1 Pavement Conditions Review

In 2015, approximately 20 kilometres of Highway 97 within the Quesnel area underwent resurfacing to extend the lifespan of the highway's road surface and structure. The extent for this recent resurfacing project included:

- Highway 97 from Quartz Road (Segment 1146 LKI Km 110.9) to Highway 26 Junction (Segment 1146 LKI Km 124.3)
- Highway 97 from Naver Road (Segment 1151 LKI Km 37.7) to Plett Road (Segment 1151 LKI Km 45.8)
- Approach to the weigh scale locates south of Highway 97 / Highway 26 junction
- 6.6 kilometres of local side roads

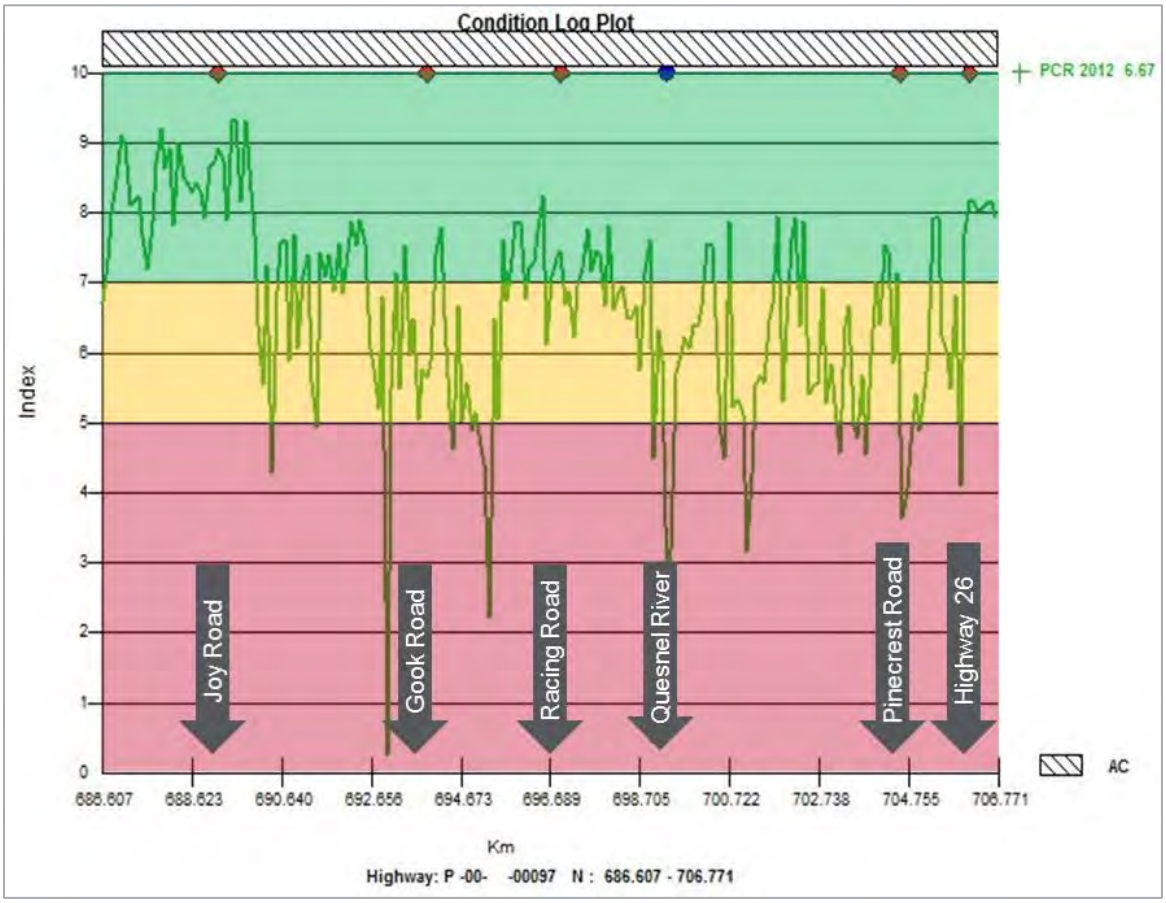
The repaving project provides drivers with a smoother ride and is expected to result in safety and efficiency improvements for highway users.

Also in 2015, the 4-laning of Highway 97 between Quartz Road and Dragon Lake began construction. The segment upgraded spans 2.8 kilometres in a rural zone of Highway 97 just south of the study area. The 4-laning project also includes improved access management, drainage, delineation, safety, and sightlines.

Prior to these resurfacing projects, the pavement conditions along the Highway 97 study corridor were assessed using a Roadway Pavement Management System (RPMS). The assessment uses the Pavement Condition Rating (PCR) to rate the condition of the pavement. The PCR for Highway 97 corridor is depicted in Figure 9.1 with respect to the Landmark Kilometre Inventory (LKI) of the study area. Pavement which is in 'Good' condition is indicated by a PCR above 7, followed by 'Fair' condition indicated by a PCR between 5 and 7, and lastly 'Poor' condition which is indicated by a PCR below 5.

Overall, the pavement within the study section of Highway 97 alignment is in good condition with sound pavement structure. However, there are three areas of concern as illustrated, which include the pavement south of Gook Road, near the creek crossing at ±LKI 113.32, and west of the Quesnel River Bridge.

Figure 9.1: Pavement Condition Histogram – Highway 97



Most of the areas which have seen construction in the recent past indicate a strong structure. Some stop condition intersections show signs of rutting from the commercial traffic having to stop. Maintenance has kept the running surface in very good condition and no significant issues were revealed.

9.2 Structure Conditions Review

Three bridge structures are located along the study segment of Highway 97, that provide important connectivity along the Highway corridor and to West Quesnel. The inspection reports for each structure were provided by MoTI's Bridge Management Information System (BMIS), which include important information on each structure's condition. Further, the inspection reports document the condition of individual components on a scale from excellent to poor, include notes of urgency, and provide an overall Bridge Condition Inspection (BCI) Rating.

The BCI rating is the normalized sum of the condition ratings for each of the structure's components rated on a scale from 1 to 5. A rating of 1 for a structure component means it is in excellent condition, followed by 2 – good condition, 3 – fair condition, 4 – poor condition, and 5 – very poor condition. The BCI rating is then adjusted to account for the structure component(s) with the lowest condition rating. Overall, a structure with an adjusted BCI rating of 1 or 2 is in good condition; whereas, a structure with an adjusted rating of 3 indicates some deterioration and need for rehabilitation. A structure with an adjusted BCI

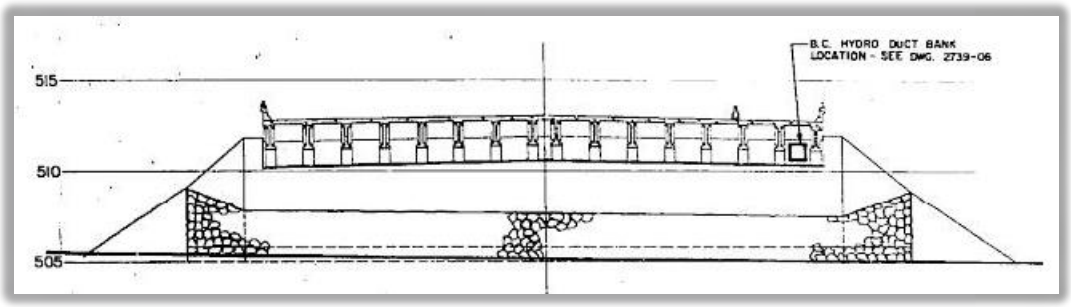
rating of 4 indicates a priority for rehabilitation or implementation of an alternate improvement. No bridge structures are permitted to reach a level 5 for the interest of public safety.

LKI 116.80 – North Star Road Overpass No. 02739 is on Highway 97 at the North Star Interchange crossing over North Star Road. The structure was constructed in 1980 and inspected by the MoTI on July 10, 2014. The adjusted BCI rating on this inspection date was 1.91. The following comments were provided in the inspection report about the structure condition:

- Substructure Scour - Slope pavement has weed and grass growing through the concrete. Cracking started since 2000.
- Wing/Retaining Walls - Minor cracks in numerous locations vary from shrinkage to map cracks.
- Stringers - Stringer SW end minor rust showing and rebar visible
- Sub Deck/Cross Ties - Subdeck now is the concrete overlay with asphalt membrane overlay new.
- Wearing Surface - prior 2001: Deck cracks noted at numerous locations.
- Deck Joints - Asphalt Plug Joint.

Overall, the structure is in good condition and needs some general maintenance. The roadside barrier on the northbound curb lane does not tie to bridge a barrier structure. The structure is widened behind the barrier to contain a BC Hydro duct bank, as depicted in Figure 9.2.

Figure 9.2 B.C Hydro Duct Bank at North Star Road Overpass No. 02739



LKI 117.48 to 117.69 - Quesnel River Bridge No.1569 is on Highway 97 crossing over Quesnel River. The structure was constructed in 1961 and inspected by the MoTI on May 29, 2014. The adjusted BCI rating on this inspection date was 2.27. <u>The inspection report identified urgent items needing attention including:</u>

- Plan replacement of joint seal
- Concrete work for the pier is serious and should be repaired
- Priority to keeping the water/salt solutions from leaking onto the caps and superstructure, rail panel securing at south east end post
- Corrosion on the bottom chords of the trusses
- Utility Concerns - rusting of connection locations for the water and gas line

The structure has a clearance of 5.3m; however, the structure width is relatively narrow and may pose a potential restriction to oversize loads which use the corridor.

In addition, there are multiple historic and current comments provided in the inspection report about the structure condition. Given the age of the structure, continual maintenance is required to various components.

LKI 117.80 to 117.85 – The Quesnel Overhead No. 01641 is on Highway 97 crossing over the CNR Railway, formerly the British Columbia Railway. The structure was constructed in 1961 and inspected by the MoTI on November 16, 2015. The adjusted BCI rating on this inspection date was 3.2. The inspection identified urgent items needing attention including:

- Subdeck in critical condition as found in 1999 when jack hammering asphalt and patching
- Rail posts cracked and deteriorated concrete with cracks
- Sidewalk has been narrowed by the added no post barriers. (18" concrete roadside barrier and a steel railing have been added to sidewalk)
- The MoTI Rehab Works Notes state: Replace structure's deck and rail system and widen deck and sidewalk

The structure's running surface was resurfaced in 2012 and is in good condition. The structure is relatively narrow and as with the Quesnel River Bridge, may pose a potential restriction to oversize loads which use the corridor.

Rehab of this structure will be needed in the near future. In particular the deck is in very poor condition, which can be seen in the underside of the deck as the running surface including deck joints has been paved over. It is expected that partial depth resurfacing will not be an option and that a new deck will have to be constructed. Usually new decks can be constructed one lane at a time but the Quesnel Overhead presents a number of challenges which might prevent this option. These challenges include cantilevered pier caps which may have to be pinned down to prevent over turning and traffic management (SLAT traffic would be required during most of the construction which could be upwards of 3 months). Even though the inspection indicates that the pier columns and pier caps are in good to fair shape, both components have large areas of concrete spalling which should be addressed during a rehabilitation procedure. Scaffolding and form work can be very challenging during a rail overhead rehabilitation as encroachment of the rail envelope will not be allowed.

10.0 PROBLEM DEFINITION STATEMENT

A clear understanding on the current state of Highway 97 through Quesnel is established through the technical analysis undertaken in this existing conditions review. The study area for this review includes Highway 97 from its southern limit at Quartz Road (LKI Segment 1146 Km 110.9) to its northern limit at the junction with Highway 26 (Segment 1146, LKI Km 124.3). Overall, the current alignment of Highway 97 is constrained through the downtown of Quesnel, which poses challenges identified in this existing conditions review for future horizons. These challenges are summarized in the following problem definition statement, organized by the four highway study segments:

Segment A - South Quesnel Commercial (LKI km 110.9 to km 115.1)

The South Quesnel Commercial area of Highway 97 experiences road safety performance challenges and geometric challenges at a number of intersections along this study segment. High collision rates were observed at the intersections of Maple Drive and Cedar Avenue, and a high collision severity rate was observed at the Racing Road (Dragon Hill Road) intersection. The highway frontage roads provide minimal vehicle queuing storage at highway intersections and inhibits trucks from making turning movements without over-tracking into adjacent lanes and the road shoulder.

Segment B - North Star Interchange (LKI km 115.1 to km 117.7)

Highway 97 across the Quesnel River Bridge and Quesnel Overhead experiences higher than average vehicle collisions and the narrow two-lane cross-section does not completely adhere to MoTI's current design guidelines. The Quesnel Overhead structure requires rehabilitation or replacement given a number of challenging circumstances to conduct rehabilitation with the existing structure design and location. In addition, the sidewalks on both structures are constrained by the railings and curb roadside barrier that inhibit pedestrian and bicycle usage. The off ramps to Valhalla Road and Dragon Hill Road do not meet existing highway design standards. Lastly, directional signage on North Star Road requires upgrades to improve wayfinding effectiveness.

Segment C - Downtown Quesnel (LKI km 117.7 to km 121.0)

The Downtown Quesnel area of Highway 97 experiences high collision rates at a number of intersections including at Kinchant Street, McLean Street, Front Street, and St. Laurent Avenue. There are a few mobility performance challenges for side-street movements on approaches to Highway 97 including vehicles leaving the hospital onto Front Street (Highway 97). There is a horizontal curve design to a minimum 90 meter radius just west of the Quesnel Overhead No. 01641 (LKI km 117.9) in which there is evidence some vehicles may be going off pavement. Lastly, a pedestrian and cycle connection from Downtown to the Two Mile Flats area is a strong desire of the City.

Segment D - Two Mile Flats (LKI km 121.0 to km 124.3)

In this Two Mile Flats segment, the Highway 97 alignment comes close to the CN Rail alignment and the rail base abuts the highway shoulder, resulting in an increased risk of vehicle impacts to the railway base and slope. At the intersection of Brownmiller Road, there is a risk of heavy vehicles tracking off pavement as they make northbound right turns around a sharp curve onto Brownmiller Road. Access management is also needed to better define permitted turning movements onto and off the highway to local

businesses. Lastly, the Highway 97 / Highway 26 (Barkerville) intersection experiences a high collision severity rating indicating a road safety issue at this location.

10.1 Next Steps

The results of this Highway 97 Quesnel Phase 1 – Existing Conditions study indicate the presence of a number of existing transportation challenges on the corridor relating to mobility, safety, highway geometry, active transportation, and structure and pavement conditions. These challenges were identified through the investigative process of this study and are clearly summarized in the problem definition statement. However, a few next steps are needed to develop and implement improvements that will address these existing challenges and the potential of challenges with future mobility conditions.

Thus, it is recommended that the findings of this existing conditions study be carried forward into the Phase 2 - Improvement Strategy for the study corridor. This improvement strategy should consist of a future highway performance assessment to understand future corridor conditions and challenges over short, medium, and long-term horizons. Other study components should include economic, structural, environmental, geotechnical, and utility constraints reviews along the study corridor that will inform the next step of generating conceptual design improvements.

In this improvement strategy phase, further study and evaluation must be taken to review the viability and feasibility of previously identified improvement options. These options mainly include the North-South connector, the East-West connector, and the Quesnel Hydraulic Road area access management options. Challenges and constraints identified in this existing conditions phase must also be studied to identify potential conceptual improvement options.

The conceptual options should then be evaluated according to a multiple account evaluation methodology to screen out less-viable options and identify those most viable. Further assessment and evaluation of the resulting “short-listed” improvement options should be undertaken to account for mobility and safety savings, project life-cycle costs (including cost estimates, operation and maintenance costs), reliability, and improvement risks. The final list of conceptual options will be packaged into an improvement strategy with defined implementation timeframes and priorities that will ensure improvements make efficient use of resources as they are needed.

Throughout Phase 2, it will be important to conduct stakeholder and public consultation to ensure conceptual options will be supported by the Quesnel area community as they are further refined to a project implementation stage. The findings of Phase 2 – Improvement Strategy will be documented into a project report, which will be used to carry conceptual improvements to preliminary design, detailed design, and implementation