



Final Report

Highway 97 Quesnel Transportation Plan Phase II – Implementation Strategy

*Prepared For:
The Ministry of Transportation & Infrastructure*

Highway 97 Quesnel Transportation Plan

Phase II – Implementation Strategy – Final Report

Client: BC Ministry of Transportation and Infrastructure
342 – 447 Columbia Street
Kamloops, BC V2C 2T3
Attention: Kathryn Weicker, Senior Regional Transportation Planning Engineer

Prepared by: Urban Systems Ltd.
304 – 1353 Ellis Street
Kelowna, BC V1Y 1Z9
Tel: (250) 762-2517



Prepared by: Kevin Gordon, CTech
Sr. Transportation Lead



Prepared by: Ian Roth, P.Eng.
Transportation Engineer

Reviewed by: James Donnelly, P.Eng., PTOE
Sr. Transportation Engineer

Date issued: March 16, 2018 Draft Report
March 28, 2018 Final Draft Report
June 28, 2018 Final Report

Project No.: 1961.0384.02

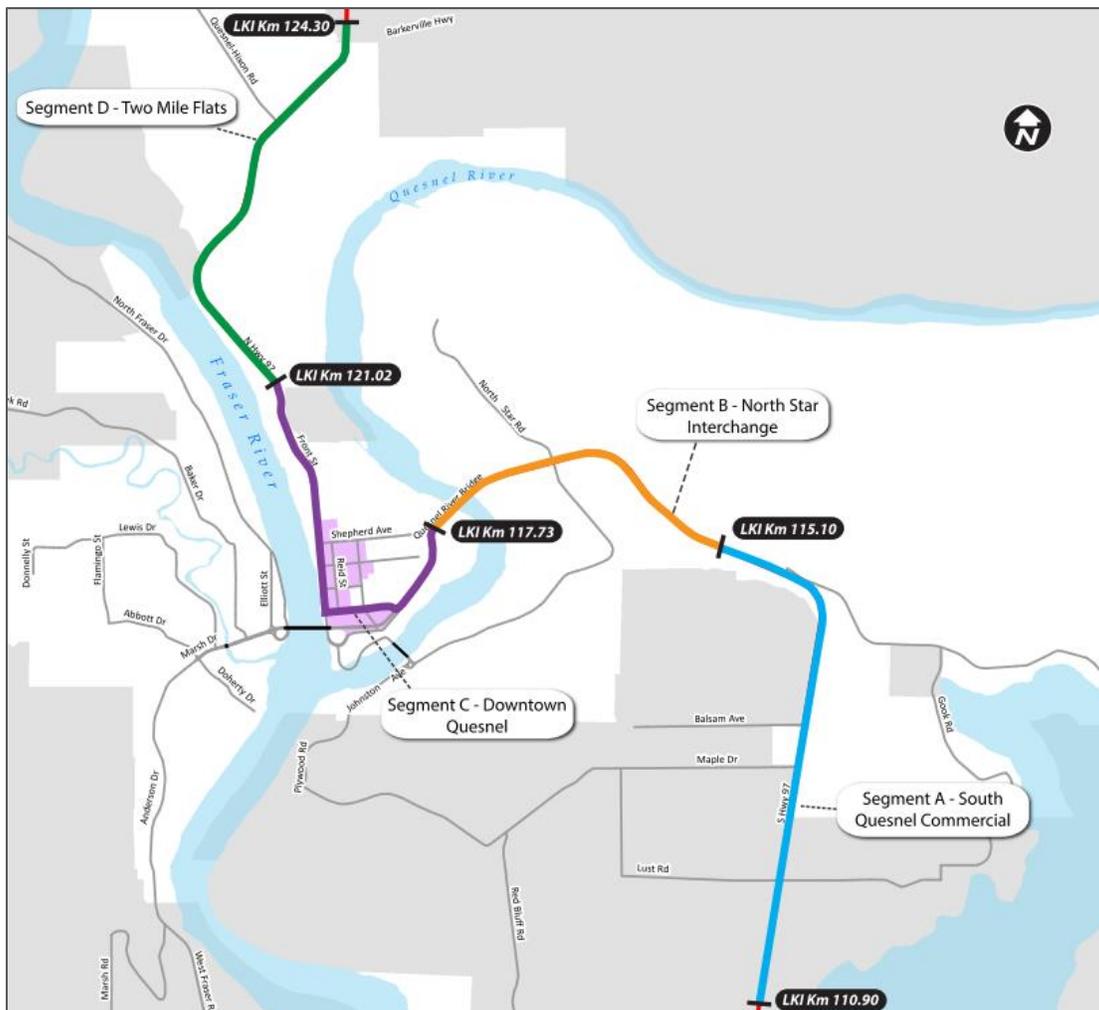
This report was prepared by Urban Systems Ltd. for the account of British Columbia Ministry of Transportation and Infrastructure. The material reflects Urban Systems Ltd.'s best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Urban Systems Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

EXECUTIVE SUMMARY

The BC Ministry of Transportation and Infrastructure (MoTI) retained Urban Systems Ltd (Urban Systems) to undertake the Phase 2 study of the Highway 97 Quesnel Transportation Plan. Subsequent to the Phase 1 Existing Conditions report that was completed in 2016, Phase 2 has focused on understanding future transportation conditions in Quesnel, explored short and long-term improvement options, and outlines a recommended implementation strategy of projects and improvements for the corridor.

This report encapsulates the Highway 97 Quesnel Transportation Plan including an assessment of future transportation conditions, the development of improvement options and guiding principles to evaluate the options, the multiple account evaluation (MAE) of advanced options, and the implementation strategy. This report also summarizes the community engagement undertaken over the course of the study, identifies potential risks for recommended improvements and outlines next steps. The study area includes 13.9 kilometres of Highway 97 between Basalt Road to Highway 26 / Barkerville Highway (LKI Segment 1146 km 110.9 to km 124.3). The study area has been categorized into four study segments as shown in **Figure ES-1** to reflect the changing form and function of the highway through Quesnel.

Figure ES - 1: Highway 97 (Quesnel) Study Area



Future Mobility Assessment

The future conditions assessment involved the analysis of local economic conditions and growth forecasts, and analysis of the future traffic conditions on the Highway 97 study corridor. The full future conditions assessment is provided in **Appendix A**.

The project team met with the City of Quesnel to understand municipal projects and economic conditions in the Quesnel area. In addition, Pearson Ellis Consulting Inc. was retained by Urban Systems to complete a socio-economic assessment entitled *Quesnel Socio-Economic Overview For Purposes of Highway Planning (2017)*. The socio-economic assessment identified trends across many sectors and aspects of the community and some of the highlights from the report (provided in **Appendix B**) are listed as follows:

- The population of the Quesnel area has seen some minor decline, based on Census results. The future population is forecasted to grow at a low rate.
- Currently, the economy of Quesnel is heavily dependent on the forestry industry and, despite much uncertainty in the future of this industry, it is expected that this industry will continue to be a major source of employment and significant contributor to heavy vehicle traffic on Highway 97 in the Quesnel area. The development of the Blackwater mine and Bonanza Ledge mine presents an opportunity for new sources of employment for the region in the future.
- G.R. Baker Memorial Hospital continues to grow and develop. This has added pedestrian and traffic movements to and from the hospital creating new issues and challenges with traffic flows along and across Front Street, which is one of the most problematic sections of the Highway 97 corridor through Quesnel.
- Community concerns for Highway 97 relate to access, safety, congestion and emissions through the Quesnel segment of the highway corridor.

The traffic volumes in the study area of Quesnel were analyzed at the 10 and 25-year horizons. To determine the future traffic volumes, existing traffic was factored using a background growth rate of 0.5% and a sensitivity growth rate of 1.5%.

The mobility analysis of the study network intersections was undertaken in accordance with the Ministry's general mobility performance criteria and thresholds. The complete mobility analysis for the future horizon years and growth rate scenarios is provided in **Appendix A** and the traffic modelling reports are provided in **Appendix C**. A summary of the key findings from the future mobility analysis is provided in **Table ES-1**.

Table ES - 1: Summary of Future Mobility Performance Conditions

	0.5% Background Growth	1.5% Background Growth
AM Peak	<ul style="list-style-type: none"> • All intersections perform at a LOS A or B. • None of the study intersection approaches exceed the v/c threshold of 0.9. • The eastbound approach at the McNaughton Avenue intersection with Highway 97 operates at a LOS E. 	<ul style="list-style-type: none"> • All intersections within the study area operate at LOS C or better. • Side-street approaches at the intersections of McNaughton Avenue, Shepherd Avenue, and Racing Road operate at LOS F with v/c ratios above 1.0.

	0.5% Background Growth	1.5% Background Growth
PM Peak	<ul style="list-style-type: none"> All intersections operate at a satisfactory LOS C or better. None of the study intersection approaches exceed the v/c threshold of 0.9. The eastbound approach at Shepherd Avenue reaches a LOS F. Minor side-street approaches perform at LOS E at McNaughton Avenue, Laurent Avenue, Carson Avenue, McLean Street, Marsh Drive (Moffat Bridge Approach), and Racing Road intersections. 	<ul style="list-style-type: none"> Side-street approaches at the intersections of McNaughton Avenue, Shepherd Avenue, and Racing Road reach a LOS F with v/c ratios above 1.0. The northbound side-street approach at the McLean Street intersection reaches a LOS F, but with a v/c ratio under 0.9.

Overall, traffic volumes are projected to grow at a slow-to-moderate pace and are not expected to exceed the highway’s current capacity by the 2042 long-term horizon.

Problem Definition Update

The problem definition summarizes the key challenges and issues along Highway 97 through Quesnel, which has been established through the technical analysis undertaken in the existing conditions assessment (Phase 1 of the study), and in the future conditions assessment. Overall, the current alignment of Highway 97 is constrained through the downtown of Quesnel, which already has mobility and safety challenges that are projected to be intensified in the future. Side-street movements were found to present a challenge as high delays and poor LOS are experienced at some intersections at the 10 and 25-year horizons. These challenges are further discussed in the following problem definition statements, 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 several intersections along this segment. Without improvements along the corridor, the existing issues with the highway frontage roads will continue be a challenge. Currently the highway frontage roads provide minimal vehicle queuing storage at highway intersections and can inhibit trucks from making turning movements without over-tracking into adjacent lanes and the road shoulder. At the 2027 and 2042 horizons, mobility performance is slightly worse compared to the existing conditions due to higher highway volumes, however, all approaches and intersections are projected to operate satisfactorily.

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

The North Star area of Highway 97 has many geometric design challenges that require significant upgrades and improvements to adhere to MoTI’s current-day design standards and guidelines. Necessary upgrades include the Quesnel River Bridge No. 1569, Quesnel Overhead No. 01641, sidewalks on both structures, the off ramps to Valhalla Road and Dragon Hill Road, and directional signage on North Star Road. In addition to structure and infrastructure upgrades, side street mobility is projected to worsen at the 10 and 25-year horizons, specifically at the Racing Road intersection which is expected to experience delays and failing levels of service.

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

The Downtown Quesnel area of Highway 97 currently has safety concerns at several intersections including at Kinchant Street, McLean Street, Front Street, and St. Laurent Avenue. There are mobility performance challenges

for side-street movements throughout this segment at the 2027 and 2042 projections due to the increase in highway traffic volumes. Specifically, the intersections of Shepherd Avenue and McNaughton Avenue are expected to perform poorly with high delays.

There is a horizontal curve with 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 Flat area would facilitate active modes wishing to travel between these two destinations.

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

In this Two Mile Flat 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. No existing or future mobility issues are expected for the intersections in this segment of the study area.

Option Generation and Evaluation

Fourteen improvement options on the existing Highway 97 alignment and six alternate route option alignments were identified and developed to a conceptual design level. Several design considerations were accounted for in the development of the options, which are detailed on the design criteria sheets provided in **Appendix D** for urban and rural segments of the Highway 97 study corridor. Further, an environmental review and geotechnical review was completed for the study area options, which is provided in **Appendix E** and **Appendix F**, respectively.

A set of six guiding principles were established based on the existing and future needs of the corridor to help guide the development and selection of preferred improvement options. These guiding principles were also used in the evaluation of improvement options to ensure the improvements achieve the objectives of the project.

The guiding principles are summarized as follows:

- ▶ **Enhance the Highway to Support Local and Regional Functions**
- ▶ **Improve Intersection and Highway Safety**
- ▶ **Support Active Transportation**
- ▶ **Improve Intersection and Corridor Mobility**
- ▶ **Improve Access and Connectivity with the Local Road Network**
- ▶ **Mitigate Heavy Vehicle Impacts**

Each option was evaluated by the above guiding principles and one of three following recommendations were provided for each option:

- ▶ Advance the option to the Multiple Account Evaluation (MAE) for further evaluation;
- ▶ Advance the option to the Implementation Strategy;
- ▶ Screen-out the option from further review;

A list of all the options generated is summarized in **Table ES-2** along with the recommendations based on the guiding principles evaluation.

The conceptual design drawings and planning-level project cost estimates are provided in **Appendix G** and **Appendix H**, respectively. Unit rates for structural costs were provided by Mott MacDonald for this study, as

detailed in the report *Highway 97 Quesnel Corridor Study – Structural Considerations* provided in **Appendix I**. Costs for acquiring property were prepared by Gateway Land Services for options where significant property impacts were required outside of the existing Highway 97 alignment. Details of the properties impacted and the costs are outlined in their report *Highway 97 Quesnel Transportation Plan Phase II – Improvement Options Property Impact Study*, provided in **Appendix J**.

Table ES - 2: Summary of Options Developed and Recommendations based on Guiding Principles Evaluation

Study Segment	Option Name	Screening Outcome
Alternate Route	Option AR-1a North-South Interconnector (4-Lane)	▶ Advance to MAE
	Option AR-1b: North South Interconnector (2-Lane)	■ Screen-Out
	Option AR-2 (a&b): North South Industrial Connector	■ Screen-Out
	Option AR-3: East-West Connector	■ Screen-Out
	Option AR-4: North-South Bypass	■ Screen-Out
A South Quesnel	Option A1: Basalt Rd. and Gook Rd. Access Management (2-lane)	■ Screen-Out
	Option A2: Basalt Rd. and Gook Rd. Access Management (4-lane)	▶ Advance to MAE
	Option A3: Juniper Road and Jade Road Network Improvements	▶▶ Advance to Implementation Plan
	Option A4: Signal Optimization of Maple Drive and Cedar Avenue Intersections	▶▶ Advance to Implementation Plan
	Option A5: Racing Rd. and Quesnel-Hydraulic Rd. Access Management	▶▶ Advance to Implementation Plan
B North Star	Option B1: Quesnel River Bridge and Quesnel Overhead Replacement	▶ Advance to MAE individually and in combination with Options C1, C2-b
	Option B2: Quesnel River Bridge to Nadeau Street Sidewalk	■ Screen-Out
C Downtown Quesnel	Option C1: Highway 97 Realignment onto Legion Drive	▶ Advanced to MAE in combination with Options B1, C2-b
	Option C2-a: Front Street 4-Laning Reconfiguration	■ Screen-Out
	Option C2-b: Front Street 3-Lane Reconfiguration	▶▶ Advance to Implementation Plan and to MAE in combination with Options B1, C1
	Option C3 Relocate Traffic Signal from Reid St. to McLean St.	▶▶ Advance to Implementation Plan
	Option C4: Signalize Sutherland Ave / Highway 97	■ Screen-Out
D Two Mile Flat	Option D1: Two Mile Flat Frontage and Backage Road Network	▶ Advance to MAE
	Option D2: Two Mile Flat Highway 97 Reconfiguration to Urban 3-Lane Design	▶ Advance to MAE

Implementation Strategy

Further to the guiding principles evaluation of all the options developed, and further to the multiple account evaluation of advanced options, **Table ES-3** summarizes the recommended options to be included in the implementation plan. Options that were screened-out after each evaluation do not advance into the implementation plan. The recommended options were reviewed with the project team's input and a phasing strategy has been developed as described in the next section of this report.

Table ES - 3: Summary of Recommended Options and Phasing for the Implementation Plan

Project Phasing	Option Name
Short Term Projects 0 - 5 Years	Option A4: Signal Optimization of Maple Drive and Cedar Avenue Intersections
	Option A5: Racing Rd. and Quesnel-Hydraulic Rd. Access Management
	Option C2-b: Front Street 3-Lane Reconfiguration
	Option C3: Relocate Traffic Signal from Reid St. to McLean St.
	Option AR-1a: North-South Interconnector (4-Lane)
Medium to Long-Term Projects 6 - 25 Years	Option A2: Basalt Rd. and Gook Rd. Access Management (4-lane)
	Option A3: Juniper Road and Jade Road Network Improvements
	Option D1: Two Mile Flat Frontage and Backage Road Network
	Option D2: Two Mile Flat Highway 97 Reconfiguration to Urban 3-Lane Design

Community Consultation

The development of the Highway 97 Quesnel Transportation Plan involved significant consultation with the community of Quesnel including municipal staff, elected officials, First Nations, community stakeholders and the public. Over the course of the Phase II planning study, there were:

- ▶ 4 x meetings with technical representatives from the City of Quesnel and the Cariboo Regional District
- ▶ 3 x meetings with Elected Officials and Lhtako Dené
- ▶ 2 x Public Open Houses
- ▶ 1 x meeting with Stakeholder Organizations
- ▶ Meetings with Individual Property Owners

The involvement of these various groups and communities in the planning study and the feedback and input received is described in **Section 3.9** of this report. The Community Engagement Summary Reports which describe the process, results and findings of both public open houses are provided in **Appendix M** and **Appendix N**.

Recommendations

The development of the Highway 97 Quesnel Transportation Plan has involved extensive collaboration and consultation with organizations and members representing the community of Quesnel. The options identified for short-term implementation are recommended for further planning and engineering design as the timeline and the MoTI's priorities permit.

Of the four options identified in the short-term implementation strategy, three of these options including Option A5 (Racing Road and Quesnel-Hydraulic Road Access Management), Option C2-b (Front Street 3-Laning Reconfiguration) and Option C3 (Relocate Traffic Signal from Reid Street to McLean Street) are being advanced into preliminary design, engineering and construction over 2018 and 2019 for immediate implementation.

Option AR-1a (North-South Interconnector) is also recommended to be advanced as a short-term project. Several next steps are required to advance this project into the design process. Further, the timeline for this project is constrained by the known ageing and lifespan issues of the existing Quesnel Overhead and Quesnel River Bridges.

Letters of support from multiple levels of government, industry and community organizations for the short-term projects including Option AR-1a North-South Interconnector are provided in **Appendix O**.

Several next steps have been identified for the following recommended improvement options, as detailed in **Section 3.10** of this report:

- ▶ Option AR-1a: North South Interconnector
- ▶ Options A2 & A3: South Quesnel Access Management
- ▶ Options D1 & D2: Two Mile Flat Access Management

TABLE OF CONTENTS

EXECUTIVE SUMMARY	I
1 INTRODUCTION	1
1.1 Study Background	2
2 FUTURE MOBILITY ASSESSMENT	3
2.1 Future Travel Demand.....	3
2.1.1 Quesnel Area Economic Conditions.....	3
2.1.2 Traffic Forecasts.....	4
2.2 Future Mobility Performance Analysis.....	4
2.3 Problem Definition Update	5
3 OPTION GENERATION AND ASSESSMENT.....	7
3.1 Guiding Principles.....	7
3.2 Design Criteria Considerations	8
3.3 Environmental Considerations.....	9
3.4 Geotechnical Considerations	9
3.5 Option Development.....	11
3.5.1 Cost Estimates	11
3.5.2 Survey Information.....	12
3.5.3 Alternate Route Options.....	12
3.5.4 Study Segment A – South Quesnel Commercial Options	28
3.5.5 Study Segment B – North Star Area Options.....	37
3.5.6 Study Segment C – Downtown Quesnel Options	41
3.5.7 Study Segment D – Two Mile Flat Options	52
3.5.8 Summary of Options Developed.....	56
3.6 Multiple Account Evaluation (MAE).....	57
3.6.1 Methodology	57
3.6.2 Alternate Route Options Evaluation.....	59
3.6.3 Study Segment A – South Quesnel Commercial Options Evaluation	63
3.6.4 Study Segment B – North star area Options Evaluation.....	66

3.6.5	Study Segment D – Two Mile Flat Options Evaluation	69
3.7	Implementation Strategy	74
3.7.6	Short-Term Projects.....	74
3.7.7	Medium and Long-Term Projects	76
3.8	Potential Risks	77
3.9	Community Consultation	80
3.9.1	Technical Representative Consultation	81
3.9.2	Elected Officials and First Nations	81
3.9.3	Local Stakeholder Consultation	82
3.9.4	Public Engagement Phase 1.....	82
3.9.5	Public Engagement Phase 2.....	82
3.10	Recommendations	84
3.10.1	Next Steps – Option AR-1: North-South Interconnector	84
3.10.2	Next Steps – Option A2 & A3: South Quesnel Access Management.....	84
3.10.3	Next Steps – Option D1 & D2: Two Mile Flat Access Management	85

APPENDICES

Appendix A	Future Conditions Assessment
Appendix B	Quesnel Socio-Economic Overview Report
Appendix C	Future Conditions Synchro Model Reports
Appendix D	Design Criteria
Appendix E	Environmental and Archaeological Scan Report
Appendix F	Terrain Stability (Geohazard) Constraints Report
Appendix G	Conceptual Design Drawing Package
Appendix H	Conceptual Planning-Level Project Cost Estimates
Appendix I	Structural Considerations Report
Appendix J	Property Impact Study
Appendix K	Traffic Signal Warrants
Appendix L	Option D1 Two Mile Flat Evaluation
Appendix M	Community Engagement Summary Report – June 2017
Appendix N	Community Engagement Summary Report – February 2018
Appendix O	Letters of Support

List of Figures

Figure 1.1: Highway 97 (Quesnel) Study Area	1
Figure 3.1 Environmental Constraints and Considerations.....	10
Figure 3.2: Forecast Usage of the North-South Interconnector (2042 Horizon, 0.5% Background Growth).....	15
Figure 3.3: Forecast Usage of the North-South Industrial Connector (2042 Horizon, 0.5% Background Growth).	20
Figure 3.4: Forecast Usage of the East-West Connector (2042 Horizon, 0.5% Background Growth).....	23
Figure 3.5: Forecast Usage of the North-South Bypass (2042 Horizon, 0.5% Background Growth).....	26
Figure 3.6: Option A1 and Option A2 Access Management from Basalt Road to Maple Drive	28
Figure 3.7: Option A3 Access Management from Cedar Avenue to Juniper Rd.....	28
Figure 3.8: Ranked Priority of Improvement Options	83
Figure 3.9: Results of Option Comparison.....	83

List of Tables

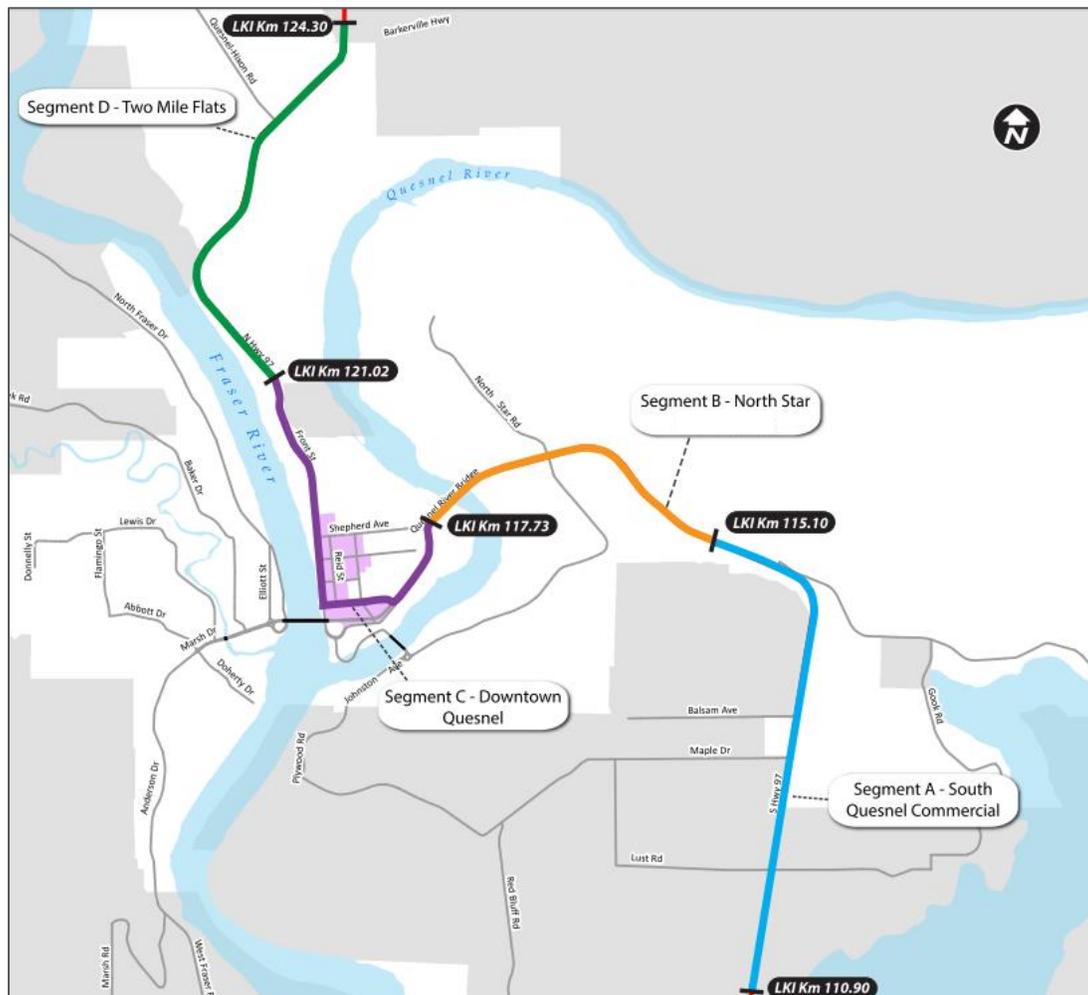
Table 2.1: Summary of Future Mobility Performance Conditions	5
Table 3.1: Highway 97 Physical and Operating Characteristics.....	8
Table 3.2: Summary of Option Development Recommendations based on Guiding Principles Evaluation	56
Table 3.3: Summary of Options Assessed in the MAE.....	57
Table 3.4: MAE for Option AR-1a in comparison with Options B1, C1, C2-b	60
Table 3.5: Option A2 MAE Evaluation	64
Table 3.6: Option B1(a&b) MAE	67
Table 3.7: Option D1 MAE	69
Table 3.8: Option D2 MAE	71
Table 3.9 Summary of Recommended Options and Phasing for the Implementation Plan	74
Table 3.10: Summary of Short Term Implementation Projects (0 to 5 Years)	75
Table 3.11: Summary of Medium to Long-Term Implementation Projects (6 to 25 Years)	76
Table 3.12: Planning-Level Summary of Potential Project Risks for Option AR-1a	78

1 INTRODUCTION

The BC Ministry of Transportation and Infrastructure (MoTI) retained Urban Systems Ltd (Urban Systems) to undertake the Phase 2 study of the Highway 97 Quesnel Transportation Plan. Subsequent to the Phase 1 Existing Conditions report that was completed in 2016, Phase 2 has focused on understanding future transportation conditions in Quesnel, explored short and long-term improvement options, and outlines a recommended implementation strategy of projects and improvements for the corridor. This report encapsulates the Highway 97 Quesnel Transportation Plan including an assessment of future transportation conditions, the development of improvement options and guiding principles to evaluate the options, the multiple account evaluation (MAE) of advanced options, and the implementation strategy. This report also summarizes the community engagement undertaken over the course of the study, identifies potential risks for recommended improvements and outlines next steps.

The study area includes 13.9 kilometres of Highway 97 between Basalt Road to Highway 26 / Barkerville Highway (LKI Segment 1146 km 110.9 to km 124.3). The study area has been categorized into four study segments as shown in **Figure 1.1** to reflect the changing form and function of the highway through Quesnel. The study area also includes intersections in the downtown of Quesnel that interface directly with the corridor.

Figure 1.1: Highway 97 (Quesnel) Study Area



1.1 Study Background

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 16.

2 FUTURE MOBILITY ASSESSMENT

Building upon the existing conditions assessment previously completed in Phase 1 of the study, the future conditions assessment involves analysis of local economic conditions and growth forecasts, and analysis of the future traffic conditions on the Highway 97 study corridor. A summary of the future conditions analysis is provided as follows, and the full future conditions assessment is provided in **Appendix A**.

2.1 Future Travel Demand

Municipal projects and local economic conditions can have a noticeable influence on the projection of various growth figures including population and traffic. To conduct the traffic forecasts and future mobility assessment, the project team met with the City of Quesnel to understand municipal projects and economic conditions in the Quesnel area. In addition, Pearson Ellis Consulting Inc. was retained by Urban Systems to complete a socio-economic assessment entitled *Quesnel Socio-Economic Overview For Purposes of Highway Planning* (2017). The findings of the assessment are provided in **Appendix B**.

2.1.1 Quesnel Area Economic Conditions

The socio-economic assessment identified trends across many sectors and aspects of the community and some of the highlights from the report are listed as follows:

- ▶ The population of the Quesnel area has seen some minor decline, based on Census results. The future population is forecast to grow at a low rate.
- ▶ Currently, the economy of Quesnel is heavily dependent on the forestry industry and, despite much uncertainty in the future of this industry, it is expected that this industry will continue to be a major source of employment and significant contributor to heavy vehicle traffic on Highway 97 in the Quesnel area. The development of the Blackwater mine and Bonanza Ledge mine presents an opportunity for new sources of employment for the region in the future.
- ▶ G.R. Baker Memorial Hospital continues to grow and develop. This has added pedestrian and traffic movements to and from the hospital creating new issues and challenges with traffic flows along and across Front Street, which is one of the most problematic sections of the Highway 97 corridor through Quesnel.
- ▶ Community concerns for Highway 97 relate to access, safety, congestion and emissions through the Quesnel segment of the highway corridor.

2.1.2 Traffic Forecasts

The traffic volumes in the study area of Quesnel were analyzed at the 10 and 25-year horizons. To determine the future traffic volumes, existing traffic was factored using an appropriate background growth rate. The grown traffic volumes were combined with the volume of traffic expected to be generated by the proposed developments for a total projected traffic volume on the study network. The new development traffic was estimated using the Institute of Transportation Engineers (ITE) Trip Generation Manual 9th Edition. Upon estimating the trips generated, estimates for the distribution and assignment of development traffic were prepared based on an understanding of existing traffic patterns of the proposed developments. A detailed description of these forecasting assumptions is provided as follows.

2.1.2.1 Background Growth

To assess future conditions in the road network at the 10 and 25-year horizons, various sources were used to understand what growth trends the road network in the Quesnel area may be experiencing. These sources include:

- ▶ Historical Traffic Volumes;
- ▶ Historical Population Growth;
- ▶ Population Forecasts;
- ▶ Proposed Developments; and
- ▶ Socio-Economic Assessment (Pearson Ellis Consulting Inc.)

After careful analysis of the available information and resources, a growth rate of 0.5% per annum was determined to best predicted background growth in the region along Highway 97. This growth rate was applied to 2017 highway traffic volumes to grow them to 2027 and 2042 horizon volumes. Side street traffic was not factored as it was assumed there would be no background growth.

A second growth scenario was also analyzed based on a 1.5% growth rate for highway traffic. This was run as a sensitivity scenario to account for potentially higher growth in the Quesnel area.

2.1.2.2 Development Assumptions

The new developments that are proposed in the Quesnel area include a retail centre and drive-through restaurant on Rita Road, and a bowling alley on Racing Road. Details of these developments and the trip generation assumptions applied to the future traffic volumes are detailed in **Appendix A**.

2.1.2.3 Future Network Traffic Volumes

The trips generated by the proposed development and assigned to the study network were superimposed on the future background volumes to obtain the total network volumes. Future 2027 and 2042 horizons were analyzed using a 0.5% highway growth rate. A sensitivity scenario was also analyzed at the 2042 horizon using a 1.5% highway growth rate. The final volumes used in the analysis are provided in **Appendix A**.

2.2 Future Mobility Performance Analysis

The mobility analysis of the study network intersections was undertaken in accordance with the Ministry's general mobility performance criteria and thresholds. The complete mobility analysis for the future horizon years and

growth rate scenarios is provided in **Appendix A** and the traffic modelling reports are provided in **Appendix C**. A summary of the key findings from the future mobility analysis is provided in **Table 2.1**.

Table 2.1: Summary of Future Mobility Performance Conditions

	0.5% Background Growth	1.5% Background Growth
AM Peak	<ul style="list-style-type: none"> ▶ All intersections perform at a LOS A or B. ▶ None of the study intersection approaches exceed the v/c threshold of 0.9. ▶ The eastbound approach at the McNaughton Avenue intersection with Highway 97 operates at a LOS E. 	<ul style="list-style-type: none"> ▶ All intersections within the study area operate at LOS C or better. ▶ Side-street approaches at the intersections of McNaughton Avenue, Shepherd Avenue, and Racing Road operate at LOS F with v/c ratios above 1.0.
PM Peak	<ul style="list-style-type: none"> ▶ All intersections operate at a satisfactory LOS C or better. ▶ None of the study intersection approaches exceed the v/c threshold of 0.9. ▶ The eastbound approach at Shepherd Avenue reaches a LOS F. ▶ Minor side-street approaches perform at LOS E at McNaughton Avenue, Laurent Avenue, Carson Avenue, McLean Street, Marsh Drive (Moffat Bridge Approach), and Racing Road intersections. 	<ul style="list-style-type: none"> ▶ Side-street approaches at the intersections of McNaughton Avenue, Shepherd Avenue, and Racing Road reach a LOS F with v/c ratios above 1.0. ▶ The northbound side-street approach at the McLean Street intersection reaches a LOS F, but with a v/c ratio under 0.9.

Overall, traffic volumes are projected to grow at a slow-to-moderate pace and are not expected to exceed the highway's current capacity by the 2042 long-term horizon.

2.3 Problem Definition Update

The problem definition summarizes the key challenges and issues along Highway 97 through Quesnel, which has been established through the technical analysis undertaken in the existing conditions assessment (Phase 1 of the study), and in the preceding future conditions assessment.

Overall, the current alignment of Highway 97 is constrained through the downtown of Quesnel, which currently poses challenges identified in the existing conditions review that are projected to be intensified in the future. Side-street movements were found to present a challenge as high delays and poor LOS are experienced at some intersections at the 10 and 25-year horizons. These challenges are further discussed in the following problem definition statements, 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 several intersections along this segment. Without improvements along the corridor, the existing issues with the highway frontage roads will continue to be a challenge. Currently the highway frontage roads provide minimal vehicle queuing storage at highway intersections and can inhibit trucks from making turning movements without over-tracking into adjacent lanes and the road shoulder. At the 2027 and 2042 horizons, mobility performance is slightly worse compared to the existing conditions due to higher highway volumes, however, all approaches and intersections are projected to operate satisfactorily.

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

The North Star area of Highway 97 has many geometric design challenges that require significant upgrades and improvements to adhere to MoTI's current-day design standards and guidelines. Necessary upgrades include the Quesnel River Bridge No. 1569, Quesnel Overhead No. 01641, sidewalks on both structures, the off ramps to Valhalla Road and Dragon Hill Road, and directional signage on North Star Road. In addition to structure and infrastructure upgrades, side street mobility is projected to worsen at the 10 and 25-year horizons, specifically at the Racing Road intersection which is expected to experience delays and failing levels of service.

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

The Downtown Quesnel area of Highway 97 currently has safety concerns at several intersections including at Kinchant Street, McLean Street, Front Street, and St. Laurent Avenue. There are mobility performance challenges for side-street movements throughout this segment at the 2027 and 2042 projections due to the increase in highway traffic volumes. Specifically, the intersections of Shepherd Avenue and McNaughton Avenue are expected to perform poorly with high delays.

There is a horizontal curve with 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 Flat area would facilitate active modes wishing to travel between these two destinations.

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

In this Two Mile Flat 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. No existing or future mobility issues are expected for the intersections in this segment of the study area.

3 OPTION GENERATION AND ASSESSMENT

3.1 Guiding Principles

As described in the problem definition statement, the current alignment of Highway 97 becomes constrained through the downtown of Quesnel mainly due to topography and water bodies, land uses, and the CN Railway. In addition to regional traffic volumes, the highway serves a significant amount of local traffic needs as it is the only major north-south arterial route that connects with all the City's neighbourhoods and other feeder routes (i.e. Blackwater Road, Quesnel-Hydraulic Road, Anderson Road).

As discussed in the future conditions assessment, traffic volumes are projected to grow at a slow-to-moderate pace and are not expected to exceed the highway's current capacity by the 2042 long-term horizon. However, there are several challenges within each study segment along the corridor that requires different design solutions to similar issues. These issues include high volumes of heavy vehicles, intersection and segment safety concerns, geometric design constraints, side-street mobility and access management.

To guide the development of improvement options for each study segment on Highway 97, a set of guiding principles has been established based on the existing and future needs of the corridor. These guiding principles were also used in the evaluation of improvement options to ensure the improvements achieve the objectives of the project. The guiding principles are as follows:

- ▶ **Enhance the Highway to Support Local and Regional Functions** – Minimize the highway's impacts to the local community and develop a corridor that balances the function of the highway as a provincial route, and as a route that is frequently travelled by local users.
- ▶ **Improve Intersection and Highway Safety** – Improvements to highway geometry, intersection design, and access management need to be considered to improve safety conditions and reduce currently high collision and severity rates.
- ▶ **Support Active Transportation** - Pedestrian and bicycle movements are significant in the downtown and consideration should be given to improving the safety of pedestrian and bicycle traffic crossing the highway. Routes across the Quesnel River, between downtown Quesnel and Two Mile Flat and in the South Quesnel commercial area have also been identified by the City of Quesnel as important connections between residential areas and industrial and commercial employment destinations.
- ▶ **Improve Intersection and Corridor Mobility** – Some side-street approaches to Highway 97 experience long delays and/or challenging movements due to geometric constraints. Improvements to intersection controls, laning and access should be considered in the development of options.
- ▶ **Improve Access and Connectivity with the Local Road Network** – There are numerous public and private accesses that are located directly on the highway and many properties with more than one access. The Two Mile Flat, Downtown Quesnel, and the South Quesnel areas are where the majority of public and private accesses are located. Consolidating accesses and identifying connections to the local network to achieve better controlled access on the highway should be considered to improve safety conditions and traffic flow.
- ▶ **Mitigate Heavy Vehicle Impacts** – Significant heavy vehicle volumes exist on all segments of the corridor and have the greatest impact in the Downtown Quesnel segment to the safety and mobility of all

transportation users. Improvement options to mitigate heavy vehicle impacts should involve upgrades to geometric design, safety, access management, and the identification of alternate routes.

3.2 Design Criteria Considerations

The design of the existing Highway 97 alignment through Quesnel varies in different segments based on the highway standards implemented at the time each section of the highway was constructed or upgraded. Some sections of Highway 97 that were previously 2 lanes wide with posted speeds of 50 km/h, were upgraded to 4 lanes wide with posted speeds of 70 km/h to 80 km/h (i.e. Two Mile Flat and South Quesnel). Whereas, other sections through downtown Quesnel and over the Quesnel River Bridge have not seen upgrades due to various design and project constraints.

The design criteria for improvement options on the highway and for the alternate routes was developed with careful consideration to addressing the actual transportation problems and needs for improvements within the context of the existing highway's design. The criteria adheres to the guidelines and standards outlined in the *Geometric Design Guide for Canadian Roads* (TAC, 1998) and in the *BC Supplement to TAC Geometric Design Guide for Canadian Roads* (MoTI, 2007). Improvements to the existing highway alignment have been designed to support current day geometric design standards where possible, and where not possible, alternatives have been suggested.

The detailed design criteria sheets for Urban and Rural segments of Highway 97 through Quesnel are included in **Appendix D**. A summary of the design criteria considerations for the existing rural and urban segments of Highway 97 in Quesnel is provided in **Table 3.1**. Overall, the highway Segments A, B, and D are classified as rural segments and Segment C is classified as an urban segment.

Table 3.1: Highway 97 Physical and Operating Characteristics

Function	Rural Segments & Alternate Routes	Urban Segments
Location	North of Rome Avenue and South of Quesnel River Bridge	From Quesnel River Bridge to Rome Avenue
Mobility	70 – 80 km/h	50 km/h
Access	<ul style="list-style-type: none"> ▶ Good access to major centres / destinations ▶ Limited direct property access ▶ Signalized intersection spacing >400m – 800m ▶ Generally at-grade intersections, but some grade-separation at significant access points 	<ul style="list-style-type: none"> ▶ Good access to major centres / destinations ▶ Direct property access permitted ▶ Signalized intersection spacing >100m ▶ Generally at-grade intersections
Network Hierarchy	<ul style="list-style-type: none"> ▶ Connects to major municipal streets ▶ Continuous parallel local routes / frontage roads 	<ul style="list-style-type: none"> ▶ Connects to major / minor municipal streets ▶ Continuous parallel local routes / frontage roads
Transit	<ul style="list-style-type: none"> ▶ Supports transit on-highway where practical and beneficial ▶ Transit stops located off mainline wherever possible (e.g. frontage roads, side-streets). 	<ul style="list-style-type: none"> ▶ Supports transit on-highway where practical and beneficial ▶ Bus stops may be supported on mainline where safety and traffic capacity are not hindered.

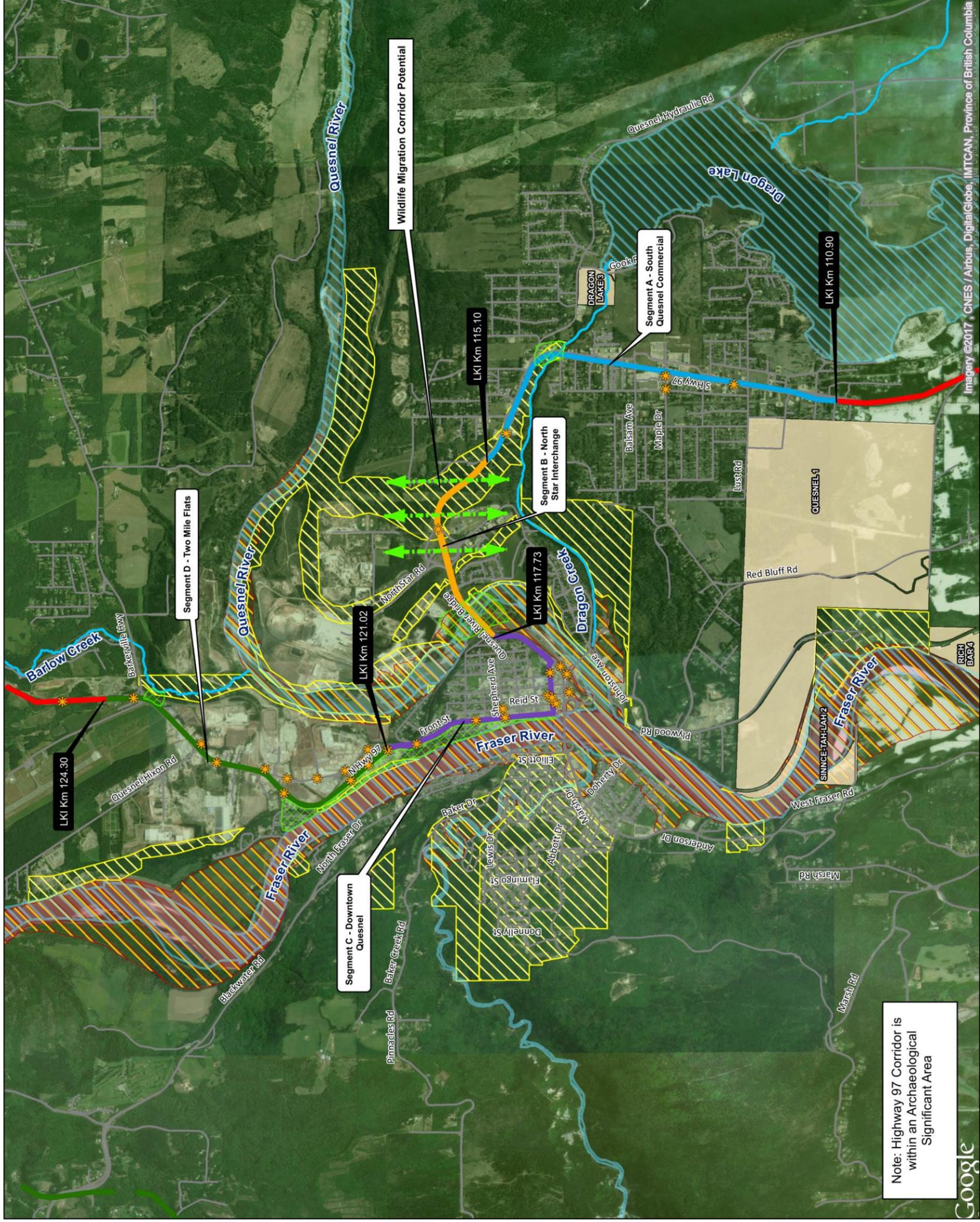
Function	Rural Segments & Alternate Routes	Urban Segments
Cycling	<ul style="list-style-type: none"> ▶ On shoulders in rural areas ▶ On multi-use pathways or cycle lanes parallel to the corridor 	<ul style="list-style-type: none"> ▶ On multi-use pathways or cycle lanes parallel to the corridor
Pedestrians	<ul style="list-style-type: none"> ▶ Safe, comfortable crossings ▶ Grade-separated crossings in high-speed areas ▶ At-grade crossings in lower-speed urban environments ▶ Separated sidewalks 	<ul style="list-style-type: none"> ▶ Safe, comfortable crossings ▶ At-grade crossings in lower-speed urban environments ▶ Sidewalks along Highway 97 in more urban / developed areas

3.3 Environmental Considerations

A desktop scan was conducted to identify and summarize environmental and archaeological constraints for the Highway 97 corridor study area. This task involved the review of environmental, archaeological and contaminated sites information from available reports, literature, maps, photos and databases. Biophysical components evaluated include: contaminated sites, topography, surficial geology, hydrogeology, surface water, fish and fish habitat, flora and fauna, species of management concern, and environmentally significant areas. Many of these environmental constraints are illustrated on an aerial map of Quesnel in **Figure 3.1**. A detailed account of the environmental and archaeological planning considerations and constraints is provided in the *Environmental and Archaeological Scan Report* in **Appendix E**.

3.4 Geotechnical Considerations

A desktop scan was conducted to identify and summarize geotechnical conditions, constraints and challenges for the Highway 97 corridor study area and for the improvement options developed within this study. The desktop review involved a review of previous studies and use of LiDAR imagery to identify known landslide features and potentially unstable terrain areas. The complete geotechnical review is detailed in the technical memorandum *Terrain Stability (Geohazard) Constraints – Summary Highway 97 Quesnel Transportation Plan* provided in **Appendix F**.



3.5 Option Development

Fourteen improvement options on the existing Highway 97 alignment and six alternate route option alignments were identified and developed to a conceptual design level. Each improvement option identified is described in further detail on the following option description sheets from **Section 3.5.3 to 3.5.7** of this report. Each sheet includes a description of the option, an image of the conceptual design¹, an evaluation of the option according to the guiding principles, conceptual level planning cost estimate, and an evaluation summary.

The options are organized accordingly:

- ▶ Alternate Routes
- ▶ Study Segment A – South Quesnel Commercial Area
- ▶ Study Segment B – North Star Area
- ▶ Study Segment C – Downtown Quesnel Area
- ▶ Study Segment D – Two Mile Flat Area

The conceptual design drawings including plan view horizontal profiles and vertical profiles for each option are provided in **Appendix G**.

Each option has been evaluated against the study's six guiding principles to determine if the option supports the study objectives. Based on this evaluation, one of three recommendations are provided for each option:

- ▶ **Screen-Out from Further Review** – this means the guiding principles evaluation has found a fatal flaw(s) with the option and the recommendation is to screen-out the option from further evaluation in the MAE and to not implement the option.
- ▶ **Advance to Multiple Account Evaluation** – this means the guiding principles evaluation has found an option could provide good benefits, however further evaluation in the MAE is needed to understand if the benefits outweigh the costs.
- ▶ **Advance to Implementation Plan** – this means the guiding principles evaluation has found an option provides multiple benefits (generally at a low cost) and the option is a high priority for implementation.

3.5.1 Cost Estimates

Conceptual planning-level project cost estimates have been developed for each option and are provided in **Appendix H** for all options. These cost estimates include the capital investment costs for planning, project management, property acquisition, design and engineering, environmental, construction, First Nations accommodation and regional recoveries. A contingency of 35% has been applied to each of these cost elements. Quantities for the cost estimates have been developed from the conceptual designs and items, and unit rates are based on the MoTI's Historical Construction Cost Data website. Unit rates for structural costs were provided by Mott MacDonald for this study, as detailed in the report *Highway 97 Quesnel Corridor Study – Structural Considerations* provided in **Appendix I**.

Costs for acquiring property were prepared by Gateway Land Services for options where significant property impacts were required outside of the existing Highway 97 alignment. Details of the properties impacted and the costs are outlined in their report *Highway 97 Quesnel Transportation Plan Phase II – Improvement Options*

¹ *Conceptual designs are preliminary drawings that require further preliminary design and engineering analysis prior to construction and do not include input from necessary field investigations such as geotechnical, environmental and archaeological investigations.*

Property Impact Study, provided in **Appendix J**. The property costs are only for fee simple lands. No assumptions for capacity building for First Nations are included in these conceptual planning-level project costs. Lastly, Environmental and Archaeological assumptions have not been addressed in the cost estimates prepared including any work related to investigations, mitigation or alterations.

3.5.2 Survey Information

Various topographical survey information sources were used to develop the conceptual designs for the improvement options developed. All of the options were developed, at a minimum, using model data from the Canadian Digital Elevation Model (CDEM) data with an accuracy of plus/minus 20 m. Image files were provided by the City of Quesnel and are from 2016. Further, LiDAR data was available along the whole length of Highway 97 and was incorporated into the design models to improve the design accuracy where this information was available. Additional LiDAR survey was taken by McElhanney Consultants in November, 2017 for the north-south interconnector route alignment with a high level of accuracy of ground surfaces with abnormalities including weeds, bushes and trees screened out.

3.5.3 Alternate Route Options

A total of six alternate route option alignments were identified and developed to a conceptual design level. The six options identified correspond to three identified route connections including:

- **North-South Interconnector** – a 2-lane or 4-lane highway connection around the north side of the downtown Quesnel peninsula including the replacement of the Quesnel River and Quesnel Overhead structures. Two options have been conceptualized and evaluated.
- **North-South Industrial Connector** – a 2-lane or 4-lane highway connection from the North Star Interchange, through industrial land uses and across a new structure over the Quesnel River to Highway 97 in the Two Mile Flat area. Three options have been conceptualized and evaluated, including a bypass option.
- **East-West Connector** – a highway connection from Highway 97 (just north of Pinecrest Road) and across a new structure over the Fraser River to Blackwater Road.

3.5.3.1 Option AR-1a: North-South Interconnector (4-Lane)

Background:

Many transportation issues on the study segment of Highway 97 occur in downtown Quesnel where six intersections experience high collision rates for frequency and/or severity; and, where the combination of high traffic volumes and a downtown urban environment increases travel time and delays. Further, heavy vehicles and trucks carrying dangerous goods impact perceived community safety as trucks travel through the downtown area along Front Street. Thus, there is a need to explore options to move highway traffic out of downtown Quesnel.

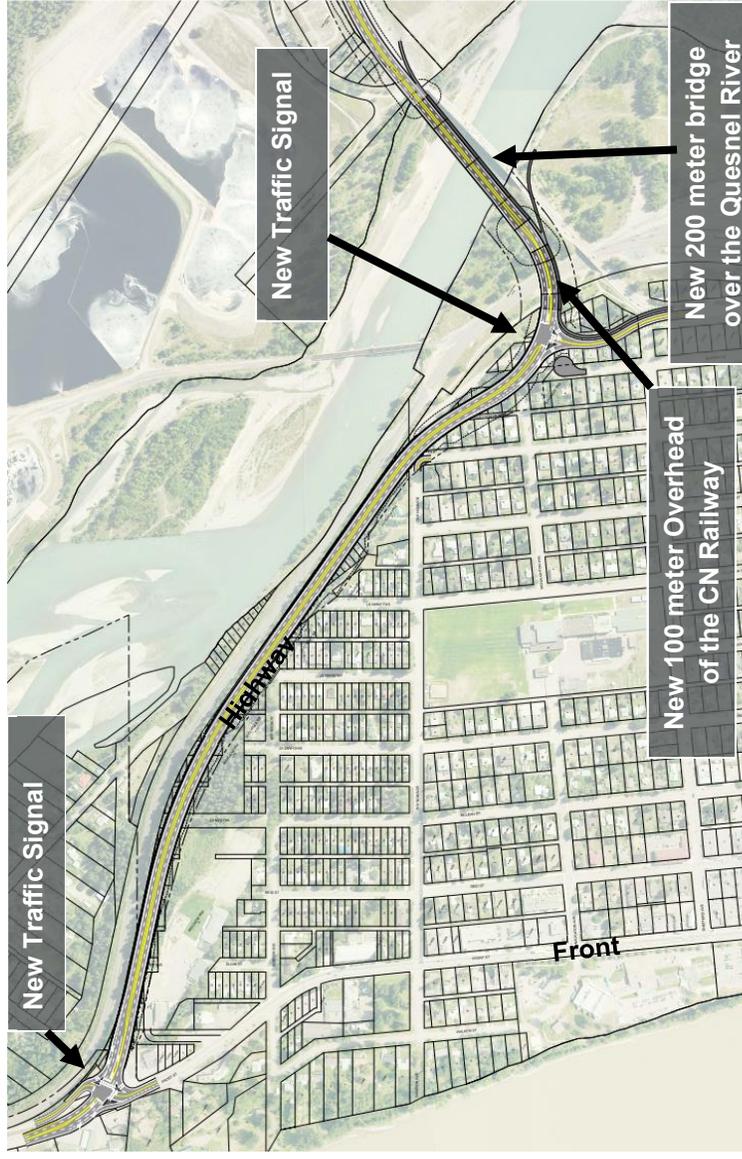
Option Description:

Two options of the North-South Interconnector route were explored including a 4-lane option and a 2-lane option. Both options cross the Quesnel River north of the existing bridge to allow for the construction of the bridge and approaches while maintaining service on the existing highway network.

This 4-lane option includes two new structures that would replace the Quesnel River Bridge and Quesnel Overhead structure on an alignment that would direct highway traffic around downtown Quesnel. It includes two new signalized intersections that would provide connections onto the existing Highway 97 alignment, including Front Street and Moffat Bridge Approach.

Design Consideration:

This 4-lane option allows for the existing highway to remain open to traffic flow during construction. This 4-lane option provides typical 3.6 metre lane widths, 2.5 metre shoulders, a 2.6 metre median, and horizontal and vertical curves to support travel speeds of up to 60 km/h. Other design considerations would likely include sound walls, either an open shoulder or curb and gutter shoulder, and clear zone requirements.



A number of property acquisitions would be required near the location of the new structures and along the route alignment to provide the necessary width for cut and fill slopes and highway right of way requirements. Many existing residential structures would be impacted as part of these property requirements. The property acquisitions would mostly be required in a well-established downtown residential neighbourhood so as to avoid impacts to the CN railway located immediately north of the proposed alignment.

The through movements on this alternate route support WB-24 design vehicles; however, turning movements on / off Front Street and Moffat Bridge Approach at both intersections are difficult to accommodate without widening both intersections, which would require more property acquisition.

Option AR-1a: Evaluation Summary

Mobility

- ▶ Local and regional network connectivity is improved with the addition of a parallel route to Highway 97 in the downtown;
- ▶ Benefits to highway mobility would be observed as an estimate of 10,300 vehicles per day (vpd) could be redistributed onto the new route by 2042 under the 0.5% background growth rate, as shown in **Figure 3.2**;
- ▶ Heavy vehicle traffic on the existing Carson Avenue and Front Street sections of Highway 97 could be completely removed and directed to use this new alternate route alignment (as confirmed through the origin-destination analysis);

Safety

- ▶ By realigning the highway, approximately 13 public accesses and many private driveways can be eliminated from the highway;
- ▶ 7 signalized intersections are removed from the existing highway alignment through Downtown Quesnel;
- ▶ The high collision rate and severity issues at the intersections of Highway 97 and Kinchant Street, McLean Street, Front Street, St. Laurent Avenue, and McNaughton Avenue are mitigated by the redistribution of regional trips and many local trips to this alternate route;

Social / Community

- ▶ Highway 97 through the downtown including the sections on Carson Avenue and Front Street could be returned to the City of Quesnel and repurposed as part of an expanded / revitalized downtown road network;

Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic	✓				
Improve Safety		✓			
Ped / Bike Conditions		✓			
Level of Service	✓				
Access Management / Local Connectivity	✓				
Mitigate Heavy Vehicle Impacts	✓				

Conceptual Planning-Level Project Cost Estimate:

Option AR-1a: \$162,959,887

The conceptual design drawing is provided in **Appendix G**.
The cost estimate breakdown is provided in **Appendix H**.

Other

- ▶ Based on the proposed alignment, the amount of property acquisitions required for this 4-lane option is not significantly more than for the 2-lane option;
- ▶ Pedestrian and bicycle facilities would be upgraded on the new structures with increased travel width and improved connections to the riverfront trail system on both sides of the river;
- ▶ There are geotechnical challenges on the slopes of the alignment that will require further geotechnical and site investigations;
- ▶ This option's proposed alignment improves highway traffic reliability by removing the impacts that the downtown Quesnel freshet detour has on the existing highway alignment. However, the freshet detour will still impact local traffic.

Review of Option AR-1a: Option AR-1a offers a long-term solution to address the highway traffic and heavy vehicle impacts in the Quesnel downtown by diverting most heavy vehicle traffic and traffic passing through only the downtown onto a dedicated route. This option should be compared to Option AR-1b and to the online combination of Options B1, C1 and C2-b. Thus, it is recommended that this option be advanced to the MAE for further evaluation.

Recommendation for Option AR-1a

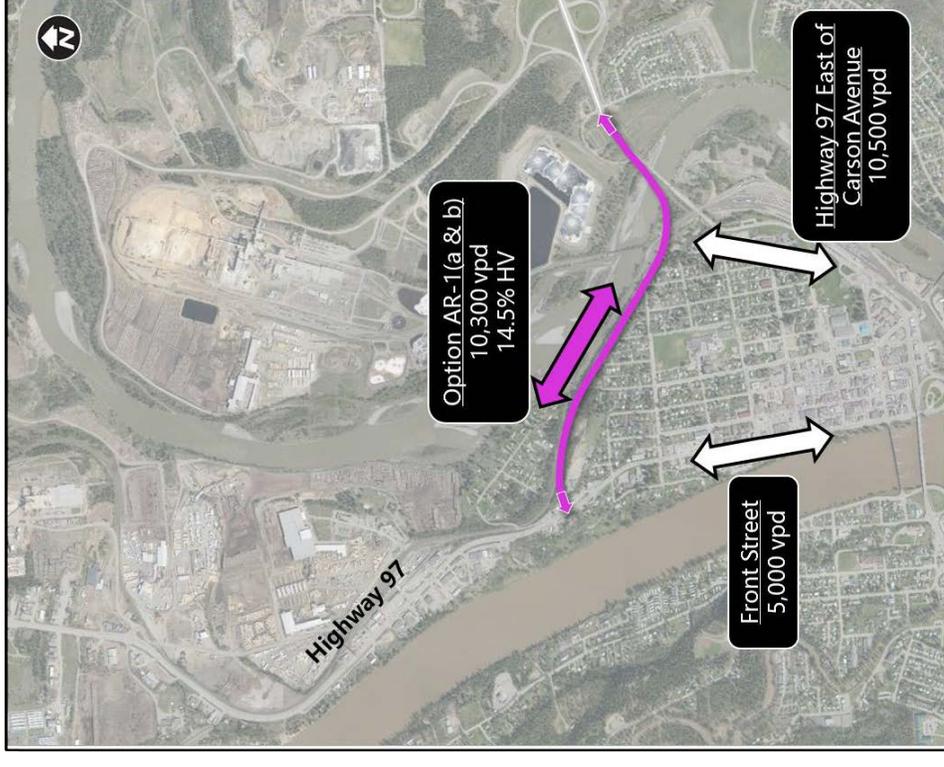
- ▲ Advance to Multiple Account Evaluation

3.5.3.2 Option AR-1b: North-South Interconnector (2-Lane)

Option Description:

This 2-lane alternate route option crosses the Quesnel River north of the existing bridge. It includes two new 4-lane structures that would replace the Quesnel River Bridge and Quesnel Overhead structure on an alignment that would direct highway traffic around downtown Quesnel. It includes two new intersections that would provide connections onto the existing Highway 97 alignment, including Front Street and Moffat Bridge Approach.

Figure 3.2: Forecast Usage of the North-South Interconnector (2042 Horizon, 0.5% Background Growth)

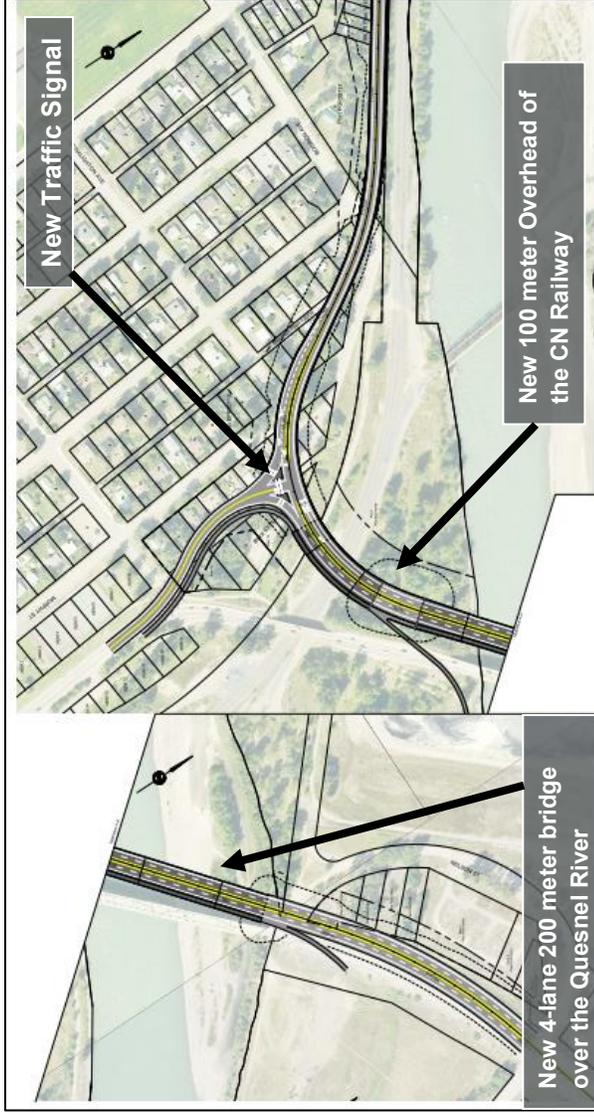


While another 2-lane alignment was also investigated with the bridge and overhead replacement located south of the existing structures, it was found through the structural review that this alignment variation would be too challenging to construct at the west end of the Quesnel Overhead while keeping Highway 97 open to traffic.

Design Consideration:

This 2-lane option allows for the existing highway to remain open to traffic flow during construction. This option provides typical 3.6 metre lane widths, 2.5 metre shoulders and horizontal and vertical curves to support travel speeds of up to 60 km/h. A median treatment would be considered for safety conditions, but not required. Other design considerations would likely include sound walls, either an open shoulder or curb and gutter shoulder, and clear zone requirements.

Some property acquisitions would be required near the location of the new structures and along the route alignment to provide the necessary width for cut and fill slopes and highway right of way requirements. However, the difference of impacts to existing houses and buildings in comparison to the 4-lane option is minimal. The property acquisitions would mostly be required in a well-established downtown residential neighbourhood so as to avoid impacts to the CN railway located immediately north of the proposed alignment. That said, this 2-lane option could serve as the first phase of the north-south interconnector where property and ROW is obtained to support future 4-laning of a 2-lane interconnector.



The through movements on this alternate route support WB-24 design vehicles; however, turning movements onto and off Front Street and Moffat Bridge Approach at both intersections are difficult to accommodate without widening out both intersections, which would also require more property acquisition.

Option AR-1b: Evaluation Summary

In addition to those listed for Option AR-1a:

- ▶ The amount of property acquisitions and impacts to structures is not significantly less than that required for the 4-lane option;
- ▶ A 2-lane alignment provides desirable mobility performance and traffic flow up to the ultimate and beyond the 25-year horizon;
- ▶ Strong consideration should be given to provide 4 lanes to ensure the north-south interconnector can provide a long term solution in the range of 50 to 75 years from present and can accommodate the potential for future unforeseen increases in traffic volumes;
- ▶ The conceptual project cost estimate for Option AR-1b (2-lane) is \$154,523,536, or 5.2% less than the 4-lane option;

Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic	✓				
Improve Safety		✓			
Ped / Bike Conditions		✓			
Level of Service	✓				
Access Management / Local Connectivity	✓				
Mitigate Heavy Vehicle Impacts	✓				

Conceptual Planning-Level Project Cost Estimate:

Option AR-1b: \$154,523,536

The conceptual design drawing is provided in **Appendix G**. The cost estimate breakdown is provided in **Appendix H**.

Review of Option AR-1b: Option AR-1b offers a solution to address the highway traffic and heavy vehicle impacts in the Quesnel downtown by diverting most heavy vehicle traffic and traffic passing through only the downtown onto a dedicated route. However, the cost to construct this option is not significantly less than the cost to construct the 4-lane Option AR-1a, and it would have many of the same impacts to property as the 4-lane option. In the far long-term (25 to 75 years), the 4-lane North-South Interconnector will provide a more reliable and consistent design and driver experience with the adjacent 4-lane sections of Highway 97. Thus, it is recommended that this 2-lane option be screened-out from further review and from implementation.

Recommendation for Option AR-1b

Screen-out from further review and from implementation.

3.5.3.3 Options AR-2(a & b): North-South Industrial Connector

Background:

Previous planning studies including *The Quesnel Highway 97 Local Improvement Study* (Reid Crowther, 1998) and *The Quesnel North-South Industrial Connector Feasibility Study* (Urban Systems, 2004) have looked at options to provide an alternate route for heavy trucks and highway traffic to bypass downtown Quesnel between the North Star Interchange and Two Mile Flat area. Two options for this north-south industrial connector route have been revisited to understand the design considerations, benefits and drawbacks as a potential solution.

Overview and Design Description:

Several crossing locations in the vicinity of the previously studied improvement options were investigated and found that the grades could not be achieved to meet the design criteria. To support the original alignment (shown below), a tunnel under the CN railway would be required. This is both a costly and difficult option to build under an active railway. For this reason, we investigated a location where the grades and crossing the railroad could be accommodated to meet the design criteria.

Options AR-2a and AR-2b utilize the existing North Star Interchange and run north along the existing North Star Road and Sword Avenue which allows for an intersection at Sword Avenue eastbound. This alignment maintains all existing access points and crosses the existing overpass on North Star Road. The Quesnel River Bridge is located at a point on the river that is narrow and straight to minimize issues to the structure and minimize the length. The alignment then curves up through the log storage yard to gain an acceptable grade to the highway.



Original N-S Industrial Connector Alignment

(Adapted from *Quesnel North-South Industrial Connector Feasibility Study* (2004, Urban Systems Ltd.)



Option AR-2a: North-South Industrial Connector

Design Consideration:

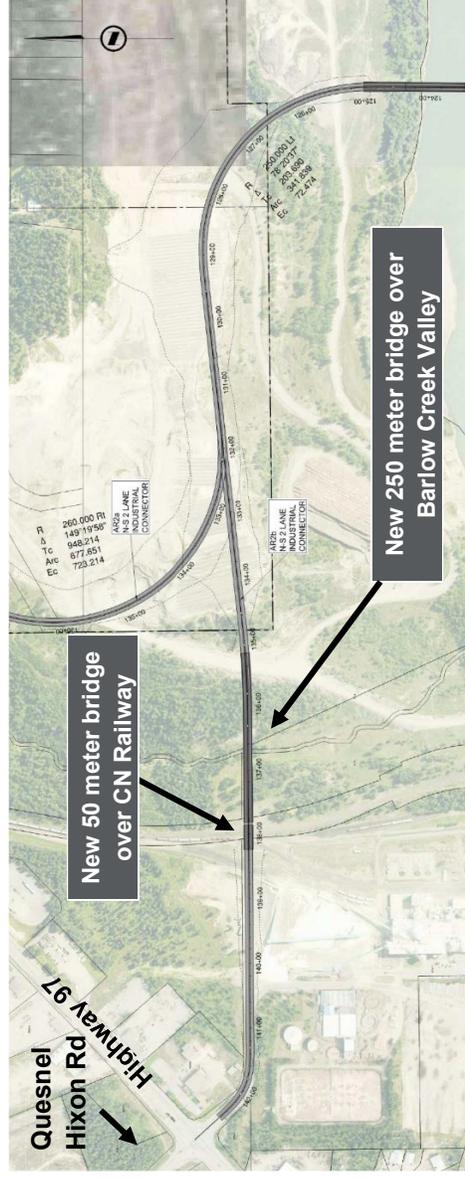
This option curves up to the north crossing under the power lines and over Barlow Creek and the CN railway, tying to Highway 26 east of the existing Highway 97 and Highway 26 intersection. A 2-lane rural arterial undivided road standard was investigated with vertical and horizontal curves that would support vehicle speeds up to 70-80 km/h. In addition to the 400 meter bridge structure required to cross the Quesnel River, a second overhead structure of approximately 100 meters in length would cross Barlow Creek and the CN railway. A median treatment would be considered for safety conditions, but not required. Significant property acquisitions would be required as this route follows an alignment through the industrial site of Cariboo Pulp and Paper (on some existing internal roads) and through industrial lands on the north side of the Quesnel river. Given the internal road network on the Cariboo Pulp and Paper site serves a variety of private transportation functions (e.g. heavy equipment and machinery movements), there is potential that a third structure would be required to maintain grade separation between a public right of way and private uses.

This alignment, along with Option AR-2b supports turning movements for WB-24 design vehicles.

Option AR-2b: North-South Industrial Connector

Design Consideration:

This option runs west crossing Barlow Creek, CN railway and under the power lines tying to Highway 97 at the Finning Road/Quesnel-Hixon Road intersection. A 2-lane rural arterial undivided road standard was investigated with vertical and horizontal curves that would support vehicle speeds up to 70-80 km/h. In addition to the 400 meter bridge structure required to cross the Quesnel River, up to two additional overhead structures, one 250 meters in length and one 50 meters in length would be needed to cross Barlow Creek and the CN railway. A median treatment would be considered for safety conditions, but not required.



Similar to Option AR-2a, significant property acquisitions would be required as this route follows an alignment through the industrial site of Cariboo Pulp and Paper (on some existing internal roads) and through industrial lands on the north side of the Quesnel river. Given the internal road network on the Cariboo Pulp and Paper site serves a variety of private transportation functions (e.g. heavy equipment and machinery movements), there is potential that a third structure would be required to maintain grade separation between a public right of way and private uses. This alignment, along with Option AR-2a supports turning movements for WB-24 design vehicles.

Option AR-2(a & b): Evaluation Summary

Mobility

- ▶ Both options mainly support a regional connection to move through traffic on Highway 97 around the core area of Quesnel;
- ▶ Benefits to highway mobility would be observed as an estimate of between 8,100 to 9,800 vpd could be redistributed onto the new route by 2042 under the 0.5% background growth rate, as shown in **Figure 3.3**;
- ▶ Heavy vehicle traffic on Highway 97 in Downtown Quesnel would be partially reduced assuming appropriate guide signage and heavy vehicles would be required to use either alternate route Option AR-2a or AR-2b;
- ▶ Highway 97 through the downtown would continue to be required and maintained as a highway in addition to either alternate route option;
- ▶ The number of public and private accesses on the Highway would be unchanged;
- ▶ Option AR-2a provides an alignment around Two Mile Flat, which may be perceived to be more of a bypass route than a connection between South Quesnel and the industrial land uses in Two Mile Flat;

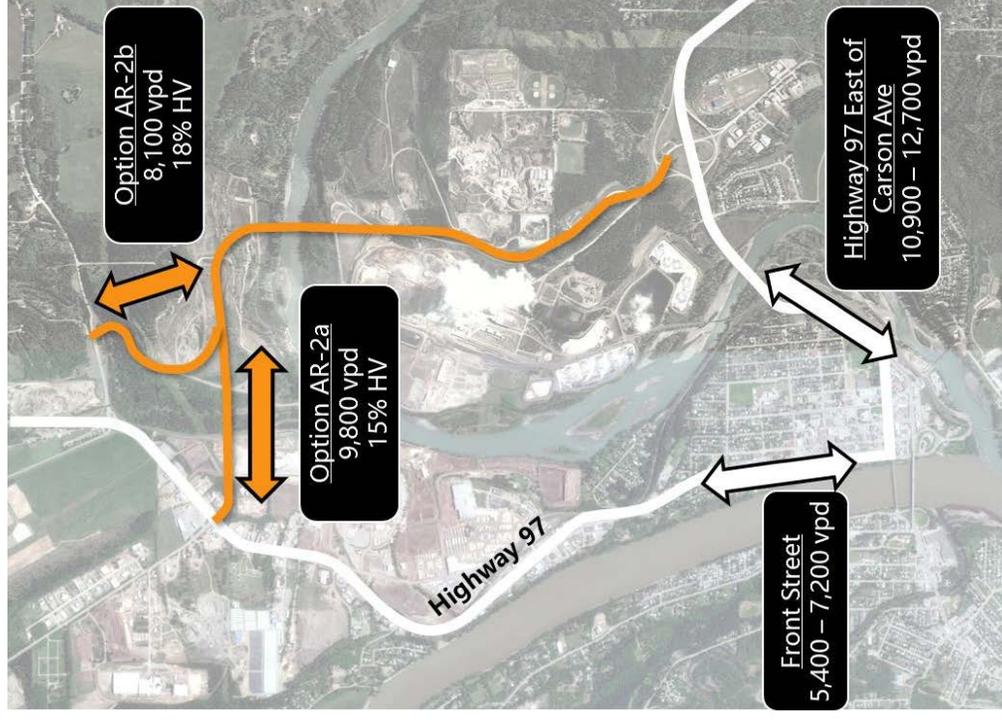
Safety

- ▶ Road safety on the existing highway network would be somewhat improved by a partial redistribution of traffic volumes to this industrial connector route; however, this would likely be temporary due to future traffic volume growth;

Social / Community

- ▶ This option is not favoured by the City of Quesnel as it does not effectively divert industrial traffic from West of the downtown (West Quesnel) off of Front Street;

Figure 3.3: Forecast Usage of the North-South Industrial Connector (2042 Horizon, 0.5% Background Growth)



- ▶ If the Ministry were to implement this option and seek to relocate the Highway 97 route onto the North South Industrial Connector, the City would likely be unwilling to take ownership of the existing highway assets including the Quesnel Overhead and Quesnel River Bridge;

Other

- ▶ Rehabilitation and/or replacement of the Quesnel River Bridge and Quesnel Overhead bridge would still be required, despite these alternate route options;
- ▶ New operation and maintenance costs for both options would be significantly high, considering that both routes would be intended to provide a secondary route to Highway 97 and the existing highway alignment would still need to be maintained;
- ▶ The alignment of both options traverses the Quesnel River Slide Complex that is located on the north side of the Quesnel River crossing; which is a known geotechnical hazard. Thus, constructability of this option may be severely restricted;
- ▶ The geotechnical conditions of this route are challenging as this route traverses the Quesnel River Slide Complex, as described in Amed Foster Wheeler Environment and Infrastructure’s Technical Memorandum included in **Appendix F**;

Review of Option AR-2(a&b)

Option AR-2(a&b) presents a long-term solution to reduce highway traffic on the existing corridor and to move some heavy vehicles off of Front Street. However, this option does not provide a solution to removing all pass-through heavy vehicles from Front Street as heavy trucks from West Quesnel are unlikely to use this alternate route. Further, this option has some major geotechnical challenges that could further increase construction costs pending further site investigations. While these challenges could be addressed, this route is not supported by the City of Quesnel and it would not be possible for the MoTI to devolve the existing Quesnel River Bridge, Quesnel Overhead and highway alignment through downtown and Two Mile Flat area. Thus, the MoTI would incur responsibility for replacing the existing bridges, and for building a new alternate route with at least two additional structures. The cost of these capital improvements would be prohibitive compared to the benefits that would be achieved.

Recommendation for Option AR-2a and AR-2b:

- Screen out from further review and implementation.

Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic		✓			
Improve Safety		✓			
Ped / Bike Conditions			✓		
Level of Service		✓			
Access Management / Local Connectivity			✓		
Mitigate Heavy Vehicle Impacts	✓				

Conceptual Planning-Level Project Cost Estimate:

Option AR-2a: \$191,599,647

Option AR-2b: \$220,039,945

The conceptual design drawing is provided in **Appendix G**.

The cost estimate breakdown is provided in **Appendix H**.

3.5.3.4 Option AR-3: East-West Connector

Background:

The East West connector option has been previously studied with the original purpose of providing a new crossing over the Fraser River to serve truck logging traffic coming from the Blackwater / Nazko lands west of Quesnel to industry in Two Mile Flat. Previous studies included a *Quesnel East-West Connector Business Case* (PriceWaterhouseCoopers, 2003), a *Quesnel East-West Connector Business Case* (Northern Region and Cariboo District, MoTI, 2003) and the *East West Connector Quesnel – Mobility Benefits* (Urban Systems, 2014).

Option Description:

This 2-lane option runs from Highway 97 just south of the Lear Road/Keis Road intersection west through the industrial area dropping down into the agricultural area and across the Fraser River. It then raises up on the bend above the river and ties to Blackwater Road near its intersection with Yargeau Road. The East-West connector is not considered to provide an alternate route to the existing Highway 97 alignment through Quesnel. However, it would provide an alternate route for all traffic, notably logging truck traffic, travelling between Blackwater Road and the Two Mile Flat area without using the Moffat Bridge and Highway 97 along Front Street in Downtown Quesnel.

Design Consideration:

This alternate route would adhere to a 2-lane rural arterial undivided road standard with vertical and horizontal curves that would support vehicle speeds up to 70-80km/h. Given the width of the Fraser River at the crossing location, a significant bridge span of 600 meters in length would be required. In addition, the slopes on either side of the Fraser River are steep and would require significant cuts and fills to achieve grades that fall within the acceptable design criteria. Still, a maximum grade of 7.0% would be required over a distance of 500 – 700 meters on both sides of the river to support this alignment.

This route does not use any existing road alignments, and thus, will require property acquisition from mainly industrial and agricultural land uses. This alignment, along with Option AR-2b supports turning movements for WB-24 design vehicles.



Option AR-3: Evaluation Summary

Mobility

- ▶ While this option provide better local connectivity between Two Mile Flat and Blackwater Road, it also has the effect of adding additional northbound traffic from logging and industrial sites south of Quesnel to use Front Street to access the East-West Connector (as opposed to using the Moffat Bridge);
- ▶ As shown in **Figure 3.4**, approximately 3,700 vpd would use the East West Connector, but many of these vehicles would continue to/from their destination south of downtown Quesnel instead of using the Moffat Bridge crossing;
- ▶ By 2042, the volumes on Front Street could increase from a future base level of 15,300 vpd to 17,500 vpd, resulting in worsened conditions on Highway 97 in downtown Quesnel;
- ▶ Some heavy vehicle traffic on Front Street would be reduced; however, this would only include trucks travelling between Blackwater Road and Two Mile Flat;
- ▶ There are many other heavy truck movements between South Quesnel and North Quesnel that would continue to use Highway 97 in the downtown to access industrial sites in and around Two Mile Flat and Cariboo Pulp and Paper;
- ▶ The number of public and private accesses on the Highway would mostly go unchanged, except for the addition of a new intersection at Highway 97 in Two Mile Flat to support this route;

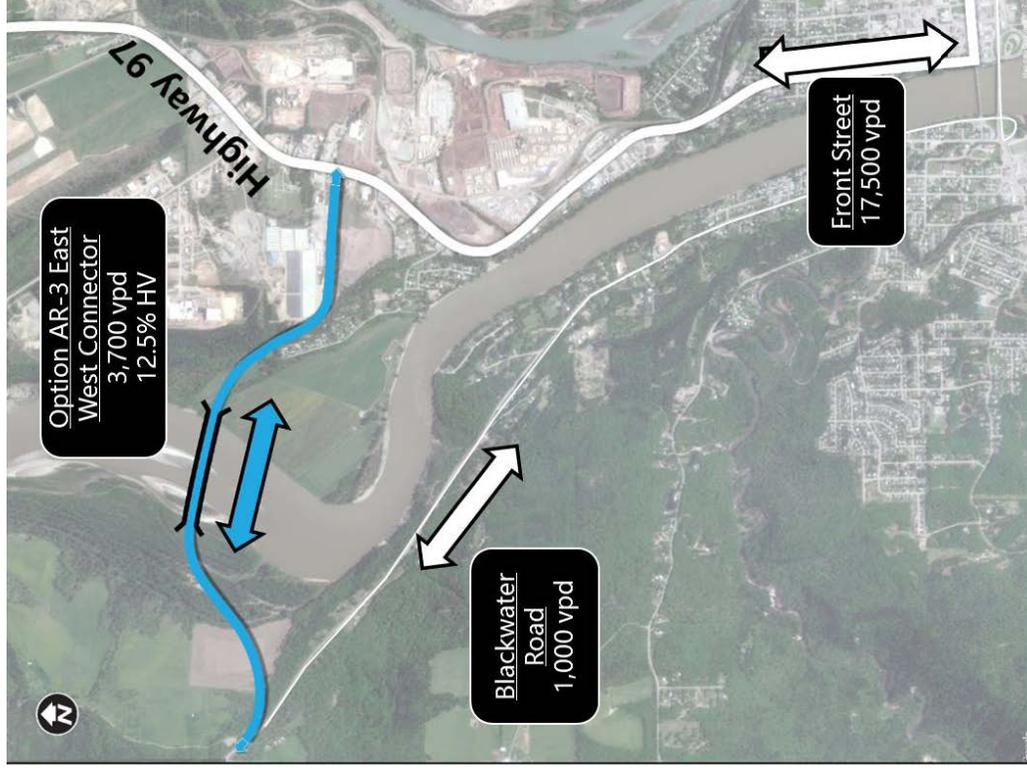
Safety

- ▶ Highway safety may observe some moderate improvements as this connection would reduce many of the heavy vehicles that travel between West Quesnel and the Two Mile Flat area; however this benefit may be offset by the increase in passenger vehicle traffic that may choose to take Front Street to access Blackwater Road from areas south of downtown Quesnel;

Social / Community

The City of Quesnel reviewed this option and supports its development when the volume of industrial traffic justifies the cost;

Figure 3.4: Forecast Usage of the East-West Connector (2042 Horizon, 0.5% Background Growth)



Other

- ▶ Rehabilitation and/or replacement of the Quesnel River Bridge and Quesnel Overhead bridge would still be required, despite this alternate route option;
- ▶ Operation and maintenance costs would increase substantially to maintain approximately 3.5km of new roadway surface and the 600-meter-long bridge deck surface area;
- ▶ the geotechnical conditions of this route are challenging, as described Amed Foster Wheeler Environment and Infrastructure’s Technical Memorandum included in **Appendix L**;
- ▶ Option AR-3 traverses five known geohazard constraints including the Gravel Pit Slide, Garbage Dump Slide, West Bank of Fraser River, Upper Fraser River Valley Slope, and the Terrace Slope Along Yargeau Road;
- ▶ Each known geohazard requires further site investigation;

Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic			✓		
Improve Safety			✓		
Ped / Bike Conditions			✓		
Level of Service					✓
Access Management / Local Connectivity			✓		
Mitigate Heavy Vehicle Impacts		✓			

Conceptual Planning-Level Project Cost Estimate:

Option AR-3: \$163,295,871

The conceptual design drawing is provided in **Appendix G**.
The cost estimate breakdown is provided in **Appendix H**.

Review of Option AR-3

Overall, Option AR-3 is a significant infrastructure project with a significant cost that provides few benefits to highway users and would be used by a small volume of local users travelling between Blackwater Road and the Two Mile Flat area. This option does not address the existing challenges on Highway 97 such as the need to replace the Quesnel River Bridge and Quesnel Overhead, nor does it address the safety issues through downtown Quesnel.

Recommendation for Option AR-3:

- Screen out from further review and implementation.

3.5.3.5 Option AR-4: North-South Bypass

Background:

The previous planning study *The Quesnel Highway 97 Local Improvement Study* (Reid Crowther, 1998) looked at the option to provide a full bypass of downtown Quesnel and Two Mile Flat for Highway 97 traffic. This bypass option was revisited to further understand the design considerations, benefits and drawbacks as a potential solution.

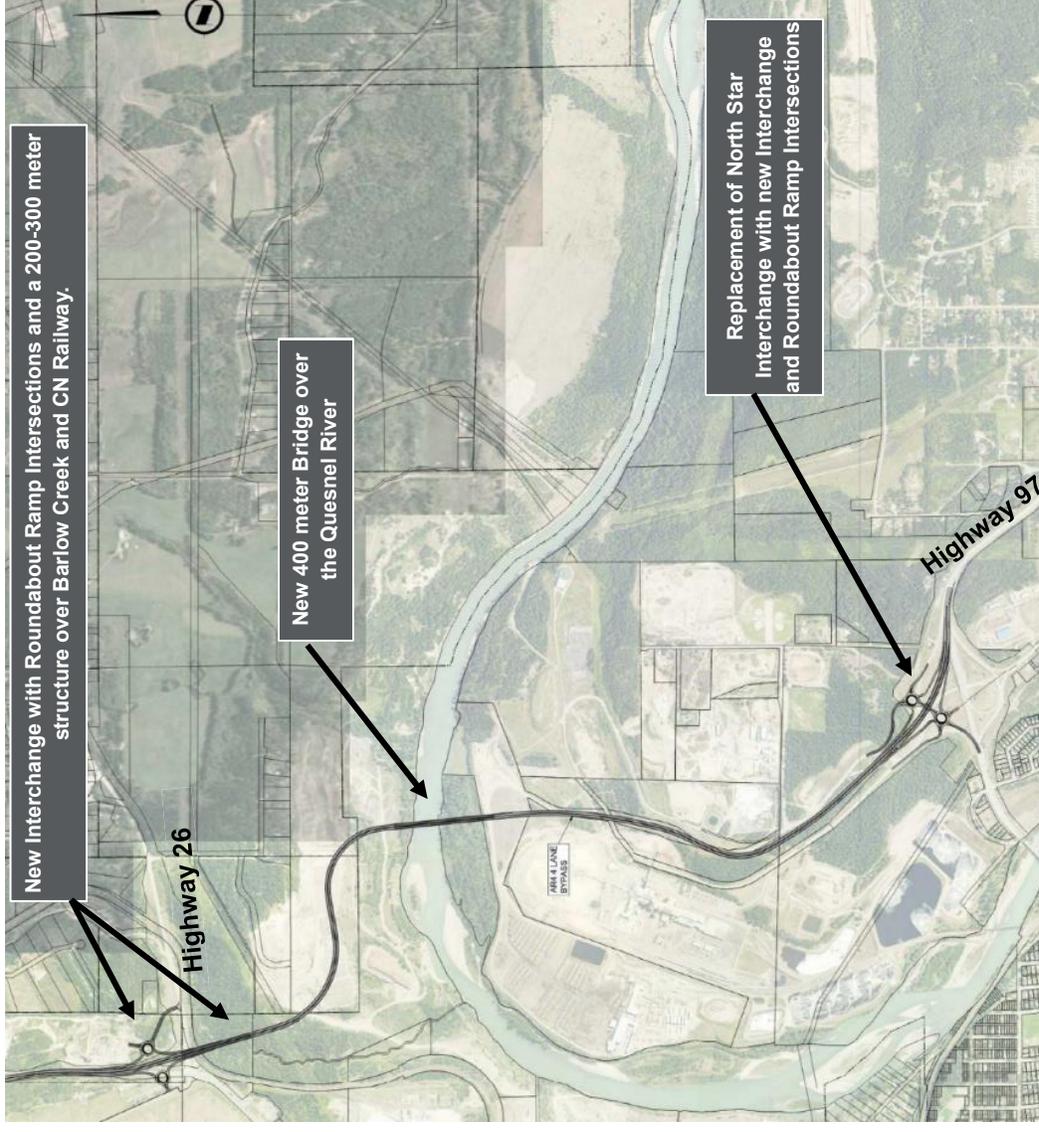
Option Description:

This option bypasses the city with a 4-lane highway from the North Star Interchange to the Highway 26 intersection. Highway 97 through downtown Quesnel and Two Mile Flat could be converted to the City's local road network, and this connection would become the new alignment for Highway 97.

The option replaces the North Star interchange with a roundabout interchange that allows for the highway to have free flow movement and avoids the existing city water infrastructure. Upon further design, the existing interchange may be able to be incorporated.

Design Consideration:

The alignment will require an extension to the existing overpass on North Star Road from the mill. The Quesnel River bridge crossing is at 2.5% grade and the hill up towards Highway 26 is at 6.1%. The alignment cross Barlow Creek, CN railway and Highway 26 on an approximately 200 – 300 meter long structure into a roundabout interchange. Consideration will need to be taken into account for the proximity of the airport and the required clearances with regards to the structure and lighting heights.



Significant property acquisitions would be required as this route follows an alignment through the industrial site of Cariboo Pulp and Paper (on some existing internal roads) and through industrial lands on the north side of the Quesnel river. Given the internal road network on the Cariboo Pulp and Paper site serves a variety of private transportation functions (e.g. heavy equipment and machinery movements), there is potential that a third structure would be required to maintain grade separation between a public right of way and private uses.

This alignment, along with Option AR-2b supports turning movements for WB-24 design vehicles.

Option AR-4: Evaluation Summary

Mobility

- ▶ This option supports regional connectivity and would reduce travel times for drivers passing through Quesnel without stopping; however, only a small percentage of trips are actually pass-through trips;
- ▶ Benefits to highway mobility would be observed as an estimate of 8,100 vpd day could be redistributed onto the new route by 2042 under the 0.5% background growth rate, as shown in **Figure 3.5**;
- ▶ While this alternate route would become the new Highway 97 alignment, only a portion of the existing highway traffic in the downtown would be redistributed to this new route;

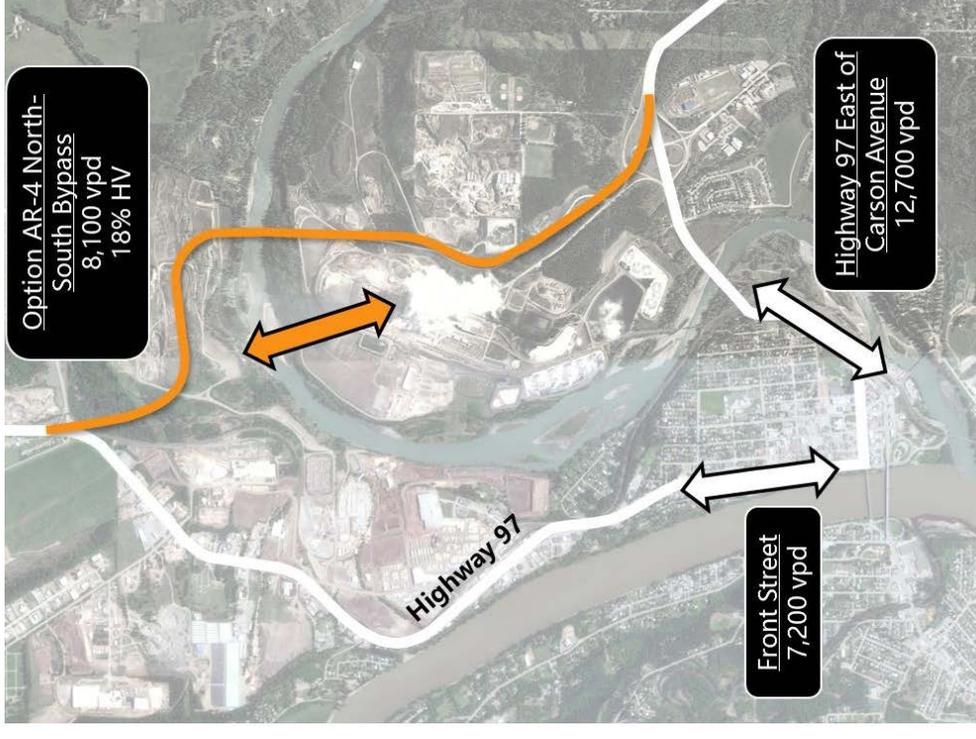
Safety

- ▶ Safety issues at intersections in downtown Quesnel and access management issues in the Two Mile Flat area would be partially alleviated; but not completely eliminated;
- ▶ Heavy vehicle traffic entering Quesnel from west of the Fraser River would still require using Front Street and/or the Quesnel River and Quesnel Overhead bridges; thus not all heavy vehicle impacts in the downtown could be eliminated;

Social / Community

- ▶ There are no notable improvements or changes to pedestrian and bicycle conditions with this option;
- ▶ This option is not supported by the City of Quesnel as it does not divert industrial traffic from West of the downtown (West Quesnel) off of Front Street;

Figure 3.5: Forecast Usage of the North-South Bypass (2042 Horizon, 0.5% Background Growth)



- ▶ If the Ministry were to implement this option and seek to relocate the Highway 97 route onto the North-South Bypass, the City would be unwilling to take ownership of the existing highway assets including the Quesnel Overhead and Quesnel River Bridge;

Other

- ▶ While this option would realign Highway 97 around the east side of Quesnel, the Quesnel River Bridge and Quesnel Overhead structures would need to be retained for local road network connectivity; thus, rehabilitation or replacement of the existing structures would still be required;
- ▶ Similar to Option AR-2(a&b), the geotechnical conditions of this route are challenging, as described further within the geotechnical review completed by Amed Foster Wheeler Environment and Infrastructure, provided in **Appendix F**;
- ▶ The alignment of this option traverses the Quesnel River Slide Complex that is located on the north side of the Quesnel River crossing; which is a known geotechnical hazard. Thus, constructability of this option may be severely restricted;

Review of Option AR-4

The North-South Bypass is a revisited solution that has been explored many times prior to this study. This option does not provide a solution to reducing all pass-through heavy vehicles from Front Street as heavy trucks from West Quesnel are unlikely to use this alternate route. This option has some major geotechnical challenges that could further increase construction costs pending further site investigations. While these challenges could be addressed, this route is not supported by the City of Quesnel and it would not be possible for the MoTI to devolve the existing Quesnel River Bridge, Quesnel Overhead and highway alignment through downtown and Two Mile Flat area. Thus, the MoTI would incur responsibility for replacing the existing bridges, and for building this bypass route that already has a conceptual project cost of \$426 Million. As a result, the cost of this project would be prohibitive compared to the benefits that could be achieved.

Recommendation for Option AR-4:

- Screen out from further review and implementation.

Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic		✓			
Improve Safety	✓				
Ped / Bike Conditions			✓		
Level of Service	✓				
Access Management / Local Connectivity	✓				
Mitigate Heavy Vehicle Impacts		✓			

Conceptual Planning-Level Project Cost Estimate:

Option AR-4: \$425,979,419

The conceptual design drawing is provided in **Appendix G**. The cost estimate breakdown is provided in **Appendix H**.

3.5.4 Study Segment A – South Quesnel Commercial Options

A set of 6 improvement options were identified for Highway 97 within Study Segment A – South Quesnel, as previously defined from the intersection of Basalt Road / Highway 97 to Racing Road / Highway 97. These options were developed to address the existing transportation challenges and issues identified from the existing conditions

assessment and as defined in the problem definition statement. In summary, the issues include difficult geometric constraints with the interface of frontage roads and intersections with Highway 97, and higher than average collision rates at key intersections including Maple Drive, Cedar Avenue, and Racing Road.

Overall South Quesnel Access Management Solution

A summary graphic of improvement Options A1, A2, A3 and A4 is provided in **Figure 3.6** and **Figure 3.7** (at right), and is also provided in **Appendix G**. These individual options form an overall access management solution for the South Quesnel area and should be developed in collaboration with the City of Quesnel. These options may be phased and implemented over time.

In addition to the access management options, the City of Quesnel has identified a need for an off-highway truck parking area in the South Quesnel area to remove heavy vehicles from parking on the highway shoulder. The City may pursue this project and seek to collaborate with the MoTI as the priority for this project increases.

Figure 3.6: Option A1 and Option A2 Access Management from Basalt Road to Maple Drive

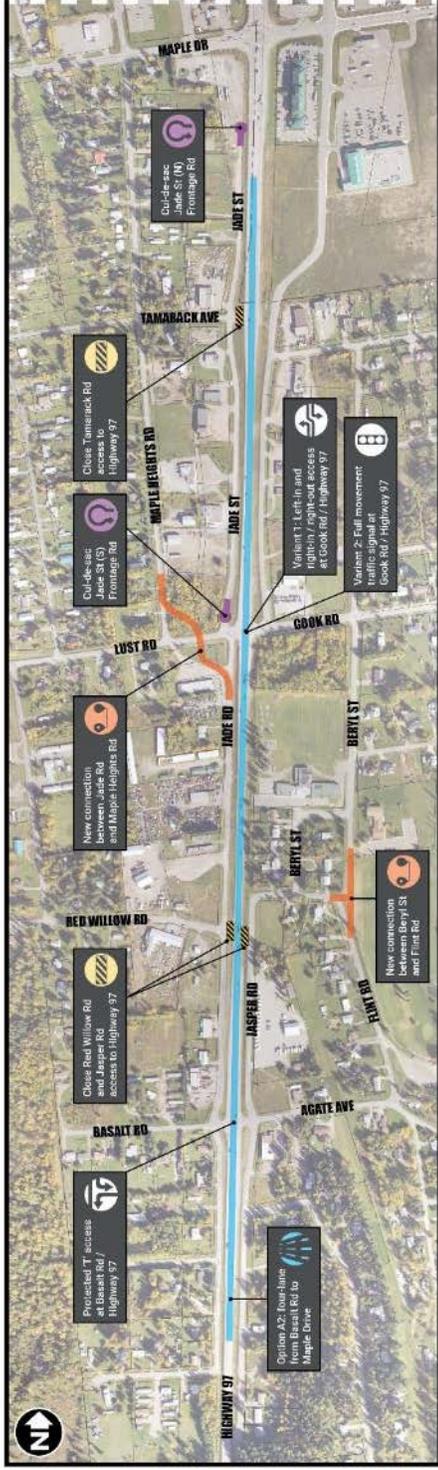


Figure 3.7: Option A3 Access Management from Cedar Avenue to Juniper Rd



3.5.4.1 Option A1: Basalt Road and Gook Road Access Management (2-Lane)



Background:

There are known design issues that exist on Highway 97 between Basalt Road and Maple Drive. 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. Further, the highway is 4 lanes wide on the segments both north and south of this study segment, which this option does not address.

Option Description:

This option maintains a 2-lane mainline cross-section on Highway 97 and involves access management improvements including the following:

Intersection Improvements:

- ▶ Highway 97 and Basalt Road (Agate Ave) - Protected 'T' configuration serving left turning movements on east leg, and right-in / right-out only movements on west leg; and,
- ▶ Highway 97 / Gook Road (Lust Road) – Left-in turn restriction configuration serving left turn-in movements and right-in / right-out only movements on both side street legs;

Local Connection Improvements:

- ▶ Increase throat storage length between the frontage road / side street intersections and the side-street / Highway 97 intersections to support design vehicle turning movements;
- ▶ Connect Flint Road to Beryl Street to improve backage road connection;
- ▶ Close Jade Frontage Road access at Gook Road to use Maple Heights Drive as backage road connecting to Maple Drive;
- ▶ Close sub-standard frontage road access at Highway 97 / Red Willow Road (Flint Road) intersection;



Design Consideration:

The protected 'T' intersection at Basalt Road / Highway 97 has been selected to support the higher turning volumes accessing the east leg of the intersection with minimal impacts to the low turning volumes accessing the west leg. Left turn-out vehicles on the west leg are redistributed along the frontage road connections to the traffic signal at Maple Drive. The frontage road intersections on Basalt Road consisting of Jade Road west of Highway 97 and Jasper Roads east of Highway 97 are realigned 25 meters back from the side-street / frontage road intersections to support WB-24 design vehicle turning movements.

The left-in turn restriction at Gook Road / Highway 97 supports higher left turn-in volumes accessing both legs of the intersection. Left turn-out vehicles on the west leg are redistributed along the Maple Heights Drive backage road connection to the traffic signal at Maple Drive. Left turn-out vehicles on the east leg are redistributed on the frontage road network to the Protected 'T' intersection at Basalt Road. The frontage road intersections on Gook Road at Jade Road west of Highway 97 and Jasper Roads east of Highway 97 are realigned 25 meters back from the existing side-street / frontage road intersections to support WB-24 design vehicle turning movements.

Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic		✓			
Improve Safety	✓				
Ped / Bike Conditions			✓		
Level of Service		✓			
Access Management / Local Connectivity	✓				
Mitigate Heavy Vehicle Impacts	✓				

Conceptual Planning-Level Project Cost Estimate:

Option A1: \$14,487,216

The conceptual design drawing is provided in **Appendix G**.
The cost estimate breakdown is provided in **Appendix H**.

- ▶ Supports turning movements for WB-24 design vehicles;
- ▶ Maintains network connectivity while improving access management;
- ▶ Access restrictions and acceleration / deceleration improvements increase intersection safety;
- ▶ Left-out and left-in turns can be made for at least one intersection, with the frontage road network supporting redistributed left turns where necessary;
- ▶ Desirable mobility service can be maintained with the 2-lane option over the 25 year horizon without the need for additional through lanes;
- ▶ Widening the throat length between frontage road / side street intersections and the highway requires property acquisition;
- ▶ Does not support 4-laning as the frontage roads would need to be relocated and would require subsequent reconstruction;
- ▶ Does not address existing safety issue with Highway 97 traffic travelling from adjacent 4-lane wide segments to this short 2-lane segment;

Review of Option A1:

Option A1 provides a potential solution to address the existing access management issues in the study area. However, the fatal flaw with this option is that it does address the existing safety issues of highway traffic travelling on a 4-lane highway down to a 2-lane highway, and back to a 4-lane highway in both directions. This flaw contributes to safety issues including vehicle weaving, speed differentials and poor driver expectancy / behaviour. Thus, it recommended that this option be screened-out.

Recommendation for Option A1:

■ Screen-Out

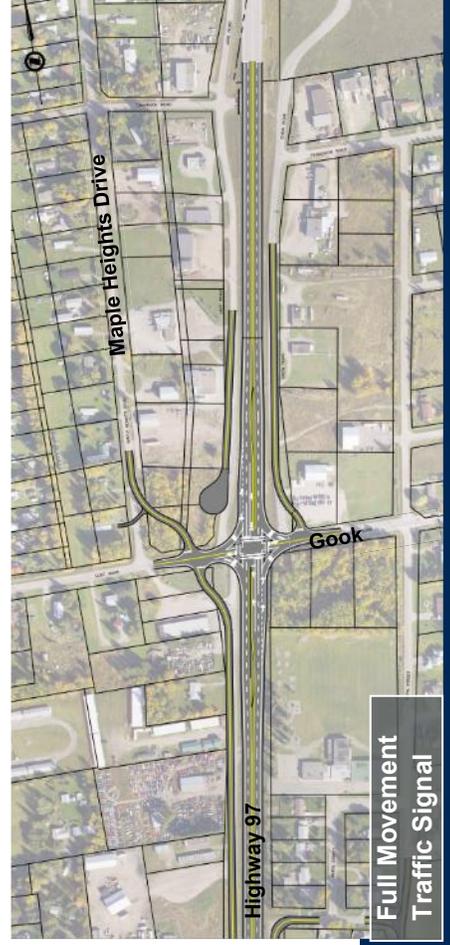
3.5.4.2 Option A2: Basalt Road and Gook Road Access Management (4-Lane)



Protected T Intersection



Left-in Only Restriction



Full Movement Traffic Signal

Background:

The same issues identified for Option A1 are consistent with Option A2. In addition, Highway 97 is already 4-laned to the south at Dragon Lake Road and to the north at Maple Drive; thus, any improvements to this section of Highway 97 should consider 4 lanes as part of a long-term solution.

Option Description:

This option widens the existing 2-lane mainline cross-section on Highway 97 to a 4-lane section between Maple Drive and Basalt Road. It also includes the access management improvements as described in Option A1 including the following:

Intersection Improvements:

- ▶ Highway 97 and Basalt Road (Agate Ave) - Protected 'T' configuration serving left turning movements on east leg, and right-in / right-out only movements on west leg; and,
 - ▶ **Variant 1:** Highway 97 / Gook Road (Lust Road) – Left-in turn restriction configuration serving left turn-in movements and right-in / right-out only movements on both side street legs;
- Or,
- ▶ **Variant 2:** Highway 97 / Gook Road (Lust Road) – Traffic signal with full turning movements onto and off Highway 97 to side-streets;

Local Connection Improvements:

- ▶ Increase throat storage length between the frontage road / side street intersections and the side-street / Highway 97 intersections to support design vehicle turning movements;
- ▶ Connect Flint Road to Beryl Street to improve backage road connection;
- ▶ Close Jade Frontage Road access at Gook Road to use Maple Heights Drive as backage road connecting to Maple Drive;

Design Consideration:

In addition to the intersection and access management design considerations listed under Option A1, this 4-lane design was developed in consideration of the regional Cariboo Connector 4-laning project that will eventually provide four continuous travel lanes on Highway 97 between Cache Creek and Prince George. This option includes a variant improvement at Gook Road / Highway 97. Instead of a left-in turn restriction, a full movement traffic signal was investigated following feedback received by the City of Quesnel and the Cariboo Regional District that left turn outs out of Gook Road need to be maintained to support businesses and residences. A traffic signal is warranted based on present day traffic volumes, as documented in **Appendix K**.

4-laning of Highway 97 between Maple Drive and Basalt Road requires that the frontage roads adjacent to Highway 97 including Jade Road, Jasper Road, and Chew Road be pushed outward to maintain the existing ditch drainage area along the highway corridor. Further, the conceptual design for this option does not include a clear zone, which would require an addition 3-4 meters of offset between the highway shoulder and frontage road.

Option A2 Evaluation Summary:

- ▶ This option extends the existing 4-laning from Maple Drive to the recently completed 4-laned section at Dragon Lake Road;
- ▶ Traffic volumes up to the 25-year horizon do not require 4 lanes of traffic to maintain desirable mobility performance; however, with 4 lanes provided to the south and north of this option, 4 lanes is supported to provide a consistent design to maintain safe driver expectations and behaviour;
- ▶ Widening the highway to 4 lanes and widening the throat length between frontage road / side street intersections and the highway requires significantly more property acquisition from adjacent properties;
- ▶ The increased setback between the highway and frontage roads supports turning movements for WB-24 design vehicles;
- ▶ The combination of turning movement controls maintains network connectivity while improving access management;
- ▶ Increased safety with the types of intersection designs selected and provision of deceleration and acceleration lanes;
- ▶ The left-in restriction variant for Gook Road / Highway 97 maintains highway traffic flow; however, it reduces direct connectivity onto the highway;
- ▶ The traffic signal option for Gook Road / Highway 97 maintains direct connectivity onto the highway, but adds some traffic delay to highway through traffic.

Review of Option A2:

Option A2 offers a 4-lane solution to address the same existing access management issues as Option A1 proposes to address. Given the similarities among these two options, it is recommended that this option be advanced to the MAE for further evaluation.

Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic				✓	
Improve Safety	✓				
Ped / Bike Conditions			✓		
Level of Service	✓				
Access Management / Local Connectivity	✓				
Mitigate Heavy Vehicle Impacts	✓				

Conceptual Planning-Level Project Cost Estimate:

Option A2 Variant 1: \$22,260,023

Option A2 Variant 2: \$22,298,285

The conceptual design drawing is provided in **Appendix G**. The cost estimate breakdown is provided in **Appendix H**.

Recommendation for Option A2:



Advance to Multiple Account Evaluation

3.5.4.3 Option A3: Juniper and Jade Frontage Road Network Improvements

Background:

Juniper Road intersects with Larch Avenue and provides minimal vehicle storage for vehicles turning onto the highway and trucks over-track on the shoulder and into adjacent lanes. Similarly, vehicle storage and truck over-tracking occurs on the west side of the intersection with Ash Avenue intersecting Cedar Avenue before Highway 97. These issues may contribute to the higher than average collision rate and collision severity statistics at the Cedar Avenue / Highway 97 intersection. The right-in / right-out access to Juniper Road does not have a deceleration lane (only a taper) and requires drivers to drastically reduce speed to turn off the highway.

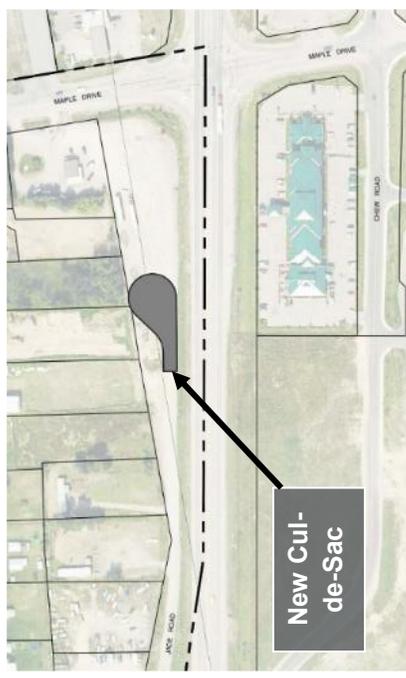
Option Description:

This option includes new roads, improvements to the frontage road network between Maple Drive and Juniper Road and the closure of the Juniper Road right-in / right-out access to Highway 97. The improvements include:

- ▶ Closure of the sub-standard right-in / right-out access at Juniper Road / Highway 97;
- ▶ Closure of the north leg at the Juniper Road / Larch Avenue (Cedar Avenue) intersection with a hammerhead configuration;
- ▶ Closure of Ash Avenue at Cedar Avenue;
- ▶ Realignment of Juniper Road with a new road behind existing businesses to form a new intersection with Larch Avenue (Cedar Avenue);
- ▶ Cul-de-sac Jade Road on the west side of Highway 97 before Maple Drive (in support of the backage road connection on Maple Heights Drive).

Design Consideration:

The closure of the right-in / right-out access at Juniper Road / Highway 97 also assumes the removal of the sub-standard right-turn deceleration taper. Consideration should be given to whether to remove the access completely and replace with standard ditch drainage, or to maintain the existing paved access for emergency situations and/or other special uses (e.g. speed radar) only. Whichever



design consideration is made, the concrete raised median should be removed for safety and a physical barrier provided to separate Highway 97 from Juniper Road with either a ditch or concrete roadside barrier.

Closing the north leg of the Juniper Road / Larch Avenue intersection and realigning Juniper Road with a new road connection behind the existing businesses will reduce turning movement conflicts, improve safety and support WB-24 design vehicle turning movements. While a cul-de-sac configuration was explored for the closed end of Juniper Road, this type of design would have impacts to the property and the large warehouse building on the northeast corner of the intersection.

The closure of the north leg of the Ash Avenue / Cedar Avenue intersection removes the sub-standard access design that currently results in turning conflicts and over tracking of heavy vehicles. This closure would have a minimal impact on connectivity as residential property owners can continue to use Ash Avenue, Short Avenue and/or Elm Street to connect to Cedar Avenue and onto Highway 97.

Option A3 Evaluation Summary:

- ▶ Improves safety conditions at Cedar Avenue / Highway 97, a known high collision rate and high collision severity location, by reducing turning movement conflicts with minimally spaced frontage road intersections;
- ▶ Access management allows turning movements and network connectivity to be maintained;
- ▶ Improved safety on Highway 97 with removal of sub-standard right-in/right-out at Juniper Road / Highway 97;
- ▶ Hammerhead treatment on Juniper Road is less desirable for emergency vehicle movements;
- ▶ The increased setback between the highway and frontage roads supports turning movements for WB-24 design vehicles.

Review of Option A3:

Option A3 offers a good long-term solution for improving access and safety in the vicinity of the Cedar Avenue / Highway 97 intersection. It is recommended that this option be advanced to the implementation plan as a long-term improvement in conjunction with either Option A1 or Option A2.

Recommendation for Option A3:

- ▶▶ Advance to Implementation Plan

Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic			✓		
Improve Safety	✓				
Ped / Bike Conditions			✓		
Level of Service		✓			
Access Management / Local Connectivity		✓			
Mitigate Heavy Vehicle Impacts	✓				

Conceptual Planning-Level Project Cost Estimate:

Option A3: \$1,726,837

The conceptual design drawing is provided in **Appendix G**. The cost estimate breakdown is provided in **Appendix H**.

3.5.4.4 Option A4: Signal Optimization at Maple Drive and Cedar Avenue Intersections

Background:

The intersection of Maple Drive and Cedar Avenue with Highway 97 experience higher than average collision rates than other locations in the province. More specifically, left turn collision types are more pronounced at the two intersections. The design of these intersections currently meets the rural design criteria for Highway 97 in the South Quesnel Area. Both intersections have advanced warning flashers (AWF) lights in advance of both intersections and in both directions of travel. Protective plus permissive phasing for the left turn movements is provided, which given the high rates of vehicle speeds on the highway, may be contributing to the higher collision rates.

Additionally, more than 400 students and teachers at Quesnel Junior School are relocating to the Maple Drive Middle School in March of 2018. Given the proximity of the commercial services on the east side of Highway 97 and the school on the west side of the highway, an increase in cross-highway pedestrian traffic is expected.

Option Description:

This option involves re-timing the traffic signals at both intersections to provide higher levels of safety while maintain the good mobility levels of service. Re-timing measures may include

- ▶ Increasing the yellow and all-red timings for each phase;
- ▶ Optimizing the time delay between the AWF lights and the traffic signals;
- ▶ Removing the permissive phase of left turn movements off the highway and providing only a protective phase for the left turns;
- ▶ Optimize pedestrian phases across Highway 97 and side-streets (Maple Drive and Cedar Avenue);

Option A4 Evaluation Summary:

- ▶ Improves highway and local side-street traffic conditions;
- ▶ Maintains existing mobility levels while provided increase time-separation of typically higher-severity turning movements;
- ▶ Supports increase in pedestrian traffic crossing Highway 97 at Maple Drive.

Review of Option A4:

This option provides a short-term solution as part of general ongoing traffic signal optimization improvements on provincial highways. This option improves safety conditions for the intersections of Maple Drive and Cedar Avenue with Highway 97 in the South Quesnel area. These improvements should be advanced for implementation.

Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic			✓		
Improve Safety	✓				
Ped / Bike Conditions		✓			
Level of Service			✓		
Access Management / Local Connectivity			✓		
Mitigate Heavy Vehicle Impacts			✓		

Recommendation for Option A4:



Advance to Implementation Plan

3.5.4.5 Option A5: Racing Road and Quesnel-Hydraulic Road Access Management

Option A5(i): Signalize Racing Road Intersection



Option A2(ii): Signalize Quesnel-Hydraulic Road



Option A3(iii): Access Left-Out Turn Restrictions



***Reference:** Refer to Highway 97 – Racing Road and Quesnel-Hydraulic Road Intersection Improvements memorandum (May, 2017, Urban Systems) for further detailed evaluation that was undertaken of these three improvement options.

Background:

Three variant designs were considered to improve access management and safety at the Racing Road and Quesnel-Hydraulic Road intersections.

Option Description:

Option A5-i: Signalize the Racing Road intersection and restrict access at the Quesnel Hydraulic Road intersection.

Option A5-ii: Signalization of the Quesnel-Hydraulic Road intersection and restrict access at the Racing Road intersection

Option A5-iii: Remove left-out turning movements at both Racing Road and Quesnel-Hydraulic Road intersections and require left turning traffic to detour to intersections further south including Cedar Avenue.

Review of Option A5*

This option has been advanced for further detailed design as a short-term priority project* to address the high collision severity and road safety concerns at these intersections. The preferred design variant will be identified after the completion of a road safety audit by a third party retained by the MoTI.

Recommendation for Option A5:

▶▶ Advance to Implementation Plan

3.5.5 Study Segment B – North Star Area Options

A set of two improvement options were identified for Study Segment B on Highway 97 around the North Star Area and Quesnel River Bridge. As identified in the existing conditions review, the Quesnel River Bridge and the Quesnel Overhead requires significant and challenging rehabilitation or full bridge replacement in the next 5 to 10 years. The Quesnel Overhead in particular is ranked as a high priority for improvement among structures across the province due to its poor bridge condition rating. The Quesnel River Bridge is in slightly better condition; however, this bridge has known constraints including that it cannot support oversize or overweight heavy vehicle movements; the lanes are narrow than current design standards and there are no shoulders. There is a horizontal curve just west of the Quesnel Overhead in which there is evidence some vehicles may be going off pavement.

3.5.5.1 Option B1(a&b): Quesnel Overhead and Quesnel River Bridge Replacement

Background

Structural condition assessments for the Quesnel River Bridge and the Quesnel Overhead were reviewed to determine the condition and life expectancy of the structures, which found that the Quesnel Overhead is in poor condition with a replacement of the bridge or significant rehabilitation required in the next 5 to 10 years. The Quesnel River Bridge also poses safety challenges due to its design and age. Two sub-options were explored. Option B1-a consists of two 4-lane structures and Option B1-b consists of two 2-lane structures, which is considered the do-minimum improvement for these bridges.

Option Description:

This option explores replacing the Quesnel River Bridge and Quesnel Overhead structure with either 4-lane or 2-lane wide structures while maintaining the alignment of Highway 97 on either side of the river crossing. Two new bridge structures would be constructed parallel to the existing structures to minimize property impacts and land required. The new crossing would provide an improved pedestrian and bicycle connection up to the Johnston Neighbourhood area east of the North Star Interchange.



Design Consideration:

As discussed, this option involves two structures with the bridge over the Quesnel River coming to a length of approximately 200 meters and the structure over the rail crossing coming to a length of approximately 100 meters. The over-head structure shown with a tangent, spiral, and curve of highway alignment is more challenging to design and construct than a standard highway curve.

The existing highway structures would remain open to traffic during construction of the new structures and tie-ins to the existing alignment. Traffic would be rerouted onto the new structures once complete, followed by decommissioning of the existing structures. A pedestrian and bicycle facility could be provided on the bridge to provide connections to the riverfront trail system on both sides of the Quesnel River, and to the Johnston Neighbourhood area on the east side of the river.

Option B1(a&b): Evaluation Summary:

- ▶ The 4-lane bridge replacement would increase traffic capacity and level of service whereas a 2-lane structure would not;
- ▶ Highway safety would improve given many property damage and injury related collisions have occurred on this segment;
- ▶ Highway geometry would improve with the removal and replacement of the tight horizontal curve just west of the Quesnel Overhead;
- ▶ Compared to the alternate route options, this option would be lower in relative cost since the structures would connect back into the existing highway alignment with less property acquisition and impacts;
- ▶ This option does not reduce highway traffic volumes or trucks and dangerous goods from moving through downtown Quesnel;
- ▶ This option helps to mitigate heavy vehicle impacts on the existing Quesnel River Bridge, in which the truss structure is occasionally scraped, impacted and damaged by heavy vehicles travelling through the narrow passage over the existing structure;
- ▶ This option would remove the heavy vehicle restrictions in place on the existing bridges for oversized vehicles;
- ▶ This option could be paired with Option C1 to eliminate highway traffic from Carson Avenue.

Review of Option B1(a&b):

Option B1 offers the do-minimum solution to replace the existing aged structures over the Quesnel River and the Quesnel Overhead. This option should be compared with Option AR-1 North South Interconnector Route, and as part of an online combination of Options B1, C1 and C2-b. Thus, it is recommended that this option be advanced to the MAE for further evaluation.

Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic	✓				
Improve Safety	✓				
Ped / Bike Conditions	✓				
Level of Service		✓			
Access Management / Local Connectivity			✓		
Mitigate Heavy Vehicle Impacts		✓			

Conceptual Planning-Level Project Cost Estimate:

Option B1 (2-lane): \$41,389,600

Option B1 (4-lane): \$62,371,000

The conceptual design drawing is provided in **Appendix G**. The cost estimate breakdown is provided in **Appendix H**.

Recommendation for Option B1(a&b):

- ▲ Advance to Multiple Account Evaluation as individual option.
- ▲ Advance to Multiple Account Evaluation in Combination with Options C1 and C2-b

3.5.5.2 Option B2: Quesnel River Bridge to Nadeau Street Sidewalk Improvement



Background:

The City of Quesnel have indicated the asphalt sidewalk extending south from the Quesnel River Bridge to Nadeau Street 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. Two short-term options have been developed that improve pedestrian facilities along this segment of Highway 97.

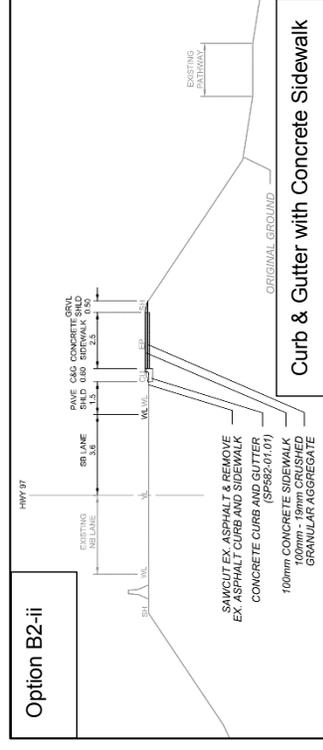
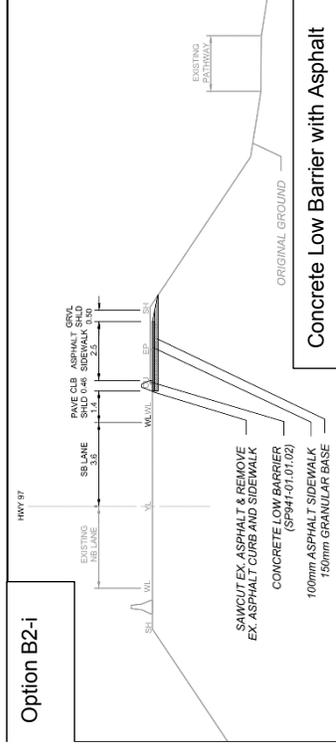
Option Description:

Option B2-i – Concrete Low Barrier with Asphalt Sidewalk: To increase pedestrian safety and separation from the highway it is proposed that a low concrete barrier be installed along the segment. To ensure the barrier sits flush on the roadway, the existing raised asphalt is proposed to be removed, and a roadway shoulder be constructed that is level with the existing road surface.

Option B2-ii – Curb & Gutter with Concrete Sidewalk: To formalise the pedestrian facilities along the highway, it is proposed that the south roadside be urbanised with curb and gutter, with an adjacent concrete sidewalk.

Design Consideration:

- ▶ **Option B2-i - Concrete Low Barrier with Asphalt Sidewalk:**
 - Barrier should be installed to alignment with existing drainage system;
 - Replaced granular base has been assumed;
 - 100mm asphalt sidewalk is proposed, considerations could also include concrete;
- ▶ **Option B2-ii - Curb & Gutter with Concrete Sidewalk:**
 - Existing catch basins proposed to be integrated with face of curb;
 - 100mm concrete sidewalk is proposed, considerations could also include asphalt.



City Trail Connection:

Considerations to connect the sidewalk from the Quesnel River Bridge to the City’s trail network south of the highway have also been evaluated. However, this has been deemed costly due to the significant grade difference that exists between the two facilities. To construct a connection at the appropriate grade would require a ramp in excess of 100 meters, with complex grading, pathway landing areas, and possible retaining walls.

Evaluation Summary:

- ▶ The current roadside configuration offers little protection for pedestrians from the adjacent highway travel lane;
- ▶ Formalizing and improving the separation along this roadside will create a safer environment for both road users;
- ▶ Although greater shoulder width can be achieved within Option B2-ii, Option B2-i provides the greatest separation and safety for pedestrians;
- ▶ Option B2-i is also proposed to be relatively cost effective.

Review of Option B2

While the two sub-options could be implemented within a short timeframe and at a low cost, it is a known issue that the Quesnel River Bridge and Quesnel Overhead will require replacement within the next five to ten years. Replacement of the bridge will require substantial reconstruction works of the approaches to the river crossing. Thus, this option may have a short lifespan and would need to be reconstructed once the bridge replacement project is advanced to construction. Thus, this option provides limited value for the potential investment that would be required.

Recommendation for Option B2:

- Screen out from further review and implementation.

Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic			✓		
Improve Safety	✓				
Ped / Bike Conditions		✓			
Level of Service			✓		
Access Management / Local Connectivity		✓			
Mitigate Heavy Vehicle Impacts			✓		

Conceptual Planning-Level Project Cost Estimate:

Option B2-i: \$134,761

Option B2-ii: \$247,430

The conceptual design drawing is provided in **Appendix G**. The cost estimate breakdown is provided in **Appendix H**.

3.5.6 Study Segment C – Downtown Quesnel Options

A set of four main improvement options were identified for Study Segment C on Highway 97 through the downtown of Quesnel as defined by the Quesnel Overhead (west end) to the Sutherland Avenue / Highway 97 intersection. These options were identified to address the issues identified in the problem definition statement including safety concerns at downtown intersections, and side-street traffic delays on approaches to the highway.

3.5.6.1 Option C1: Highway 97 Realignment onto Legion Drive

Background:

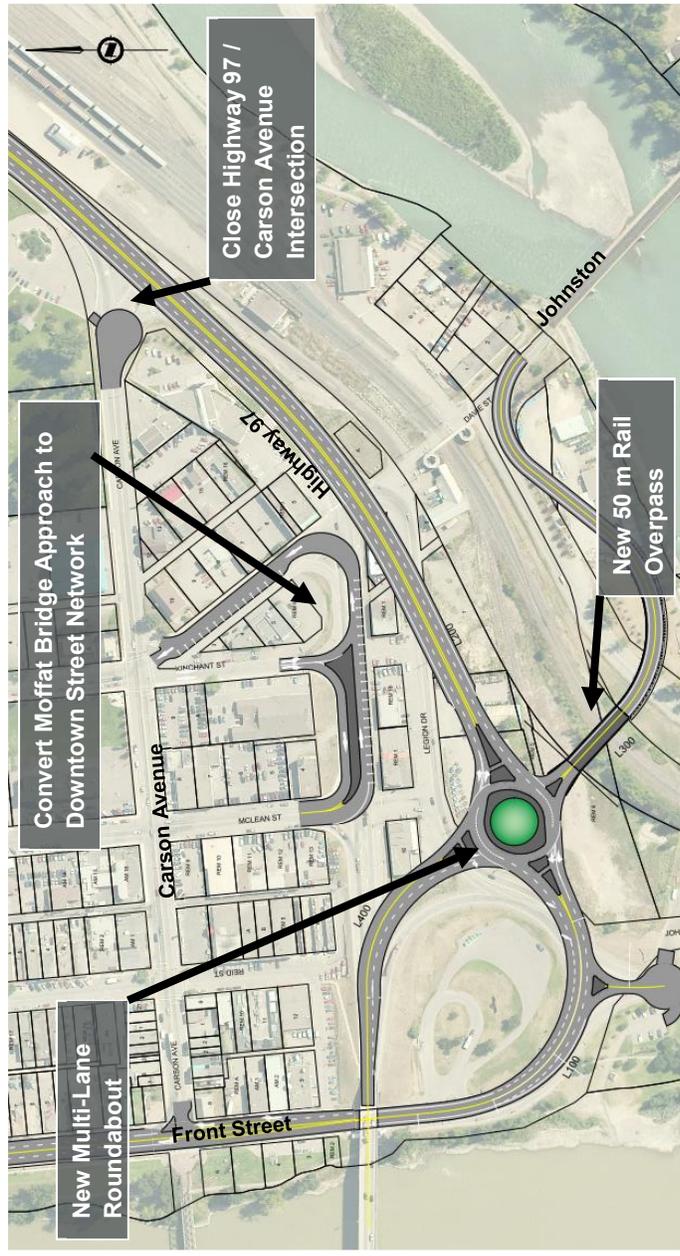
Traffic volumes on Highway 97 are at their highest entering the downtown onto Carson Avenue and Front Street, of which a significant portion consists of heavy vehicles. As a result, collision rates at intersections are higher than average and community concerns exist around the amount and type of traffic passing through the downtown.

Option Description:

This option explores the possibility of maintaining Highway 97 in the downtown peninsula of Quesnel, but realigning to the south of the downtown's core business area to reduce collision rates at downtown intersections and mitigate heavy vehicle impacts on Carson Avenue. This option proposes to close the east end of Carson Avenue to Highway 97 and bring traffic down the Moffat Bridge Approach route and connect directly to the Front Street bridge loop via Legion Drive with an intersection connecting the Johnston Bridge and the Moffat Bridge to West Quesnel. A multi-lane roundabout is proposed at the intersection of these streets due to the balanced amount of traffic entering the roundabout from each approach. However, a traffic signal is also a feasible option.

Design Consideration:

This option would involve significant changes to traffic patterns in the downtown by restricting highway traffic from using Carson Avenue, and instead re-directing south of the downtown and onto Front Street. This option offers opportunities for the City of Quesnel to re-incorporate Carson Avenue into its local downtown street network and provide additional on-street parking, pedestrian and cycle amenities and local services.



Given the urban location in the downtown, this option should follow the urban design criteria with speeds between 50 to 60 km/h. A multi-lane roundabout template and a 4-lane configuration is recommended to provide desirable mobility performance up to the 25 year horizon. North of the roundabout, the Moffat Bridge overpass of Front Street constrains the highway to reduce from 4 lanes wide to 2 lanes wide. Following further mobility performance assessment of this option, it may be determined that a multi-lane roundabout is required. If the traffic demand exceeds the capacity for a multi-lane roundabout, a traffic signal option will be investigated.

This option proposes a new structure over the CN rail that would connect to the Johnston Bridge Loop Road and Johnston Neighbourhood subdivision on the east side of the Quesnel River. Currently, the spring freshet on the Quesnel River floods the Johnston Bridge Loop Road for upwards of three months each year. Drivers travelling between downtown Quesnel and the Johnston neighbourhood must use a temporary detour onto Davie Street and across the CN grade rail crossing. The proposed structure would offer a permanent solution to provide access between the downtown and Johnston neighbourhood areas, and mitigate the problems and challenges associated with the existing freshet detour.

Option C1: Evaluation Summary

- ▶ Local and regional traffic patterns are improved by consolidating them to an improved highway alignment with fewer accesses and without two 90 degree turns as currently exists on the Carson Avenue and Front Street alignment;
- ▶ Safety conditions at the existing highway intersections on Carson Avenue would be improved with reduced traffic volumes;
- ▶ Travel conditions for pedestrians and bicyclists using Carson Avenue would improve with lower vehicle traffic volumes and turning conflicts;
- ▶ The new alignment with reduced accesses would improve corridor mobility and travel times;
- ▶ Heavy vehicle traffic would not be removed from Front Street;
- ▶ Heavy vehicle traffic would be removed from Carson Avenue and offer some relief to local motorists and the downtown business community;
- ▶ This option could be paired with Option B1 to provide more efficient travel through the downtown;
- ▶ The new rail overpass structure and road connection eliminates the annual Freshet detour route;

Review of Option C1:

Option C1 offers a solution to partially address the highway traffic and heavy vehicle impacts in the Quesnel downtown. This option should be compared as part of an online combination of Options B1, C1 and C2-b to Option AR-1 North South Interconnector Route. Thus, it is recommended that this option be advanced to the MAE for further evaluation.

Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic	✓				
Improve Safety	✓				
Ped / Bike Conditions		✓			
Level of Service		✓			
Access Management / Local Connectivity	✓				
Mitigate Heavy Vehicle Impacts		✓			

Conceptual Planning-Level Project Cost Estimate:

Option C1: \$34,319,297

The conceptual design drawing is provided in **Appendix G**.
The cost estimate breakdown is provided in **Appendix H**.

Recommendation for Option C1:

- ▶ Advance to Multiple Account Evaluation in
- ▶ Combination with Options C1 and C2-b

3.5.6.2 Option C2 (a & b): Front Street (Highway 97) Laning Reconfiguration

Background:

Safety is the predominant concern with Highway 97 on Front Street with higher than average collision rates at key intersections and the consistent feedback received from the public and the City about heavy vehicles carrying dangerous goods past G.R. Baker Memorial Hospital and through the downtown.

Options Description:

Two improvement options on Front Street were identified to improve mobility and safety conditions. Option C2-a explores the potential for 4-lane configuration of Front Street and Option C2-b identifies a 3-lane configuration consisting of two through travel lanes and a centre two-way left turn lane. As described in the following option description and evaluation, there is limited room on Front Street to accommodate the 4-lane Option C2-a, and further design is necessary to determine if property acquisition is required. If property is required, it could be significant given numerous private structures and buildings reside immediately adjacent to the corridor. Option C2-b provides greater flexibility as it fits within the existing travel surface width and would not require property acquisition.



3.5.6.3 Option C2-a: Front Street Laning Reconfiguration (4-Lane)

Design Consideration

This option includes using the existing travel surface on Front Street and potentially requires widening the road right of way to accommodate 4 lanes of travel. The extents of this option are from north of the Moffat Bridge structure to north of Sutherland Avenue where Highway 97 currently returns to 4 lanes.

The option to 4-lane Front Street offers some potential advantages and challenges; however, 4-laning is not required to provide desirable mobility service up to 25 year horizon. Capacity would be increased in the northbound direction only, since 2 lanes are currently provided southbound. Based on the cadastral information, there are some sections where it appears 4-laning will fit within the existing right of way; however, this could still require moving the curb, gutter, sidewalk, street lighting, and street furniture to fit the cross-section within an already constrained corridor. In some cases, the 4-lane cross-section would require property acquisition and could have major impacts to adjacent buildings and structures.

The pedestrian half signal at Shepherd Avenue would be maintained; however full signalization of the half signal at McNaughton Avenue has been considered to provide improved access for emergency vehicles, pedestrians and local cross-highway traffic into the G.R. Baker Memorial Hospital. This intersection was assessed with a traffic signal warrant, which found that a full signal is not warranted due to low side-street approach volumes (see **Appendix K**). Given the importance of this access, further consideration for a traffic signal is recommended.



Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic		✓			
Improve Safety			✓		
Ped / Bike Conditions				✓	
Level of Service		✓			
Access Management / Local Connectivity			✓		
Mitigate Heavy Vehicle Impacts					✓

Conceptual Planning-Level Project Cost Estimate:

Option C2-a: \$11,544,207

The conceptual design drawing is provided in **Appendix G**.

The cost estimate breakdown is provided in **Appendix H**.

Option C2-a: Evaluation Summary

- ▶ This option primarily provides increased capacity to the highway through downtown Quesnel, which improves conditions for local and regional traffic usage; however, 4-laning is not required to serve traffic demands;
- ▶ Safety conditions would be unlikely to change, and pedestrian conditions would be impacted given the pedestrian crosswalk distances would be longer and there is a known issue of pedestrian-related collisions along this corridor;
- ▶ This option leaves no room to provide a median pedestrian crosswalk refuge area;
- ▶ Heavy vehicle impacts could worsen with more lanes bringing trucks closer to the sidewalk and business frontages along Front Street.

Review of Option C2-a

While this option may provide a valid solution to improve traffic capacity along Front Street, this option would negatively impact pedestrian safety, which is a key issue for community members in Quesnel. Of note, there was a pedestrian fatality in November, 2016 where the pedestrian was using the crosswalk. In addition, heavy vehicle traffic is another significant community concern and reconfiguring Front Street to 4 lanes wide would have a noticeable effect of shifting heavy vehicles to the outside lane that is closest to the sidewalk and adjacent businesses and land uses. 4 lanes would also be expected to increase speeds, noise, and reduce safety.

Recommendation for Option C2-a:

- Screen out from further review and implementation.

3.5.6.4 Option C2-b: Front Street Laning Reconfiguration (3-Lane)

Design Consideration

This option involves reconfiguring the laning on the existing travel surface on Front Street without the need for road widening, as is the case with Option C2-a. The extents of this option are from north of the Moffat Bridge structure to north of Sutherland Avenue where Highway 97 currently returns to 4 lanes.

The option to convert the existing 2-lane southbound and 1-lane northbound configuration to 1-lane northbound, 1-lane southbound and a centre turn lane offers many advantages in comparison to the challenges noted for Option C2-a. The existing inside southbound lane already acts as a turn lane for southbound traffic, so providing a centre turn lane would not significantly reduce southbound through traffic level of service, which carries the same volume as northbound traffic. A centre turn lane allows for left turn movements to be made in both directions into public and private access without impeding through traffic. The centre turn lane also provides opportunities for pedestrian refuge areas to be installed, which would improve pedestrian and safety conditions along Front Street



The pedestrian half signal at Shepherd Avenue would be maintained; however full signalization of the half signal at McNaughton Avenue has been considered to provide improved access for emergency vehicles, pedestrians and local cross-highway traffic into the G.R. Baker Memorial Hospital. This intersection was assessed with a traffic signal warrant, which found that a full signal is not warranted due to low side-street approach volumes (see **Appendix K**). Given the importance of this access, further consideration for a traffic signal is recommended.

Option C2-b: Evaluation Summary

- ▶ Local and regional traffic continues to be supported with improved access for traffic turning into the downtown;
- ▶ Safety conditions are expected to improve with better separation of turning movements from travel lanes;
- ▶ Opportunity to improve pedestrian crosswalks with refuge areas to serve hospital and senior populations crossing the highway;
- ▶ Heavy vehicle impacts would not see a significant change from the status quo, except that trucks would be restricted to travelling in 2 lanes on Front Street from 3 lanes currently;
- ▶ Since this option consists of reconfiguring the laning within the existing paved right of way on Front Street, operation and maintenance costs are not expected to change from existing;
- ▶ This option is strongly supported by the City of Quesnel as a short-term option that can help improve pedestrian safety and traffic conditions;
- ▶ Further, the City identified this option as a high priority safety improvement project that can occur in the short-term to mitigate existing safety and mobility concerns along this downtown section of Highway 97.

Review of Option C2-b

This option provides a short-term solution to improving vehicle and pedestrian safety along Front Street without significant physical changes to the existing geometric design of the corridor. Further, this option can pair with any of the other options developed in the study including Options B1, C1, AR-1, C3, and C4.

Recommendation for Option C2-b:

- ▶▶ Advance to Implementation Plan
- ▶ Advance to Multiple Account Evaluation in Combination with Options C1 and C2-b

Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic		✓			
Improve Safety		✓			
Ped / Bike Conditions	✓				
Level of Service		✓			
Access Management / Local Connectivity			✓		
Mitigate Heavy Vehicle Impacts			✓		

Conceptual Planning-Level Project Cost Estimate:

Option C2-b: \$9,376,801 (original planning estimate only)

Note: Cost is being refined in preliminary design.

The conceptual design drawing is provided in **Appendix G**.
The cost estimate breakdown is provided in **Appendix H**.

3.5.6.5 Option C3: Relocate Traffic Signal from Reid Street to McLean Street

Background:

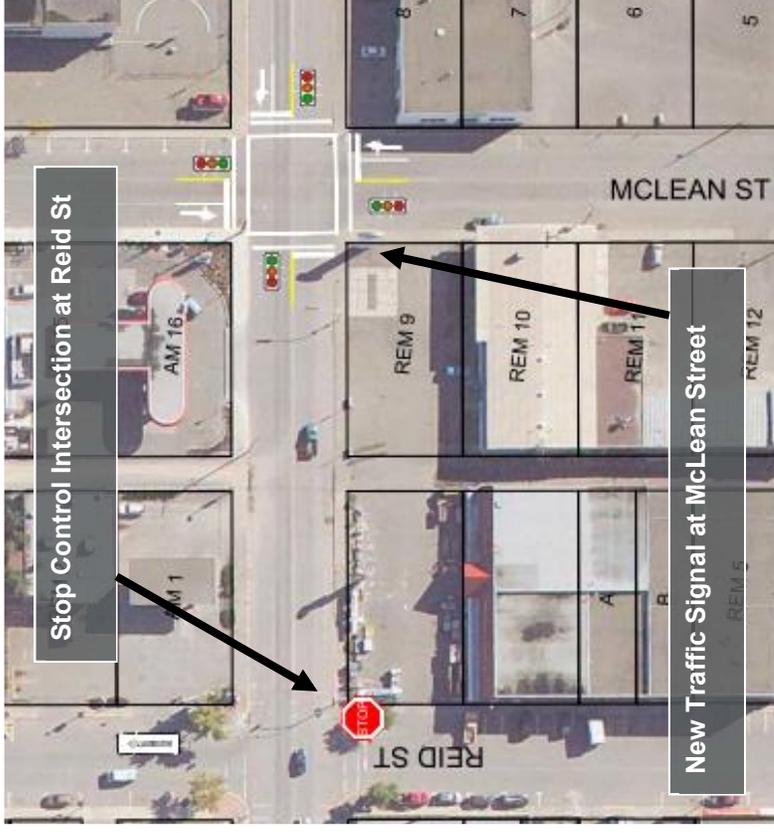
A traffic signal exists at the Reid Street / Highway 97 (Carson Avenue) intersection and is underutilized. It serves only one-way traffic northbound on Reid Street, and two-way traffic to only a few businesses located south of the intersection. The McLean Street intersection further east is stop controlled on the side-street approaches; however, this intersection observes higher turning volumes and provides access to the Moffat Bridge and subsequently to West Quesnel for drivers travelling on Highway 97 southbound.

Option C3 Description:

This short term option involves decommissioning the traffic signal at Reid Street and installing a new signal at McLean Street to better serve local and regional traffic patterns.

Design Consideration:

The traffic signal at Reid Street should be considered for removal and converted back to a two-way stop-controlled intersection on the side street approaches. A traffic signal at McLean Street intersection and is warranted as documented in **Appendix K**. A roundabout option was considered; however, due to the presence of structures on the south and north sides of the intersection including an active gas station, a traffic signal is a more feasible solution. Relocation would result in two closely spaced signals (100m) at McLean and Kinchant.



Option C3: Evaluation Summary

- ▶ A traffic signal would provide improved connectivity and level of service for local traffic and some regional highway traffic that is destined for West Quesnel;
- ▶ Safety conditions would improve as turning movements at the intersection would be supported by signal phasing and controls;
- ▶ This option does not appear to have significant effects on pedestrian, bicycle and heavy vehicle conditions;
- ▶ Signal coordination would be recommended between the closely spaced signals at McLean and Kinchant;
- ▶ Operation and maintenance costs would not increase as the O&M costs for the new traffic signal at McLean Street would replace the O&M costs of operating the existing traffic signal;
- ▶ The City supports this option as a short-term project.

Review of Option C3

Option C3 provides a good low-cost solution to improve transportation conditions on Highway 97, particularly for local traffic entering and exiting the highway to/from the downtown and to/from West Quesnel.

Recommendation for Option C3:

▶▶ Advance to Implementation Plan

Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic		✓			
Improve Safety		✓			
Ped / Bike Conditions			✓		
Level of Service		✓			
Access Management / Local Connectivity	✓				
Mitigate Heavy Vehicle Impacts			✓		

Conceptual Planning-Level Project Cost Estimate:

Option C3: \$488,144

The conceptual design drawing is provided in **Appendix G**.
The cost estimate breakdown is provided in **Appendix H**.

3.5.6.6 Option C4: Signalize Sutherland Avenue / Highway 97

Background:

Safety is a concern at the Sutherland Avenue intersection given its location on the inside of a horizontal curve and on a moderate vertical curve. Left turns into and out of Sutherland Avenue are challenging for passenger vehicles and for school busses that come to and from St. Anne's Catholic School.

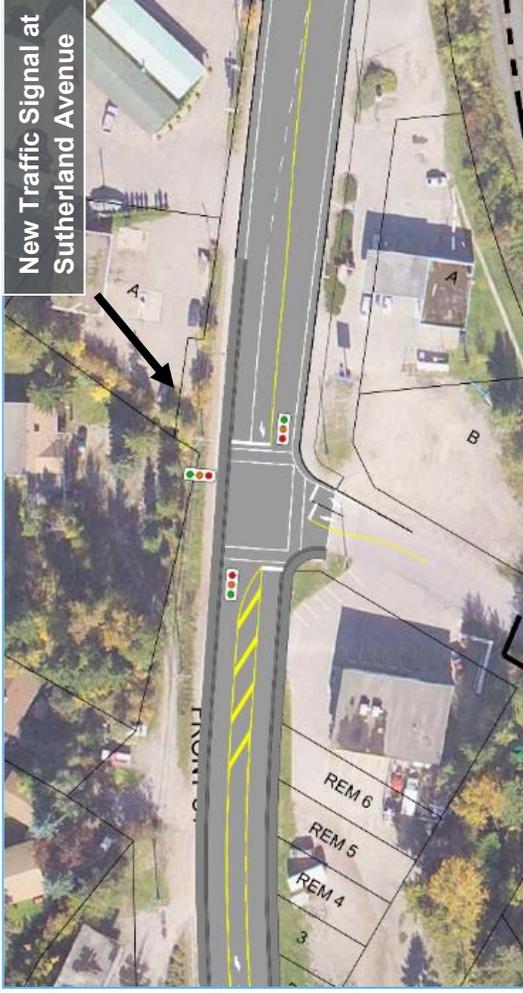
Option C4 Description

A traffic signal has been identified as a short term improvement to address sightline issues and improve access into and out of Sutherland Avenue.

Design Consideration:

The horizontal curve presents a challenge for passenger vehicles and school busses attempting to turn left or right out of the intersection. Further, buses and passenger vehicles turning left onto Sutherland Avenue sometimes have to pause in the southbound through travel lane, creating an uncomfortable situation for these drivers when through traffic is passing at higher speeds. A traffic signal is warranted at this location as documented in **Appendix K**.

It is important to note that the north-south interconnector route identified in **Section 3.5.3.1** of this memo would both connect back onto the existing Highway 97 alignment at the Sutherland Avenue intersection under a different configuration. Thus, this option should not proceed to implementation until a decision has been made about the implementation of the north-south interconnector.



Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic			✓		
Improve Safety	✓				
Ped / Bike Conditions			✓		
Level of Service		✓			
Access Management / Local Connectivity			✓		
Mitigate Heavy Vehicle Impacts			✓		

Conceptual Planning-Level Project Cost Estimate:

Option C4: \$250,000

The conceptual design drawing is provided in **Appendix G**.

The cost estimate breakdown is provided in **Appendix H**.

Option C4: Evaluation Summary

- ▶ Local traffic to and from Sutherland Avenue would most benefit from a traffic signal at this intersection, with little to no benefit for regional through traffic;
- ▶ Safety conditions would improve with preventing left turns out onto Highway 97 from a stop controlled approach on the inside of a curve;
- ▶ Level of service would improve for side-street traffic; however, a traffic signal or roundabout would likely reduce through movement service;
- ▶ This option does not improve access management or change conditions for pedestrians, cyclists, or heavy vehicle impacts;
- ▶ The alignment of Option AR-1 North-South Interconnector runs through this intersection and if constructed, access to properties services by Sutherland Avenue would change.

Review of Option C4

Option C4 provides a short-term improvement to address safety concerns and connectivity to Sutherland Avenue, and particularly access to St. Ann's Catholic School. However, this option should be screened-out until Option AR-1 North South Interconnector has been fully explored and a decision made on whether to implement or eliminate it. If Option AR-1 does proceed, it will involve a signalized intersection at Front Street in a similar location to the existing Sutherland Avenue / Highway 97 intersection, but under a different configuration that supports access to downtown Quesnel from the interconnector.

Recommendation for Option C4:

- Screen out from further review and implementation.

3.5.7 Study Segment D – Two Mile Flat Options

Two improvement options were identified for Study Segment D on Highway 97 through the Two Mile Flat industrial area of Quesnel. Both options provide a solution to address the access management challenges identified on this segment including the numerous private driveways that provide direct access to businesses and adjacent land uses. Both options encompass the whole study segment from the intersection of Sutherland Avenue to Highway 26.

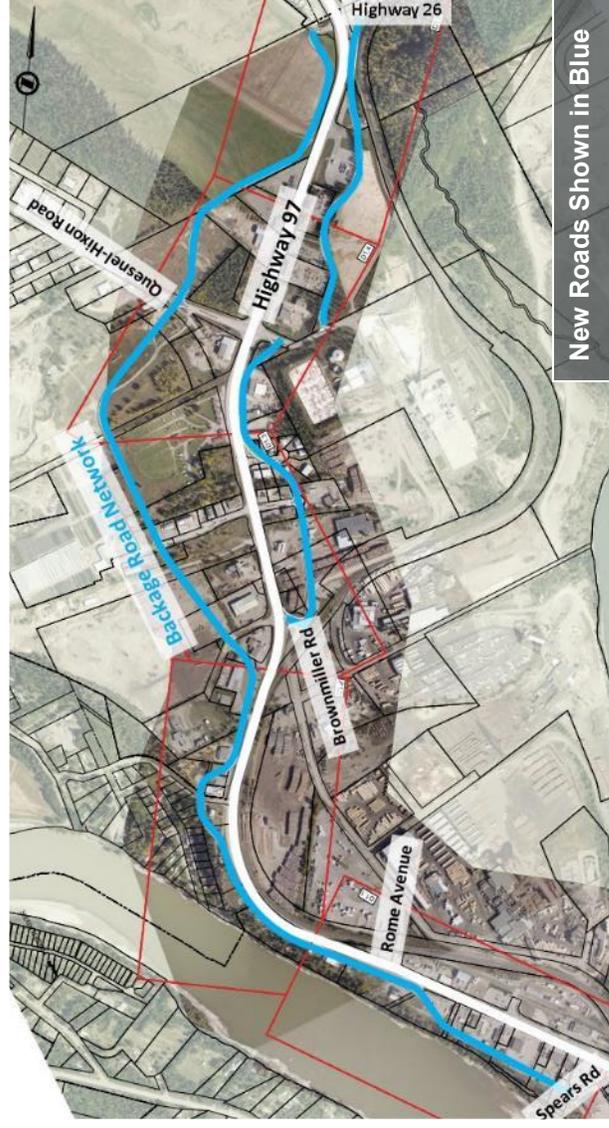
3.5.7.1 Option D1 (.1, .2, .3, .4, .5): Two Mile Flat Access Management

Background:

The section of Highway 97 which runs through the Two Mile Flat area of Quesnel from Sutherland Avenue to Highway 26 presents a few notable challenges for developing improvement solutions. While collision rates are generally lower on this section, there are a number of constraints including the proximity of the CN rail corridor, industrial land uses that abut the highway, and numerous private driveways with direct highway access. At the intersection of Brownmiller Road, heavy vehicles track off the pavement due to the poor geometry on the side-street approach to the highway. In addition, the Highway 26 intersection experiences a high collision severity rate.

Option Description:

This option identifies a long-term plan to improve access management throughout the whole Two Mile Flat segment of Highway 97 from Spears Road to Highway 26. In this segment, Highway 97 serves numerous private industrial businesses, services and activities including the CVSE truck weigh scale, and the Quesnel Airport. Many of these businesses and services have direct driveway access off Highway 97, which is 4 lanes wide and has a posted speed of 70 km/h. Few or no dedicated turn lanes are provided to separate higher speed through traffic from traffic turning into these driveways. Thus, this option identifies a network of possible frontage and backage roads that were developed based on available public right-of-way and private undeveloped land with as few impacts to existing structures as possible.



This option is separated into five sub-areas by their connection to the nearest major intersection at Spears Road, Hilborn Road, Pinecrest Road, Quesnel-Hixon Road, and Highway 26. All five sub-areas are described and evaluated in further detail in **Appendix L**.

Design Consideration:

Option D1 proposes to change many of the private accesses to businesses on both sides of Highway 97. Currently, many of these businesses have direct access to Highway 97 by driveway and this options would move many of these direct accesses off Highway 97 and onto the backage / frontage Road network. There are many design challenges related to Option D1 including property impacts and acquisition, utility impacts, environmental constraints, presence of existing contaminated sites, and the presence of potential archaeological sites. The conceptual design must support WB-24 design vehicles.

Option D1 Overall Evaluation Summary:

- ▶ Providing a frontage / backage road reduces accesses and limits local traffic to access the highway;
- ▶ Consolidating private driveways can improve traffic safety;
- ▶ Level of service and heavy vehicle impacts would not change by a considerable level;
- ▶ Property constraints on the east side of the highway near Spears Road limits ability to consolidate accesses;
- ▶ While few collisions have occurred on this segment, reducing the number of accesses in this section would provide a benefit to road safety conditions.

Review of Option D1:

Option D1 offers a long-term solution to address the amount of highway traffic and heavy vehicles accessing private businesses and industry directly off Highway 97 in the Two Mile Flat area. This option should be compared to Option D2, which identifies improvements within the existing highway right of way through Two Mile Flat. Thus, it is recommended that this option be advanced to the MAE for further evaluation.

Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic		✓			
Improve Safety		✓			
Ped / Bike Conditions			✓		
Level of Service			✓		
Access Management / Local Connectivity		✓			
Mitigate Heavy Vehicle Impacts			✓		

Conceptual Planning-Level Project Cost Estimate:

Option D1: \$34,302,369

The conceptual design drawing is provided in **Appendix G**.
The cost estimate breakdown is provided in **Appendix H**.

Recommendation for Option D1:

 Advance to Multiple Account Evaluation

3.5.7.2 Option D2: Two Mile Flat Highway 97 Reconfiguration

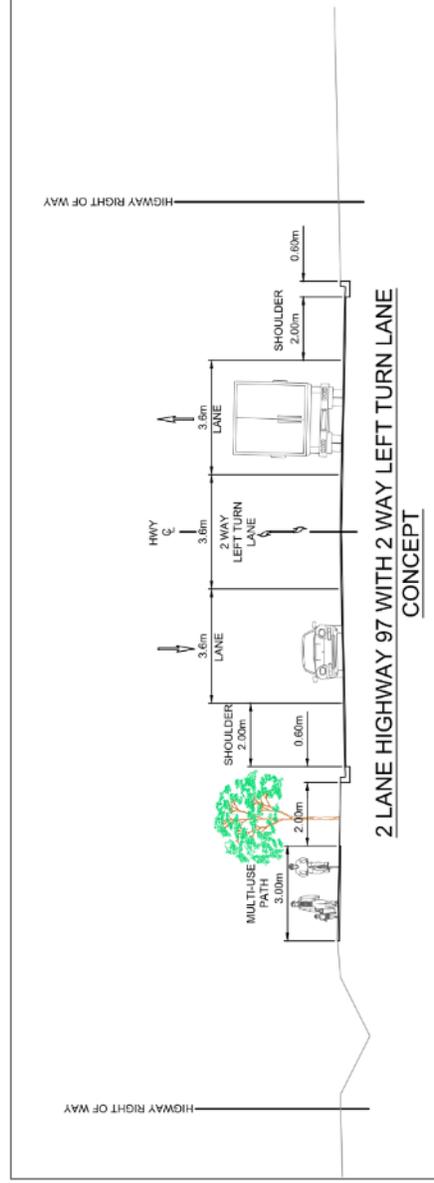
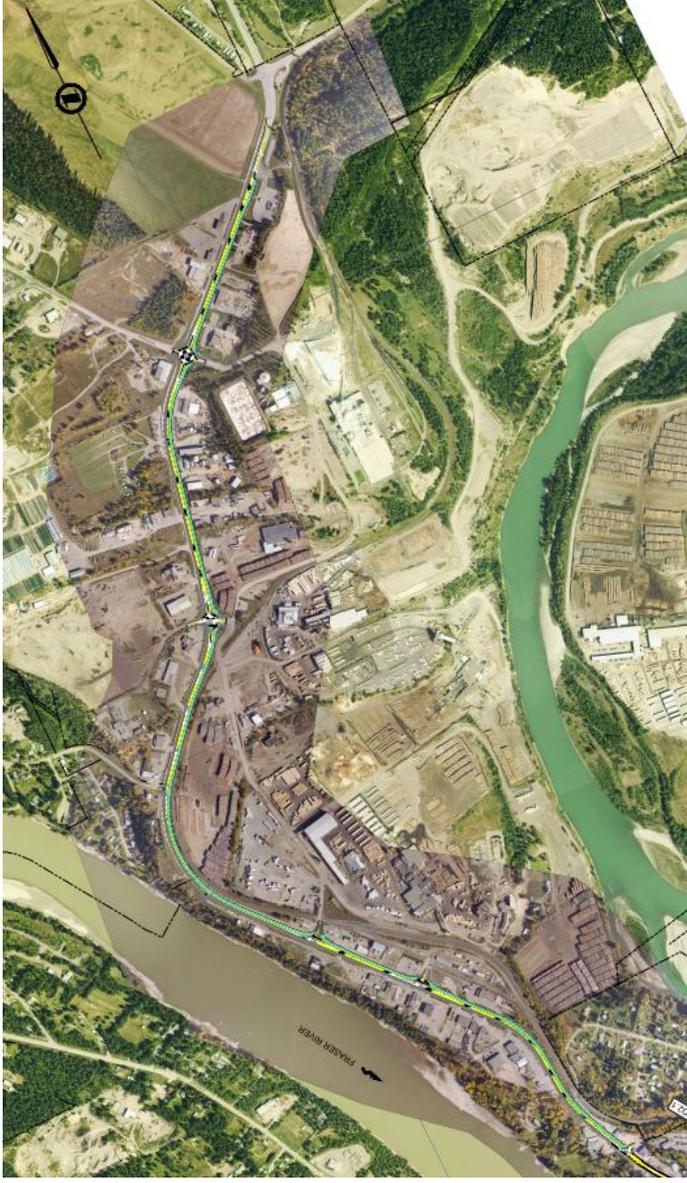
Background

A different approach was explored to address the highway safety, access and property constraint issues on Highway 97 through Two Mile Flat as described in Option D1.

Option D2 Description

This option presents a short to medium term approach to improve access management throughout the whole Two Mile Flat by reconfiguring Highway 97 from a 4-lane rural arterial undivided highway into a 3-lane urban arterial undivided highway. This option was identified due to the challenges of building a frontage / backage road network through Two Mile Flat including property constraints, topography and contaminated sites. By reconfiguring the existing width of the highway, it is possible to provide dedicated left turn lanes and right turn deceleration and acceleration lanes at local road intersections and at major driveway accesses that serve multiple businesses and land uses. This option also allows for a multi-use pathway to be provided in parallel to the highway between Sutherland Avenue and Highway 26.

A full set of plan view conceptual drawings of this option is included in **Appendix G**.



Design Consideration:

Highway 97 is reconfigured to an urban cross-section with curb gutter and sidewalk. The travel lane and centre two way left turn lane width is 3.6 meters. Since this design effectively narrows the highway and supports access to adjacent land use, the highway speed would be reduced to 50 km/h. The multi-use pathway is 3.0 meters wide and is separated from the roadway with a 2.0 meter boulevard. There is additional space within the highway right of way to provide acceleration and deceleration lanes at key intersections and major accesses; or to adjust the design details for the width of the lane, boulevard, and multi-use pathway.

Option D2: Evaluation Summary

- ▶ This option improves the design and safety of access to adjacent land uses and provides some opportunity to consolidate accesses;
- ▶ Heavy vehicle and trucks movements are improved with dedicated left turn lanes and right turn deceleration and acceleration lanes;
- ▶ Highway through capacity is reduced; however, the dedicated left turn and right turn lanes help maintain through traffic speeds;
- ▶ Passing opportunities are restricted with the reduction of through lane capacity from 2 lanes to 1 lane in each direction;
- ▶ This option improves pedestrian and bicycle conditions as there is no active transportation connection currently in existence between the downtown and Two Mile Flat;
- ▶ Safety conditions for pedestrians and cyclists would improve as these modes would not be required to share the shoulder and/or travel lanes along Highway 97;
- ▶ There should be few challenges with the constructability of this option given the design fits within the existing right of way;
- ▶ Minimal impacts to properties and adjacent land uses.

Review of Option D2:

Option D2 provides a different solution to address the amount of direct access that local traffic has to Highway 97 in the Two Mile Flat area by reducing through lane capacity to improve side-street access capacity. This option should be compared to Option D1, which identifies a long-term frontage and backage road network to address the same problem. Thus, it is recommended that this option be advanced to the MAE for further evaluation.

Relationship to Guiding Principles

	Improved	Somewhat Improved	Status Quo	Somewhat Poorer	Poorer
Local & Regional Traffic		✓			
Improve Safety		✓			
Ped / Bike Conditions	✓				
Level of Service				✓	
Access Management / Local Connectivity		✓			
Mitigate Heavy Vehicle Impacts		✓			

Conceptual Planning-Level Project Cost Estimate:

Option D2: \$24,710,466

The conceptual design drawing is provided in **Appendix G**.
The cost estimate breakdown is provided in **Appendix H**.

Recommendation for Option D2

▲ Advance to Multiple Account Evaluation

3.5.8 Summary of Options Developed

Table 3.2 summarizes the recommendations for each option as previously evaluated according to the guiding principles. It is noted that Options B1, C1 and C2-b advance to the MAE for further evaluation as a combined downtown online solution.

Table 3.2: Summary of Option Development Recommendations based on Guiding Principles Evaluation

Study Segment	Option Name	Screening Outcome
Alternate Route	Option AR-1a North-South Interconnector (4-Lane)	▶ Advance to MAE
	Option AR-1b: North South Interconnector (2-Lane)	■ Screen-Out
	Option AR-2 (a&b): North South Industrial Connector	■ Screen-Out
	Option AR-3: East-West Connector	■ Screen-Out
	Option AR-4: North-South Bypass	■ Screen-Out
A South Quesnel	Option A1: Basalt Rd. and Gook Rd. Access Management (2-lane)	■ Screen-Out
	Option A2: Basalt Rd. and Gook Rd. Access Management (4-lane)	▶ Advance to MAE
	Option A3: Juniper Road and Jade Road Network Improvements	▶▶ Advance to Implementation Plan
	Option A4: Signal Optimization of Maple Drive and Cedar Avenue Intersections	▶▶ Advance to Implementation Plan
	Option A5: Racing Rd. and Quesnel-Hydraulic Rd. Access Management	▶▶ Advance to Implementation Plan
B North Star	Option B1: Quesnel River Bridge and Quesnel Overhead Replacement	▶ Advance to MAE individually and in combination with Options C1, C2-b
	Option B2: Quesnel River Bridge to Nadeau Street Sidewalk	■ Screen-Out
C Downtown Quesnel	Option C1: Highway 97 Realignment onto Legion Drive	▶ Advanced to MAE in combination with Options B1, C2-b
	Option C2-a: Front Street 4-Laning Reconfiguration	■ Screen-Out
	Option C2-b: Front Street 3-Lane Reconfiguration	▶▶ Advance to Implementation Plan and to MAE in combination with Options B1, C1
	Option C3 Relocate Traffic Signal from Reid St. to McLean St.	▶▶ Advance to Implementation Plan
	Option C4: Signalize Sutherland Ave / Highway 97	■ Screen-Out
D Two Mile Flat	Option D1: Two Mile Flat Frontage and Backage Road Network	▶ Advance to MAE
	Option D2: Two Mile Flat Highway 97 Reconfiguration to Urban 3-Lane Design	▶ Advance to MAE

3.6 Multiple Account Evaluation (MAE)

As previously outlined, a set of 14 on-highway improvement options and 6 alternate route options were developed to a conceptual level. The options were evaluated against the project's six guiding principles to understand how well each of the options support the objectives of the overall Highway 97 Quesnel Transportation Plan. Of the total 20 options that were previously identified, 7 options have been advanced for further evaluation within the MAE framework including a benefit-cost analysis (Note: Option B1 is assessed in the MAE twice). **Table 3.3** summarizes the options that have been evaluated within the MAE.

Table 3.3: Summary of Options Assessed in the MAE

Study Area	Option Name
Alternate Route	Option AR-1a: North-South Interconnector (4-Lane)
A - South Quesnel	Option A2: Basalt Rd. and Gook Rd. Access Management (4-lane)
B - North Star	Option B1: Quesnel River Bridge and Quesnel Overhead Replacement
D - Two Mile Flat	Option D1: Frontage and Backage Road Network
	Option D2: Highway 97 Reconfiguration to Urban 3-Lane Design
Online Downtown Solution (Evaluated as 1 Option)	Option B1: Quesnel River Bridge and Quesnel Overhead Replacement
	Option C1: Highway 97 Realignment onto Legion Drive
	Option C2-b: Front Street 3-Lane Reconfiguration

3.6.1 Methodology

The MAE was applied to 7 of the 20 options developed in this study. The primary purpose to advance these options into the MAE was to determine a preferred option among the competing options. Further, the benefits and costs were quantified to obtain an overall benefit-cost ratio that was used to identify the preferred options.

The MAE consists of five accounts including the Financial, Customer Service (Mobility and Safety), Social / Community, Environmental, and Economic Indicators accounts. The assumptions and methodology applied to quantifying the benefits and costs of each account is described as follows:

Financial Account

The financial account includes the conceptual planning level project cost estimate which includes the capital investment costs for planning, project management, property acquisition, design and engineering, environmental, construction, First Nations accommodation and regional recoveries. These high-level planning cost estimates include a contingency of 35% for each of the cost elements. Quantities for the cost estimate have been developed from the conceptual designs and items and unit rates are based on similar BC MoTI projects.

This account also includes annual maintenance and rehabilitations costs, and the salvage value (based on 20% of the construction cost only) at the end of the project's life cycle. These future annual costs are discounted at a rate of 6% to calculate the net present value of the overall net project cost.

Customer Service Account

The customer service account represents the cost to intersection users over the life cycle of the project. This includes values for travel time, vehicle operating costs, and collisions accrued and discounted over 25 years. Given that the customer service account reflects the benefits of proposed improvements to highway users over 25 years, this account is particularly sensitive to traffic growth rate assumptions. Thus, the options that are evaluated in the MAE have been assessed with the normal 0.5% background traffic growth rate, and with the 1.5% sensitivity analysis traffic growth rate.

The mobility (travel time savings) have been calculated using Synchro and SimTraffic models for the selected options to measure the level of improvement or reduction in vehicle travel time, travel distance and fuel consumed that the option offers in comparison to existing conditions. The travel time savings have been calculated using the MoTI Default Values for Benefit Cost Analysis (2012), which were factored up to account for inflation. An annual inflation rate of 1.47%, as supplied by Statistics Canada, was applied to these default values.

Vehicle operating costs are measured based on the type and percentage of passenger vehicles and heavy vehicles travelling on the highway, and their fuel usage, which is factored into an actual cost and discounted over the 25 year lifecycle.

The safety benefits have been calculated based on a high-level comparison of the main differences that the option provides over existing conditions (e.g. unsignalized intersection vs. signalized). A simplified collision prediction model (CPM) was developed for the base highway conditions and collision modification factors (CMF) were applied for the option to obtain a relative safety benefit for the option.

Social Community Account

The social / community account assesses the potential effect of the option on community and social values. The criteria used to evaluate this account include vehicle connectivity, pedestrian and cyclist connectivity, and consistency with community plans. Input provided by technical representatives from the City of Quesnel and the Cariboo Regional District has been incorporated into this account.

Environmental Account

The environmental account describes the potential for biophysical and natural resource impacts of a project. This is not intended to replace an environmental assessment, if required, but as a qualitative and quantitative measure of potential impacts. Qualitative criteria including noise, visual and pollution impacts have been used to evaluate the options. Greenhouse gas (GHG) emissions have been quantified based on the SimTraffic analysis results for traffic fuel use, which is based on the rate of vehicle stopping, travel time and delays. A calculation of carbon dioxide, nitrogen oxide and hydrocarbon emissions for the option in comparison to existing conditions is provided.

Economic Indicators Account

The economic indicators account represents a summation of the quantitative benefits and costs from each of the four preceding accounts to obtain a benefit-cost ratio (b/c ratio) and a net present value (NPV) of the project costs in today's dollars. Typically a b/c ratio of 1.0 or greater is needed to justify the economic feasibility for a project to proceed to implementation. At the end of the MAE of each option, an outcome is provided with a clear recommendation of whether to implement the option or to not implement the option.

3.6.2 Alternate Route Options Evaluation

3.6.2.1 Option AR-1a: North-South Interconnector

This option consists of providing a new alignment for Highway 97 around the north side of the downtown Quesnel and replacing the Quesnel River Bridge and Quesnel Overhead with a 4-lane highway design. The MAE is provided for Option AR-1a as summarized in **Table 3.4**.

Option AR-1a is compared to the downtown online improvement solution that is formed by the combination of Options B1, C1 and C2-b. The costs and benefits of these combined improvements are evaluated here in comparison to Option AR-1a.

Financial Account

Option AR-1a - The conceptual project cost estimate for Option AR-1a (4-lane) North-South Interconnector is \$162,959,887 and an estimate breakdown is provided in **Appendix H**. Operation and maintenance costs are approximately \$2.6M to maintain the new travel lanes and bridge structures (at this time, additional operational costs for retaining walls have not been incorporated). However, if the existing highway alignment along Carson Avenue and Front Street can be devolved to the City, this new route could result in less overall O&M costs than existing. The salvage value, based on construction costs, is \$19.3M.

Options B1, C1, C2-b – The conceptual project cost estimate for all three options combined to form a downtown improvement solution is \$104,287,695. Operation and maintenance costs account for cost to maintain the new structures over the Quesnel River Bridge, additional travel lane resurfacing, and the new Rail overpass structure as part of Option C1. The salvage value, based on construction costs, is \$12.6M.

Customer Service Account (Safety and Mobility Benefits)

Option AR-1a – This options provides a significant safety benefit as it reduces the number of major intersections on the highway from eleven to two and shortens the overall length of Highway 97. The safety benefits amount to \$23.4M under normal growth and \$25.6M under the sensitivity growth scenario.

Mobility benefits are also significant as an estimate of 10,300 vpd could be redistributed onto the new route by 2042 under the 0.5% background growth rate, as previously shown in **Figure 3.2**. The forecast usage of this route is based on the analysis of origin-destination data collected as part of the existing conditions study. Further, traffic volumes on Front Street would reduce from 15,300 vpd to as low as 5,000 vpd and volumes on Highway 97 east of Carson Avenue before the Quesnel Overhead could be reduced to as low as 10,500 vpd.

Option AR-1a is 1.4 km shorter in distance compared to the existing Highway 97 alignment through downtown, and has 11 fewer intersections. This shorter and more direct route leads to an average estimated travel time savings of 2 minutes and 38 seconds per vehicle or 52% travel time savings over the existing route. This estimate is based on average travel conditions and is considered conservative. This redistribution of highway traffic to a faster and more direct route is estimated to result in \$93.1M of mobility benefits under the normal growth scenario, and \$113.6M under the sensitivity scenario.

Options B1, C1, C2-b – Unlike Option AR-1a, the downtown solution provides only an incremental improvement in mobility and safety benefits as the number of major intersections which highway traffic must pass through reduces from 11 to 8 intersections. This translates to a safety benefit of \$3.2M under normal growth conditions, and \$4.1M under the sensitivity growth scenario. Mobility benefits amount to \$7.1M under normal growth conditions, and \$14.3M under the sensitivity growth scenario.

Table 3.4: MAE for Option AR-1a in comparison with Options B1, C1, C2-b

MAE - 25 Year Benefit Cost Analysis	0.5% Annual Traffic Growth		Sensitivity Analysis 1.5% Annual Traffic Growth	
	Option AR-1a	Option B1, C1, C2-b	Option AR-1a	Option B1, C1, C2-b
	North-South Interconnector 4 Lanes	Online Downtown Highway Improvements	North-South Interconnector 4 Lanes	Online Downtown Highway Improvements
FINANCIAL				
Project Cost - Actual	\$ 162,959,887	\$ 143,363,306	\$ 162,959,887	\$ 143,363,306
B1-b	\$ 94,257,794	\$ 74,661,213	\$ 94,257,794	\$ 74,661,213
Maintenance	\$ 2,638,583	\$ 2,439,900	\$ 2,638,583	\$ 2,439,900
Salvage Value	\$ 19,344,370	\$ 16,779,550	\$ 19,344,370	\$ 16,779,550
TOTAL LIFE CYCLE COSTS - ACTUAL	\$ 146,254,100	\$ 129,023,656	\$ 146,254,100	\$ 129,023,656
TOTAL LIFE CYCLE COSTS - NET OF DO-MINIMUM	\$ 84,547,247	\$ 67,316,803	\$ 84,547,247	\$ 67,316,803
SAFETY BENEFITS				
Existing Safety Costs	\$ 38,574,832	\$ 38,574,832	\$ 41,457,048	\$ 41,457,048
Improved Safety Costs	\$ 15,146,002	\$ 35,291,696	\$ 15,809,369	\$ 37,380,824
TOTAL SAFETY BENEFITS	\$ 23,428,830	\$ 3,283,136	\$ 25,647,679	\$ 4,076,224
MOBILITY BENEFITS				
Existing Mobility Costs	\$ 100,211,723	\$ 100,211,723	\$ 122,642,178	\$ 122,642,178
Improved Mobility Costs	\$ 47,873,348	\$ 94,886,115	\$ 58,539,644	\$ 112,708,662
MOBILITY BENEFIT	\$ 52,338,375	\$ 5,325,608	\$ 64,102,534	\$ 9,933,516
Vehicle Operating Existing Costs	\$ 82,935,021	\$ 82,935,021	\$ 99,305,508	\$ 99,305,508
Vehicle Operating Improved Costs	\$ 42,127,942	\$ 81,182,492	\$ 49,797,854	\$ 94,874,763
OPERATING COST BENEFIT	\$ 40,807,080	\$ 1,752,529	\$ 49,507,654	\$ 4,430,745
TOTAL MOBILITY BENEFITS	\$ 93,145,455	\$ 7,078,137	\$ 113,610,188	\$ 14,364,261
SOCIAL/COMMUNITY				
Vehicle Connectivity	●	○	●	○
Pedestrian and Cyclist Connectivity	●	●	●	●
Consistency with Community Plan	○	○	○	○
ENVIRONMENTAL				
Noise Impacts	○	○	○	○
Visual Impacts	○	○	○	○
Pollution Impacts	●	○	●	○
GHG EMISSIONS				
EXISTING GHG (tonnes/yr)	8,930.42	8,930.42	10,026.96	10,026.96
IMPROVED GHG (tonnes/yr)	4,309.35	8,312.02	4,757.95	9,068.10
ANNUAL SAVINGS (tonnes/yr)	4,621.07	618.40	5,269.01	958.86
ECONOMIC DEVELOPMENT				
BENEFIT COST RATIO - NET OF DO-MINIMUM	1.38	0.15	1.65	0.27
NET PRESENT VALUE - NET OF DO-MINIMUM	\$ 32,027,037.96	\$ (56,955,530.19)	\$ 54,710,619.95	\$ (48,876,318.06)

Social / Community Account

Option AR-1a - Since the north-south industrial connector would provide an alternate route to the existing alignment, vehicle connectivity would improve. Both local and regional travellers would have two route options to travel north-south across the City, as opposed to only one currently. Pedestrian and cyclist connectivity would

also improve with the addition of new pedestrian and cycle facilities on the new Quesnel River Bridge and Quesnel Overhead structures.

While this option is not discussed or shown in existing community plans, the City of Quesnel has expressed strong support for this option. Some of the community benefits it offers include moving most heavy vehicles and highway traffic off of Front Street and the downtown core to improve safety and accessibility. Moving heavy vehicles off of Front Street also reduces the risk of chemical spills in the downtown and improved air quality. This option also provides significant opportunity for redevelopment of the downtown and for the City to consider acquiring Front Street and Carson Avenue back into the downtown street network.

Options B1, C1, C2-b – The combination of improvements to Highway 97 on the existing alignment would have little improvement to vehicle connectivity and actually reduces connectivity to Carson Avenue. Similar to Option AR-1a, pedestrian and cyclist connectivity would improve with a new facility that would be provided on the new Quesnel River crossing structures for these users. As previously discussed for Option C1, the City does not see significant value with this solution as it does not address the key objectives of reducing highway and heavy truck traffic on Front Street.

Environmental

Option AR-1a – This option could potentially have impacts to noise levels in the residential areas that would be located closest to this route; however, these impacts could be mitigated by sound barrier walls. The route would follow parallel to the CN railway and be located about half-way between the plateau on which downtown Quesnel is built on, and the waterfront. Thus, visual impacts would be relatively contained. Pollution and GHG emissions would be reduced by up to 4,621 tonnes per year as a result of lower vehicle operating costs and fuel consumption.

This option does traverse known geotechnical issues along the embankment between downtown Quesnel and the Quesnel River including the PGE Railway Mile 385 Slide and the PGE Railway Texaco Slide. Both slides require further site investigation as the existing slope stability is uncertain. The description of these slides is discussed further within the technical memorandum *Terrain Stability (Geohazard) Constraints – Summary, Highway 97 Quesnel Transportation Plan*, completed by Amed Foster Wheeler Environment and Infrastructure and included in **Appendix F**.

Options B1, C1, C2-b – Environmental impacts as a result of this downtown network solution would be relatively minimal. While Option C1 would have a visual impact on the south downtown Quesnel area, the overall solution maintains Highway 97 on a very similar alignment to how it exists today. Some incremental reductions to GHG emissions and pollution could be achieved with this solution.

Economic Indicators Account

The benefit-cost ratio and net present value for both Option AR-1a and the downtown combined solution (Option B1, C1 and C2-b) were calculated based the assumption that the existing Quesnel River Bridge and the Quesnel Overhead must be replaced. The do-minimum cost to replace these bridges is the same as the conceptual project cost estimate for Option B1-b.

Option AR-1a -The b/c ratio net of the do-minimum cost (Option B1-b) is a ratio of 1.38 under normal growth conditions, and 1.65 under sensitivity growth conditions. This is equal to a positive net present value of \$32.027M under normal growth conditions or \$54.711M under sensitivity growth conditions.

Options B1, C1, C2-b - The b/c ratio net of the do-minimum cost (Option B1-b) is a ratio of 0.15 under normal growth conditions, and 0.27 under sensitivity growth conditions. This is equal to a negative net present value of \$(56.956M) under normal growth conditions or \$(48.876M) under sensitivity growth conditions.

Review of Option AR-1a and Downtown Options (B1, C1, C2-B)

Overall, Option AR-1a provides great value, benefits and a b/c ratio that is justified as a positive economic project, and which supports the objectives of the City of Quesnel, the MoTI, and community organizations. Option B1, C1, and C2-b provides only a fraction of the value that Option AR-1a provides, but at a similar order of magnitude cost and with a negative net present value.

Outcome for Option AR-1a:

Recommended for Implementation as a Short-Term Project.

Outcome for Downtown Solution - Options B1, C1 and C2-b

Not Recommended.

3.6.3 Study Segment A – South Quesnel Commercial Options Evaluation

3.6.3.1 Option A2: Basalt Road and Gook Road Access Management (4-Lane)

Option A2 consists of upgrading Highway 97 from 2 lanes to 4 lanes of traffic with turn lanes at the intersections of Basalt Road and Gook Road. Two design variants are explored at the Gook Road / Highway 97 intersection including a left-turn in restricted intersection (Variant 1), and a full movement signalized intersection (Variant 2). A protected 'T' intersection is proposed at the Basalt Road / Highway 97 intersection. The MAE for Option A2 is summarized in **Table 3.5**.

Financial Account

The conceptual project cost estimate for Option A2 Variant 1 is \$22,260,023 and the cost estimate for Option A2 Variant 2 is \$22,298,285. An estimate breakdown for both design variants is provided in **Appendix H**. In comparison to Option A1, this option requires more property to widen the existing 2-lane highway to a 4-lane highway, and it requires offsetting the existing frontage roads further back from the existing highway shoulder. Operation and maintenance costs would be expected to increase by an additional \$828,500 over the 25 year project lifecycle for both variants due to the wider paved right of way on Highway 97. The salvage value at the end of the lifecycle for design variant 1 with turn restricted intersections is \$1,473,630; and for design variant 2 is \$1,514,130.

Customer Service Account (Safety and Mobility Benefits)

Highway traffic safety would be improve under both design variants. Consistent among both design options, three existing accesses to the frontage roads would be closed, which results in fewer turning movements on and off the highway and safety benefits. The left-turn in restriction at Gook Road / Highway 97 would restrict all left turns and cross highway turns from the side-streets onto Highway 97. Similarly, the protected 'T' restricted intersection at Basalt Road / Highway 97 would restrict left turns into and out of the east leg of the intersection. The net safety benefit with design variant 1 is estimated to be \$2,155,000 over existing conditions.

Design variant 2 with a traffic signal proposed at Gook Road / Highway 97 would also observe a safety benefit, albeit slightly less than variant 1 as no turning restrictions would be implemented, and because traffic signals have a limited effectiveness of reducing collisions. The net safety benefit with design variant 2 is estimated to be \$1,391,600 over existing conditions. Further, the design of these intersections includes greater throat spacing between the highway intersections and the frontage road intersections, which improves heavy vehicle turning movements and prevents vehicle over-tracking into opposing lanes.

Highway mobility is expected to improve with both design variants. A2 with design variant 1 (turn restrictions) was calculated to have a mobility benefit of \$6,280,500 under normal growth. The mobility benefit for design variant 2 (signalization) is \$2,226,500 under normal growth. Clearly, the traffic signal would incur some additional delay to highway through volumes, which results in the lower mobility benefit compared to variant 1 with the restricted intersection designs at Basalt Road and Gook Road.

Table 3.5: Option A2 MAE Evaluation

MAE - 25 Year Benefit Cost Analysis	0.5% Annual Traffic Growth Option A2: 4-Lane Basalt Road to Gook Road		Sensitivity Analysis 1.5% Annual Traffic Growth Option A2: 4-Lane Basalt Road to Gook	
	Variant 1 Left-in Only Restriction' at Gook Road / Highway 97	Variant 2 Signal at Gook Road / Highway 97	Variant 1 Left-in Only Restriction' at Gook Road / Highway 97	Variant 2 Signal at Gook Road / Highway 97
FINANCIAL				
Project Cost	\$22,260,023	\$22,298,285	\$22,260,023	\$22,298,285
Maintenance	\$ 828,473.16	\$ 828,473.16	\$ 828,473.16	\$ 828,473.16
Salvage Value (20%)	\$ 1,473,630.00	\$ 1,514,130.00	\$ 1,473,630.00	\$ 1,514,130.00
TOTAL LIFE CYCLE COSTS	\$ 21,614,866.16	\$ 21,612,628.16	\$ 21,614,866.16	\$ 21,612,628.16
SAFETY BENEFITS				
Existing Safety Costs	\$12,711,256	\$12,711,256	\$13,610,964	\$13,610,964
Improved Safety Costs	\$10,556,127	\$11,319,622	\$11,283,353	\$12,065,175
TOTAL SAFETY BENEFITS	\$ 2,155,129.00	\$ 1,391,634.00	\$ 2,327,611.00	\$ 1,545,789.00
MOBILITY BENEFITS				
Existing Mobility Costs	\$ 21,166,000.00	\$ 21,166,000.00	\$ 21,931,000.00	\$ 21,931,000.00
Improved Mobility Costs	\$ 16,199,000.00	\$ 19,790,000.00	\$ 17,110,000.00	\$ 21,002,000.00
MOBILITY BENEFIT	\$ 4,967,000.00	\$ 1,376,000.00	\$ 4,821,000.00	\$ 929,000.00
Vehicle Operating Existing Costs	\$ 7,062,546.19	\$ 7,062,546.19	\$ 7,462,048.01	\$ 7,462,048.01
Vehicle Operating Improved Costs	\$ 5,749,000.00	\$ 6,212,000.00	\$ 6,048,000.00	\$ 6,575,000.00
OPERATING COST BENEFIT	\$ 1,313,546.19	\$ 850,546.19	\$ 1,414,048.01	\$ 887,048.01
TOTAL MOBILITY BENEFITS	\$ 6,280,546.19	\$ 2,226,546.19	\$ 6,235,048.01	\$ 1,816,048.01
SOCIAL/COMMUNITY				
Vehicle Connectivity	○	●	○	●
Pedestrian and Cyclist Connectivity	○	●	○	●
Consistency with Community Plan	○	○	○	○
ENVIRONMENTAL				
Noise Impacts	○	○	○	○
Visual Impacts	○	○	○	○
Pollution Impacts	●	●	●	●
GHG EMISSIONS				
EXISTING GHG (tonnes/yr)	990.61	990.61	1,063.89	1,063.89
IMPROVED GHG (tonnes/yr)	806.12	870.70	861.30	936.36
ANNUAL SAVINGS (tonnes/yr)	184.49	119.90	202.59	127.53
ECONOMIC DEVELOPMENT				
Benefit Cost Ratio	0.39	0.17	0.40	0.16
Net Present Value	\$ (13,179,190.97)	\$ (17,994,447.97)	\$ (13,052,207.16)	\$ (18,250,791.16)
●	Good			
○	Fair			
○	Poor			

Social / Community Account

Variant 1 with the turn restricted intersections would result in reduced vehicle connectivity for traffic entering and leaving some of the businesses and land uses adjacent to Highway 97. Further, variant 1 would provide improved pedestrian and cycle connectivity on either side of Highway 97 as a result of the frontage and backage road network improvements; however these users would not observe any changes with respect to crossing the highway. The City has expressed concern that the turn restrictions at Gook Road / Highway 97 would make it challenging for nearby businesses to access the highway.

Variant 2 would provide improved vehicle connectivity across the highway with the traffic signal at Gook Road. This design variant would also result in improved pedestrian and cycle conditions with the addition of new signalized crosswalks that would be provided in conjunction with a traffic signal at Gook Road / Highway 97 and the associated frontage and backage road improvements. This design variant is supported by the City.

Environmental

Impacts to the environment are expected to be incrementally positive in general. No significant noise impact is expected with variant 1; however, the traffic signal under variant 2 will lead to increased vehicle stopping and starting noise on highway through movements. Pollution and GHG emissions are forecast to reduce on an incremental level as vehicle fuel and operating costs are expected to reduce.

Economic Indicators

The benefit cost analysis of both design variants indicates that neither option has a b/c ratio greater than 1.0. Design variant 1 has the highest b/c ratio of 0.39 and design variant 2 has a b/c ratio of 0.17 under normal growth conditions. Further, the net present value of each design option is considerably negative despite the mobility and safety benefits that are applied. The b/c ratio and net present value of the options would likely be much higher if the traffic usage of the highway and side-streets was higher and if there was a history of more collisions than is currently present and forecast over the project lifecycle.

Review of Option A2

Despite the low b/c ratio that this option provides, there is still good long-term value in providing a consistent design to the Highway 97 corridor in the South Quesnel area. As such, we recommend reviewing the economic feasibility of this project, and revisiting detailed access / intersection configurations in the future as a long-term implementation project.

Outcome for Option A2:

Recommended for Implementation as a Long-Term Project.

3.6.4 Study Segment B – North star area Options Evaluation

3.6.4.1 Option B1(a&b): Quesnel River Bridge and Quesnel Overhead Replacement

Option B1-b consists of replacement of the existing 2-lane wide Quesnel River Bridge and the Quesnel Overhead bridges while maintaining Highway 97 on its existing alignment into downtown Quesnel. Option B1-a consists of the same replacement, but with two 4-lane wide structures to match the laning and capacity of Highway 97 south of the bridges. The MAE for Option B1(a&b) is summarized in **Table 3.6**. Option B1-a has also been assessed in conjunction with Option C1 and C2-b as a downtown online Highway 97 improvement solution and is compared with Option AR-1: North-South Interconnector. This comparison is provided with the MAE for Option AR-1.

Financial Account

The conceptual project cost estimate for Option B1-a is \$99,667,206 to replace the existing 2-lane structures with 4-lane wide structures, as shown in the estimate breakdown provided in **Appendix H**. The conceptual project cost estimate for Option B1-b, otherwise known as the do-minimum option, is \$68,702,093 to replace the existing 2-lane structures with new 2-lane structures. Operation and maintenance costs would observe an increase over the existing facility by approximately \$1.2M to \$2.3M to maintain the additional pavement surface and bridge deck surface area. The salvage value of the new structures is estimated at \$8.3M for Option B1-b and \$12.4M for Option B1-a.

Customer Service Account (Safety and Mobility Benefits)

The safety and mobility benefits for replacing the existing structures are relatively low in comparison to the project costs. The safety benefits of the proposed improvements account for the wider 4-lane cross-section with Option B1-a, wider shoulders and a wider median along the highway and bridge decks since there is no shoulder or median on the existing structures. Under the normal 0.5% traffic growth scenario, the safety benefits amount to \$7.6M for Option B1-a and \$7.2M for Option B1-b.

The mobility benefits were calculated for Option B1-a based on the additional lane capacity that the structures would provide. The analysis was run in SimTraffic to calculate the travel time savings under both normal and sensitivity growth scenarios. The normal growth scenario lead to a mobility benefit of \$10.7M and the sensitivity scenario lead to a benefit of \$3.7M. No mobility benefits are anticipated for Option B1-b as this option does not increase traffic capacity or mobility compared to the existing bridges.

Social / Community Account

Vehicle connectivity on the Highway would be maintained as this option does not provide any additional connections to local and regional routes in comparison to the existing infrastructure. However, this criteria is especially important as the Quesnel River Bridge and Quesnel Overhead provide critical connectivity to the whole BC interior region that is connected by Highway 97. Pedestrian and cyclist connectivity is improved as new sidewalk and pathway facilities would be provided on the structures that would provide improved accessibility and safety for these users to cross the Quesnel River. Further, this option is consistent with the existing OCP and transportation network, though it is noted that it does not provide any new opportunities for changing the role and function of local streets and land uses that connect with the highway in downtown Quesnel. The City supports the replacement of the bridges, but prefers that this replacement occurs in support of Option AR-1a: North South Interconnector.

Environmental

Impacts to the environment are generally neutral as this option is essentially a replacement of existing infrastructure; thus, visual and noise impacts are considered minimal. Pollution and GHG emissions are forecast to reduce as a result of the additional laning capacity that reduces vehicle fuel consumption over the 25-year project lifecycle.

Table 3.6: Option B1(a&b) MAE

MAE - 25 Year Benefit Cost Analysis	0.5% Annual Traffic Growth		Sensitivity Analysis - 1.5% Annual Traffic Growth	
	Option B1-a	Option B1-b	Option B1-a	Option B1-b
	4-Lane Quesnel River Bridge and Overhead Replacement	2-Lane Quesnel River Bridge and Overhead Replacement	4-Lane Quesnel River Bridge and Overhead Replacement	2-Lane Quesnel River Bridge and Overhead Replacement
FINANCIAL				
Project Cost	\$ 99,667,208	\$ 68,702,093	\$ 99,667,208	\$ 68,702,093
Maintenance	\$ 2,335,439	\$ 1,232,680	\$ 2,335,439	\$ 1,232,680
Salvage Value	\$ 12,474,200	\$ 8,277,920	\$ 12,474,200	\$ 8,277,920
TOTAL LIFE CYCLE COSTS	\$ 89,528,446.72	\$ 61,656,852.83	\$ 89,528,446.72	\$ 61,656,852.83
SAFETY BENEFITS				
Existing Safety Costs	\$18,094,438	\$18,094,438	\$19,155,768	\$19,155,768
Improved Safety Costs	\$10,430,108	\$10,899,072	\$11,010,681	\$11,538,383
TOTAL SAFETY BENEFITS	\$ 7,664,330.00	\$ 7,195,366.00	\$ 8,145,087.00	\$ 7,617,385.00
MOBILITY BENEFITS				
Existing Mobility Costs	\$ 23,254,000.00	\$ 23,254,000.00	\$ 25,668,000.00	\$ 25,668,000.00
Improved Mobility Costs	\$ 13,851,000.00	\$ 23,254,000.00	\$ 22,947,000.00	\$ 25,668,000.00
<i>MOBILITY BENEFIT</i>	\$ 9,403,000.00	\$ -	\$ 2,721,000.00	\$ -
Vehicle Operating Existing Costs	\$ 4,629,439.65	\$ 4,629,439.65	\$ 4,764,423.46	\$ 4,764,423.46
Vehicle Operating Improved Costs	\$ 3,323,000.00	\$ 4,629,439.65	\$ 4,308,000.00	\$ 4,764,423.46
<i>OPERATING COST BENEFIT</i>	\$ 1,306,439.65	\$ -	\$ 456,423.46	\$ -
TOTAL MOBILITY BENEFITS	\$ 10,709,439.65	\$ -	\$ 3,177,423.46	\$ -
SOCIAL/COMMUNITY				
Vehicle Connectivity			○	
Pedestrian and Cyclist Connectivity			●	
Consistency with Community Plan			●	
ENVIRONMENTAL				
Noise Impacts			○	
Visual Impacts			○	
Pollution Impacts			●	
GHG EMISSIONS				
EXISTING GHG (tonnes/yr)	650.13	650.13	682.96	682.96
IMPROVED GHG (tonnes/yr)	469.88	650.13	619.91	682.96
ANNUAL SAVINGS (tonnes/yr)	\$ 180.25	\$ -	\$ 63.05	\$ -
ECONOMIC DEVELOPMENT				
BENEFIT COST RATIO	0.21	0.12	0.13	0.12
NET PRESENT VALUE	\$ (71,154,677.07)	\$ (54,461,486.83)	\$ (78,205,936.26)	\$ (54,039,467.83)

Economic Indicators

Option B1-a with a b/c ratio of 0.21 and Option B1-b with a b/c ratio of 0.12 under normal growth conditions suggests that these options are not economically feasible. However, it should be considered that this option is essentially a long-term asset management cost as the existing Quesnel River Bridge and Quesnel Overhead provide immense economic value and support to multiple communities located throughout the BC Interior region, stretching from Cache Creek up to Prince George. The cost of losing this vital economic link would be significantly greater than the cost to replace both structures.

Review of Option B1(a&b)

Overall, Option B1(a&b) provides a straightforward approach to addressing the largest challenge with Highway 97 in Quesnel, which is the required replacement of the Quesnel River Bridge and Quesnel Overhead. The poor B/C ratio may be hard to justify this option given that Option AR-1a North South Interconnector is able to retain a much higher B/C ratio in comparison and can address many other challenges including highway safety on Front Street, increased travel time savings, and improved connectivity. If Option AR-1a becomes unfeasible to construct upon further highway planning and preliminary design, this option should move forward as the preferred alternative.

Outcome for Option B1:

Not Recommended. However, Option B1 may be considered the preferred alternative to Option AR-1a if it is found through further study that the North-South Interconnector is unfeasible for construction.

3.6.5 Study Segment D – Two Mile Flat Options Evaluation

3.6.5.1 Option D1: Frontage and Backage Road Network

Option D1 consist of developing a network of frontage and backage roads that parallels Highway 97 through adjacent local land uses and available public right-of-way to reduce the number of private driveways and accesses on Highway 97. This option involves significant land impacts and constraints with existing business operations. This option is intended to be a long term plan for further discussion. Option D1 is assessed in the MAE as summarized in **Table 3.7** in a more qualitative layout due to limited traffic count information to quantify mobility and safety benefits.

Financial Account

The conceptual project cost estimate for this option is \$34,302,369 and an estimate breakdown is provided in **Appendix H**. Operating and maintenance costs would increase due to the increased length and paved surface area of new roads and supporting infrastructure.

Table 3.7: Option D1 MAE

Customer Service Account (Safety and Mobility Benefits)

Highway traffic safety would improve by removing many of the private driveways and accesses, and consequently the turning movements on and off the highway that are currently permitted. Further, local traffic would be directed to access the highway at controlled access points that would also result in improved local traffic safety. It should be noted that collision rates are relatively low along this segment of Highway 97 and the safety benefits may not outweigh the cost of providing this local road network system until traffic volumes and collision rates increase. Pedestrian and cyclist safety would improve considerably as these users would be able to use the local frontage and backage road network instead of using the shoulder of Highway 97.

Highway and local traffic mobility would be expected to improve. With fewer turning movements onto and off the highway, through traffic would observe fewer delays and local traffic would be able to make greater use of the dedicated left turn and right turn bays that are provided at the major intersections of Rome Avenue, Pinecrest Avenue, Quesnel-Hixon Road and Highway 26.

Social / Community Account

Similar to the customer service account, vehicle, pedestrian and cyclist connectivity would also observe improvements as these modes can only currently rely on Highway 97 as the main transportation route. Providing

ACCOUNT	Two Mile Flat Frontage and Backage Road Network
FINANCIAL	Option D1
Project Cost	\$ 34,302,369.00
Operating & Maintenance Cost	○
SAFETY BENEFITS	
Safety (highway and local traffic)	●
Safety (pedestrians / cyclists)	●
MOBILITY BENEFITS	
Mobility (highway)	●
Mobility (local traffic)	●
Vehicle Operating Costs	●
SOCIAL/COMMUNITY	
Vehicle Connectivity	●
Pedestrian and Cyclist Connectivity	●
Consistency with Community Plan	○
ENVIRONMENTAL	
Noise Impacts	○
Visual Impacts	○
Pollution / GHG Emission Impacts	●

● Good ○ Fair ○ Poor

a frontage and backage road network would provide more options to these users for easier access to residences, businesses and industry in the Two Mile Flat area.

The City has reviewed this option and feels that the network of frontage and backage roads is theoretical and difficult to implement due to the existing amount of developed land use along the corridor. However, the City supports MoTI's plan for Option D1 where it is feasible to construct frontage / backage roads.

Environmental

Noise and visual impacts to the environment in the community would be the most noticeable since much of the local traffic which currently accesses businesses from the highway would be re-directed to the new frontage and backage road network where other businesses and residents may not be accustomed to. Pollution and GHG emissions may or may not reduce for two reasons. First, removing the accesses and associated traffic from the highway would reduce through traffic delay and result in improved emissions. However, local traffic may have to take a longer route on the frontage and backage road network to access the highway, which would increase emissions.

Review of Option D1

This option offers a long-term solution for access management on Highway 97 between Spears Road and Highway 26. However, this option comes at a significant cost and with the typical challenges that are involved in planning, designing and building new roads around existing developed land uses. This option could be implemented in phases over time and as development occurs. This option would require the direct input and collaboration with City staff and Council.

Option D2 provides an alternative solution that involves reconfiguring the existing highway design to better support access to adjacent land uses. While Option D2 would be considered easier to implement due to fewer property acquisitions, constraints and technical challenges, its review in the MAE indicates that such a solution would come at the cost of highway traffic mobility.

Outcome for Option D1:

Recommend for further study and consultation jointly with Option D2.

3.6.5.2 Option D2: Reconfiguration to Urban 3-Lane Design

Option D2 consists of reconfiguring the existing rural arterial undivided 4-lane segment of Highway 97 between Spears Road to Highway 26 into an urban arterial undivided 3-lane segment with turn lanes at intersections and major accesses. While Option D1 provides a long-term, yet challenging, solution to address access issues along the corridor, Option D2 provides a solution to address these access issues by considering that the existing high-speed rural 4-lane highway may not be the best facility to support safe access to the adjacent land use that is becoming more urbanized. The design of Option D2 includes 1 lane in each direction with a centre two-way left turn lane and/or back-to-back left turn lanes, shoulders, curb and gutter, and a multi-use pathway that is separated by a boulevard. The MAE for Option D2 is summarized in **Table 3.8**.

Financial Account

The conceptual project cost estimate for this option is \$24,710,466 and an estimate breakdown is provided in **Appendix H**. Operating and maintenance costs would decrease since the paved surface width of asphalt area of the travel lanes and the multi-use pathway is approximately 4 metres less than the existing paved width of the

rural 4-lane highway over a distance of 3.5 kilometres. The salvage value at the end of the project's 25-year lifecycle is \$2,750,980.

Table 3.8: Option D2 MAE

MAE - 25 Year Benefit Cost Analysis	0.5% Annual Traffic Growth	Sensitivity Analysis - 1.5% Annual Traffic Growth
	Option D2: 3-Lane Highway 97 With Multi-Use Path and Sidewalks	
FINANCIAL		
Project Cost	\$24,710,466	\$24,710,466
Maintenance	\$ (353,617)	\$ (353,617)
Salvage Value (20%)	\$ 2,750,980	\$ 2,750,980
TOTAL LIFE CYCLE COSTS	\$ 21,605,869.41	\$ 21,605,869.41
SAFETY BENEFITS		
Existing Safety Costs	\$19,301,171	\$20,374,781
Improved Safety Costs	\$12,938,041	\$13,420,331
TOTAL SAFETY BENEFITS	\$ 6,363,130.00	\$ 6,954,450.00
MOBILITY BENEFITS		
Existing Mobility Costs	\$ 66,881,000.00	\$ 69,832,000.00
Improved Mobility Costs	\$ 77,951,000.00	\$ 86,555,000.00
MOBILITY BENEFIT	\$ (11,070,000.00)	\$ (16,723,000.00)
Vehicle Operating Existing Costs	\$ 18,238,671.12	\$ 19,766,525.40
Vehicle Operating Improved Costs	\$ 26,945,000.00	\$ 26,768,000.00
OPERATING COST BENEFIT	\$ (8,706,328.88)	\$ (7,001,474.60)
TOTAL MOBILITY BENEFITS	\$ (19,776,328.88)	\$ (23,724,474.60)
SOCIAL/COMMUNITY		
Vehicle Connectivity	●	●
Pedestrian and Cyclist Connectivity	●	●
Consistency with Community Plan	●	●
ENVIRONMENTAL		
Noise Impacts	●	●
Visual Impacts	●	●
Pollution Impacts	○	○
GHG EMISSIONS		
EXISTING GHG (tonnes/yr)	2,567.28	2,814.30
IMPROVED GHG (tonnes/yr)	3,808.04	3,905.62
ANNUAL SAVINGS (tonnes/yr)	\$ (1,240.77)	\$ (1,091.32)
ECONOMIC DEVELOPMENT		
Benefit Cost Ratio	-0.62	-0.78
Net Present Value	\$ (35,019,068.29)	\$ (38,375,894.01)

- Good
- ◐ Fair
- Poor

Customer Service Account (Safety and Mobility Benefits)

Highway safety improves with this option with a safety benefit of \$6,363,130 under the normal growth scenario and \$6,954,450 under the sensitivity growth scenario. These safety benefits are obtained by converting the corridor into an urban 3-lane segment, which is characterized with having lower travel speeds compared to a 4-lane rural highway. Thus, collision severity is reduced, which leads to lower collision costs and improved safety on this segment.

While highway safety improves, highway mobility reduces as a result of the reduction in through travel lanes, reduced vehicle speeds, and the elimination of passing opportunities. The mobility benefits under the normal growth scenario are negative \$(19,776,328), and under the sensitivity growth scenario are negative \$(23,724,474). The SimTraffic analysis that was used to calculate the mobility benefits assumed that the vehicles speed limit would reduce from the existing 70 km/h posted limit to 60 km/h limit with the 3-lane cross-section. However, it should be noted that the performance of the turning movements at key intersections in a 3-lane design, including Rome Avenue, Pinecrest Road, Quesnel-Hixon Road and Highway 26, performs above MoTI thresholds for acceptable traffic performance.

Social / Community Account

The 3-lane urban design option rates good for all three criteria for a few reasons. First, vehicle connectivity is supported with this option by the provision of additional dedicated deceleration and acceleration lanes for left and right turns at key intersections, and at major access points to adjacent industry and businesses. Pedestrian and cyclist connectivity is improved by providing a multi-use pathway that provides a direct connection in parallel to Highway 97 to support access between origin and destination points in downtown Quesnel and in the Two Mile Flat area. Lastly, the multi-use pathway and urban design supports the City of Quesnel's vision for a pedestrian and cycle connection into Two Mile Flat as it is defined in the City's Active Transportation Plan (2016) and in its OCP.

Environmental

Environmental impacts as a result of the 3-lane design are mixed. In terms of noise and visual impacts, the project would provide an improvement to these conditions as the urban design would provide an improved visual aesthetic along the corridor while vehicle noise would reduce with a lower speed limit and fewer travel lanes for vehicles to pass. However, this option would result in an increase to GHG emissions and pollution as vehicle fuel use would observe an increase due to the lower travel speeds and moderate increase in vehicle travel times with this option.

Economic Indicators

The benefit cost analysis of this option is -0.62 under the normal growth scenario, and -0.78 under the sensitivity scenario. This significantly negative b/c ratio and net present value is mainly an outcome of the poor mobility benefits that would be observed. However, this overall quantitative result should not completely distract from the mostly positive, yet more qualitative benefits that this option could have for the local community and for safety on the corridor.

Review of Option D2

This option can offer a relatively easy solution to address access management issues on Highway 97 and improve highway safety and local community uses; albeit at a significant cost to vehicle mobility and economic development. The sensitivity analysis confirms that growing traffic volumes will further reduce the cost effectiveness of this option as a potential solution. Further, converting this section of Highway 97 to 3 lanes is inconsistent with the recommended 4-lane improvements identified in Option A2 for South Quesnel, or with Option AR-1a for the North-South Interconnector. In comparison, Option D1 would maintain 4 lanes for vehicle

mobility and address the need for improved pedestrian and cycle conditions by moving these users onto a frontage / backage road network. Further study and consultation of Option D1 and Option D2 is recommended.

Recommendation for Option D2:

Recommend for further study and consultation jointly with Option D1.

3.7 Implementation Strategy

Further to the guiding principles evaluation of all the options developed, and further to the multiple account evaluation of advanced options, **Table 3.9** summarizes the recommended options to be included in the implementation plan. Options that were screened-out after each evaluation do not advance into the implementation plan. The recommended options were reviewed with the project team's input and a phasing strategy has been developed as described in the next section of this report.

Table 3.9 Summary of Recommended Options and Phasing for the Implementation Plan

Project Phasing	Option Name
Short Term Projects 0 - 5 Years	Option A4: Signal Optimization of Maple Drive and Cedar Avenue Intersections
	Option A5: Racing Rd. and Quesnel-Hydraulic Rd. Access Management
	Option C2-b: Front Street 3-Lane Reconfiguration
	Option C3: Relocate Traffic Signal from Reid St. to McLean St.
	Option AR-1a: North-South Interconnector (4-Lane)
Medium to Long-Term Projects 6 - 25 Years	Option A2: Basalt Rd. and Gook Rd. Access Management (4-lane)
	Option A3: Juniper Road and Jade Road Network Improvements
	Option D1: Two Mile Flat Frontage and Backage Road Network
	Option D2: Two Mile Flat Highway 97 Reconfiguration to Urban 3-Lane Design

3.7.6 Short-Term Projects

Five improvement options have been advanced as short-term projects for implementation as part of the Highway 97 Quesnel Transportation Plan. A summary of each project including the conceptual planning level cost estimate is provided in **Table 3.10**. Options A4, A5, C2-b and C3 address priority issues on the existing highway alignment to improve road safety, access and mobility issues. These improvements are supported by the City of Quesnel and the community for implementation over 2018 to 2019.

Option AR-1a is recommended as a short-term project as it is critical that further planning, site investigations, preliminary and detailed design be completed within the next five years. These next steps, as described in **Section 3.10** of this report, are required to enable construction of the new alignment and Quesnel River Bridge and Overhead replacement to be completed before the existing bridges reach their end-of-life. If Option AR-1 cannot proceed under this short-term timeline, the existing bridges will require significant rehabilitation in the 5-10 year timeframe (2022 – 2027) that could result in significant closures that would impact local and provincial trade, goods movement and regional mobility. This improvement is supported by the City of Quesnel and the community at large, as documented in **Section 3.9** of this report.

Table 3.10: Summary of Short Term Implementation Projects (0 to 5 Years)

Option & Location	Needs Description	Improvement	Class ‘D’ Conceptual Cost Estimate
Option A4 Highway 97 / Cedar Avenue and Highway 97 / Maple Drive	<ul style="list-style-type: none"> Above average collision rates Increase in pedestrian traffic in area due to relocation of students to Maple Drive Middle School 	<ul style="list-style-type: none"> Signal timing optimization 	Ongoing Traffic Operation Maintenance
Option A5 Highway 97 / Racing Road, Highway 97 / Quesnel-Hydraulic Road and connecting Segment	<ul style="list-style-type: none"> High collision severity and collision rates; Sub-standard existing access design. 	<ul style="list-style-type: none"> Access management and traffic control improvements at both intersections. 	Cost being Refined in Preliminary Design
Option C2-b Front Street (Highway 97) from Carson Avenue to Sutherland Avenue.	<ul style="list-style-type: none"> High collision frequency intersections; Pedestrian safety challenges; Inefficient laning configuration for turning movements; 	<ul style="list-style-type: none"> Reconfigure Front Street to 1 lane each direction and a centre turn lane; Pedestrian crossing improvements. 	Cost being Refined in Preliminary Design
Option C3 Carson Avenue (Highway 97) / Reid Street and Carson Avenue / McLean Street	<ul style="list-style-type: none"> Traffic capacity and network mobility needs at McLean Street / Carson Avenue; Inefficient use of traffic signal at Reid Street / Carson Avenue; 	<ul style="list-style-type: none"> Remove traffic signal from Reid Street / Carson Avenue; Install new traffic signal at McLean Street / Carson Avenue 	\$488,144
Option AR-1a Highway 97 from Nadeau Street east of Quesnel River to Sutherland Avenue northwest of downtown Quesnel	<ul style="list-style-type: none"> Required replacement of Quesnel River Bridge and Quesnel Overhead; High collision rates on highway segment; Highway safety issues and traffic congestion in downtown Quesnel; Heavy truck and dangerous goods movement safety and pollution concerns in downtown Quesnel 	<ul style="list-style-type: none"> Replacement of Quesnel River Bridge and Quesnel Overhead on new 4-lane highway alignment; Re-align Highway 97 north of Quesnel downtown up to Sutherland Avenue; Improve highway safety & design; Improve mobility and reduce travel time by 50% through downtown Quesnel; Remove most heavy vehicles and dangerous goods from travel through downtown Quesnel; Provide a Long-term solution for Highway 97. 	\$162,959,887

3.7.7 Medium and Long-Term Projects

Four improvement options have been advanced as medium to long-term projects for implementation as part of the Highway 97 Quesnel Transportation Plan. A summary of each project including the conceptual planning level cost estimate is provided in **Table 3.11**.

Options A2 and A3 form a long-term access management solution for Highway 97 in the South Quesnel commercial area between Basalt Road and Juniper Road and is support by the City of Quesnel and the community. Options D1 and D2 each provide a possible solution for addressing the needs identified on the segment of Highway 97 that runs through the Two Mile Flat area between Sutherland Avenue and Highway 26. Both Option D1 and D2 should be studied further in consultation with the City of Quesnel to determine if either one option or a combination of both frontage network and online improvements can provide a feasible and practical solution to address the access management issues identified on this segment.

Table 3.11: Summary of Medium to Long-Term Implementation Projects (6 to 25 Years)

Option & Location	Needs Description	Improvement	Class 'D' Conceptual Cost Estimate
<p>Option A2 Highway 97 from Basalt Road to South of Maple Drive and intersections at Basalt Road and Gook Road</p>	<ul style="list-style-type: none"> Segment is 2 lanes wide and highway segments both north and south are 4 lanes wide; Driver expectancy and behaviour challenged by changing highway design; Side-street accesses are sub-standard; Challenging turning movements into and out of side-streets for heavy trucks and vehicles with trailers; 	<ul style="list-style-type: none"> Widen highway to 4 lanes for consistent design with adjacent segments; Realign frontage roads to improve turning movements at intersections and to accommodate wider highway cross-section; Improve traffic control at Highway 97 / Basalt Road and Highway 97 / Gook Road <ul style="list-style-type: none"> Variant 1 – Left-In Restriction at Gook Rd / Highway 97 Variant 2 – Traffic Signal at Gook Rd / Highway 97 	<p>\$22,260,023 (Variant 1)</p> <p>\$22,298,285 (Variant 2)</p>
<p>Option A3 Juniper Road and Jade frontage and interface with Highway 97</p>	<ul style="list-style-type: none"> Side-street accesses are sub-standard at Juniper Road / Highway 97, Juniper Road / Cedar Avenue, and Jade Road / Cedar Avenue High collision frequency at Cedar Avenue / Highway 97 intersection; Challenging turning movements into and out of side-streets for 	<ul style="list-style-type: none"> Close Juniper Road / Highway 97 access; Close north leg of Juniper Road at Cedar Avenue intersection and realign Juniper Road further east to a new intersection with Cedar Avenue; Close north leg of Jade Road / Cedar Avenue intersection (traffic redistributed on existing network) 	<p>\$1,726,837</p>

Option & Location	Needs Description	Improvement	Class 'D' Conceptual Cost Estimate
	heavy trucks and vehicles with trailers.		
Option D1 Highway 97 from Sutherland Avenue to Highway 26	<ul style="list-style-type: none"> There are numerous private driveways with direct access onto Highway 97; 	<ul style="list-style-type: none"> Develop a frontage and backage road network and relocate accesses to these local roads; Access management solutions including closing and consolidating accesses; Controlled access to Highway 97; 	\$34,302,369 Further Study Recommended
Option D2 Highway 97 from Sutherland Avenue to Highway 26	<ul style="list-style-type: none"> Challenging turning movements for heavy vehicles using some accesses and the intersection of Brownmiller Road / Highway 97; 	<ul style="list-style-type: none"> Reconfigure Highway 97 to an urban street design with dedicated turn lanes for accesses to major driveways and intersections; Reduce from 4 lanes of traffic to 2 lanes of traffic with a centre turn lane to accommodate right turn lanes and a multi-use pathway 	\$24,710,466 Further Study Recommended

3.8 Potential Risks

As with any improvement project that the MoTI undertakes, there are typically risks associated related to design, constructability, cost and many other elements. Further, it is important to identify potential risks as they can impact the overall cost, schedule and feasibility of the recommended improvement options. A planning level assessment of potential risks by study segment is provided in **Table 3.12**. Many of the risks identified apply to Option AR-1a; thus, it is recommended that the MoTI undertake a complete risk register for Option AR-1a.

Table 3.12: Planning-Level Summary of Potential Project Risks for Option AR-1a

No.	Risk Name	Risk Description	Applicable to Options:
Engineering (Design)			
ED1	Design Standards	Design of structures and approaches must meet Transport Canada railway requirements.	• Option AR-1a
ED2	Design Standards	Type of bridge (pier vs. clear span) to be determined upon further design and First Nation consultation.	• Option AR-1a
ED3	Estimated Quantities	Retaining walls are included in conceptual design quantities and cost estimate; however, there is a risk additional retaining wall structures may be required upon further design.	• Option AR-1a
Geotechnical			
G1	Technical Geotechnical Conditions	There are known slope geotechnical issues that require further site investigations to confirm feasibility of construction, as documented in Appendix F .	• Option AR-1a
G2	Site Contamination Investigation	There are many contaminated sites in the Two Mile Flat area, including the Super Save Gast Station at the northeast corner of Sutherland Avenue / Highway 97, that are known contaminated sites.	• Option AR-1a • Option D1
G3	Site Contamination Remediation	There are many contaminated sites in the Two Mile Flat area including the Super Save Gast Station at the northeast corner of Sutherland Avenue / Highway 97, that are suspected sources of ground contaminants that requires remediation.	• Option AR-1a • Option D1
G4	Geotechnical Investigations	Archaeological investigations will need to occur concurrently with the geotechnical investigations.	• Option AR-1a
Environmental			
EN1	Environmental Assessment	In-river and land wildlife species are present and require further environmental assessment to confirm impacts and mitigation measures.	• Option AR-1a • Option D1
EN2	Environmental Work Window	Environmental work windows likely to be required around fish migration and spawning periods.	• Option AR-1a
Archaeology			
AR1	Archaeology Finds During Design	Risk that archaeological finds are discovered during planning and design phases of the project sites including First Nations artefacts and Railway artefacts.	• Option AR-1a • Option D1
AR2	Archaeology Finds During Construction	Risk that archaeological finds are discovered during construction phase of the project including First Nations artefacts and Railway artefacts.	• Option AR-1a • Option D1
AR3	Geotechnical Investigations	Archaeological investigations will need to occur concurrently with the geotechnical investigations.	• Option AR-1a

No.	Risk Name	Risk Description	Applicable to Options:
Properties			
P1	Property Acquisition	Loss of business to existing in-home businesses located along route alignment.	•Option AR-1a
P2	Property Acquisition	Loss of commercially owned property located along frontage / backage road alignment.	•Option D1
P2	Property Acquisition	Closure of the gas station at Sutherland Ave / Highway 97 could result in expropriation.	•Option AR-1a
P3	Project Delays	Closure of the Super Save Gas Station at Sutherland Avenue / Highway 97 could have potential impacts to project schedule.	•Option AR-1a
P4	Property Acquisition	Municipally owned greenspace and property at the west end of existing Quesnel Overhead including existing monument / memorials could require replacement value.	•Option AR-1a
P5	Property Acquisition	Small amount of property acquisition from St. Ann's Catholic School property is requires that could require replacement value.	•Option AR-1a
Construction (Access, Traffic Management, Weather)			
C1	Access Management	Project requires access changes to St. Ann's Catholic school and church both temporarily during construction and permanently as part of the design.	•Option AR-1a
C2	Railway Traffic Management	Working around railroads requires full-time flaggers and engineers for railway operation safety.	•Option AR-1a •Option D1
C3	Traffic Management	Construction on busy provincial highway route;	•All Options
C4	Drainage	Uncertainty regarding impacts to drainage along existing or proposed highway alignment.	•Option AR-1a •Option A2 •Option D1
C5	Weather	Seasonal weather windows create shorter construction season. (Eg. Late Spring thaw, early snow, summer thunderstorms)	•All Options
First Nations			
FN1	FN Consultation	FN consultation inadequate to meet needs of FN groups.	•Option AR-1a
FN2	Accommodation Agreements	Accommodation Agreements take longer than anticipated to negotiate, resulting in schedule delays.	•Option AR-1a
FN3	Spiritual / Cultural Monitors	Project may require spiritual and / or cultural monitors.	•Option AR-1a •Option A2 •Option D1
FN4	Increased Expectations	FNs have increased expectations based on other project precedents.	•All Options

No.	Risk Name	Risk Description	Applicable to Options:
Third Parties (Municipalities, Utilities)			
TP1	City of Quesnel	Require property west of the existing Quesnel Overhead in area designated as park.	• Option AR-1a
TP2	Utility Relocations	BC Hydro Distribution, Gas, Telus / Shaw require advanced notification to relocate.	• Option AR-1a • Option A2 • Option D1
Funding and Timing			
FT1	Project Delays due to Funding	Substantial rehabilitation of Quesnel Overhead and rehabilitation of Quesnel River Bridge occurs to maintain service extending life without addressing existing highway safety, traffic congestion and heavy truck issues on the structure.	• Option AR-1a
FT2	Project Delays due to Funding	Significant challenges for rehabilitation of Quesnel Overhead due to the type of structure and the presence of an active railway. Rehabilitation would require, at minimum, single-lane alternating traffic.	• Option AR-1a

3.9 Community Consultation

The development of the Highway 97 Quesnel Transportation Plan involved significant consultation with the community of Quesnel including municipal staff, elected officials, First Nations, community stakeholders and the public. Over the course of the Phase II planning study, there were:

- ▶ 4 x meetings with technical representatives from the City of Quesnel and the Cariboo Regional District
- ▶ 3 x meetings with Elected Officials and Lhtako Dené First Nation
- ▶ 2 x Public Open Houses
- ▶ 1 x meeting with Stakeholder Organizations
- ▶ Meetings with Individual Property Owners

The involvement of these various groups and communities in the planning study and the feedback and input received is described as follows.

3.9.1 *Technical Representative Consultation*

A group of technical representatives from the City of Quesnel and the Cariboo Regional District was formed to provide direct input and feedback to the project team on the technical analysis and findings as the study proceeded through the key tasks. Specifically, the MoTI project team and their consultant met with these technical representatives on the following dates to discuss and provide input regarding the following topics of the planning study:

Meeting Date	Meeting Topics / Purpose
▶ January 19th, 2017	Phase II Kick-Off Meeting Future Economic and Traffic Forecasts
▶ April 19th, 2017	Discuss Municipally Planned Improvements relevant to Highway 97
▶ June 20th, 2017	Review Public Open House #1 Findings Discuss Potential Improvement Options
▶ September 19th, 2017	Review Options Developed and Incorporate technical representative input Discuss Evaluation and Screening-Out of Options

In addition, the project team and their consultant met with the technical representative in advance of both public open houses to provide a brief update on the study and to confirm the messaging and intent for both engagement sessions.

3.9.2 *Elected Officials and First Nations*

The MoTI project team and their consultant met with elected officials three times throughout the study to provide an update on the study's progress and to gather input and feedback on the development of the Highway 97 Quesnel Transportation Plan. These elected officials included Mayor and Council from the City of Quesnel, and the Directors from the Cariboo Regional District. Specifically, these meetings occurred on the following dates to discuss the following topics:

Meeting Date	Meeting Topics / Purpose
▶ January 19th, 2017	Phase II Kick-Off Meeting Present Future Economic and Traffic Forecasts
▶ September 19th, 2017	Present Options Developed and Seek Input
▶ March 28th, 2018	Present the Final Draft Highway 97 Quesnel Transportation Plan

Further, the MoTI project team met with Lhtako Dené First Nation three times throughout the study to provide an update on the study's progress and to gather input and feedback on the Highway 97 Quesnel Transportation Plan.

3.9.3 Local Stakeholder Consultation

The MoTI project team and their consultant met with various local stakeholders individually throughout the study to brief them on the purpose and direction of the Highway 97 Quesnel Transportation Plan, and to gather their input on the key transportation issues that their respective organizations have observed along Highway 97. Their input was incorporated into the problem definition statement to inform the options developed and the solutions recommended from this plan. Specifically, the MoTI project team and their consultant met with the following stakeholders:

- ▶ Staff from Ministry of Forests, Lands Natural Resources, Operations and Rural Development
- ▶ Director and Staff from the G.R. Baker Memorial Hospital
- ▶ Economic Development Officer of the City of Quesnel
- ▶ Staff from BC Ambulance

3.9.4 Public Engagement Phase 1

To understand the needs, issues, concerns, and opportunities of Highway 97 in Quesnel, community and stakeholder feedback was essential. To collect this information, the MoTI invited the public to participate in Public Open House #1 on April 3rd, 2017 and provide their input by completing a feedback form at the open house, through an online survey, and by submitting feedback by email. The public open house was held at the Quesnel Senior's Centre on Carson Avenue from 4:00 PM to 8:00 PM. In total, 81 residents and community members attended the public open house and 123 survey responses were completed. The full results and findings of Public Open House #1 are documented in the *Community Engagement Summary Report – June 2017*, provided in **Appendix M**.

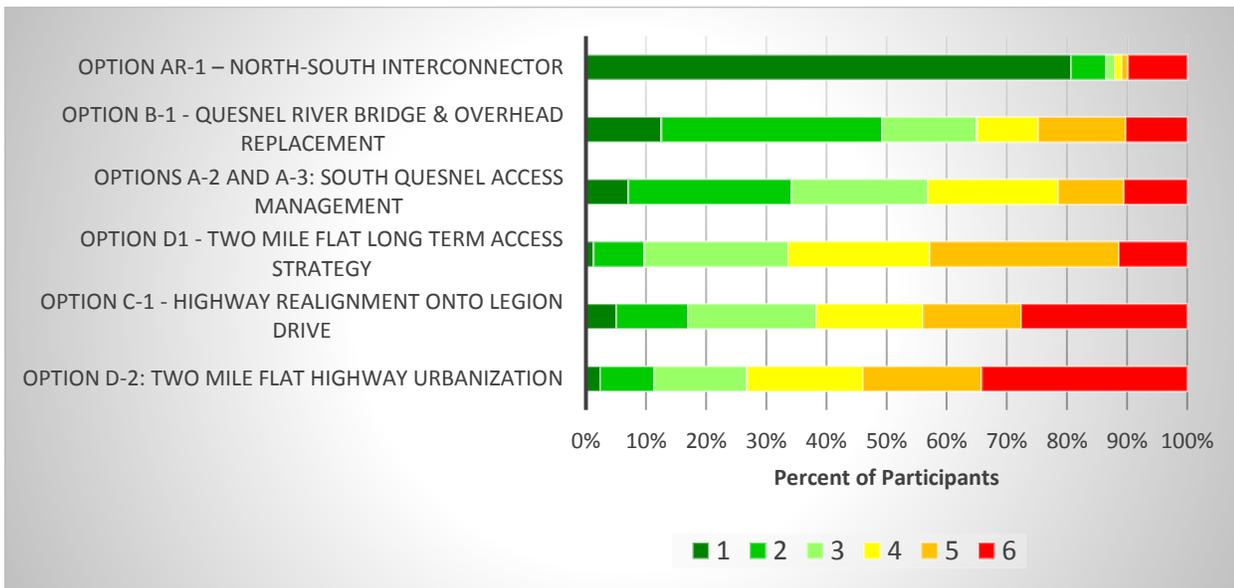
3.9.5 Public Engagement Phase 2

On February 7th, 2018 and February 19th, 2018, the MoTI invited the public to participate in the study's second Public Open House held over these two days. Community members were invited to provide their input on the conceptual improvement options that were developed to address the existing and future transportation issues identified in Phase 1 of the study. Participants were asked to provide their input on the options developed by completing a feedback form survey that was available in hard copy and web-based formats, and by submitting any additional feedback by email to the project team. The public open house was held at the Quesnel Senior's Centre on Carson Avenue from 3:00 PM to 7:00 PM both days. In total, 903 residents and community members attended the public open house and 843 survey responses were completed. The full results and findings of Public Open House #2 are documented in the *Community Engagement Summary Report – February 2018*, provided in **Appendix N**.

Key Findings

Participants were asked to rank the priority of the potential improvement options on a scale from 1 to 6, with 1 being the most important and 6 being the least important. The ranking results for each distinct option are shown in **Figure 3.8**. The highest ranked option was Option AR-1 – North-South Interconnector with 81% of responses ranking it number 1. The lowest ranked option was Option D-2 - Highway Realignment onto Legion Drive with 34% of responses ranking it number 6.

Figure 3.8: Ranked Priority of Improvement Options

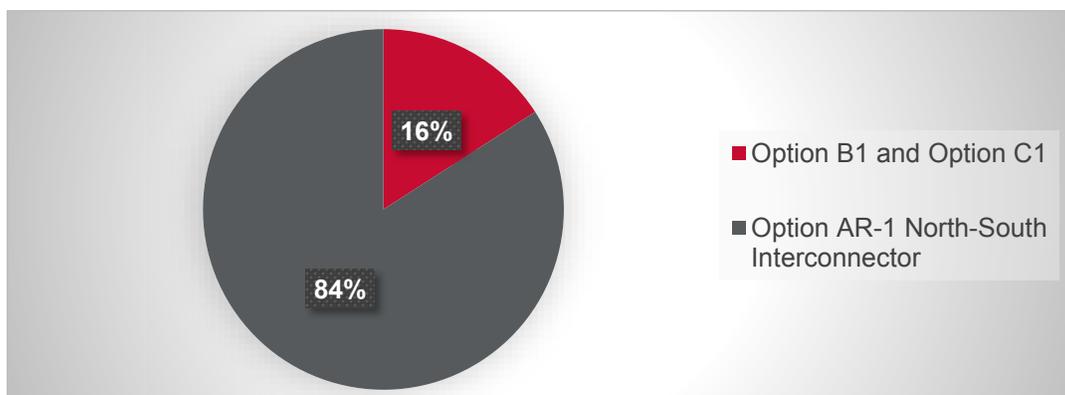


Further, participants were asked to choose one of the two options if given a choice:

- ▶ Option B1 - Quesnel River Bridge and Overhead Replacement and Option C1 - Highway 97 Realignment onto Legion Drive; or
- ▶ Option AR-1 North-South Interconnector (includes Quesnel River bridge and Quesnel Overhead replacement on new alignment)

The results of the survey are shown in **Figure 3.9**. Out of the total 784 responses to this question, a large majority of participants (84%) selected Option AR-1 North-South Interconnector over Option B1 and Option C1 (16%).

Figure 3.9: Results of Option Comparison



3.10 Recommendations

The development of the Highway 97 Quesnel Transportation Plan has involved extensive collaboration and consultation with organizations and members representing the community of Quesnel. The options identified for short-term implementation are recommended for further planning and engineering design as the timeline and the MoTI's priorities permit.

Of the four options identified in the short-term implementation strategy, three of these options including Option A5 (Racing Road and Quesnel-Hydraulic Road Access Management), Option C2-b (Front Street 3-Laning Reconfiguration) and Option C3 (Relocate Traffic Signal from Reid Street to McLean Street) are being advanced into preliminary design, engineering and construction over 2018 and 2019 for immediate implementation.

Option AR-1a (North-South Interconnector) is also recommended to be advanced as a short-term project. Several next steps are required to advance this project into the design process. Further, the timeline for this project is constrained by the known ageing and lifespan issues of the existing Quesnel Overhead and Quesnel River Bridges.

Letters of support from multiple levels of government, industry and community organizations for the short-term projects including Option AR-1a North-South Interconnector are provided in **Appendix O**.

3.10.1 Next Steps – Option AR-1: North-South Interconnector

The conceptual design developed for the North-South Interconnector and its priority as a short-term project has outlined the need for further site investigations, fieldwork, and design work required for this project. The next steps as this project advances to preliminary design should include:

- ▶ Conduct a project risk register assessment of the North-South Interconnector;
- ▶ Undertake geotechnical and archaeological site investigations and reporting;
- ▶ Undertake utility locates and field ties and involve utility owners in the design process to ensure requirements are incorporated and delays are minimized;
- ▶ Undertake a value analysis exercise to meet Ministry requirements and help to refine the design;
- ▶ Advance the design through the next phases and incorporate responses from all stakeholders;
- ▶ Continue engagement with local governments, Lhtako Dené, key stakeholders and the general public.

3.10.2 Next Steps – Option A2 & A3: South Quesnel Access Management

The following next steps are recommended for the conceptual design improvements identified for access management in the South Quesnel area as a long-term solution:

- ▶ Work collaboratively with staff from the City of Quesnel and the Cariboo Regional District to refine the access management plan so that it integrates cohesively with the local road network system, existing land use and potential future development;
- ▶ Support the City and the Regional District to incorporate the access management improvements into appropriate local government documents, such as the City of Quesnel's OCP Road Network Plan, the Cariboo Regional District's Quesnel Fringe Area OCP or the Quesnel Active Transportation Plan);
- ▶ Conduct a risk assessment of the South Quesnel Access Management Plan.

3.10.3 Next Steps – Option D1 & D2: Two Mile Flat Access Management

The following next steps are recommended for the conceptual design improvements identified for access management in the Two Mile Flat area as a long-term solution:

- ▶ Work collaboratively with staff from the City of Quesnel to refine the access management plan so that it integrates cohesively with the local road network system, existing land use and potential future development;
- ▶ Support the City to incorporate the access management improvements into appropriate local government documents (such as the Quesnel OCP Road Network Plan and/or the Quesnel Active Transportation Plan);
- ▶ Conduct a risk assessment of the Two Mile Flat Access Management Plan.