BRITISH COLUMBIA

Ministry of Transportation and Infrastructure

HIGHWAY 97 PEACHLAND TRANSPORTATION STUDY – PHASE II

Potential Corridor Improvements and Implementation Strategy

July 2021

PARSONS

This document "Highway 97 Peachland Transportation Study – Phase II, Potential Corridor Improvements and Implementation Strategy", prepared for the Ministry of Transportation and Infrastructure under the direction of a Professional Engineer registered in the Province of British Columbia. The document has also been prepared to meet Parsons' Quality Management requirements and the Organizational Quality Management Program of the Engineers and Geoscientists of British Columbia.

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1. INTRODUCTION

The Central Okanagan region has experienced strong economic and population growth accompanied by increasing highway traffic volumes. As the only north-south link connecting the Okanagan communities, Highway 97 is vital in connecting the residents and visitors to the region's wealth of economic, social, educational, recreational, and other opportunities. The 16-kilometre segment of Highway 97 running through the District of Peachland is the only remaining two-lane segment along an otherwise four-lane (or greater) highway corridor that runs 141 kilometres through the extended Okanagan region from Penticton through Summerland, Peachland, West Kelowna, Kelowna, Lake Country, Vernon, and Armstrong.

There are several long-standing concerns with respect to the existing highway corridor through Peachland that are related to road safety, traffic operations, and community connectivity. In response, the BC Ministry of Transportation and Infrastructure (BC MoTI) initiated the Highway 97 Peachland Transportation Planning Study, which aimed to assess current and anticipated future issues along the existing highway corridor through Peachland. The analysis considered demographics, community plans, existing and future traffic volumes, and the recorded collision history along the highway. The study then explored long-term options to improve future road safety and mobility for the corridor through either a series of upgrades to the existing route or through provision of an alternate route that will pass around much of the community.

The long-term solution for the corridor through Peachland, involving a full four-lane corridor either via an upgrade of the existing route or an alternate route, is not anticipated to be warranted for another 15 to 20 years. However, given the identified concerns with the existing highway corridor, several opportunities exist for smaller-scale targeted improvements that could potentially be implemented in the short and medium terms to address current issues related to road safety, active transportation connectivity, and access to transit.

In total, the Highway 97 Peachland Transportation Planning Study identified ten potential corridor improvement options:

- Four potential improvement options targeted for the short-term planning horizon;
- Three potential improvement options targeted for the medium-term planning horizon; and
- Three potential long-term corridor wide improvements.

1.1 Study Objectives

The objective of this part of the overall study is to identify potential improvements to the existing Highway 97 corridor through Peachland. This report presents several candidate improvements that address key corridor issues previously identified in the Phase I study. These candidate improvement options, being considered for the short to medium-term time frames, were evaluated based on their anticipated benefits, impacts, and costs. Stemming from the evaluation outcomes, recommendations are provided with respect to which candidate improvement options warrant further consideration in terms of potential implementation, including timing and / or prioritization. For completeness, this report also describes the general scope of the potential long-term improvement options, which will be refined in future work before a recommended long-term solution for the Highway 97 corridor is identified. These long-term options are consistent with the findings from the *Highway 97 Peachland Transportation Study – Phase I* report (Parsons, 2019).

1.2 Study Area

The study area is located within the District of Peachland and Regional District of Central Okanagan (RDCO). Existing route options focus on the Highway 97 corridor within the District of Peachland, while the long-term alternate route options are located within both the District of Peachland and RDCO boundaries. The south extent of the study area is near the Antlers Beach area, and the north extent is close to the Highway 97C / 97 interchange. ***Figure 1.1*** illustrates the study area within the context of the regional district.

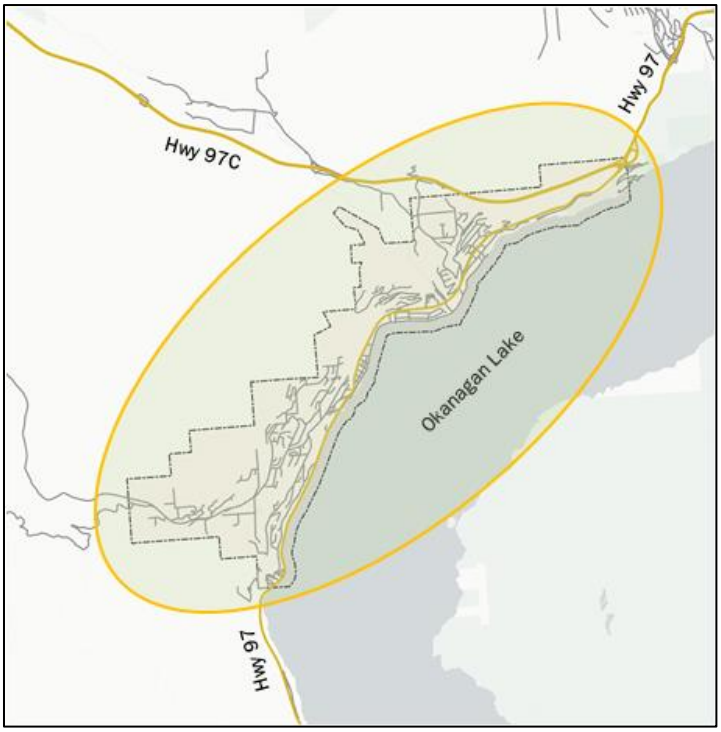


Figure 1.1: Study Area

1.3 Report Organization

The remainder of this report is structured as follows:

- **Section 2: Option Generation and Evaluation Framework** describes the guiding principles used to identify where and what types of improvement options were developed, how they were organized into short and medium-term improvement options, and the framework used to evaluate these options.
- **Section 3: Candidate Short-Term Improvements** defines several improvement options being considered in the short-term time frame and evaluates the benefits, costs, and impacts of each option through a variety of quantitative and qualitative criteria.
- **Section 4: Candidate Medium-Term Improvements** defines several improvement options being considered in the medium-term time frame evaluates the benefits, costs, and impacts of each option through a variety of quantitative and qualitative criteria.
- **Section 5: Overview of Potential Long-Term Improvement Options** presents the two alternate route options (Option AR-4 and Option AR-5) and one existing route option (Option ER-A).
- **Section 6: Input from Public Engagement Process** summarizes the feedback with respect to the short and medium-term options, which was received through the engagement process that took place in August and September 2020.
- **Section 7: Potential Implementation Strategy** provides recommendations as to which candidate improvement options warrant further consideration in terms of potential implementation as well as the associated timeframe – short-term or medium-term.

2. OPTION GENERATION AND EVALUATION FRAMEWORK

This section describes the approach used to develop the potential short and medium-term corridor improvement options, how the short and medium terms are defined, and the criteria used to evaluate the options.

2.1 Approach to Option Generation

With the primary role of Highway 97 in the Central Okanagan region to connect communities, regional / provincial activity centres, and other provincial highways, the various improvement options were developed and evaluated based on several high-level guiding principles as highlighted below:

- Addressing road safety and operations issues along the corridor;
- Supporting transit service along the corridor; and
- Supporting active transportation.

Options were generated based on these guiding principles, which generally involved the following types of infrastructure improvements:

- Intersection safety improvements, particularly through the elimination of unprotected turning movements onto the highway or turning movements from the highway through-lanes;
- Bus stop infrastructure to provide Peachland residents with access to the existing BC Transit Route 70 regional transit service that currently runs through but does not stop within the community; and
- Active transportation infrastructure improvements by improving connectivity and level of service for pedestrians and cyclists.

Improvement options were generated at a conceptual level of detail to enable the evaluation of the potential benefits and impacts, as well as to form a basis in developing high-level cost estimates. For the purposes of developing assumptions for evaluation, options were initially categorized into being candidates for implementation in the short-term or in the medium-term. Generally, the lower-cost or simpler-to-implement improvement options were categorized as candidates for the short-term time frame. In contrast, more costly or challenging improvement options (for example, those with greater potential for property impacts or other complexities), or for which the design concept could be further influenced / optimized based on which long-term option is ultimately selected, were categorized as candidates for the medium-term time frame. Depending on the evaluation outcomes, candidate options for short-term improvements that show value but may address a less urgent issue could potentially be deferred to the medium-term. Moving forward, BC MoTI will need to continue to monitor trends in traffic volumes and travel patterns on the highway corridor, and if necessary, may need to update projections and refine anticipated implementation timelines.

2.2 Evaluation Methodology

In order to assess the relative merits of each short and medium-term option relative to a "do nothing" base case, evaluation criteria were developed based on the Multiple Account Evaluation methodology typically used for Ministry of Transportation and Infrastructure planning studies. Recognizing the smaller scale of the short and medium-term options being considered as well as the existing highway environment at each option location, a high-level multiple account evaluation framework was developed that included the following criteria:

- Travel time savings
- Road safety
- Environmental impacts
- Socio-community impacts
- Compatibility with the longer-term options
- Capital costs

Each improvement option is intended to address different issues along the length of the highway corridor through Peachland, therefore the improvement options were assessed independently of one another and relative to a location-specific "do nothing" base case. Recognizing that the short or medium-term improvement options are independent of one another, it is possible for several (or potentially all) of the improvement options to be implemented along the corridor in a complementary manner.

Evaluation Scoring Approach

The evaluation outputs will involve a range of quantitative and qualitative scorings; these two scoring systems are described below.

Quantitative evaluation was used in instances where specific measurements of impacts could be made, and where feasible, a quantitative assessment using monetary values was preferred based on an approach consistent with the *Default Values for Cost Benefit Analysis (2018)*. Generally, quantitative evaluation was used to calculate travel time savings for vehicular modes, road safety, and capital costs. Given that costs could be incurred, and benefits could accrue over an extended time frame, monetized costs and benefits were reported in the form of present values in order to account for the time value of money. The calculation of present values required specific assumptions regarding the timing of these costs and benefits. Therefore, strictly for the purposes of developing and evaluating the short and medium-term improvement options, the following time frames were applied:

- The short-term was defined as within the next five years (i.e. 2021 through 2025). For evaluation purposes, it was assumed that all short-term improvement options would be implemented in year 2022 and be in service at the beginning of 2023.
- The medium-term was defined as being in the six-year to 15-year time frame (i.e. 2026 through 2035). For evaluation purposes, it was assumed that all medium-term improvement options would be implemented in 2030 and be in service at the beginning of 2031.

- The long-term was defined as being 16 years and beyond (i.e. 2036 and beyond), and for the purposes of this analysis, it was assumed that a long-term option would begin implementation after 2030, with an in-service date of 2036. Therefore, the final year for benefits accrual for the short and medium-term improvement options was 2035.

It should be noted that these option evaluation assumptions do not necessarily imply a BC MoTI commitment to implement any of these improvement options within the associated time frames, nor that these improvement options are inherently required to be implemented by these specific timeframes.

In some cases, the evaluation criteria could not be assessed using a commonly accepted monetary value per unit of impact or would not have a readily available measurement unit for impacts in the first place. Therefore, for several evaluation criteria, a qualitative scoring system was used to evaluate outcomes when specific measurements could not be made readily, but there would be obvious benefits or impacts as compared to the base case. Criteria assessed using a qualitative evaluation approach included travel time savings (in some cases, primarily for walking, cycling, and transit modes), road safety (in some cases), socio-community impacts, environmental impacts, and compatibility with the long-term options. To evaluate qualitative scoring consistently, a five-level rating system was applied, as shown in ***Table 2.1***.

Table 2.1: Qualitative Scoring System

Score	Meaning
○	Significantly Worse
◔	Somewhat Worse
◑	Similar to Base Case / Neutral
◕	Somewhat Better
●	Significantly Better

Evaluation Criteria Definitions and Assessment Methodologies

The specific methodology of applying the above-noted evaluation criteria in the assessment was based on the context and the intent of each improvement option. The above-noted evaluation criteria are defined and the methodology (or methodologies, as applicable) to evaluate the criteria are described in the sub-sections that follow.

2.2.1 Travel Time Savings

Travel time savings are a measure of the reduction (or increase, potentially) in overall travel time road users would experience if an improvement option were to be implemented, compared to the base case scenario where the improvement option is not implemented. Several factors could lead to travel time savings, such as increased road capacity for a given volume of vehicles if the road is currently operating near capacity, providing a more direct route that reduces travel distances, or elimination of travel delays / blockages such as those created by vehicles waiting for a gap in the opposing traffic stream in order to complete a turning movement.

The travel time savings associated with each option were assessed separately for road users in passenger vehicles (or goods movement vehicles), those using active modes (walking and cycling), and those using transit.

TRAVEL TIME SAVINGS: PASSENGER AND GOODS MOVEMENT VEHICLES

For passenger vehicles and goods movement vehicle modes, travel time savings were monetized. Traffic volumes used in the travel time savings analysis were based on observed count data and AM and PM peak hour traffic volume outputs from the Regional District of Central Okanagan (RDCO) regional travel demand model (version 1.01) for the 2014 base year and 2040 planning horizon year.

Where applicable, such as for the options involving intersection improvements, an industry standard intersection capacity analysis software (Synchro) was applied to assess operational performance, and models of the intersection for the base case and each improvement option were developed. For each option, traffic signal timing plans were optimized for each scenario and the associated turning movement volumes, and person-delay was calculated for all intersection approaches for both the 2014 and 2040 conditions. Travel time savings resulting from the improvement option were calculated by comparing vehicular delays for each option and the base case, and calculating the difference between the two scenarios. These travel time savings were expanded to daily and then annualized to 2014 and 2040 values using the methodology described in ***Appendix A***. Annualized vehicular travel time savings were then linearly interpolated for the intermediate years between the 2014 base year and the 2040 planning horizon year, and incorporated between the beginning of the implementation period (as noted above, this was assumed to be 2023 for short-term options and 2031 for medium-term options) until the end of 2035, subsequent to which a long-term option was assumed to supersede these interim improvement options.

Monetization of these savings was applied in accordance with the values shown in ***Table 2.2***, with a positive dollar value representing a net reduction in travel time (i.e. a savings), and a negative dollar value representing a net increase in travel time. Travel time savings for the Highway 97 approaches and the cross-street approaches were reported separately.

Table 2.2: Basis for Value of Time Factors (2020$)

Mode	Value	Source	Comments
PASSENGER VEHICLE	**$/PERSON-HR**	*Default Values for Cost Benefit Analysis in British Columbia*, BC Ministry of Transportation and Infrastructure, May 2018.	Inflated from 2018$ to April 2020$ using Statistics Canada Consumer Price Index.
Person	$19.23		
STRAIGHT TRUCK (LGV)	**$/TRUCK-HR**		
Total	$38.77		
COMBINATION TRUCK (HGV)	**$/TRUCK-HR**		
Total	$47.31		

TRAVEL TIME SAVINGS: WALKING, CYCLING, AND TRANSIT

In cases where the improvement options were expected to bring travel time benefits to transit users, pedestrians, and cyclists, benefits were assessed qualitatively using the qualitative scoring system shown in ***Table 2.1***. With respect to walking and cycling, pedestrian and cyclist volumes were not available from existing data sources. While overall / cumulative travel time savings could not be quantified, the average savings that an individual walking or cycling would experience was still captured in order to provide a quantitative basis to support a qualitative assessment.

With respect to transit, the primary issue to be addressed in several improvement options was the non-existence of bus stops for the Route 70 regional transit service through Peachland. As the service does not currently stop in Peachland and residents are unable to board the bus, the existing travel times for transit users are, by definition, zero. Providing transit service will attract transit ridership, and these trips would generate a larger-than-zero cumulative travel time, which would cause the evaluation to show a "negative travel time savings". Assessment of travel time savings is applicable when demand is not anticipated to be influenced by the existence of the improvement option. In contrast, the intended benefit of the bus stops stems from the improved access by transit that the bus stops would provide to the rest of the region, rather than providing significant travel time savings for existing riders.

2.2.2 Road Safety

The road safety criterion was a measure of how an option could increase or decrease safety for all road users, including pedestrians, cyclists, and vehicles, by eliminating conditions that could result in collisions. Such decreases may result from reductions in the number of conflicting movements between all modes or reducing existing hazards related to road geometry and adjacent constraints.

BC MoTI Collision Information System data for the study area were compiled for the time period between 2004 and 2018 to determine an annual average number of collisions overall, as well as the annual average number of collisions of each severity type: property damage only (PDO), injury, and fatal. Road safety changes resulting from each improvement option were estimated using collision modification factors from the AASHTO *Highway Safety Manual (2010)*. The collision modification factors relevant to each improvement type were then applied to estimate the annual average number of collisions that may occur after the improvement option is implemented.

Annualized road safety benefits were then linearly interpolated for the intermediate years between the 2014 base year and the 2040 planning horizon year. The interpolated values were then incorporated between the beginning of the implementation period (as noted above, this was assumed to be 2023 for the short-term improvement options and 2031 for the medium-term improvement options) until the end of 2035, subsequent to which a long-term option was assumed to supersede these improvement options. Due to a lack of data to establish a relation between the change in volume and the change in collision frequency, the reduction in collisions facilitated by the improvement option was assumed to remain constant.

Monetization of these collision reductions was applied in accordance with the values shown in ***Table 2.3*** and a present value of monetized road safety benefits was calculated, assuming a 6% discount rate, consistent with the BC MoTI *Default Values for Cost Benefit Analysis (2018)*. A positive value represented a reduction in collision costs (i.e. a benefit), while a negative value represented an increase in collision costs (i.e. a disbenefit).

Table 2.3: Financially Quantitative Input Assumptions for Road Safety Analysis (2020$)

Collision Type	Value	Source	Comments
Property Damage Only	$ 13,752.02	*Default Values for Cost Benefit Analysis in British Columbia*, BC Ministry of Transportation and Infrastructure, May 2018.	Inflated from 2018$ to April 2020$ using Statistics Canada Consumer Price Index.
Injury	$ 307,875.23		
Fatality	$ 8,227,209.58		

In addition to the quantitative (and monetized) assessment, in select cases, a qualitative evaluation of road safety was also undertaken when a quantitative assessment was not possible[1] or where the quantitative assessment could be complemented by an additional qualitative description of potential road safety impacts. Qualitative road safety impacts were evaluated using the scoring system shown in ***Table 2.1.***

2.2.3 Socio-Community Impacts

The socio-community impact criterion considered how an improvement option may impact the community. The assessment was based on high-level desktop investigations using local land use maps, previous studies, and feedback from stakeholders and residents. Considerations for this criterion included:

- Properties acquisition requirements;
- Urban or agricultural lands – order of magnitude of area impacted;
- Impacts to access for residential, commercial, or industrial properties;
- Community severance (i.e. highway seen or acts as a barrier);
- Accessibility and connectivity for all modes across or along the highway at key activity centres / roads;
- Equity;
- Visual and noise impacts;
- Impacts to archeological sites; and
- Consistency with community plans.

Socio-community impacts were evaluated using the scoring system shown in ***Table 2.1.***

2.2.4 Environmental Impacts

The environmental impact criterion considered how an improvement option may potentially impact environmental features that support biodiversity and sustainable ecosystems including: wetlands, agricultural lands, forested areas, parks, conservation zones, aquatic resources, wildlife corridors, species at risk and sensitive areas. The environmental screening was based upon a high-level desktop investigation using previous studies as well as available documentation including the *Penticton Indian Band Ecological and Cultural Heritage Assessment*.(Penticton Indian Band and Okanagan Nation Alliance, 2017). No field visits were conducted.

Findings were based on information stemming from a previous review of the long-term options, wherein an assessment was undertaken within the study area using available information from online government resources and other data such as:

- BC DataBC, iMapBC online mapping database
- Ministry of Environment & Climate Change Strategy (MENV) Fisheries Information Data Queries (MENV 2019)

[1] (For example, where safety concerns are known to exist even if there is no specific / applicable collision history)

- Okanagan Large Lakes Foreshore Protocol (OLLFP) (Updated in 2018) (MFLNRO&RD 2018a), including:
    - Guidance for Foreshore Plants in the Okanagan (MFLNRO&RD 2018b)
    - Guidance for Freshwater Mussels in the Okanagan (MFLNRO&RD 2018c)
- Foreshore Inventory Mapping (Updated in 2016) (Schleppe and Plewes 2017)
- British Columbia Great Blue Herons Atlas (GBHMT 2019)
- BC Conservation Data Centre (CDC) Species and Ecosystem Explorer database and associated reports (BC CDC 2019)
- Available Google Earth imagery of the local area (including street view)

The following local government resources were also reviewed:

- Peachland – Official Community Plan (Bylaw No. 2220, 2018) (District of Peachland 2018)
- Regional District of Central Okanagan (RDCO) GIS Mapping (RDCO Web Map)

Spatial data from the following studies and reports assessed as part of the previously completed Phase I study (*Highway 97 Peachland Transportation Study Phase I Final Report, 2019*) were also re-assessed:

- A Biodiversity Conservation Analysis Summary for the Okanagan Region (Caslys 2013)
- Keeping Nature in our Future: Volume 1 – A Biodiversity Conservation Analysis Summary for the South Okanagan-Similkameen Region (Caslys 2011)
- Draft Peachland Bypass: Highway 97 Transportation Corridor Enhancement Ecological and Cultural Heritage Assessments (Gyug et al. 2017) completed by the Penticton Indian Band and the Okanagan Nation Alliance

Along with Indigenous knowledge and input, pertinent regulatory acts such as the *Species at Risk Act* (SARA) allowed for the estimation of the presence of at-risk species, the amount and severity of impacted vegetation, and what environmental reviews were expected to be necessary. For at-risk species, the specific SARA status and BC list status were given.

Caslys Consulting Ltd. produced a combined Biodiversity Conservation Analysis Summary for the Okanagan Region in 2013, a key output of which was several major "decision support" tools:

- **Conservation Ranking** wherein individual ecosystem polygons derived from Terrestrial Ecosystem Mapping and Vegetation Resources Inventory data were scored using the Conservation Framework goals of "proactive conservation" and "maintaining BC's native biodiversity", and were assigned ranks as follows: Low (Class 4), Moderate (Class 3), High (Class 2), and Very High (Class 1).
- **Relative Biodiversity** was derived from modeling to identify existing areas of greatest ecological and biodiversity significance based on conservation ranking: presence of wetlands, antelope brush, potential riparian habitat, habitat patch size, and distance to roads[2], the presence of undeveloped buffers around wetlands (deep soil grasslands and shrub steppe units within 250 m of a wetland were scored higher); and presence of wetlands providing tiger salamander habitat (deep soil grasslands and shrub-steppe

[2] (further distance considered beneficial for increasing potential for high biodiversity)

units within a 630 m buffer around any wetland identified as providing tiger salamander habitat were scored higher).

- **Wildlife Habitat Connectivity** was derived from modelling of existing conditions using five parameters: elevation (lower elevation areas scoring highest), slope (steep slopes scoring lowest), terrain ruggedness (less variable terrain scoring highest), accessibility to water (areas with ready access scoring highest), and urban areas (urban areas and roads were not considered to provide connectivity). After totaling the scores for each parameter for each polygon, a numeric value was assigned to indicate relative wildlife habitat connectivity. Across the entire Okanagan Valley, Highway 97 was considered an impediment and significant barrier to east-west wildlife movements.

This criterion also considered potential impacts to greenhouse gas emissions and resiliency to climate change. Environmental impacts were evaluated using the scoring system shown in ***Table 2.1.***

2.2.5 Compatibility with Long-Term Options

While each improvement option was assessed individually and independent of other improvement options, consideration was given that a four-lane corridor solution for the highway, either along the existing or an alternate alignment, would be implemented over the longer-term. This criterion assessed the compatibility of each candidate short and medium-term improvement option with the long-term four-laning options on a qualitative basis, by determining whether the infrastructure would be complementary or reusable between the time frames.

Compatibility was assessed for both of the alternate route options as well as the existing route option since all three long-term options (i.e. the two alternate route options and the existing route option) are considered equally viable at this time. No specific scoring system was provided for this metric, given the existence of three potential long-term solutions for the highway corridor and no singular "base case" against which to compare the options. However, in general, the candidate short and medium-term improvement options would tend to have the following types of impacts with respect to the longer-term options:

- If an alternate route option were to be implemented in the future, then many of the short and medium-term options would likely continue to provide a benefit once the alternate route option is in service. The effect of selecting an alternate route option would simply be that in some cases, the magnitude of the benefits may simply be reduced beginning in 2036 as compared to what these benefits would be had an alternate route not been implemented. This potential reduction in benefits would be related to the diversion of some traffic from the existing highway to the alternate route. For example, if there is less traffic on the existing highway corridor once an alternate route is in place, then congestion or safety challenges on the existing highway may not be as severe. Conversely, in some cases, improvement options may continue to provide their full value even if an alternate route is implemented.
- Many of the short and medium-term improvement options included scope elements that also form part of the long-term existing route option. The effect of selecting the existing route option would be that, in some cases, the capital cost of the long-term existing route option would be reduced because some of these same scope elements would have already been implemented as part of a short or medium-term improvement option. In other words, the incremental cost of implementing the existing route option could be reduced by the cost of the scope elements included in the short or medium-term improvement options.

2.2.6 Capital Cost

The project management, design, and construction cost of each improvement option was assessed at a high level using a conceptual sketch, typical unit costs, and the methods of Highway Cost Estimating Using the Elemental Parametric Method. A contingency value of 50% was applied given the conceptual nature and lack of engineering detail at this stage of option development. Property costs were not included in the estimates at this time, noting that property impacts may only apply to the medium-term improvement options being considered. The net impact of the improvement options with respect to long-term maintenance and rehabilitation costs is anticipated to be relatively minor, therefore these costs were not assessed.

All costs were developed in 2020 dollars and were assumed to be incurred in 2022 (for candidate short-term improvement options) and 2030 (for candidate medium-term improvement options). These costs were then discounted in order to be expressed as a present value assuming a 6% discount rate, consistent with the *Default Values for Cost Benefit Analysis (2018)*. Note that although capital costs have an assumed year of expenditure, these costs are still measured in non-escalated constant 2020 dollars to facilitate a consistent approach to calculation of present values for all financially quantitative criteria. Although these figures are appropriate for economic analysis, they should not be interpreted as a year-of-expenditure dollars cost estimate (i.e. a cost estimate with escalation included) that would be used for project budgeting.

2.2.7 Benefit-Cost Ratio

A benefit-cost ratio was developed by dividing the sum of the present values of the monetized benefits (i.e. travel time savings for auto modes and road safety) by the present value of the project costs. Although a value greater than 1.0 typically represents "value for money" in terms of the intended transportation function of the improvement option, there were several caveats associated with this interpretation:

- A benefit-cost ratio should not be considered in isolation, as it excluded other benefits or impacts that did not lend themselves to monetization, or for which there was no data available to provide a basis for quantification and monetization. For example, an improvement option which was primarily intended to improve active transportation or transit service may have a very low benefit-cost ratio because the benefits for people walking, cycling or using transit could not monetized.
- The typical evaluation period for a project is 25 years, which allows for an implementation period followed by 20+ years of benefits accrual. However, the assumed implementation of the long-term improvement option truncated the benefits accrual period (13 years for candidate short-term improvement options, and four years for candidate medium-term improvement options). Therefore, the magnitude of benefits for each improvement option was lower than what it would be had the improvement option been assessed using a more typical 25-year evaluation period. However, in practice the candidate short and medium-term improvement options would still provide value over the long-term, either in the form of ongoing benefits for alternate route options or a lower incremental capital cost for the existing route option, neither of which were reflected in the benefit-cost ratio.
- Related to the point above, as the candidate short and medium-term improvement options had different accrual periods, their associated benefit-cost ratios are not "like-with-like" comparisons and should not be compared across time frames.

2.2.8 Summary Table

An example summary table, ***Table 2.4***, presents the format in which all the criteria used in the evaluation of the candidate short and medium-term improvement options are summarized.

Table 2.4: Summary of Short and Medium-Term Option Evaluation Metrics

Criteria	Units
Travel Time Savings (Passenger and Goods Movement Vehicles)	$
Travel Time Savings (Walking, Cycling and Transit)	Qualitative Scoring
Road Safety	$ / Qualitative Scoring
Socio-Community Impacts	Qualitative Scoring
Environmental Impacts	Qualitative Scoring
Compatibility with Long-Term Options	Descriptive
Capital Cost	$
Benefit-Cost Ratio	Unitless Quantitative

3. CANDIDATE SHORT-TERM IMPROVEMENTS

Several candidate improvement options for potential implementation in the short-term were identified. These options were intended to provide safety and transit connectivity improvements for modest costs and create little to no property impacts (or other complexities) as compared to the medium and long-term options.

The four candidate short-term improvement options identified along Highway 97 are as follows:

- Short-Term Option 1: Trepanier Bench Road Signalization and Access Management Upgrades
- Short-Term Option 2: Princeton Avenue Intersection Safety and Transit Improvements
- Short-Term Option 3: Clements Crescent Intersection Transit and Pedestrian Connectivity Improvements
- Short-Term Option 4: Renfrew Road Intersection Safety Improvements

3.1 Description of Candidate Improvement Options

In this section, the four potential short-term improvement options are described complete with conceptual-level sketches. In addition, an overview of the objectives of each improvement option are identified.

3.1.1 Short-Term Option 1: Trepanier Bench Road Signalization and Access Management Upgrades

Currently, the Trepanier Bench Road, Buchanan Road (West) and Buchanan Road / Huston Road intersections with Highway 97 all experience traffic operations and road safety challenges with respect to access onto and, to a lesser extent, off of the highway. These challenges can be particularly acute during the summertime when traffic volumes on the highway are higher, and gaps in the traffic stream to turn onto the higher are fewer. An example of this is shown in ***Figure 3.1***, where high volumes of southbound traffic on Highway 97 leave few gaps in the traffic stream for vehicles from Huston Road and Buchanan Road to access the highway. A similar situation at the Trepanier Bench Road intersection is shown in ***Figure 3.2***.

Figure 3.1: Queued Vehicles Waiting to Access Highway 97 from Huston Road (Left) and Buchanan Road (Right)

Figure 3.2: Queued Vehicles Waiting to Access Highway 97 from Trepanier Bench Road

BC MoTI has already begun investigating the option to signalize the Trepanier Bench Road T-intersection with Highway 97 and implement a number of access management measures at the Buchanan Road South and Huston Road / Buchanan Road intersections. The proposed overall scope of this initiative is shown in ***Figure 3.3***, as provided by BC MoTI.

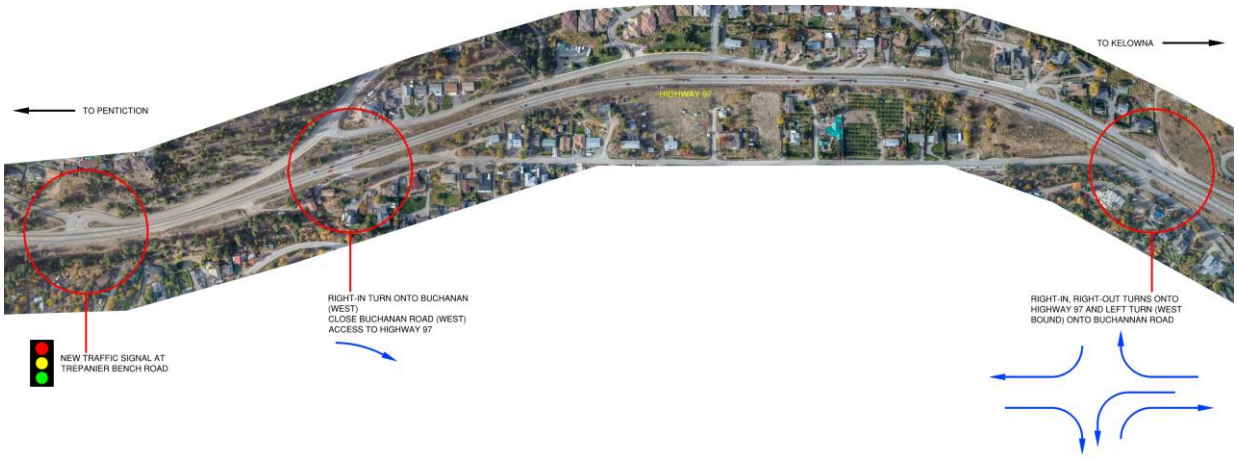


Figure 3.3: Trepanier Bench Road Signalization and Access Management Upgrades – Proposed Overall Scope[3]

[3] Note that Buchanan Road South is labelled as Buchanan (West) in this graphic.

The proposed conceptual layout for the signalized T-intersection of Trepanier Bench Road and Highway 97 provided by the BC MoTI is shown in ***Figure 3.4*** below. In addition to providing a traffic signal at the Trepanier Bench Road intersection, the adjacent Desert Pines Avenue T-intersection is converted to an outbound (to Trepanier Road) configuration only; vehicles will no longer be able to access Desert Pines Avenue (almost) directly from the highway.

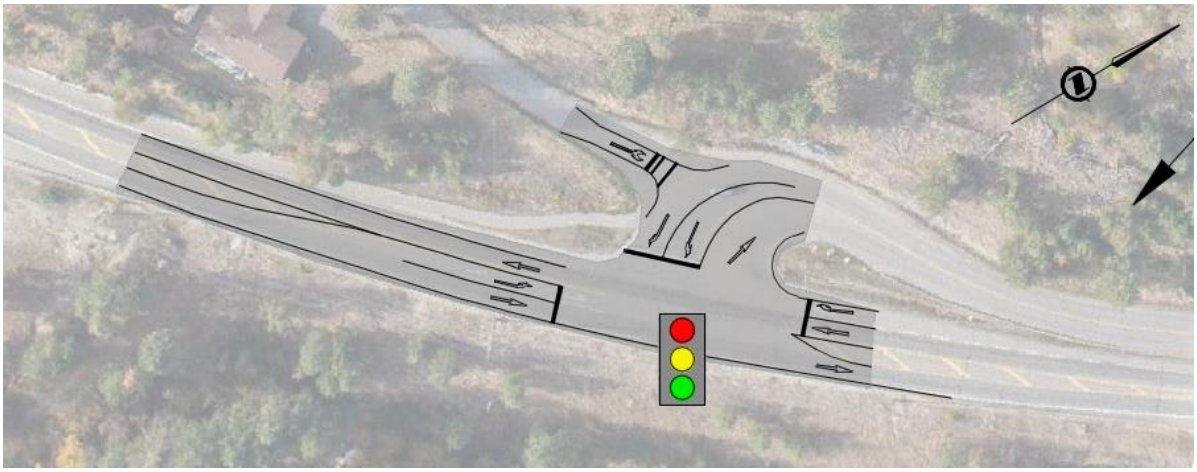


Figure 3.4: Trepanier Bench Road Signalization and Access Management Upgrades – Trepanier Bench Road Signalized Intersection

The access management measures along Highway 97 at the Buchanan Road west intersection are shown in ***Figure 3.5.*** In this improvement option, all movements at the intersection except for right turn movements from the highway onto Buchanan Road will be prohibited.

Figure 3.5: Trepanier Bench Road Signalization and Access Management Upgrades – Buchanan Road West Intersection

The access management measures along Highway 97 at the Huston Road / Buchanan Road intersections are graphically shown in ***Figure 3.6***. These measures will convert the Highway 97 / Huston Road / Buchanan Road intersection(s) to a right-in / right-out configuration, with the exception of also allowing the southbound left turn movement.

This potential short-term option is anticipated to facilitate safer and more reliable access onto Highway 97 for local residents, although in some cases the access management strategy will result in circuitous highway access.

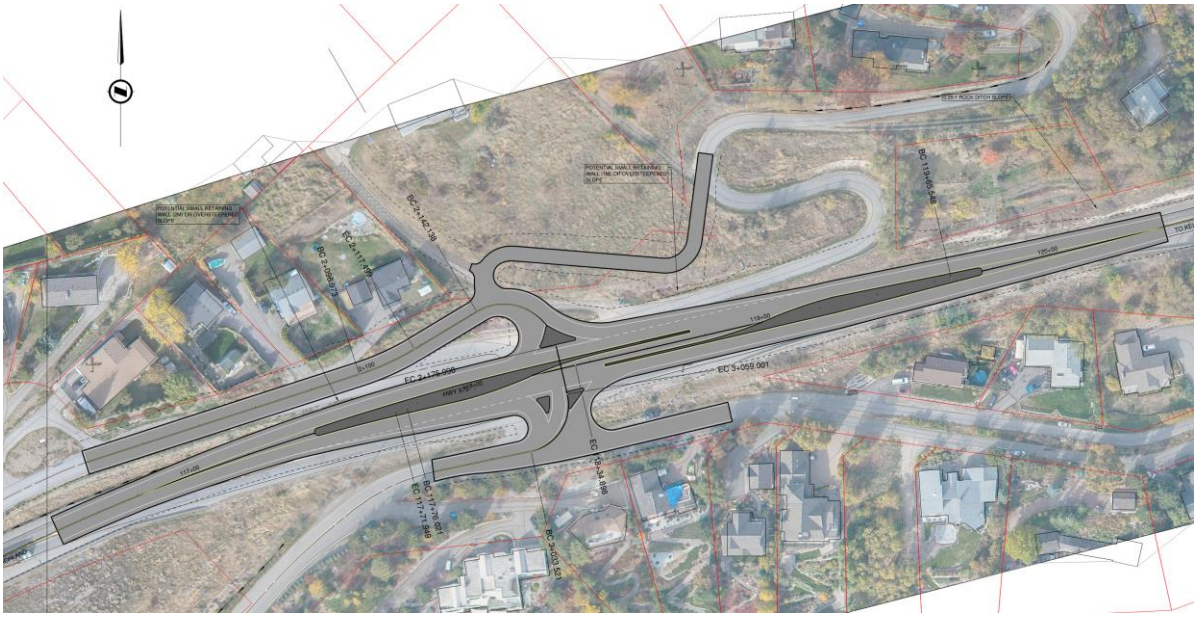


Figure 3.6: Trepanier Bench Road Signalization and Access Management Upgrades – Huston Road / Buchanan Road Intersection

3.1.2 Short-Term Option 2: Princeton Avenue Intersection Transit and Safety Improvements

This potential short-term option is a combination of two separate elements:

- An on-corridor bus stop for the Route 70 regional transit service; and
- A dedicated southbound right-turn lane in order to separate the southbound through and right-turn movements that currently share a lane at this intersection.

With respect to transit service, Route 70 is a recently launched express bus service operating regionally between Penticton and Kelowna; however, due to a lack of suitable stop locations within Peachland, this recently introduced regional transit service simply passes through Peachland rather than servicing Peachland residents and businesses. Through engagement with BC Transit, the junctions along Highway 97 at Princeton Avenue and Clements Crescent were identified as potential stop locations within Peachland for the Route 70 regional transit service, subject to the availability of suitable bus stop infrastructure. Therefore, implementing bus stop infrastructure at Princeton Avenue was identified as a short-term improvement option to provide a new regional transit service to Peachland residents. For reference, the existing Route 22 service runs from Beach Avenue to Princeton Avenue, therefore crosses Highway 97 but does not require bus stop infrastructure along Highway 97. BC Transit expressed a preference for far-side bus stops, therefore the concept was developed to include the provision of far-side bus stops. Furthermore, given the high travel speeds along the corridor, it was assumed that bus bays would be provided[4]. Sidewalks to facilitate access to and from the transit stop were also included. BC Transit further suggested that the feasibility of transit priority measures be incorporated as part of the option development. In response, bus queue jumper lanes were added into the option for both the northbound and southbound directions.

[4] This is consistent with the BC Transit *Infrastructure Design Guidelines* (2010), which calls for bus bays on roadways with a prevailing speed of 70 km/h or higher. The posted speed limit along this section of highway is 70 km/h.

With respect to the southbound right-turn lane, the existing highway curvature north of the intersection combined with the rock wall on the west side of the highway, impacts sightlines for southbound drivers. This is particularly a concern given that the Princeton Avenue signalized intersection is located just downstream of this curve. Therefore, drivers may have insufficient time to react and come to a stop if a queue of traffic extends back from the traffic signal and reduces the stopping distance available to the intersection stop line. An existing advance warning flasher sign upstream of the intersection advises southbound drivers about red light phases so they can begin to decelerate in advance of seeing the physical traffic signal head and / or the rear of the vehicle queue. However, while these flashers will alert drivers to stopped vehicles associated with a red light, they do not alert drivers to a stopped vehicle waiting to execute a southbound right-turn maneuver. It is also noted that the existing road geometry provides a wide angle on the northwest corner of the intersection that allows southbound right-turning vehicles to execute the turn at higher speeds and drivers may feel pressured to make the turn immediately and / or at a higher speed if they believe they are at risk of being rear-ended. However, this right-turn maneuver can create a safety concern for pedestrians emerging from the underpass to cross Princeton Avenue using the crosswalk, given that:

- The rock wall and ramp up from the pedestrian underpass means that drivers will have less time available to detect a pedestrian, thereby potentially increasing the risk of a driver executing a turn maneuver while the pedestrian has the right-of-way; and,
- The severity of pedestrian / vehicle collisions increases significantly with higher vehicle speeds.

A sketch of the potential short-term option showing the proposed bus stop locations, bus queue jumper lanes, and the southbound right-turn lane is provided in ***Figure 3.7***.

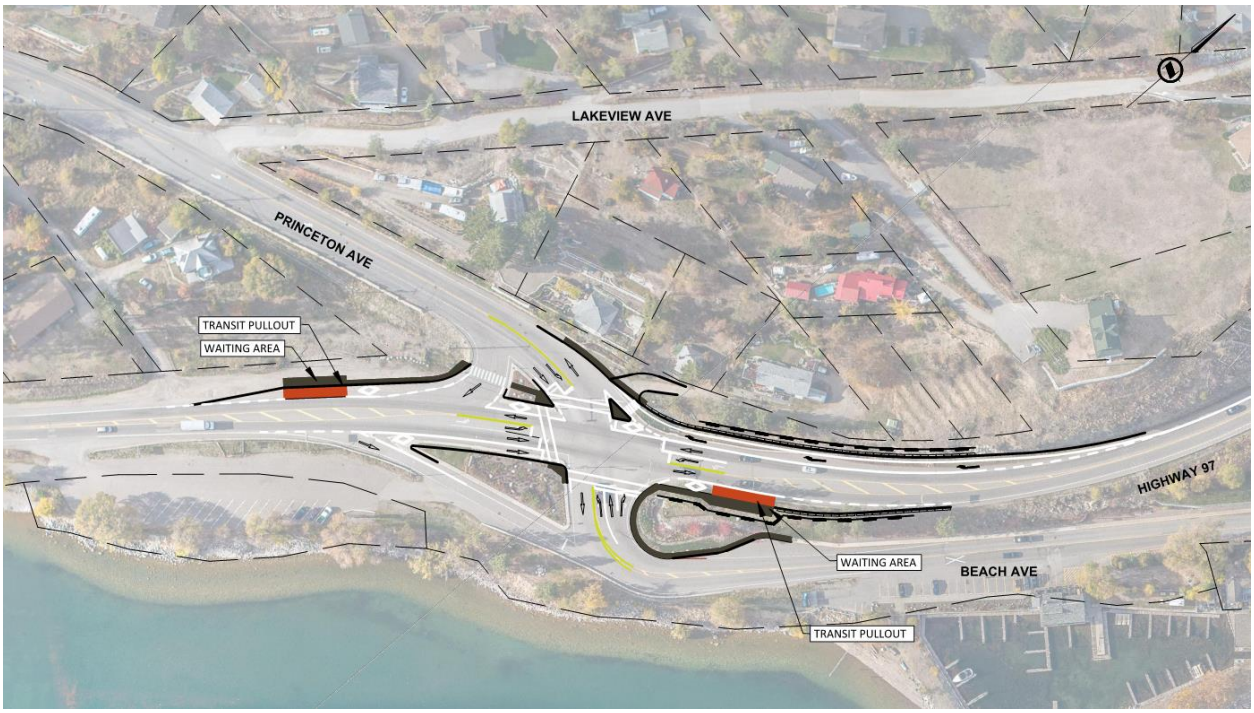


Figure 3.7: Princeton Avenue Intersection Transit and Safety Improvements

Anticipated benefits of this potential short-term improvement option include:

- The bus stops will provide Peachland residents with access to the recently introduced regional transit service, thereby providing alternatives to driving. Providing this improved transit service for Peachland residents presents a one-time capital cost but a negligible long-term incremental operating cost since the bus route will continue to operate regardless of the implementation of bus stop infrastructure. The only changes to the route operations would entail the bus stopping at Princeton Avenue.
- The bus queue jumper lanes will provide a small improvement in terms of bus travel time reliability.
- The dedicated southbound right-turn lane will improve road safety by reducing the risk of a southbound right-turning vehicle, that is waiting for a pedestrian to cross, from being rear-ended by a southbound through-moving vehicle. The right-turn lane can also be developed with a slightly sharper curve radius to encourage turning maneuvers at slower speeds, in order to reduce the risk of collisions with crossing pedestrians, and the severity of such collisions if they do occur.
- The southbound right-turn lane eliminates delays to southbound through-moving vehicles (other than when a southbound Route 70 bus is using the proposed queue jumper lane).

Anticipated challenges of this potential short-term improvement option include:

- The pedestrian underpass on the north leg of the intersection, shown in ***Figure 3.8***, is to be eliminated, as retaining the access to the underpass on the northwest quadrant of the intersection will be challenging given the installation of the proposed southbound right-turn lane. This change means that all pedestrians crossing the highway will have to do so at the south crossing.
- Access to the properties on the northwest quadrant of the intersection needs to be reconfigured, although the property parcels themselves are not anticipated to be affected.
- The proposed retaining wall on the west side of the highway may be a "throwaway" cost if the existing route Option ER-A were to be implemented over the long-term. Further widening of the highway away from the lake will begin to impact the adjacent property and by extension require reconstruction of the retaining wall included as part of this short-term option.

Figure 3.8: Existing Pedestrian Underpass Underneath the North Leg of Princeton Avenue Intersection with Highway 97

3.1.3 Short-Term Option 3: Clements Crescent Intersection Transit and Pedestrian Connectivity Improvements

In addition to Princeton Avenue, Clements Crescent was also identified by BC Transit as a potential stop location for the Route 70 regional transit service. The existing Route 22 transit service currently stops within the nearby Peachland Centre shopping plaza; however, this stop requires buses to execute a turnaround maneuver within the shopping centre. Unlike the smaller buses used for Route 22, the larger buses used for Route 70 are not able to execute this turnaround. Therefore, on-corridor bus stops along Highway 97 are required to enable Route 70 to service this area. Similar to Princeton Avenue, it was assumed that the bus stops would be implemented as on-corridor far-side stops with bus bays, and that bus queue jumper lanes would also be provided. A sketch showing the proposed bus stops and the bus queue jumper lanes is provided in ***Figure 3.9***.

With the on-corridor stops in place, BC Transit could potentially also re-route the Route 22 service to use these new highway stops instead of diverting into the shopping plaza. This will result in increased walking access distance for trips to the shopping plaza or Peachland Elementary School, but may improve travel times for other bus passengers and enable more efficient transfers between the two services. Should BC Transit wish to implement timed transfers between the two services at this location, the bus bays will need to be designed of a sufficient length to accommodate both a Route 22 bus and Route 70 bus to be stopped simultaneously without obstructing the adjacent general-purpose traffic lanes.

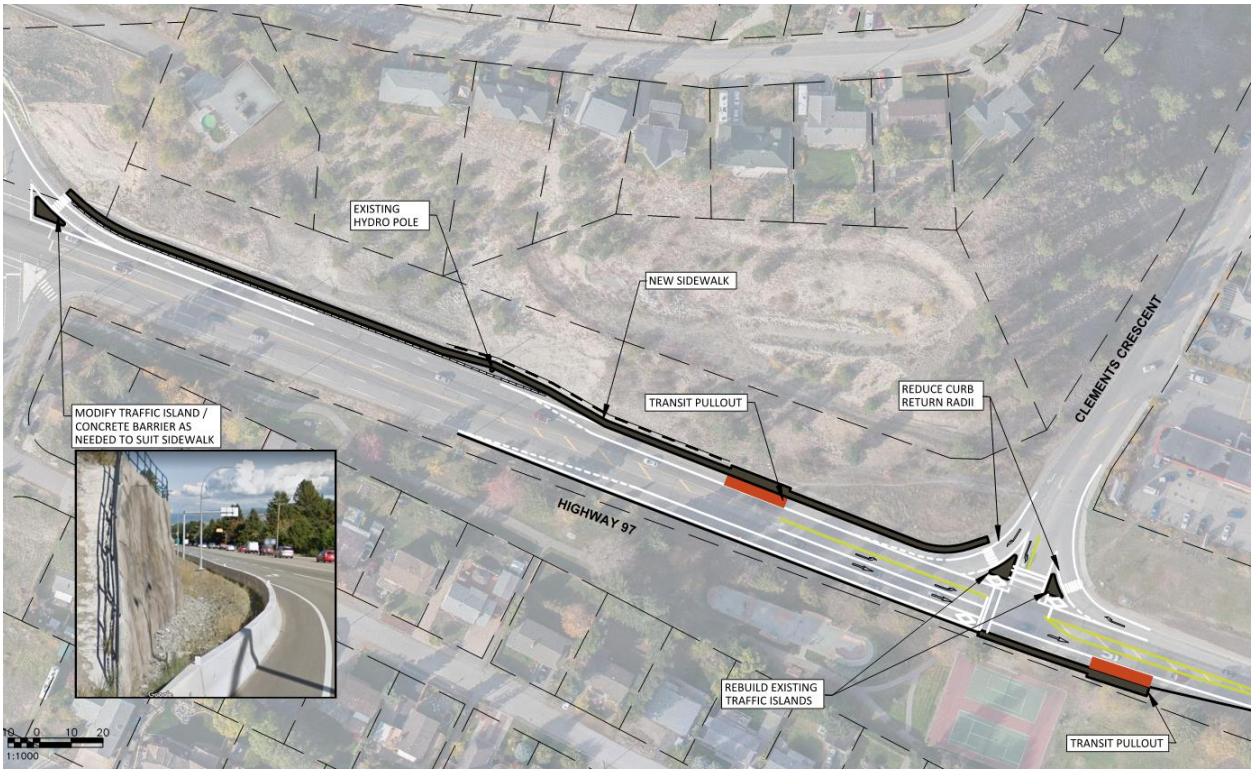


Figure 3.9: Clements Crescent Intersection Transit and Pedestrian Connectivity Improvements

Feedback from previous stakeholder engagement also noted concerns regarding the lack of direct pedestrian connectivity between Ponderosa Drive and Clements Crescent on the west side of the highway, as shown in ***Figure 3.10***. Such a route will enable residents of the Ponderosa neighbourhood to access, more directly,

destinations such as the Peachland Centre shopping plaza, Peachland Elementary School, and the southbound bus stop. Given that a portion of this sidewalk is already required to provide access to / from the proposed southbound far-side bus stop, an extension of this sidewalk further south to Ponderosa Drive was also incorporated into this potential short-term option.

Figure 3.10: Highway 97 Looking South from Clements Crescent to Ponderosa Drive

Anticipated benefits of this potential short-term improvement option include:

- The bus stops will provide Peachland residents with access to the recently introduced regional transit service, thereby providing alternatives to driving. Providing this improved transit service for Peachland residents presents a one-time capital cost but a negligible long-term incremental operating cost since the bus route will continue to operate regardless of the implementation of bus stop infrastructure. The only changes to the route operations would entail the bus stopping at Princeton Avenue.
- The bus stops will provide an opportunity to improve routing efficiency on Route 22 as well as facilitate efficient transfers between the two services.
- The bus queue jumper lanes will provide a small improvement in terms of bus travel time reliability.
- The proposed sidewalk connection will enable residents of the Ponderosa neighbourhood to access destinations such as the Peachland Centre shopping plaza, Peachland Elementary School, and the southbound bus stop without needing to cross the highway twice in each direction (or four times total for a round-trip).

It was anticipated that the retaining wall that would be constructed to provide a sidewalk connection between Clements Crescent and Ponderosa Drive may be a "throwaway" cost if the existing route Option ER-A were to be implemented over the long-term. Option ER-A includes highway widening to accommodate four lanes that will further require cutting back the hillside and constructing a significantly larger retaining wall beyond what will be required for this potential short-term improvement option.

3.1.4 Short-Term Option 4: Renfrew Road Intersection Safety Improvements

The existing Renfrew Road T-intersection with Highway 97 incorporates a southbound right-turn lane as well as an eastbound right-turn add-lane that transitions to a southbound passing lane on the highway. However, as shown in ***Figure 3.11***, there are no comparable auxiliary lanes for movements on and off the highway in the northbound direction.

Figure 3.11: Existing Renfrew Road T-Intersection

A potential short-term option was identified to improve safety at the Renfrew Road / Highway 97 Road intersection, as shown in ***Figure 3.12.*** This potential option involves reconfiguring the intersection as a "Protected-T" intersection and includes a proposed northbound left-turn lane to avoid left-turning vehicles stopping in the northbound through lane when there are no gaps in the oncoming traffic stream. Vehicles turning from Renfrew Road onto Highway 97 northbound will also be able to do so more safely and efficiently as drivers

will only need to wait for a gap in the traffic stream travelling in the southbound direction as well as the northbound left-turning traffic.

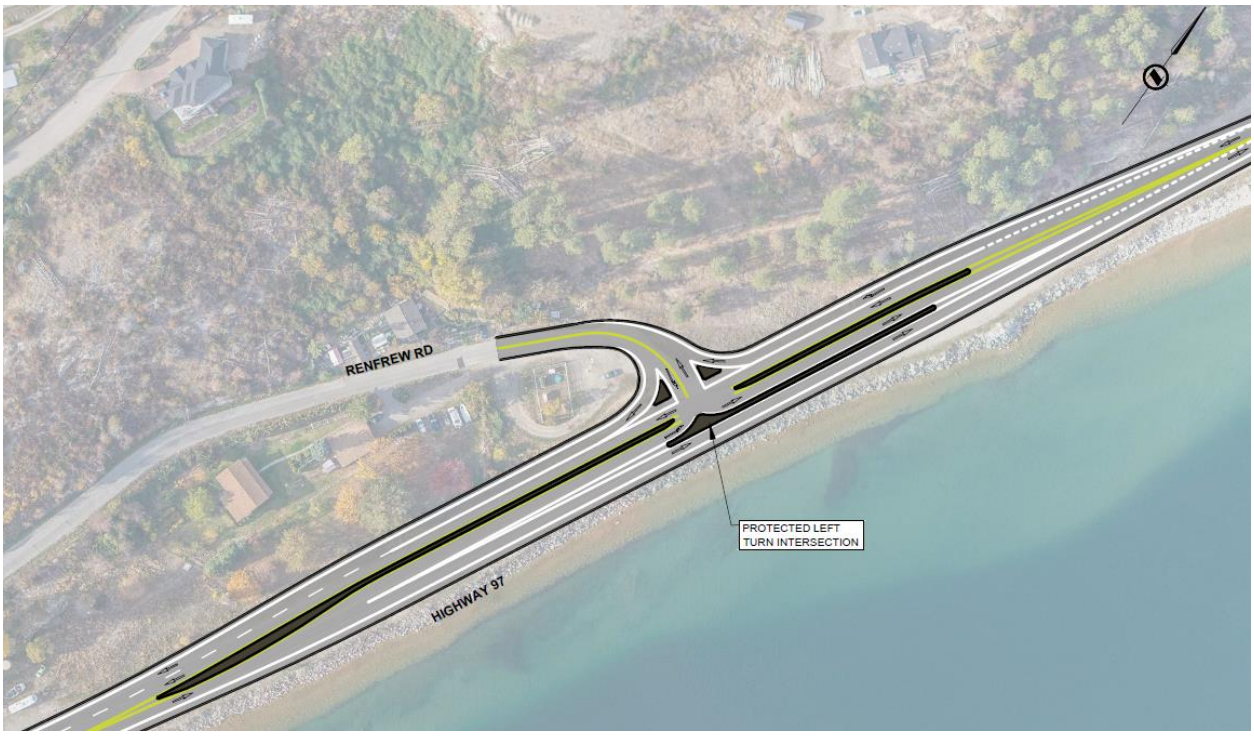


Figure 3.12: Renfrew Road Intersection Safety Improvements

Anticipated benefits of this potential short-term improvement option at Renfrew Road include:

- The potential to mitigate collision risks associated with northbound left-turning vehicles (such as being rear-ended by through traffic).
- The potential to provide safer movements for eastbound left-turn movements from Renfrew Road onto Highway 97, as turning vehicles from Renfrew Road will only need to ensure clearance for traffic travelling in the southbound direction and with northbound left-turning traffic.
- The potential to eliminate delays to northbound through-traffic that would otherwise be caught behind a northbound left-turning vehicle waiting for a gap in the southbound traffic stream.

A key challenge with this potential short-term improvement option is the proximity of the lake to the highway and the need to avoid impacts to the foreshore. The proposed widening required for this project assumes that no changes would be made to the highway on the east side (northbound lane and shoulder) and that any widening would be focused to the westside of the highway.

3.2 Evaluation of Candidate Improvement Options

This sub-section presents the results of the evaluation of each potential short-term option based on the criteria described previously in Section 2.2, including the quantitative and qualitative measurement of the benefits, impacts, and costs. As noted previously, the individual assessments of each option were independent of the other options.

3.2.1 Short-Term Option 1: Trepanier Bench Road Signalization and Access Management Upgrades

The Trepanier Bench Road Signalization and Access Management Upgrades option was assessed based on the potential travel time savings, improved road safety performance, environmental impacts, socio-community impacts, compatibility with the long-term options, and capital cost.

TRAVEL TIME SAVINGS

Potential travel time savings are discussed separately for the passenger vehicle and goods movement vehicle modes, as well as the walking, cycling, and transit modes.

Passenger and Goods Movement Vehicles

Travel time savings for the Trepanier Bench Road Signalization and Access Management Upgrades were calculated based on a combination of estimated detour driving time relative to the base case, and changes in intersection delay as calculated using industry standard intersection capacity analysis software (Synchro).

Existing conditions on the corridor in this study area were based on the most recent turning movement counts. For the analysis of the improvement option, traffic volumes were manually re-assigned to the appropriate intersection recognizing the proposed turning restrictions and to choose routes with acceptable levels of delay. In the case of the re-routed vehicles, additional travel time was included in the analysis of that scenario to account for the change in travel distance. For both the existing and post improvement condition, 2040 volumes were forecasted using the regional travel demand model. The proposed traffic signal at Trepanier Bench Road was assessed as uncoordinated with the adjacent traffic signals and was optimized using the Synchro intersection capacity analysis software.

The cumulative daily travel times and monetized annual travel time savings associated with the Trepanier Bench Road Signalization and Access Management Upgrades option are shown in ***Table 3.1*** and ***Table 3.2***, respectively, for both the 2014 base year and the 2040 planning horizon year. Two of the three intersection improvements, namely the turn restrictions at Buchanan Road West and Huston Road / Buchanan Road, will provide significant travel time savings as a result of reduced delay, especially for traffic from the cross streets since many of these movements will be restricted and therefore traffic will no longer be delayed at these locations. However, the proposed traffic signal at Trepanier Bench Road will result in an overall increase in traffic delay, with the increased traffic delay associated with the highway traffic (which is currently free flow) being greater than the decrease in traffic delay for cross-street traffic. Overall, travel time is anticipated to increase by 4.4 hours per day in the 2014 scenario and 46.2 hours per day in the 2040 scenario as a result of this short-term improvement option.

Table 3.1: Delay Modelling Results for Trepanier Bench Road Signalization and Access Management Upgrades

Intersection	Approaches	2014		2040	
		Base Case Daily Intersection Delay (Hours)	With Option Daily Intersection Delay (Hours)	Base Case Daily Intersection Delay (Hours)	With Option Daily Intersection Delay (Hours)
Trepanier Bench Road	Highway	2.1	47.5	3.1	140.9
	Cross street	15.2	7.6	39.8	19.8
Buchanan Road West	Highway	0.0	0.0	0.0	0.0
	Cross street	0.9	0.0	4.1	0.0
Huston Road / Buchanan Road	Highway	1.4	0.9	6.4	6.3
	Cross street	33.5	1.4	69.9	2.5
Option Total	Highway	3.5	48.4	9.4	147.2
	Cross street	49.6	9.0	113.8	22.2
	Total	**53.0**	**57.4**	**123.2**	**169.5**

Table 3.2: Travel Time Savings and Annual Benefits for Trepanier Bench Road Signalization and Access Management Upgrades

Approaches	2014		2040	
	Daily Travel Time Savings (Hours)	Annual Time Savings Benefits (2020$)	Daily Travel Time Savings (Hours)	Annual Time Savings Benefits (2020$)
Highway	-44.9	-$310,000	-137.8	-$940,000
Cross street	40.5	$260,000	91.5	$590,000
Total	**-4.4**	**-$45,000**	**-46.2**	**-$350,000**

The corresponding present value of the monetized travel time savings between the assumed 2023 in-service date and the assumed end of the analysis period in 2035 are shown in ***Table 3.3***.

Table 3.3: Present Value of Travel Time Savings for Trepanier Bench Road Signalization and Access Management Upgrades

Approach	Present Value (2020$)
Highway	-$5,790,000
Cross street	$3,930,000
Total	**-$1,850,000**

Walking, Cycling, and Transit

The scope of the potential short-term option does not include a crosswalk at the proposed Trepanier Bench Road signalized intersection because there is no suitable path on the south / east side of the intersection or highway segment for use by pedestrians or cyclists.

The potential short-term option is anticipated to have a number of impacts to transit service and riders:

- The northbound Route 22 service passes through the Highway 97 / Buchanan Road West and the Highway 97 / Huston Road / Buchanan Road intersections as it diverts from the highway to Buchanan Road and then back onto the highway. The access management measures at these two intersections will impact the routing of the existing bus service. However, the restricted movements at the Highway 97 Huston Road / Buchanan Road intersection will eliminate the risk of the bus being caught behind through-moving or left-turning traffic that is waiting for a simultaneous gap in both the Highway 97 northbound and southbound traffic streams. Therefore, a small travel time savings for the bus service is anticipated.
- The southbound Route 22 service passes through the Highway 97 / Huston Road / Buchanan Road and the Highway 97 / Trepanier Bench Road intersections as it diverts from the highway to Huston Road, then Trepanier Bench Road and then back onto the highway. The signalization of the Highway 97 / Trepanier Bench Road intersection will provide opportunities for south / east left-turning vehicles to turn from Trepanier Bench Road onto Highway 97 northbound, and will eliminate the risk of the bus being caught behind left-turning traffic that is waiting for a simultaneous gap in both the Highway 97 northbound and southbound traffic streams. Therefore, a small travel time savings for the bus service is anticipated.
- The proposed traffic signal at Trepanier Bench Road will create delays to the through movements along the highway, which will also affect northbound Route 22 service and both northbound and southbound service on Route 70. Therefore, a minor increase in travel times for these two bus services is anticipated.

All of these transit-related impacts are anticipated to be relatively minor in magnitude, and to an extent may counteract one another. Based on these considerations, this potential short-term option is not anticipated to provide any impact (either positive or negative) for walking, cycling and transit movements.

Overall rating is Similar to Base Case / Neutral.

ROAD SAFETY

The collision history of the three intersections affected by this short-term option are summarized in ***Table 3.4***.

Table 3.4: Collision History (Total Collisions between 2004 and 2018)

Intersection	PDO	Injury	Fatal	Total
Highway 97 / Trepanier Bench Road	10	8	0	**18**
Highway 97 / Buchanan Road West	7	8	1	**16**
Highway 97 / Huston Road / Buchanan Road	8	5	0	**13**

The road safety performance of the Trepanier Bench Road Signalization and Access Management Upgrades option is shown in ***Table 3.5.*** The package of three intersection modifications is forecasted to result in an overall reduction of 1.70 collisions per year, on average, of which a small percentage are fatalities based on the collision history at this location. The number and severity of collisions that these improvements are predicted to avoid each year are anticipated to result in annual benefits for this option. The corresponding monetized annual road safety benefits, as well as the present value for the overall benefits accrual period, are provided in ***Table 3.6***.

Table 3.5: Highway Safety Predictive Analysis for Trepanier Bench Road Signalization and Access Management Upgrades

Intersection	Improvement	Type of Collision	Base Case Collisions per Year	Collision Modification Factor	With Option Collisions per Year
Trepanier Bench Road	New traffic signal	PDO	0.67	0.56	0.37
		Injury	0.53	0.56	0.30
		Fatal	0	0.56	0
Buchanan Road West	Prohibit all movements except right turns from Highway 97	PDO	0.47	0.32	0.15
		Injury	0.53	0.32	0.17
		Fatal	0.07	0.32	0.02
Huston Road / Buchanan Road	Prohibit all left-turns except from Highway 97 onto Buchanan Road	PDO	0.53	0.49	0.26
		Injury	0.33	0.49	0.16
		Fatal	0	0.49	0
Option Total		**PDO**	**1.67**	-	**0.78**
		Injury	**1.40**	-	**0.63**
		Fatal	**0.07**	-	**0.02**

Table 3.6: Annual and Present Value Road Safety Benefits for Trepanier Bench Road Signalization and Access Management Upgrades

Collisions Type	Cost per Collision	Change Collisions	Safety Benefits
Annual PDO	$13,752	-0.88	$12,000
Annual Injury	$307,975	-0.77	$236,000
Annual Fatal	$8,227,209	-0.05	$372,000
Annual Total	-	**-1.70**	**$620,000**
Present Value (2020$)	-	-	**$5,500,000**

SOCIO-COMMUNITY IMPACTS

The access control measures at the Highway 97 / Huston Road / Buchanan Road intersection (specifically, the realignment of the Walker Road connection) are anticipated to create a property impact to one undeveloped parcel.

Given the location of the BC Ambulance Service, Peachland Fire department and RCMP detachment, it is likely that emergencies along Huston Road or Walker Road will be accessed via the Trepanier Bench Road intersection rather than directly from the highway, which may result in a slight increase in response time.

Signalization of the Trepanier Bench Road / Highway 97 intersection will increase the safety and comfort of the left-turn movements onto the highway at this location as well as improving the access to Highway 97 for the community on the mountain side of the highway, thereby improving community connectivity overall. During the public engagement process held in summer 2020, the new traffic signal was identified as being the most favoured component of the proposed short-term improvement option. However, due to the restriction of the left-turn movements at the Highway 97 / Huston Road / Buchanan Road and the Highway 97 / Buchanan Road

West intersections, more circuitous routing will result, and this longer routing may not be intuitive for some travellers. It is understood that this improvement option is supported, by resolution, by Peachland Council.

Overall rating is Somewhat Better.

ENVIRONMENTAL IMPACTS

From the perspective of terrestrial and aquatic impacts, this potential short-term option will cross through two vegetation polygons containing red-listed ecosystems (endangered or threatened) and one containing blue-listed ecosystems (special concern). The proposed improvements will also affect a number of areas containing sensitive ecosystems (woodlands and sparsely vegetated). A portion of the improvements associated with this option will be located within one area designated as "High" conservation ranking. Relative biodiversity in the areas along the highway are rated as "Low" or "Very Low" and as such, this option is predicted to have relatively low effects on areas of environmental concern. An environmental assessment, including an archeological assessment, may be required for the widening of Highway 97 and realignment of intersections at Huston Road and Buchanan Road.

From a greenhouse gas emissions perspective, the increased travel distances and vehicle idling at the proposed traffic signal are likely to lead to a minor increase in greenhouse gas emissions.

Overall rating is Somewhat Worse.

COMPATIBILITY WITH THE LONG-TERM OPTIONS

Compatibility with Alternate Route Options AR-4 and AR-5

If an alternate route is ultimately implemented as the long-term solution to improve the Highway 97 corridor through Peachland, the Trepanier Bench Road Signalization and Access Management Upgrades infrastructure will remain in place and continue to produce benefits after the alternate route is constructed. The benefits will simply be less in magnitude as some highway traffic that would otherwise travel through the intersection will instead divert to the alternate route. In the event that an alternate route option were to be considered further in the future, it is anticipated that the signal timings at this intersection may need to be updated to reflect changing traffic volumes through the intersection.

Compatibility with Existing Route Option ER-A

For reference, the layout of long-term existing route Option ER-A also incorporates a signalized intersection at Trepanier Bench Road as shown in ***Figure 3.13***. Note that Option ER-A includes further changes (cul-de-sac of Desert Pines Avenue, proposed transit stops, etc.) that are not part of the scope of the short-term option. It is further noted that the conceptual layout of the Trepanier Bench Road Signalization and

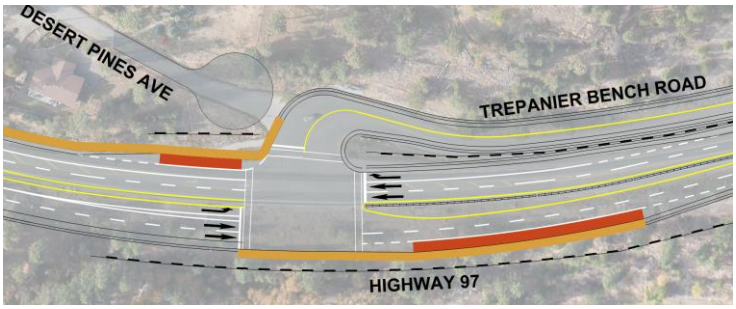


Figure 3.13: Trepanier Bench Road Signalization and Access Management Upgrades – Potential Long-Term Intersection Layout with Option ER-A Implemented

Access Management Upgrades, as shown, do not create any provision for eventual four-laning of the highway. Therefore, it is suggested that prior to construction, a review be undertaken of opportunities to minimize "throwaway" work associated with the potential widening of the highway to accommodate four lanes in the event that this option were to be considered further in the future.

The access management measures at the Highway 97 / Huston Road / Buchanan Road intersection will involve "throwaway" elements as this access will need to shift to Shaw Road in order to provide sufficient space to accommodate a four-lane highway. However, although the concrete medians may need to be removed, the expanded road base could potentially be incorporated into the future four-lane cross-section associated with long-term existing route Option ER-A.

CAPITAL COST

Planning-level cost estimates were prepared using the Elemental Parametric Method of cost estimation (Wolski method). In addition to construction costs, costs estimates include provisions for future planning, design, project management, engagement and consultation, construction administration, contingency, and management reserve[5]. The capital cost estimate of the Trepanier Bench Road Signalization and Access Management Upgrades option is $4.5 million (in 2020$) and the resultant present value is $4.3 million. This potential short-term improvement option has the following key capital cost drivers:

- ~$1.2 million for engineering, other technical services and engagement
- ~$1.7 million for construction
- ~$1.7 million for contingency and management reserve

As noted previously, neither property costs nor cost escalation are included in these estimates.

BENEFIT-COST RATIO

The results of the benefit-cost analysis of Short-Term Option 1 are shown in ***Table 3.7***. When considering the increased overall travel times (i.e. a negative benefit) caused by the proposed traffic signal at the Highway 97 / Trepanier Bench Road intersection, the significant road safety benefits of the option package as a whole are insufficient, relative to the cost of construction, to produce a benefit cost ratio over 1.0. As property costs were not included at this time, the benefit / cost ratio will be lower than currently estimated.

Table 3.7: Benefit Cost Analysis for Trepanier Bench Road Signalization and Access Management Upgrades

Present Value of Monetized Benefits (2020$)	$3.7 million
Present Value of Costs (2020$)	$4.3 million
Benefit-Cost Ratio	0.85

[5] Management Reserve is similar to Contingency; however, whereas Contingency is used to cover unanticipated cost increases to deliver a defined project scope, Management Reserve is used to cover unanticipated increases in the overall scope (and thus cost) of a project.

3.2.2 Short-Term Option 2: Princeton Avenue Intersection Transit and Safety Improvements

The Princeton Avenue Intersection Transit and Safety Improvements option was assessed based on the potential travel time savings, improved road safety performance, environmental impacts, socio-community impacts, compatibility with the long-term options, and capital cost.

TRAVEL TIME SAVINGS

Travel time savings are discussed separately for the passenger vehicle and goods movement vehicle modes, as well as walking, cycling and transit modes.

Passenger and Goods Movement Vehicles

Travel time savings for the Princeton Avenue Intersection Transit and Safety Improvements option were calculated based on changes in intersection traffic delay as calculated using the Synchro model developed for this intersection location. Existing conditions on the corridor were based on the most recent turning movement counts. Future 2040 traffic volumes for the base and improvement condition, were forecasted using the regional travel demand model. The traffic signal at the Highway 97 / Princeton Avenue intersection was optimized in each scenario using Synchro.

The cumulative daily travel times and monetized annual travel time savings associated with the Princeton Avenue Intersection Transit and Safety Improvements option are shown in ***Table 3.8*** and ***Table 3.9***, respectively, for both the 2014 base year and the 2040 planning horizon year. Traffic delay on the Princeton Avenue approaches to the intersection will be unaffected by the option, but traffic delay is anticipated to be reduced for highway traffic by 2.7 hours per day in the 2014 scenario and by 3.4 hours per day in the 2040 scenario as a result of the proposed southbound right-turn lane.

Table 3.8: Delay Modelling Results for Princeton Avenue Intersection Transit and Safety Improvements

Approaches	2014		2040	
	Existing Daily Delay (Hours)	Improved Daily Delay (Hours)	Existing Daily Delay (Hours)	Improved Daily Delay (Hours)
Highway	83.4	80.7	564.2	560.8
Cross street	20.4	20.4	21.3	21.3
Total	103.8	101.1	585.6	582.2

Table 3.9: Travel Time Savings and Annual Benefits for Princeton Avenue Intersection Transit and Safety Improvements

Approaches	2014		2040	
	Daily Travel Time Savings (Hours)	Annual Time Savings Benefits (2020$)	Daily Travel Time Savings (Hours)	Annual Time Savings Benefits (2020$)
Highway	2.7	$20,000	3.4	$20,000
Cross street	0.0	$0	0.0	$0
Total	**2.7**	**$20,000**	**3.4**	**$20,000**

The corresponding present value of the monetized travel time savings between the assumed 2023 in-service date and the assumed end of the analysis period in 2035 are shown in ***Table 3.10***.

Table 3.10: Present Value of Travel Time Savings for Princeton Avenue Intersection Transit and Safety Improvements

Approach	Present Value (2020$)
Highway	$180,000
Cross street	$0
Total	**$180,000**

Walking, Cycling, and Transit

With respect to walking, the pedestrian underpass on the north leg of the crossing is proposed to be removed, as retaining the access to the underpass in the northwest quadrant of the intersection will be challenging given the additional width required for the proposed southbound right-turn lane. This change means that all pedestrians crossing the highway will have to do so at the new south crosswalk, which could result in more circuitous routing for some trips (plus addition time waiting at the traffic signal). Therefore, increased travel time for pedestrians is anticipated. This potential short-term improvement option is not anticipated to have any effect, either positive or negative, on cyclists.

The proposed far-side bus stops at Princeton Avenue will facilitate access for Peachland residents to the existing Route 70 regional transit service, and provide an opportunity for Peachland residents to travel along the Highway 97 corridor even if they do not have access to a passenger vehicle or prefer to use transit instead. The Princeton Avenue stop location will provide access to Route 70 for residents of the Lower Princeton, Downtown, and Beach Avenue neighbourhoods. Destinations along Beach Avenue will be facilitated by transfers to the Route 22 service that runs along Beach Avenue and Princeton Avenue. This short-term improvement option is not necessarily intended to produce "travel time savings" benefits, but rather a benefit for Peachland residents in terms of increased mobility and access to opportunities throughout the Central Okanagan region. However, the bus stops will create a minor increase in travel times for transit riders passing through Peachland (e.g. a rider travelling between Penticton and Kelowna) as the Route 70 regional transit service currently does not stop in Peachland.

The proposed queue jumper lanes for buses upstream of the subject intersection will create a minor benefit for bus travel time reliability, which will in turn reduce travel times for both riders passing through Peachland as well as Peachland residents who will now have access to the transit service.

Overall rating is Somewhat Better.

ROAD SAFETY

The collision history of the Highway 97 / Princeton Avenue intersection is summarized in ***Table 3.11***.

Table 3.11: Collision History (Total Collisions between 2004 and 2018)

Collisions Type	PDO	Injury	Fatal	Total
Highway 97 / Princeton Avenue	27	23	0	**50**

The road safety performance of the Princeton Avenue Intersection Safety and Transit Improvements option is shown in ***Table 3.12*** and ***Table 3.13.*** As can been seen in the tables, the predicted reductions in collision number and severity resulting from the implementation of the proposed southbound right turn lane are relatively small.

Table 3.12: Highway Safety Predictive Analysis for Princeton Avenue Intersection Transit and Safety Improvements

Intersection	Improvement	Type of Collision	Base Case Collisions per Year	Collision Modification Factor	With Option Collisions per Year
Princeton Avenue	SB right turn lane	PDO	1.80	0.96	1.73
		Injury	1.53	0.96	1.47
		Fatal	0	0.96	0

Table 3.13: Annual and Present Value Road Safety Benefits for Princeton Avenue Intersection Transit and Safety Improvements

Collisions Type	Cost per Collision	Change Collisions	Safety Benefits
Annual PDO	$13,752	-0.07	$1,000
Annual Injury	$307,975	-0.06	$19,000
Annual Fatal	$8,227,209	0	$0
Annual Total	-	**-0.13**	**$20,000**
Present Value (2020$)	-	-	**$180,000**

At a qualitative level, the elimination of the pedestrian underpass is anticipated to have some impact in terms of increasing pedestrian exposure to vehicle traffic, particularly for vulnerable road users. In particular, some people with mobility challenges may have difficulties crossing the highway at the typically assumed walk speed of 1.2 metres per second. Therefore, as part of this potential short-term improvement option, it is proposed that the traffic signal at Princeton Avenue be re-timed with a slower assumed walk speed of 1.0 metres per second. This re-timing will help ensure that even slower-moving persons are able to finish crossing the highway before the signal changes and will not be exposed to through-moving traffic on the highway. As a potential scope addition, conversion of the northbound right turn slip lane to a more conventional right turn lane could also improve safety for pedestrians.

It is also noted that during the public engagement process held in summer 2020, safety issues were noted by community members as the higher priority component of the corridor improvement option.

Overall rating is Similar to Base Case / Neutral.

SOCIO-COMMUNITY IMPACTS

Access to the property on the northwest quadrant of the intersection will need to be re-configured, although the property parcel itself is not anticipated to be affected.

With respect to providing equitable access for active modes, it is noted that, as shown in ***Figure 3.8***, the underpass structure is relatively narrow and the access ramp on the west side of the highway is relatively steep. Both of these conditions can create challenges for people with mobility difficulties. In contrast, it is anticipated that that proposed crosswalk will provide a wider crossing with a shallower grade. As noted above, pedestrian

crossing times were developed with a slower (and move inclusive) assumed walk speed of 1.0 metres per second in order to reduce the risk of slower-moving pedestrians being caught in the intersection when the traffic signal turns green for the conflicting direction.

Facilitating access to the Route 70 regional transit service through the provision of bus stops at the subject intersection will provide more equitable access to opportunities throughout the Central Okanagan region for all Peachland residents, including those who do not have access to a vehicle or are otherwise unable to drive.

Overall rating is Somewhat Better.

ENVIRONMENTAL IMPACTS

From the perspective of terrestrial and aquatic impacts, the relative biodiversity in the areas adjacent to this option is anticipated to be "Moderate" or "Very Low", and this option is anticipated to have negligible effects on areas of environmental concern. The roadway widening associated with this option is not anticipated to affect red-listed (endangered or threatened), blue-listed (special concern), or sensitive ecosystems.

From a greenhouse gas emissions perspective, the opportunity for Peachland residents to make use of transit rather than driving for regional trips, as well as the reduced idling for southbound right-turning vehicles, are together likely to lead to a decrease in greenhouse gas emissions.

Overall rating is Somewhat Better.

COMPATIBILITY WITH LONG-TERM OPTIONS

Compatibility with Alternate Route Options AR-4 and AR-5

If an alternate route is ultimately implemented as the long-term solution to improve the Highway 97 corridor through Peachland, the Route 70 regional transit service may continue to run along the existing highway, meaning that the bus stops and queue jumpers will continue to provide value over the long-term. While the proposed right-turn lane at Princeton Avenue may no longer be quite as beneficial if some highway traffic is diverted to an alternate route, this auxiliary lane will continue to reduce delay and improve safety for local traffic movements.

Compatibility with Existing Route Option ER-A

The proposed retaining wall on the west side of the highway may be a "throwaway" cost if existing route Option ER-A were to be implemented in the long-term horizon. As shown in ***Figure 3.14***, further widening of the highway to accommodate four through lanes will begin to impact the adjacent property to the west, and by extension, require re-construction of the proposed retaining wall and the bus stop areas. In contrast, the northbound lanes (including the northbound bus stop) may be able to remain as-is, therefore lowering the incremental cost of implementing Option ER-A in the event that this option were to be considered further in the future.

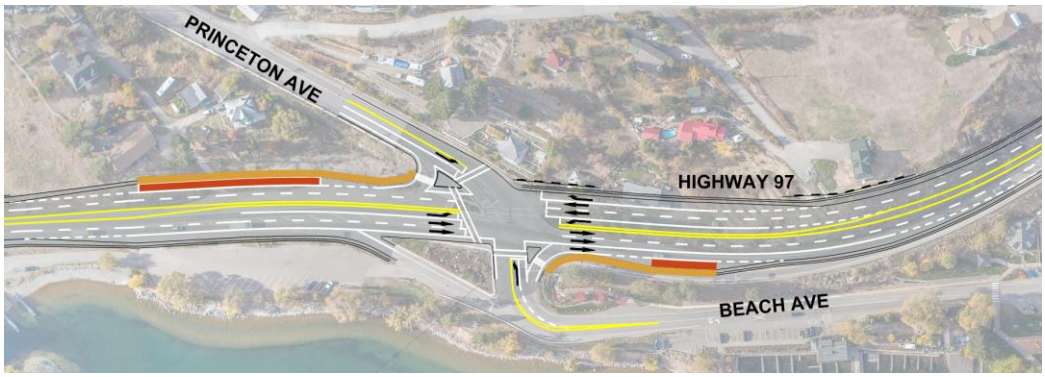


Figure 3.14: Princeton Avenue Intersection Transit and Safety Improvements – Potential Long-Term Layout with Option ER-A Implemented

CAPITAL COST

Planning-level cost estimates were prepared using the Elemental Parametric Method of cost estimation (Wolski method). In addition to construction costs, costs estimates include provisions for future planning, design, project management, engagement and consultation, construction administration, contingency, and management reserve. The capital cost estimate of the Princeton Avenue Intersection Transit and Safety Improvements option is $3.1 million (in 2020$) and the resultant present value is $2.9 million. This potential short-term improvement option has the following key capital cost drivers:

- ~$0.9 million for engineering, other technical services and engagement
- ~$1.0 million for construction
- ~$1.1 million for contingency and management reserve

As noted previously, neither property costs nor cost escalation are included in these estimates.

While the recently introduced regional bus service on Highway 97 has an annual operating cost, this cost is already being incurred by the operator. The additional bus stop, as part of this option, will result in only minor increased costs for the operator while allowing Peachland residents to gain access to the existing service.

BENEFIT-COST RATIO

The results of the benefit-cost analysis of Short-Term Option 2 are shown in ***Table 3.14***. Over the life of the project to 2036, the value of the road safety and travel time benefits will result in a benefit / cost ratio less than 1.0. However, one of the key benefits of this improvement option, which is to facilitate access to the Route 70 regional transit service for Peachland residents, is not reflected in this benefit-cost ratio.

Table 3.14: Benefit Cost Analysis for Princeton Avenue Intersection Transit and Safety Improvements

Present Value of Monetized Benefits (2020$)	$0.4 million
Present Value of Costs (2020$)	$2.9 million
Benefit-Cost Ratio	0.13

3.2.3 Short-Term Option 3: Clements Crescent Intersection Transit and Pedestrian Connectivity Improvements

The Clements Crescent Intersection Transit and Pedestrian Connectivity Improvements option was assessed based on travel time savings for active and transit mode users, environmental impacts, socio-community impacts, compatibility with the long-term options, and capital cost.

TRAVEL TIME SAVINGS

Travel time savings are discussed separately for the passenger vehicle and goods movement vehicle modes, as well as the walking, cycling, and transit modes.

Passenger and Goods Movement Vehicles

This potential short-term improvement option is not anticipated to create any impacts for passenger vehicles or goods movement vehicles. As such, the monetized net travel time impact was not calculated.

Walking, Cycling, and Transit

The provision of a walking route set back from the Highway 97 southbound lanes will enable residents of the Ponderosa neighbourhood to walk to destinations such as the Peachland Centre shopping plaza and Peachland Elementary School, while avoiding the need to cross the highway at the Highway 97 / Ponderosa Drive / 13 Street intersection as well as at the Highway 97 / Clements Crescent Intersection. For a round trip, this proposed walking route will eliminate four separate signalized intersection crossings. The proposed path will also be slightly more straight / direct than the more circuitous and meandering path through Lambly Park, although the latter route will likely be more pleasant due to landscaping and reduced proximity to vehicular traffic. It is also noted that during the public engagement process held in summer 2020, this new walking connection was identified by the community as being the highest priority component of the improvement option.

The proposed far-side bus stops at Princeton Avenue will facilitate access for Peachland residents to the Route 70 regional transit service, and provide an opportunity for Peachland residents to travel along the Highway 97 corridor even if they do not have access to a passenger vehicle or prefer to use transit instead. The Clements Crescent bus stop location will provide access to Route 70 for residents of the Ponderosa, Beach Avenue, Clements, and Trepanier neighbourhoods. Destinations along Beach Avenue will be facilitated by transfers to the Route 22 service that runs along Beach Avenue and Princeton Avenue. This short-term improvement option is not necessarily intended to produce “travel time savings” benefits, but rather a benefit for Peachland residents in terms of increased mobility and access to opportunities throughout the Central Okanagan region. However, the bus stops will create a minor increase in travel times for transit riders passing through Peachland (e.g. a rider travelling between Penticton and Kelowna) as the Route 70 regional transit service currently does not stop in Peachland.

The proposed queue jumper lanes for buses upstream of the subject intersection will create a minor benefit for bus travel time reliability, which will in turn reduce travel times for both riders passing through Peachland as well as Peachland residents who would now have access to the transit service.

Overall rating is Significantly Better.

ROAD SAFETY

No quantitative / monetized road safety analysis was completed for this potential short-term improvement option. As such, the monetized road safety impact was not calculated.

From a qualitative perspective, as noted above, the proposed walking route which is set back from the Highway 97 southbound lanes will eliminate four separate signalized intersection crossings for round trips between the Ponderosa neighbourhood and destinations such as the Peachland Centre shopping plaza and Peachland Elementary School. The more direct route could be particularly beneficial in terms of reducing exposure to traffic for vulnerable road users such as children walking to school.

Overall rating is Significantly Better.

SOCIO-COMMUNITY IMPACTS

The proposed sidewalk connection will provide connectivity for pedestrians between Peachland Elementary, the Peachland Centre shopping area, and the residential areas to the south and west. The existing pedestrian connection between these areas requires two crossings of Highway 97, and the proposed sidewalk will increase connectivity for the community.

Facilitating access to the existing Route 70 regional transit service will provide more equitable access to opportunities throughout the Central Okanagan region for all Peachland residents, including those who do not have access to a vehicle or prefer to use transit instead.

Overall rating is Somewhat Better.

ENVIRONMENTAL IMPACTS

No significant terrestrial or aquatic environmental impacts are anticipated from the Clements Crescent Intersection Transit and Pedestrian Connectivity Improvements within the current scope given the level of review at the current conceptual stage.

From a greenhouse gas emissions perspective, the opportunity for Peachland residents to make use of transit rather than driving for regional trips may lead to a decrease in greenhouse gas emissions.

Overall rating is Similar to Base Case / Neutral.

COMPATIBILITY WITH LONG-TERM OPTIONS

Compatibility with Alternate Route Options AR-4 and AR-5

If an alternate route is ultimately implemented as the long-term solution to improve the Highway 97 corridor through Peachland, the Route 70 regional transit service may continue to run along the existing highway, meaning that the bus stops and queue jumpers will continue to provide value over the long-term. In addition, although traffic volumes and speeds may be slightly lower, the proposed sidewalk will continue to provide a

shorter and safer walking route for residents of the Ponderosa neighbourhood, Peachland Elementary School students and staff, and those accessing the Peachland Centre shopping centre.

Compatibility with Existing Route Option ER-A

The proposed retaining wall that forms part of the improvement option in order to provide sufficient width for the sidewalk connection between Clements Crescent and Ponderosa Drive, may be a "throwaway" cost if existing route Option ER-A were to be implemented over the long-term horizon. Existing route Option ER-A involves widening of the highway to accommodate four lanes that will in turn require cutting back the hillside and constructing a significantly larger retaining wall beyond what is proposed for this potential short-term improvement option. The southbound bus stop infrastructure will also need to be shifted / re-constructed accordingly. In contrast, the northbound bus stop may be able to remain as-is, and therefore this component will lower the incremental cost of implementing Option ER-A in the event that this option were to be considered further in the future.

CAPITAL COST

Planning-level cost estimates were prepared using the Elemental Parametric Method of cost estimation (Wolski method). In addition to construction costs, costs estimates include provisions for future planning, design, project management, engagement and consultation, construction administration, contingency, and management reserve. The capital cost estimate of the Clements Crescent Intersection Transit and Pedestrian Connectivity Improvements option is $3.1 million (in 2020$) and the resultant present value is $3.0 million. This potential short-term improvement option has the following key capital cost drivers:

- ~$0.9 million for engineering, other technical services and engagement
- ~$1.1 million for construction
- ~$1.1 million for contingency and management reserve

As noted previously, neither property costs nor cost escalation are included in these estimates.

While the recently introduced regional bus operation on Highway 97 has an annual operating cost, this cost is already being incurred by the operator. The additional bus stop as part of this option will result in only minor increased costs for the operator, while allowing Peachland residents to gain access to the existing service.

BENEFIT-COST RATIO

The value of the potential travel time savings resulting from the proposed bus stop was not included in the monetized benefits at this point in the study. Therefore, there were no monetized benefits to be directly compared to the capital cost.

3.2.4 Short-Term Option 4: Renfrew Road Intersection Safety Improvements

The Renfrew Road Intersection Safety Improvements option was assessed based on potential travel time savings, improved road safety performance, environmental impacts, socio-community impacts, compatibility with the long-term options, and capital cost.

TRAVEL TIME SAVINGS

Travel time savings are discussed separately for the passenger vehicle and goods movement vehicle modes, as well as walking, cycling, and transit modes.

Passenger and Goods Movement Vehicles

Travel time savings for the Renfrew Road Intersection Safety Improvements option were calculated based on changes in intersection traffic delay as calculated using the Synchro model developed for this intersection location. Existing conditions on the corridor were based on the most recent turning movement counts. Future 2040 traffic volumes for the base case and improvement condition were forecasted using the regional travel demand model.

The cumulative daily travel times and monetized annual travel time savings associated with the Renfrew Road Intersection Safety Improvements are shown in ***Table 3.15*** and ***Table 3.16*** respectively, for both the 2014 base year and the 2040 planning horizon year. The highway and cross-street traffic will benefit from increased mobility related to the improvements to the left-turn movements both on and off of Highway 97. Overall, traffic delay is anticipated to be reduced at the intersection by 0.7 hours per day in the 2014 scenario and 3.1 hours per day in the 2040 scenario.

Table 3.15: Delay Modelling Results for Renfrew Road Intersection Safety Improvements

Approaches	2014		2040	
	Existing Daily Delay (Hours)	Improved Daily Delay (Hours)	Existing Daily Delay (Hours)	Improved Daily Delay (Hours)
Highway	0.2	0.0	0.3	0.0
Cross street	1.8	1.2	8.4	5.5
Total	2.0	1.2	8.6	5.5

Table 3.16: Travel Time Savings and Annual Benefits for Renfrew Road Intersection Safety Improvements

Approaches	2014		2040	
	Daily Travel Time Savings (Hours)	Annual Time Savings Benefits (2020$)	Daily Travel Time Savings (Hours)	Annual Time Savings Benefits (2020$)
Highway	0.2	$1,000	0.2	$2,000
Cross street	0.6	$4,000	2.9	$18,000
Total	**0.7**	**$5,000**	**3.1**	**$20,000**

The corresponding present value of the monetized travel time savings between the assumed 2023 in-service date and the assumed end of the analysis period in 2035 are shown in ***Table 3.17***.

Table 3.17: Present Value of Travel Time Savings for Renfrew Road Intersection Safety Improvements

Approach	Present Value (2020$)
Highway	$10,000
Cross street	$110,000
Total	**$120,000**

Walking, Cycling, and Transit

This potential short-term improvement option is not anticipated to have any effect, either positive or negative, on pedestrians and cyclists.

With respect to transit, the proposed intersection improvements are anticipated to reduce the risk of northbound Route 70 buses being delayed by northbound left-turning vehicles; however, the net benefit for transit is expected to be very minor.

Overall rating is Similar to Base Case / Neutral.

ROAD SAFETY

The collision history of the Highway 97 / Renfrew Road intersection is summarized in ***Table 3.18***.

Table 3.18: Collision History (Total Collisions between 2004 and 2018)

Collisions Type	PDO	Injury	Fatal	Total
Highway 97 / Renfrew Road	9	14	1	**24**

The road safety performance of the Renfrew Road Intersection Safety Improvements is shown in ***Table 3.19*** and ***Table 3.20.*** The protected-T intersection is predicted to reduce collisions in the area by an average of 0.51 collisions per year, which translates into substantial safety benefits over the analysis period.

Table 3.19: Highway Safety Predictive Analysis for Renfrew Road Intersection Safety Improvements

Intersection	Improvement	Type of Collision	Existing Collisions per Year	Collision Modification Factor	Improved Collisions per Year
Renfrew Road	NB left turn lane and protected left turn	PDO	0.60	0.52	0.31
		Injury	0.93	0.52	0.49
		Fatal	0.07	0.52	0.03

Table 3.20: Annual and Present Value Road Safety Benefits for Renfrew Road Intersection Safety Improvements

Collisions Type	Cost per Collision	Change Collisions	Safety Benefits
Annual PDO	$13,752	-0.45	$6,000
Annual Injury	$307,975	-0.03	$10,000
Annual Fatal	$8,227,209	-0.03	$264,000
Annual Total	-	**-0.51**	**$280,000**
Present Value (2020$)	-	-	**$2,470,000**

Given the lack of changes with respect to walking, cycling and transit, no qualitative assessment was undertaken.

SOCIO-COMMUNITY IMPACTS

An Archeological Assessment will likely be required for the implementation of the Renfrew Road Intersection Safety Improvements option, especially for any works on the lake side of Highway 97.

No other significant impacts are anticipated.

Overall rating is Similar to Base Case / Neutral.

ENVIRONMENTAL IMPACTS

From the perspective of terrestrial and aquatic impacts, an Environmental Assessment may be required for the implementation of the Renfrew Road Intersection Safety Improvements option, especially if further design development were to identify the need for works on the lake side of Highway 97. Environmental regulatory approvals may also be required.

From a greenhouse gas emissions perspective, the elimination of idling caused by northbound through-moving vehicles being obstructed by a northbound left-turning vehicle may result in a relatively minor decrease in greenhouse gas emissions. Also, the reduced delays for vehicles turning left from Renfrew Road will also result in some decrease in greenhouse gas emissions.

Overall rating is Similar to Base Case / Neutral.

COMPATIBILITY WITH LONG-TERM OPTIONS

Compatibility with Alternate Route Options AR-4 and AR-5

If an alternate route is ultimately implemented as the long-term solution to improve the Highway 97 corridor through Peachland, the Renfrew Road Intersection Safety Improvements infrastructure option will remain in place and continue to generate safety benefits and reduce delays for local traffic; the magnitude of these benefits will simply be lower.

Compatibility with Existing Route Option ER-A

The left-turn movement from Renfrew Road as facilitated by this potential short-term improvement option will be eliminated over the long-term as part of existing route Option ER-A through the conversion of this intersection to a right-in / right-out configuration, as shown in ***Figure 3.15*** below. However, other than the raised medians and channelization, it is anticipated that there are relatively little "throwaway" elements as most of the expanded road base could be incorporated into the potential future four-lane cross-section of existing route Option ER-A. Therefore, the potential short-term improvements are anticipated to lower the incremental cost of implementing Option ER-A in the event that this option were to be considered further in the future.

Figure 3.15: Renfrew Road Intersection Safety Improvements – Potential Long-Term Layout with Option ER-A Implemented

CAPITAL COST

Planning-level cost estimates were prepared using the Elemental Parametric Method of cost estimation (Wolski method). In addition to construction costs, costs estimates include provisions for future planning, design, project management, engagement and consultation, construction administration, contingency, and management reserve. The capital cost estimate of the Renfrew Road Intersection Safety Improvements option is $3.1 million (in 2020$) and the resultant present value is $2.9 million. This potential short-term improvement option has the following key capital cost drivers:

- ~$0.9 million for engineering, other technical services and engagement
- ~$1.0 million for construction
- ~$1.1 million for contingency and management reserve

As noted previously, neither property costs nor cost escalation are included in these estimates.

BENEFIT-COST RATIO

The results of the benefit-cost analysis of Short-Term Option 4 are shown in ***Table 3.21***. Over the life of the project to 2036, the value of the road safety and travel time benefits will be insufficient to create a benefit / cost ratio over 1.0.

Table 3.21: Benefit Cost Analysis for Renfrew Road Intersection Safety Improvements

Present Value of Monetized Benefits (2020$)	$2.6 million
Present Value of Costs (2020$)	$2.9 million
Benefit-Cost Ratio	0.90

3.2.5 Short-Term Option Evaluation Summary

A summary of the evaluation of each of the four potential short-term improvement options is presented in the following tables, ***Table 3.22a*** through ***Table 3.22d***, with respect to the key evaluation criteria.

Table 3.22a: Short-Term Option 1: Trepanier Bench Road Signalization and Access Management Upgrades

Criteria	Scoring	Description
Travel Time Savings – Passenger and Goods Movement Vehicles	-$1.9 M	An increase in overall traffic delay is anticipated due to the proposed installation of traffic signals at Trepanier Bench Road
Travel Time Savings – Walking, Cycling and Transit	◑	No significant walking or cycling impacts. Some minor benefits and drawbacks for transit.
Road Safety	$5.5 M	Traffic safety is anticipated to improve as access to / from the highway is enhanced.
Social Community Impacts	◕	With the improved access to / from the highway, the proposed improvements are considered to be **somewhat better** as compared to the base case conditions where the highway acts as a barrier. However, at least one property is impacted.
Environmental Impacts	◔	The environmental impacts are considered **somewhat worse** as compared to the base case conditions.
Compatibility with Long-Term Options	-	For alternate route options, continued traffic operations and safety benefits, but to a lesser degree. For existing route option, some incremental cost reductions, but also some “throwaway” works.
Capital Cost	$4.3M	2020$ Present Value. Property costs not included.

Table 3.22b: Short-Term Option 2: Princeton Avenue Intersection Safety and Transit Improvements

Criteria	Scoring	Description
Travel Time Savings – Passenger and Goods Movement Vehicles	$0.2 M	Only minor travel time savings are anticipated.
Travel Time Savings – Walking, Cycling and Transit	◕	Some increased travel times for pedestrians, no impact for cyclists. Significantly, improved access to transit, and reliability of transit service. Overall, **somewhat better** as compared to base case conditions.
Road Safety	$0.2 M	Traffic safety is anticipated to improve, but only marginally.
Social Community Impacts	◕	With access provided to the reginal transit service through the provision of the bus stop, the proposed improvements are considered to be **somewhat better** for the community as compared to base case conditions.
Environmental Impacts	◕	There are no significant impacts to the environment, and overall, the environmental impacts are considered to be **somewhat better** as compared to base case conditions.
Compatibility with Long-Term Options	-	For alternate route options, continued traffic operations, safety and transit benefits, but to a lesser degree. For existing route option, some incremental cost reductions, but also some "throwaway" works.
Capital Cost	$2.9 M	2020$ Present Value. No property acquisition anticipated.

Table 3.22c: Short-Term Option 3: Clements Crescent Intersection Transit and Pedestrian Connectivity Improvements

Criteria	Scoring	Description
Travel Time Savings – Passenger and Goods Movement Vehicles	-	No impacts anticipated for passenger and goods movement vehicles.
Travel Time Savings – Walking, Cycling and Transit	●	Connectivity and travel time for the active transportation modes are **significantly better** than the base case conditions.
Road Safety	●	The exposure risk for the active transportation modes is reduced therefore the improvements are **significantly better** as compared to the base case conditions.
Social Community Impacts	◕	With access provided to the reginal transit service through the provision of the bus stop, the proposed improvements are considered to be **somewhat better** for the community as compared to base case conditions.
Environmental Impacts	◑	No environmental impacts are anticipated, therefore these improvements are considered to be **similar / neutral** as compared to base case conditions.
Compatibility with Long-Term Options	-	For alternate route options, continued safety and transit benefits, but to a lesser degree. For existing route option, some incremental cost reductions, but also some "throwaway" works.
Capital Cost	$3.0M	2020$ Present Value. No property acquisition anticipated.

Table 3.22d: Short-Term Option 4: Renfrew Road Intersection Safety Improvements

Criteria	Scoring	Description
Travel Time Savings – Passenger and Goods Movement Vehicles	$0.1 M	Travel time savings are estimated to be minor.
Travel Time Savings – Walking, Cycling and Transit	◑	No significant impacts or benefits are anticipated, therefore these improvements are considered to be **similar / neutral** as compared to base case conditions.
Road Safety	$2.5 M	Significant safety benefits are anticipated due to a potential reduction in collisions.
Social Community Impacts	◑	No significant impacts or benefits are anticipated, therefore these improvements are considered to be **similar / neutral** as compared to base case conditions.
Environmental Impacts	◑	No significant environmental impacts are anticipated, therefore these improvements are considered to be **similar / neutral** as compared to base case conditions.
Compatibility with Long-Term Options	-	For alternate route options, continued traffic operations and safety benefits, but to a lesser degree. For existing route option, some incremental cost reductions, but also some “throwaway” works.
Capital Cost	$2.9 M	2020$ Present Value. No property acquisition anticipated.

4. CANDIDATE MEDIUM-TERM IMPROVEMENTS

Several candidate options for potential implementation in the medium-term were identified to improve traffic safety and active transportation connectivity along the existing Highway 97 corridor. Similar to the short-term options, the medium-term options are all anticipated to be of modest cost (as compared to any of the long-term options), however they may create property impacts or other implementation complexities.

The three candidate medium-term improvement options that were identified along Highway 97 are as follows:

- Medium-Term Option 1: Chidley Road Intersection Safety Improvements and Clements Crescent Connection
- Medium-Term Option 2: Lang Road – McKay Lane Walking and Cycling Connection
- Medium-Term Option 3: Hardy Street Intersection Safety Improvements.

4.1 Description of Candidate Improvement Options

In this section of the report, the three potential medium-term improvement options are described along with conceptual-level sketches to graphically illustrate the nature and extent of the proposed improvements. In addition, an overview of the objectives of each option is identified.

4.1.1 Medium-Term Option 1: Chidley Road Intersection Safety Improvements and Clements Crescent Connection

Chidley Road connects to Highway 97 via a T-intersection just north of Trepanier Creek. Although a short southbound right-turn lane is provided, no northbound left-turn lane is provided for access to Chidley Road from Highway 97. The Chidley Road approach leg is configured with only a single shared left turn / right turn lane. Without a traffic signal, left-turning vehicles travelling from Chidley Road onto Highway 97 northbound must wait for a gap in the traffic streams in both directions of the highway. With the lack of a northbound left-turn lane, northbound left-turn traffic will stop in the through lane of the highway while waiting for gaps in the southbound traffic stream.

The intersection is also slightly offset from a T-intersection with Todd Road, located on the opposite side of the highway. However, the Todd Road intersection is configured for right-in / right-out movements only and does not permit left-turn movements either onto or off of the highway.

To address the access issues, a concept was developed to close the Chidley Road access to the highway and instead provide a local road connection from Chidley Road to Clements Crescent on the opposite side of Trepanier Creek. The layout of this option, developed as part of the improvement package forming existing route Option ER-A, is shown in ***Figure 4.1***.

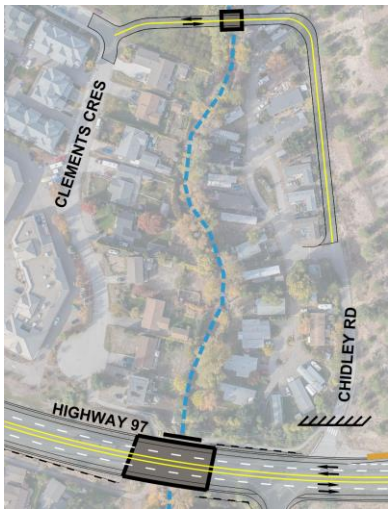


Figure 4.1: Chidley Road Intersection Safety Improvements and Clements Crescent Connection – Potential Long-Term Layout with Option ER-A Implemented

Anticipated benefits of this potential medium-term improvement option include:

- Conflict points at the Highway 97 / Chidley Road intersection (which is unsignalized and lacking in dedicated turn lanes) will be eliminated, and vehicles will be redirected to the Highway 97 / Clements Crescent intersection which is signalized and features dedicated turn lanes.
- Elimination of delays to northbound through-moving vehicles that result from left-turning vehicles stopping in the through lane and waiting for gaps in the opposing traffic stream.
- Fully compatible (i.e. no "throwaway" work) in the event that this Option ER-A were to be considered further in the future as a potential long-term solution for Highway 97 through Peachland.

Potential challenges of this potential medium improvement option include:

- Anticipated diversion of some additional traffic from Chidley Road to pass by Peachland Elementary School on Clements Crescent, as shown in ***Figure 4.2***. If the increase in traffic volume proves to be a safety concern, then additional investigations could be undertaken to identify potential safety improvement measures.
- Anticipated impacts to a property along Clements Crescent to the east of Peachland Elementary School as well as some property impacts to the Trepanier Creek Mobile Home Park.
- A recent report from the Regional District of Central Okanagan[6] notes that the area in which this connector will be implemented could be flooded by a 200-year flood level of Trepanier Creek. Therefore, consideration will need to be given to identifying a bridge elevation and tie-in road elevation that balances flood risk with geometry while reducing property impacts, and / or considers other flood mitigation measures that may be proposed in the area. It is also noted that the Highway 97 / Chidley Road intersection could potentially be gated, or barriers placed in a manner that could allow the intersection to be temporarily re-opened in the event of a flood event in the Trepanier Creek area.

Figure 4.2: Traffic from Chidley Road will be Rerouted Along Clements Crescent and Pass by Peachland Elementary School (Right)

[6] Regional District of Central Okanagan (2019). *Flood Mapping Project: Peachland and Trepanier Creeks*.

4.1.2 Medium-Term Option 2: Lang Road – McKay Lane Walking and Cycling Connection

The District of Peachland *Parks and Recreation Master Plan (2018-2028)* includes the Lang Trail, which crosses Highway 97 between Lang Road and McKay Lane. Currently, this connection is severed due to both grade differences as well as the lack of a crossing at Highway 97. This medium-term improvement option, as shown in ***Figure 4.3***, involves a pedestrian / cyclist overpass across the highway to connect Lang Road and McKay Lane. Due to the pre-existing topography in this area, this overpass does not require users to deviate from their (vertical) desire lines; Lang Road is already higher than the highway and therefore requires no significant elevation gain; however, an elevation change is required to tie into McKay Lane. This elevation change could be facilitated via either a loop or a switchback ramp configuration. Examples of each configuration are provided in this report to highlight the range of feasible design approaches. Specifically, a loop ramp configuration is depicted below in ***Figure 4.3***, while a switchback ramp configuration is depicted subsequently in ***Figure 4.6***.

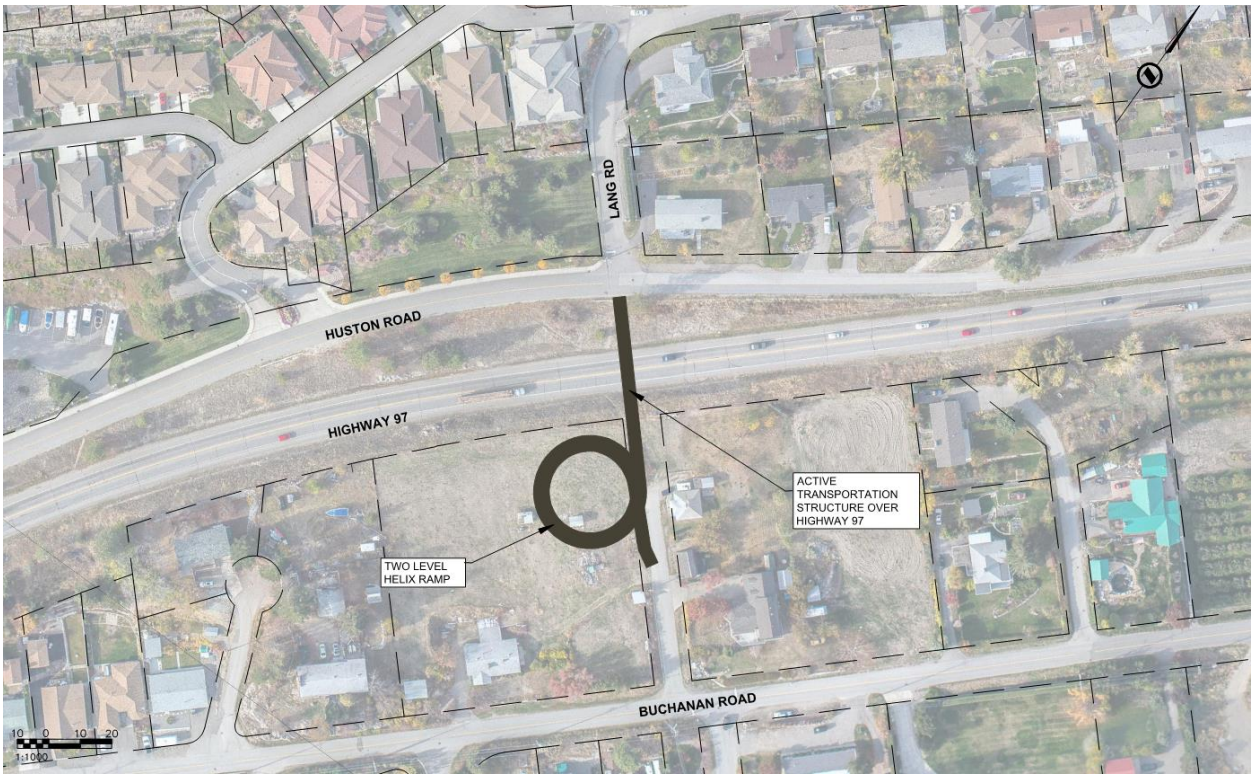


Figure 4.3: McKay Lane – Lang Road Walking and Cycling Connection

Anticipated benefits of this potential medium-term improvement option include:

- The walking and cycling grade-separations will eliminate the need for people walking or cycling across the highway to make detours to distant intersections and / or to cross the highway at unmarked locations.
- The Route 22 bus service runs in a couplet along Buchanan Road (northbound) and Huston Road (southbound). Depending on what side of the highway they are located on, and their direction of travel, residents currently have direct access either to or from a bus stop in one direction, but challenges accessing the bus stop in the other direction. Therefore, every current transit round trip will involve a

challenging crossing of the highway. The pedestrian / cyclist overpass will eliminate this challenge and improve access to / from the existing transit service.

- The pedestrian / cyclist overpass connecting Lang Road and McKay Lane is consistent with the Lang Trail in the District of Peachland Parks and Recreation Master Plan.
- The pedestrian / cyclist overpass structure could be designed in a manner that provides sufficient horizontal clearance for the potential widening of the highway to four lanes if existing route Option ER-A is identified as the long-term solution for improvements to Highway 97 through Peachland.
- The proposed pedestrian / cyclist overpass structure will also provide improved direct transit access once the Route 22 bus service routing shifts to being "on corridor", as recommended as part of existing route Option ER-A.

A possible challenge of this potential medium-term option is the property impacts on the lake side of the highway corridor in order to accommodate a loop ramp or switchback ramp, either of which are required to gain elevation in order to have sufficient vertical clearance over the highway.

4.1.3 Medium-Term Option 3: Hardy Street Intersection Safety Improvements

Detecting appropriate gaps in the southbound traffic stream can be challenging for several movements at the Highway 97 / Hardy Street intersection, specifically, the northbound left-turn, eastbound right-turn and eastbound left-turn movements. These challenges are caused by the combination of the curvature of the highway and tree cover along Peachland Creek obstructing sightlines of (and for) southbound vehicles approaching the intersection from the north. The highway curvature and tree cover are shown in ***Figure 4.4***. These trees are known to be part of a critical habitat, therefore removing them to improve sightlines is likely not feasible.

Figure 4.4: Hardy Street Intersection Existing Configuration

Additionally, there are no auxiliary / turn lanes at this intersection, therefore northbound left-turning vehicles and southbound right-turning vehicles will slow/stop in the respective through lanes to wait for gaps in the conflicting traffic movements. This lack of auxiliary or dedicated turn lanes can create delays for through traffic and also increase the risk of collisions.

This potential medium-term improvement option, shown in ***Figure 4.5***, will involve shifting the Highway 97 / Hardy Street intersection approximately 100 metres to the south where the highway approaches are both on a tangent and there is no vegetation that would impact sightlines.

Figure 4.5: Hardy Street Intersection Safety Improvements

Unlike the Renfrew Road Intersection Safety Improvements (Short-Term Option 4), a protected-T intersection was not considered at this location due to the anticipated lower volumes on Hardy Street as well as the challenges associated with avoiding impacts to the shoreline or triggering the need to replace the existing bridge span over Peachland Creek.

Anticipated benefits of this potential medium-term improvement option include:

- This option will mitigate collision risks associated with poor sightlines at the intersection.
- This option will mitigate collision risks associated with northbound left-turning and southbound right-turning vehicles stopping in the respective through lanes to wait for gaps in the conflicting trafifc movements (e.g. rear-ended by through-moving traffic).
- The option will eliminate delays to northbound through-moving vehicles associated with being caught behind a northbound left-turning vehicle waiting for a gap in the southbound traffic stream.

Possible challenges associated with this potential medium-term improvement option include the property impacts associated with the diversion of the Hardy Street connection to Highway 97 as well as the widening of the highway towards the lake.

4.2 Evaluation of Candidate Improvement Options

This sub-section presents the results of the evaluation of each potential medium-term improvement option based on the criteria described previously in Section 2.2, including the quantitative and qualitative measurement of benefits, impacts, and costs. The individual assessments are independent of each other, and the potential medium improvement options are not mutually exclusive alternatives.

4.2.1 Medium-Term Option 1: Chidley Road Intersection Safety Improvements and Clements Crescent Connection

The Chidley Road Intersection Safety Improvements and Clements Crescent Connection option was assessed based on potential travel time savings, improved road safety performance, environmental impacts, socio-community impacts, compatibility with the long-term options, and capital cost. Recognizing the proximity of the location of this option with respect to Trepanier Creek, a discussion on potential flooding resilience was also included under the Environmental Impacts criterion.

TRAVEL TIME SAVINGS

Travel time savings are discussed separately for the passenger vehicle and goods movement vehicle modes, as well as the walking, cycling, and transit modes.

Passenger and Goods Movement Vehicles

Travel time savings for the Chidley Road Intersection Safety Improvements and Clements Crescent Connection option were calculated based on a combination of estimated detour driving time relative to the base case, and changes in intersection delay as calculated using the Synchro model developed for this intersection.

Existing conditions on the corridor were based on the most recent turning movement counts. Volumes were manually re-assigned for the improvement option analysis to reflect the detour required from the closure of Chidley Road at Highway 97 and the diversion to Clements Crescent. In the case of detouring vehicles, additional travel time was included in the analysis of that scenario to account for the change in travel distance. Future 2040 volumes, for both the base case and improvement scenario, were forecasted using the regional travel demand model. The traffic signal at Highway 97 / Clements Crescent was optimized using Synchro for the base case and improvement scenario.

The cumulative daily travel times and monetized annual travel time savings associated with the Chidley Road Intersection Safety Improvements and Clements Crescent Connection option are shown in ***Table 4.1*** and ***Table 4.2*** respectively, for both the 2014 base year and the 2040 planning horizon year.

In the 2014 condition, traffic on both the highway and cross-street approaches will experience no delay because the Chidley Road access to Highway 97 will be closed. Conversely, the traffic previously using the Highway 97 /

Chidley Road intersection was re-assigned to the Highway 97 / Clements Crescent intersection and the overall delay at this intersection is anticipated to increase slightly given the higher turning movement volumes. When combined, the overall reduction in traffic delay was estimated to be 0.3 hours per day due to the larger reductions at the closed intersection.

In the 2040 scenario condition, traffic volumes on the Clements Crescent approach to the Highway 97 intersection are anticipated to increase to the point where overall intersection optimization will result in the average vehicle delay increasing slightly on the highway approaches to the intersection. However, the reduced traffic delay associated with the closed intersection will exceed the slight increase in traffic delay associated with the increased traffic volumes at the Highway 97 / Clements Crescent intersection. The combined overall reduction in traffic delay was estimated to be 2.1 hours per day.

Table 4.1: Delay Modelling Results for Chidley Road Intersection Safety Improvements and Clements Crescent Connection

Intersection	Approaches	2014		2040	
		Existing Daily Delay (Hours)	Improved Daily Delay (Hours)	Existing Daily Delay (Hours)	Improved Daily Delay (Hours)
Chidley Road	Highway	0.3	0.0	7.2	0.0
	Cross street	0.8	0.0	4.5	0.0
Clements Crescent	Highway	50.1	50.3	222.8	231.6
	Cross street	13.9	14.5	13.5	14.4
Option Total	Highway	50.4	50.3	230.0	231.6
	Cross street	14.8	14.5	18.1	14.4
	Total	**65.2**	**64.9**	**248.1**	**245.9**

Table 4.2: Travel Time Savings and Annual Benefits for Chidley Road Intersection Safety Improvements and Clements Crescent Connection

Approaches	2014		2040	
	Daily Travel Time Savings (Hours)	Annual Time Savings Benefits (2020$)	Daily Travel Time Savings (Hours)	Annual Time Savings Benefits (2020$)
Highway	0.1	$400	-1.6	-$11,000
Cross street	0.3	$1,100	3.7	$24,000
Total	0.3	$1,500	2.1	$13,000

The corresponding present value of the monetized travel time savings between the assumed 2031 in-service date and the assumed end of analysis period in 2035 are shown in ***Table 4.3***.

Table 4.3: Present Value of Travel Time Savings for Chidley Road Intersection Safety Improvements and Clements Crescent Connection

Approach	Present Value (2020$)
Highway	-$30,000
Cross street	$70,000
Total	**$40,000**

Walking, Cycling, and Transit

Access to the walking path that runs across Trepanier Creek parallel to the southbound lane on Highway 97 will be maintained as part of this potential medium-term improvement option. As such, the improvement option is not anticipated to have any effect, either positive or negative, on pedestrians and cyclists.

With respect to transit, this potential medium-term improvement option will eliminate the risk of northbound Route 70 buses being delayed by northbound left-turning vehicles at the Highway 97 / Chidley Road intersection; however, the net benefit for transit is expected to be very minor.

Overall rating is Similar to Base Case / Neutral.

ROAD SAFETY

The collision history of the Highway 97 / Chidley Road intersection is summarized in ***Table 4.4***.

Table 4.4: Collision History (Total Collisions between 2004 and 2018)

Collisions Type	PDO	Injury	Fatal	Total
Highway 97 / Chidley Road	2	2	0	**4**

The road safety performance of the Chidley Road Intersection Safety Improvements and Clements Crescent Connection option is shown in ***Table 4.5.*** and ***Table 4.6.*** The number of historical collisions observed at the Highway 97 / Chidley Road intersection was relatively small, but these are predicted to be significantly reduced if the intersection is closed and traffic diverted to the Highway 97 / Clements Crescent intersection instead. The intersection at Highway 97 / Clements Crescent, which is signalized and includes left-turn lanes, is better engineered to reduce collisions that are related to left-turn movements to / from the highway.

Table 4.5: Highway Safety Predictive Analysis for Chidley Road Intersection Safety Improvements and Clements Crescent Connection

Intersection	Improvement	Type of Collision	Existing Collisions per Year	Collision Modification Factor	Improved Collisions per Year
Chidley Road	Close intersection, diverting traffic to Clements Crescent where there are left turn lanes and a traffic signal	PDO	0.13	0.28	0.04
		Injury	0.13	0.28	0.04
		Fatal	0	0.28	0.00

Table 4.6: Annual and Present Value Road Safety Benefits for Chidley Road Intersection Safety Improvements and Clements Crescent Connection

Collisions Type	Cost per Collision	Change Collisions	Safety Benefits
Annual PDO	$13,752	-0.10	$1,000
Annual Injury	$307,975	-0.10	$29,000
Annual Fatal	$8,227,209	0.00	$0
Annual Total	-	**-0.19**	**$30,000**
Present Value (2020$)	-	-	**$130,000**

From a qualitative perspective, this potential medium-term option will generate an increase in traffic volumes (i.e. re-routed vehicles travelling to / from Chidley Road), which will pass in front of Peachland Elementary School. However, this additional traffic is anticipated to be low and should not impact the safety of students attending the school.

Overall rating is Similar to Base Case / Neutral.

SOCIO-COMMUNITY IMPACTS

The Chidley Road Intersection Safety Improvements and Clements Crescent Connection option could potentially divert some additional traffic volume from Chidley Road to pass by Peachland Elementary School. If this increase in traffic volumes proves to be a safety concern, additional investigation of potential safety countermeasures could be undertaken to ensure that this option does not create a barrier for people walking to the school.

In order to connect Chidley Road to Clements Crescent, the potential medium-term improvement option will involve some impacts to a property on Clements Crescent to the east of Peachland Elementary School, as well as property within the Trepanier Creek Mobile Home Park.

An Archeological Assessment will likely be required for the implementation of this potential medium-term improvement option, especially for any works related to the crossing of Trepanier Creek.

Overall rating is Somewhat Worse.

ENVIRONMENTAL IMPACTS

An Environmental Assessment will be required particularly with the proposed bridge crossing of Trepanier Creek, and environmental regulatory approvals may be required depending on the crossing option selected.

From a greenhouse gas emissions perspective, the elimination of idling caused by northbound through-vehicles being obstructed by a northbound left-turning vehicle may result in a minor decrease in greenhouse gas emissions. However, the increase in travel distances for vehicles travelling to / from Chidley Road to access Highway 97 at Clements Crescent may result in a minor increase in greenhouse gas emissions.

From a climate resilience perspective, the RDCO *Flood Mapping Project: Peachland and Trepanier Creeks Final Report* (2019) was referenced. The analysis documented in this report applied hydraulic modelling to estimate that the existing Highway 97 bridge over Trepanier Creek is subject to flood-related damage, and the 200-year design streamflow could inundate at least seven locations in the area of this potential medium-term improvement option. If the Chidley Road Intersection Safety Improvements and Clements Crescent Connection option was to move forward as a project, further analysis of flooding should be undertaken to ensure that the proposed road connection and bridge across Trepanier Creek are adequately designed in terms of elevation and clearance over the creek.

Overall rating is Similar to Base Case / Neutral.

COMPATIBILITY WITH LONG-TERM OPTIONS

Compatibility with Alternate Route Options AR-4 and AR-5

If an alternate route is ultimately implemented as the long-term solution to improve the Highway 97 corridor through Peachland, the infrastructure associated with this potential medium-term option will remain in place and continue to produce safety benefits and reduce delay for local traffic in the long-term horizon. However, if the existing highway becomes a local corridor in the long-term horizon, the closure of Chidley Road at Highway 97 may no longer be warranted due to a reduction in through traffic volumes as some existing highway traffic will be diverted to the alternate route.

Compatibility with Existing Route Option ER-A

This potential medium-term improvement option is fully compatible with existing route Option ER-A and is included as part of the current conceptual design of this long-term corridor improvement option. There will be no "throwaway" costs associated with the Chidley Road Intersection Safety Improvements and Clements Crescent Connection option if existing route Option ER-A Option ER-A in the event that this option were to be considered further in the future.

CAPITAL COST

Planning-level cost estimates were prepared using the Elemental Parametric Method of cost estimation (Wolski method). In addition to construction costs, costs estimates include provisions for future planning, design, project management, engagement and consultation, construction administration, contingency, and management reserve. The capital cost estimate of the Chidley Road Intersection Safety Improvements and Clements Crescent Connection option is $4.5 million (in 2020$) and the resultant present value is $4.3 million. This potential medium-term improvement option has the following key capital cost drivers:

- ~$1.3 million for engineering, other technical services and engagement
- ~$1.6 million for construction
- ~$1.7 million for contingency and management reserve

As noted previously, neither property costs nor cost escalation are included in these estimates.

BENEFIT-COST RATIO

The results of the benefit-cost analysis of the Chidley Road Intersection Safety Improvements and Clements Crescent Connection option is shown in ***Table 4.7***. Over the life of the project to 2036, the value of the road safety and travel time benefits will be equal to only 0.05 of the capital costs. However, the Chidley Road connection to Clements Crescent is expected to bring noticeable safety and travel time benefits beyond 2036, since the project will remain in place regardless of the eventual long-term solution for Highway 97 through Peachland.

Table 4.7: Benefit Cost Analysis for Chidley Road Intersection Safety Improvements and Clements Crescent Connection

Present Value of Monetized Benefits (2020$)	$0.2 million
Present Value of Costs (2020$)	$4.3 million
Benefit-Cost Ratio	0.04

4.2.2 Medium-Term Option 2: Lang Road – McKay Lane Walking and Cycling Connection

The Lang Road – McKay Lane Walking and Cycling Connection option was assessed based on potential travel time savings for pedestrians and cyclists, improved road safety performance, environmental impacts, socio-community impacts, compatibility with the long-term options, and capital cost.

TRAVEL TIME SAVINGS

Travel time savings are discussed separately for the passenger vehicle and goods movement vehicle modes, as well as the walking, cycling, and transit modes.

Passenger and Goods Movement Vehicles

This potential medium-term improvement option is not anticipated to create any benefits or impacts for passenger vehicles or goods movement vehicles. As such, the monetized net travel time impact was not calculated.

Walking, Cycling and Transit

From a walking and cycling perspective, the nearest crosswalk across Highway 97 to this location is at the Clements Crescent intersection, approximately 1.5 kilometres south of Lang Road. For pedestrians and cyclists travelling between the lake side and mountain side of Highway 97 via Lang Road, the additional travel distance to and from the Clements Crescent intersection to use the crosswalk represents significant travel time that could be reduced by the proposed pedestrian / cyclist overpass. Depending on a given trip origin and destination, the proposed connection could save as much as 40 minutes for a person walking and 12 minutes for a person cycling. In addition, the overpass will ensure that transit users are able to access either direction of the Route 22 bus service without the need to make lengthy detours to cross the highway at a formal crosswalk or to make a potentially unsafe crossing of the highway at another undesignated crossing location. Given the extent of the detour, people may elect to just cross the highway without the benefit of a crosswalk.

Overall rating is Significantly Better.

ROAD SAFETY

No collisions involving bicycles or pedestrians were recorded in the area of the proposed Lang Road – McKay Lane Walking and Cycling Connection between 2004 and 2018. As a result, the value of the safety benefits of the pedestrian / cyclist overpass were not readily measurable. However, The Lang Trail, which is included in the

District of Peachland *Parks and Recreation Master Plan (2018-2028)*, is expected to increase pedestrian travel in the area, potentially resulting in an unsafe crossing of Highway 97 if no grade separation is provided.

While the future safety risk to pedestrians and cyclists at this location is difficult to quantify given the limited data on active travel, the mitigation of risk through the provision of the overpass in the medium-term horizon is supported by historical collision data from the rest of the Highway 97 corridor that indicates that almost all collisions involving a bicycle since 2004 resulted in an injury.

Overall rating is Significantly Better.

SOCIO-COMMUNITY IMPACTS

This potential medium-term improvement option will provide increased local connectivity for pedestrians and cyclists by connecting Lang Road to McKay Lane across Highway 97, reducing community severance effects of the highway. Some property (likely one property) may be impacted along the east side of the highway, however the extent of the area impacted will be contingent on further design development. More specifically, the extent of the property impacts is dependent upon the design and whether a loop ramp or switchback ramp configuration is provided on the McKay Lane side of the highway.

The proposed pedestrian / cycling overpass will facilitate improved access to the Route 22 transit services which in turn will provide more equitable access to attractions throughout the Central Okanagan region for all Peachland residents, including those who do not have access to a vehicle or prefer to use transit instead.

Due to the natural grade from the existing cut of the highway, the overpass structure will have no major visual impacts to adjacent residents on the mountain side of the highway but will create some visual impacts for those properties on the lake side of the highway.

The overpass structure is generally consistent with the Lang Road / McKay Lane connection envisioned in the *Parks and Recreation Master Plan (2018-2028)*.

An archeological assessment may be required for the construction of the overpass.

Overall rating is Similar to Base Case / Neutral.

ENVIRONMENTAL IMPACTS

No significant terrestrial and aquatic impacts are anticipated from the Lang Road – McKay Lane Walking and Cycling Connection given the current scope and level of review at the current conceptual stage.

From a greenhouse gas emissions perspective, improved access to and from the Route 22 bus service will provide an opportunity for Peachland residents to make use of transit rather than driving. This potential for increased transit use may lead to a decrease in greenhouse gas emissions by reducing auto travel, however the decrease is expected to be very minor.

Overall rating is Similar to Base Case / Neutral.

COMPATIBILITY WITH LONG-TERM OPTIONS

Compatibility with Alternate Route Options AR-4 and AR-5

If an alternate route is ultimately implemented as the long-term solution to improve the Highway 97 corridor through Peachland, the Lang Road – McKay Lane walking and cycling connection will remain in place as a safe and convenient way to cross the existing highway, even if the existing highway has less traffic due to diversion to the alternate highway route. From a design perspective, if an alternate route is confirmed prior to the design of the overpass structure, then the overpass structure can be designed to only span the existing highway, rather than being designed to accommodate a potential four-lane cross-section.

Compatibility with Existing Route Option ER-A

The McKay Lane – Lang Road Walking and Cycling Connection is compatible with the long-term existing route Option ER-A. The pedestrian / cyclist overpass structure will be designed in a manner that provides sufficient horizontal clearance to protect for the potential widening of the highway to four lanes, as shown ***Figure 4.6,*** if existing route Option ER-A is identified as the long-term solution for improvements to Highway 97 through Peachland. As alluded to previously, the elevation change to facilitate a tie-in to McKay Lane could be accomplished via either a loop configuration (shown above in ***Figure 4.3***) or a switchback configuration (shown here).

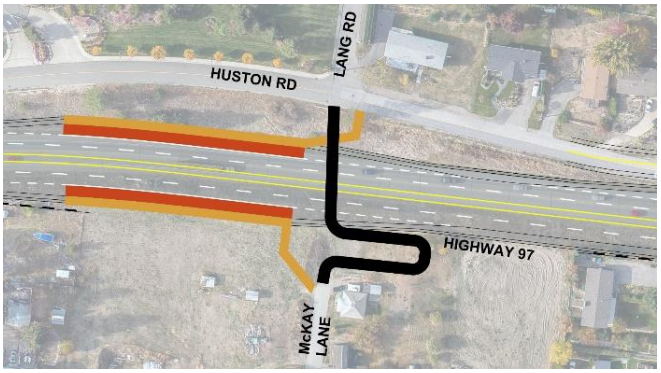


Figure 4.6: McKay Lane – Lang Road Walking and Cycling Connection – Potential Long-Term Layout with Option ER-A Implemented

The overpass structure can be implemented in advance of Option ER-A and be made fully compatible (i.e. no throwaway) but this decision to span a future four lane highway will be required prior to the design phase. If this decision to future proof the design is not provided, then a shorter span structure would need to be heavily modified or potentially rebuilt if existing route Option ER-A is identified as the long-term solution for improvements to Highway 97 through Peachland.

CAPITAL COST

Planning-level cost estimates were prepared using the Elemental Parametric Method of cost estimation (Wolski method). In addition to construction costs, costs estimates include provisions for future planning, design, project management, engagement and consultation, construction administration, contingency, and management reserve. The capital cost estimate of the Lang Road – McKay Lane Walking and Cycling Connection option is $8.3 million (in 2020$) and the resultant present value is $7.9 million. This potential medium-term improvement option has the following key capital cost drivers:

- ~$2.0 million for engineering, other technical services and engagement
- ~$3.3 million for construction
- ~$3.0 million for contingency and management reserve

Property costs were not included at this time as the impacted area is dependent upon the ramp configuration. The costs assume a structure with a span that can accommodate a four lane highway cross-section; a structure that needs to only span the existing highway corridor (i.e. if an alternate route were to be implemented over the long-term) would have a slightly lower cost.

BENEFIT-COST RATIO

The value of travel time savings for pedestrians and cyclists, and potential avoidance of collisions involving one of these vulnerable road users that may result from the implementation of the proposed pedestrian / cyclist overpass, was not calculated due to the limited availability of relevant data. As such, no comparison of the potential benefits to the capital cost was undertaken.

4.2.3 Medium-Term Option 3: Hardy Street Intersection Safety Improvements

The Hardy Street Intersection Safety Improvements option was assessed based on potential travel time savings, road safety performance, environmental impacts, socio-community impacts, compatibility with the long-term options, and capital cost. Recognizing the proximity of the location of this potential medium-term improvement option with respect to Peachland Creek, a discussion on potential flooding resilience was also included under the Environmental Impacts criterion.

TRAVEL TIME SAVINGS

Travel time savings are discussed separately for the passenger vehicle and goods movement vehicle modes, as well as the walking, cycling, and transit modes.

Passenger and Goods Movement Vehicles

Travel time savings for the Hardy Street Intersection Safety Improvements option were calculated based on changes in intersection delay as calculated using the Synchro model developed for this intersection location. Existing conditions on the corridor were based on the most recent turning movement counts and 2040 volumes were forecasted using the regional travel demand model.

The cumulative daily travel times and monetized annual travel time savings associated with the Hardy Street Intersection Safety Improvements option are shown in ***Table 4.8*** and ***Table 4.9*** respectively, for both the 2014 base year and the 2040 planning horizon year.

It is noted that traffic approaching the intersection from Hardy Street will be unaffected by this proposed improvement, but delay on the highway will be reduced since the proposed improvements will eliminate the existing impedance to the flow of through traffic related to northbound turning vehicles. As shown in ***Table 4.9***, traffic delay at the intersection is anticipated to be reduced by 0.3 hours per day in both the 2014 and 2040 scenarios.

Table 4.8: Delay Modelling Results for Hardy Street Intersection Safety Improvements

Approaches	2014		2040	
	Existing Daily Delay (Hours)	Improved Daily Delay (Hours)	Existing Daily Delay (Hours)	Improved Daily Delay (Hours)
Highway	0.3	0.0	0.5	0.2
Cross street	1.3	1.3	1.7	1.7
Total	1.6	1.3	2.1	1.8

Table 4.9: Travel Time Savings and Annual Benefits for Hardy Street Intersection Safety Improvements

Approaches	2014		2040	
	Daily Travel Time Savings (Hours)	Annual Time Savings Benefits (2020$)	Daily Travel Time Savings (Hours)	Annual Time Savings Benefits (2020$)
Highway	0.3	$2,000	0.3	$2,000
Cross street	0.0	$0	0.0	$0
Total	**0.3**	**$2,000**	**0.3**	**$2,000**

The corresponding present value of the monetized travel time savings between the assumed 2031 in-service date and the assumed end of the analysis period in 2035 are shown in ***Table 4.10***.

Table 4.10: Present Value of Travel Time Savings for Hardy Street Intersection Safety Improvements

Approach	Present Value (2020$)
Highway	$10,000
Cross street	$0
Total	**$10,000**

Walking, Cycling, and Transit

This potential medium-term improvement option is not anticipated to have any effect, either positive or negative, on people walking and cycling through the study area.

With respect to transit, this potential medium-term improvement option will reduce the risk of northbound Route 70 buses being delayed by northbound left-turning vehicles and southbound Route 70 buses being delayed by right-turning vehicles. However, the net benefit for transit is expected to be very minor.

Overall rating is Similar to Base Case / Neutral.

ROAD SAFETY

The collision history of the Highway 97 / Hardy Street intersection is summarized in ***Table 4.11***.

Table 4.11: Collision History (Total Collisions between 2004 and 2018)

Collisions Type	PDO	Injury	Fatal	Total
Highway 97 / Hardy Street	15	5	0	**20**

The road safety performance of the Hardy Street Intersection Safety Improvements option is shown in ***Table 4.12*** and ***Table 4.13.*** The severity of historical collisions observed at the Hardy Street intersection is relatively low, but the number is predicted to be reduced if the proposed turning lanes are implemented. It is estimated that the proposed turning lanes will result in a reduction of 0.69 collisions per year, on average.

Table 4.12: Highway Safety Predictive Analysis for Hardy Street Intersection Safety Improvements

Intersection	Improvement	Type of Collision	Existing Collisions per Year	Collision Modification Factor	Improved Collisions per Year
Hardy Street	NB Left turn lane and SB right turn lane	PDO	1	0.48	0.48
		Injury	0.33	0.48	0.16
		Fatal	0	0.48	0

Table 4.13: Annual and Present Value Road Safety Benefits for Hardy Street Intersection Safety Improvements

Collisions Type	Cost per Collision	Change Collisions	Safety Benefits
Annual PDO	$13,752	-0.52	$10,000
Annual Injury	$307,975	-0.17	$50,000
Annual Fatal	$8,227,209	0.00	$0
Annual Total	-	**-0.69**	**$60,000**
Present Value (2020$)	-	-	**$250,000**

Given the lack of changes with respect to walking, cycling, and transit, no qualitative assessment was undertaken for these modes.

SOCIO-COMMUNITY IMPACTS

An Archeological Assessment will be required particularly for any works on the lake side of Highway 97 and if Peachland Creek is impacted. To re-align the Hardy Street approach, some property will be impacted, although no development appears to be located on the subject property at this time. No other significant impacts are anticipated.

Overall rating is Somewhat Worse.

ENVIRONMENTAL IMPACTS

An Environmental Assessment will be required particularly for any works on the lake side of Highway 97 and if Peachland Creek is impacted. Environmental regulatory approvals may be required.

From a greenhouse gas emissions perspective, the elimination of idling caused by northbound through-moving vehicles being obstructed by a northbound left-turning vehicle and southbound through-moving vehicles being obstructed by a southbound right-turning vehicle may result in a decrease in greenhouse gas emissions, however this decrease is anticipated to be very minor.

From a climate change resiliency perspective, during periods of heavy rainfall or strong wind, flooding from Peachland Creek and wave action from Okanagan Lake have resulted in flooding and in some cases debris deposits on Highway 97 in the vicinity of Hardy Street. The *RDCO Flood Mapping Project: Peachland and Trepanier Creeks Final Report* (2019) was referenced. The analysis documented in this report applied hydraulic modelling to estimate that the Highway 97 bridge over Peachland Creek is subject to flood-related damage, and therefore out-of-channel flooding of the creek and inundation of the nearby properties. If the Hardy Street Intersection Safety Improvements option were to move forward as a project, further analysis of lake level rises, flooding, and wave action should be undertaken to ensure that the road and any bridge infrastructure are designed to appropriately mitigate the associated risks and impacts. Depending on initial findings of any future hydraulic analysis of the Peachland Creek area, as well as a more detailed assessment of the condition of the existing Peachland Creek bridge structure, opportunities to re-profile the highway to incorporate a higher bridge clearance and highway surface roadway elevation (relative to the lake level) should be considered.

Overall rating is Similar to Base Case / Neutral.

COMPATIBILITY WITH LONG-TERM OPTIONS

Compatibility with Alternate Route Options AR-4 and AR-5

If an alternate route is ultimately implemented as the long-term solution to improve the Highway 97 corridor through Peachland, the Hardy Street Intersection Safety Improvements infrastructure will remain in place and continue to produce safety benefits and reduce delay for local traffic in the long-term horizon. However, the Hardy Street improvements may be over-engineered if the existing highway becomes a local corridor in the future and posted speed limits are reduced.

Compatibility with Existing Route Option ER-A

This potential medium-term improvement option represents minimal "throwaway" work should the existing route Option ER-A be implemented over the long-term, as shown in ***Figure 4.7***. Hardy Street is also anticipated to be diverted as part of the package of improvements included in existing route Option ER-A. However, as mentioned earlier, if the existing highway bridge over Peachland Creek is to be replaced due to a combination of reaching the end of its lifecycle as well as the opportunity to provide greater flood-proofing / climate resiliency, then the design of the replacement structure as part of this potential medium-term improvement option should consider how it could be integrated or made consistent with the any possible future widening of the highway to four lanes.

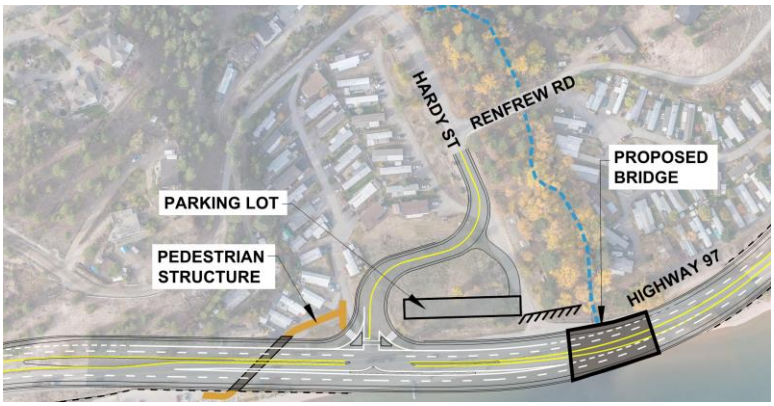


Figure 4.7: Hardy Street Intersection Safety Improvements – Potential Long-Term Layout with Option ER-A Implemented

CAPITAL COST

Planning-level cost estimates were prepared using the Elemental Parametric Method of cost estimation (Wolski method). In addition to construction costs, costs estimates include provisions for future planning, design, project management, engagement and consultation, construction administration, contingency, and management reserve. The capital cost estimate of the Hardy Street Intersection Safety Improvements option is $2.9 million (in 2020$) and the resultant present value is $2.7 million. This potential medium-term improvement option has the following key capital cost drivers:

- ~$1.0 million for engineering, other technical services and engagement
- ~$0.9 million for construction
- ~$1.1 million for contingency and management reserve

As noted previously, neither property costs nor cost escalation are included in these estimates.

BENEFIT-COST RATIO

The results of the benefit-cost analysis of the Hardy Street Intersection Safety Improvements option are shown in ***Table 4.14***. Over the life of the project to 2036, the value of the road safety and travel time benefits are equal to only 0.08 of the capital costs. However, the Hardy Street intersection improvements are expected to bring at least some safety and travel time benefits beyond 2036, the time frame for the current study, since most or all of the improvements will remain in place depending on the eventual long-term solution for the highway corridor.

Table 4.14: Benefit Cost Analysis for Hardy Street Intersection Safety Improvements

Present Value of Monetized Benefits (2020$)	$0.3 million
Present Value of Costs (2020$)	$2.7 million
Benefit-Cost Ratio	0.10

4.2.4 Medium-Term Option Evaluation Summary

A summary of the evaluation of each of the three potential medium-term improvement options is presented in the following tables, ***Table 4.15a*** through ***Table 4.15c***, with respect to the key evaluation criteria.

Table 4.15a: Medium-Term Option 1: Chidley Road Intersection Safety Improvements and Clements Crescent Connection

Criteria	Scoring	Description
Travel Time Savings – Passenger and Goods Movement Vehicles	<$0.1 M	Travel time savings for all modes are estimated to be minor.
Travel Time Savings – Walking, Cycling and Transit	◑	No significant impacts or benefits are anticipated, therefore these improvements are considered to be **similar / neutral** as compared to base case conditions.
Road Safety	$0.1 M	Road safety benefits based on collision reductions are estimated to be minor, however, risks of future collisions are reduced.
Social Community Impacts	◔	Some property impacts are anticipated, therefore the improvements are considered to be **somewhat worse** as compared to base case conditions.
Environmental Impacts	◑	No significant environmental impacts are anticipated, therefore these improvements are considered to be **similar / neutral** as compared to base case conditions.
Compatibility with Long-Term Options	-	Option may not provide significant value if an alternate route option is selected. The proposed improvements are fully compatible with the existing route option.
Capital Cost	$4.3 M	2020$ Present Value. Property costs not included.

Table 4.15b: Medium-Term Option 2: Lang Road – McKay Lane Walking and Cycling Connection

Criteria	Scoring	Description
Travel Time Savings – Passenger and Goods Movement Vehicles	-	No impacts anticipated for passenger and goods movement vehicles.
Travel Time Savings – Walking, Cycling and Transit	●	Travel time savings for the active transportation modes are **significantly better** as compared to existing conditions
Road Safety	●	Safety for the active transportation modes is **significantly better** as compared to base case conditions.
Social Community Impacts	◑	Although some property will be impacted, the proposed option is consistent with the local community plans and is therefore considered to be **similar / neutral** as base case to existing conditions.
Environmental Impacts	◑	No significant environmental impacts are anticipated, therefore these improvements are considered to be **similar / neutral** as compared to base case conditions.
Compatibility with Long-Term Options	-	This improvement option is compatible with any long-term corridor option, although a decision on the nature of the potential long-term solution (existing versus alternate route) should be made prior to design in order to size the overpass span appropriately.
Capital Cost	$7.9 M	2020$ Present Value. Property costs not included.

Table 4.15c: Medium-Term Option 3: Hardy Street Intersection Safety Improvements

Criteria	Scoring	Description
Travel Time Savings – Passenger and Goods Movement Vehicles	<$0.1 M	Travel time savings for all modes are estimated to be minor.
Travel Time Savings – Walking, Cycling and Transit	◑	No significant impacts or benefits are anticipated, therefore these improvements are considered to be **similar / neutral** as compared to base case conditions.
Road Safety	$0.3 M	Road safety benefits based on collision reductions are estimated to be moderate, however, risks of future collisions are reduced.
Social Community Impacts	◔	Some property impacts are anticipated, therefore the improvements are considered to be **somewhat worse** as compared to base case conditions.
Environmental Impacts	◑	No significant environmental impacts are anticipated, therefore these improvements are considered to be **similar / neutral** as compared to base case conditions.
Compatibility with Long-Term Options	-	For alternate route options, some limited continued traffic operations and safety benefits, but to a lesser degree (i.e. option may be over-engineered). For existing route option, some incremental cost reductions, but also some “throwaway” works.
Capital Cost	$2.7 M	2020$ Present Value. Property costs not included.

5. OVERVIEW OF POTENTIAL LONG-TERM IMPROVEMENT OPTIONS

Three comprehensive highway options are under consideration as the potential long-term solution to improve the Highway 97 corridor through Peachland. These long-term options, which were identified as part of the key findings from the *Highway 97 Peachland Transportation Planning Study – Phase I Final Report (2019),* are listed below and shown graphically in ***Figure 5.1***:

- Alternate Route Option AR-4 (Yellow / Blue) – new four-lane highway
- Alternate Route Option AR-5 (Blue) – new four-lane highway
- Existing Route Option ER-A (Red) – existing highway upgraded to four lanes

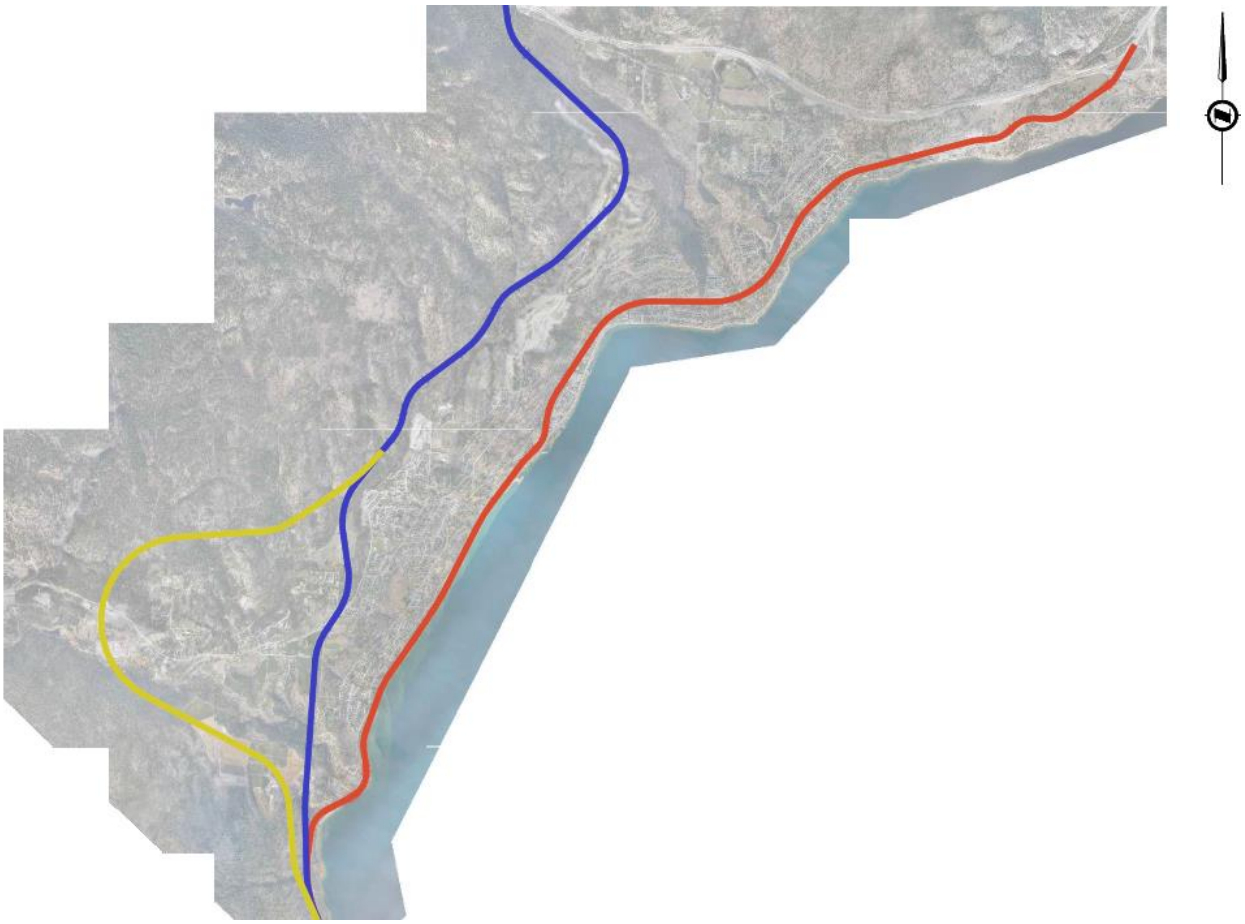


Figure 5.1: Potential Long-Term Options AR-4 (Yellow/Blue), AR-5 (Blue), and ER-A (Red)

The three long-term options are briefly described in the following sub-sections.

5.1 Option AR-4

Option AR-4 is an alternate route option consisting of a four-lane highway with a 100 km/h design speed that runs primarily along the hillside above Peachland, although the alignment diverts to the west around the zoned industrial area within the Upper Princeton Neighbourhood. The total length of new construction for this alternate route option is approximately 16.1 kilometres as measured from the new interchange at Highway 97C in the north to the existing four-lane section at Greata Ranch Road in the south.

Beginning in the south, alternate route option AR-4 starts at the northern extent of the existing four-lane segment of Highway 97 near Greata Ranch Road. From there, the widened highway proceeds northwards generally along the existing corridor, with cuts into the hillside in some areas to shift the highway slightly further away from the lake. The two existing T-intersections with Brent Road are consolidated into a single "protected-T" intersection configuration at the southmost intersection location.

North of Brent Road, the new highway alignment diverges from the existing highway corridor and begin to climb into the hillside at a six percent grade. North-facing ramps are provided at the junction with the existing Highway 97 alignment to facilitate connectivity to and from the Peachland community from the south.

The new highway climbs at a six percent grade for approximately 4.7 kilometres. The new highway alignment passes through agricultural properties on the south side of Peachland Creek, and then passes over the creek via a curved bridge structure approximately 485 metres in length. The highway passes through an industrial zoned area of Peachland on 10 – 15 metre elevated fills, and then passes over McDougal Road and Princeton Avenue via an approximately 100-metre long bridge structure. Although not shown in the design concept, it is anticipated that a partial or full movement interchange could potentially be added at Princeton Avenue in order to facilitate a direct connection between the new highway and the adjacent industrial area.

North of the industrial area, the highway runs primarily through forested areas. West of Law Street, the highway grade reaches a maximum elevation of 707 metres and begins to level out, with the horizontal alignment following the rear of a local peak in order to minimize rock cut quantities. As the new highway alignment continues to run northwards, it descends at a grade of six percent for approximately 1.4 kilometres before leveling out just west of Gerrie Road at an elevation of approximately 604 metres. The alignment of the new highway slightly impacts the southwest corner of Sanderson Park.

North of Gerrie Road, where the highway alignment becomes common with alternate route option AR-5, a pedestrian passage is provided for access to Gladstone Trail, and north of Ponderosa Drive a similar passage is provided for trails accessing Pincushion Mountain. It is anticipated that fill will be required on the east side of the highway corridor in this area, and the toe of the fill slopes will almost reach the residential developments along Gerrie Road and Ponderosa Drive. However, at this time, these fill slopes are not anticipated to physically impact these developments. Near Ponderosa Drive, a vertical sag curve is introduced into the highway alignment in order to improve the balance of cut and fill quantities.

Continuing north, the highway wraps around Pincushion Mountain, and begins to descend to the west of Trepanier Creek at a six percent grade for approximately 0.7 kilometres. At least one wildlife underpass will be provided along the corridor in this area (exact location to be determined in later design phases) in order to facilitate access to the creek.

Upon reaching Highway 97C, the alternate highway route connects to Highway 97C via a trumpet interchange configuration. The new interchange incorporates the existing east-facing ramps that connect Highway 97C to Trepanier Road. Specifically, the existing off-ramp from Highway 97C to Trepanier Road is configured as a single exit from Highway 97C, where upon exiting Highway 97C, vehicles will subsequently choose to either exit to Trepanier Road or to the alternate route around Peachland. Similarly, vehicles travelling from the alternate route to Highway 97C will make use of the exiting Trepanier Road on-ramp, with a new on-ramp being constructed for Trepanier Road in order to provide sequential merges onto the Highway 97C eastbound.

In total, this option features approximately 6.8 kilometres of alignment with a grade of six percent, outside of which grades are relatively minor (i.e. few grades that are three percent or higher, but less than six percent). The only connections to / from the alternate route are the tie-in points with the existing Highway 97 alignment at the south end near Brent Road, and with Highway 97 near Trepanier Creek Beach at Highway 97C at the north end of the alternate route. An additional interchange connection with Princeton Avenue in the Upper Princeton neighbourhood may be possible, however this potential interchange is not included in the baseline option.

5.2 Option AR-5

Option AR-5 is an alternate route option consisting of a four-lane highway with a 100 km/h design speed that runs primarily along the hillside above Peachland, with much of the alignment to the north being common with alternate route option AR-4. However, near the Upper Princeton neighbourhood, the new highway alignment runs through the neighbourhood rather than diverting to the west around the neighbourhood. The total length of new construction for this alternate route option is approximately 13.6 kilometres as measured from the new interchange at Highway 97C in the north to the existing four-lane section at Greata Ranch Road in the south.

Beginning in the south, alternate route option AR-5 starts at the northern extent of the existing four-lane segment of Highway 97 near Greata Ranch Road. From there, the widened highway proceeds northwards generally along the existing corridor, with cuts into the hillside in some areas to shift the highway slightly further away from the lake. The two existing T-intersections with Brent Road are consolidated into a single “protected-T” intersection configuration at the southmost intersection location.

South of Antlers Beach, the new highway alignment diverges from the existing highway corridor and begins to climb into the hillside at a six percent grade. North-facing ramps are provided at the junction with the existing Highway 97 alignment to facilitate connectivity to and from the Peachland community from the south.

The new highway alignment continues to climb at a six percent grade for approximately 3.1 kilometres. A significant bridge, approximately 515 metres in length, is required to cross the Peachland Creek canyon. On the north side of the canyon, the new highway alignment runs just to the west of the Vernon Avenue / Sanderson Avenue corridor, first in a significant cut and then transitioning to an elevated fill section. The new highway alignment conflicts with Elliot Avenue, Vernon Drive, and Princeton Avenue, therefore in order to maintain community connectivity, the new highway alignment passes over Vernon Drive and Princeton Avenue via a 175-metre long bridge structure. Vernon Drive is re-aligned in order to reduce the length of the bridge structure and Elliot Avenue is closed with a cul-de-sac and a new road connection is implemented between Elliot Avenue and Princeton Avenue near Mack Road to maintain access to properties along Elliot Avenue.

Continuing north, the new highway alignment impacts the western edge of Sanderson Park, where the vertical grade eventually levels off. At this point, the new highway alignment generally follows approximately the 604-metre elevation contour, with cuts and fills required where contour curvatures exceed acceptable horizontal geometry.

Just north of where the highway vertical alignment levels out near Gerrie Road, the new highway alignment begins to follow a common alignment with alternate route option AR-4 from this point to the new interchange connection with Highway 97C at the north end of the study area.

In total, this option features approximately 3.8 kilometres of alignment with a grade of six percent, outside of which grades are relatively minor (i.e. few grades that are three percent or higher, but less than six percent). Similar to Option AR-4, the only connections to / from the alternate route are the tie-in points at Highway 97C at the north end of the alternate route and with the existing Highway 97 alignment at the south end near Antlers Beach. However, unlike Option AR-4, an additional interchange connection with Princeton Avenue was not considered for this option.

5.3 Option ER-A

Option ER-A is an existing route option consisting of a four-lane highway with an 80 km/h design speed that runs primarily within the existing Highway 97 corridor through Peachland. The total length of the route is approximately 15.5 kilometres as measured from the Highway 97C interchange in the north to the four-lane section at Greata Ranch Road in the south.

Beginning in the south, widening for the existing route option starts at the northern extent of the existing four-lane segment of Highway 97 near Greata Ranch. From there, the widened highway proceeds northwards generally along the existing corridor, with cuts into the hillside in some areas to shift the highway alignment slightly further away from the lake. The two existing T-intersections with Brent Road are consolidated into a single "protected-T" intersection configuration at the southmost intersection.

North of Brent Road, the highway continues along the existing highway alignment with the expanded cross-section being achieved by widening on the inland side of the existing highway. However, in the vicinity of Antlers Beach Regional Park, the mouth of Peachland Creek, and Hardy Street, the existing horizontal curvature on the highway is slightly less than the requirements for an 80 km/h design speed. Therefore, the horizontal curvature was increased in this area in order to achieve the 80 km/h design speed. The larger radius horizontal curve, the widening of the highway to four lanes, and the provision of a protected-T intersection at Hardy Street, was accommodated by widening the highway towards Lake Okanagan in order to avoid impacting critical habitat along Peachland Creek. All sections of the re-aligned and widened roadway would be located on an elevated structure in order to minimize impacts to the lake foreshore. The elevated structure, also crossing Peachland Creek, would be constructed at an elevation approximately four metres higher than the existing span in order to mitigate risks of washouts from Peachland Creek. Hardy Street is re-aligned slightly to the south to connect to the highway via the aforementioned protected-T intersection, which is located near the existing access to the Antlers Beach Estates Mobile Home Park. In order to preserve access to the Antlers Beach Regional Park, a new parking lot is provided near Hardy Street, and a pedestrian underpass is provided underneath the highway in order to access the beach. Note that this section of the alignment was refined from the alignment presented in Phase I; specifically, the alignment no longer deviates inland to cross Peachland Creek. This refinement was made to reduce property impacts as well as critical terrestrial habitat impacts along Peachland Creek.

North of Peachland Creek, widening is accommodated on the inland side. This segment features steep slopes, with a split-grade cross-section to be considered in order to reduce cut requirements and mitigate slope stability challenges in this area. The intersection at Renfrew Road is be converted to a right-in / right-out configuration.

At Princeton Avenue, the existing signalized intersection is maintained and widened to provide two through lanes as well as right and left-turn lanes in both the northbound and southbound directions. Far-side bus stops are also provided along the corridor in order to enable the new Route 70 regional transit service to stop in this area and facilitate transfers to the Route 22 service that runs along Princeton Avenue and Beach Avenue. On the north side of the intersection, the new highway is re-aligned slightly to increase the horizontal curvature and improve sightlines for southbound vehicles approaching the intersection.

Continuing north, widening continues to be accommodated on the inland side which will impact a municipal water pump house in the vicinity of the signalized intersection with Ponderosa Drive / 13 Street. This intersection is retained and widened to allow two through lanes as well as left and right-turning lanes in both the north and southbound directions. Between the Ponderosa Drive intersection and the Clements Crescent signalized T-intersection, the highway is again widened towards the inland side, requiring significant retaining walls given the steep terrain in this area. A pedestrian pathway is also included adjacent to the retaining wall in order to provide a separated pathway between Ponderosa Drive and Clements Crescent, thereby enabling students walking to the Peachland Elementary School to avoid interactions with highway traffic.

Near the Clements Crescent intersection, the highway is widened towards the Peachland Centre shopping plaza to avoid impacting the row of trees and tennis counts in Lambly Park. Far-side bus stops are also provided at the Clements Crescent intersection in order to provide an on-corridor stop that replaces the existing bus stop within the shopping plaza. The existing two-lane bridge across Trepanier Creek is replaced with a new four-lane structure, and the adjacent pedestrian bridge would be reconfigured - if required. The Chidley Road access to the Highway 97 is closed. The Todd Road leg / south leg of the intersection is retained and configured as a right-in / right-out intersection.

At the Trepanier Bench Road intersection, the intersection is widened to provide two through lanes in each direction. The Desert Pines Avenue access to Trepanier Bench Road is closed with a cul-de-sac and far-side bus stops are provided at the highway intersection.

North of the Trepanier Bench Road intersection, the northbound right-in to Buchanan Road (West) is closed with a cul-de-sac. In this area, widening of the highway is accommodated towards the lake side in order to avoid conflicts with Huston Road that provides access to several individual properties on the west side of the corridor.

At Lang Road / McKay Lane, a pedestrian and cycling overpass is provided across the highway in order to maintain a Lang Trail connection that is consistent with the District of Peachland *Parks and Recreation Master Plan*. Bus bays are also provided on either side of the highway to facilitate transit access.

At Shaw Road, a right-in / right-out intersection configuration is provided to facilitate access to and from the highway. Huston Road is closed with a cul-de-sac on either side of Shaw Road in order to avoid introducing a second intersection immediately adjacent to the right-in / right-out highway access. To facilitate continued access to properties along Huston Road north of Shaw Road, a new local road connection is provided to Walker Road and Clarence Road.

Between Shaw Road and the existing Buchanan Road / Robinson Place intersection with Highway 97, a new intersection is provided with a re-aligned Buchanan Road that features right-in / right-out access to the highway as well as a southbound left-in access to Buchanan Road. Robinson Place is then re-aligned to connect to the new Buchanan Road alignment. Bus bays and a grade-separated pedestrian crossing are also provided in this area.

The existing Drought Road T-intersection with the highway is converted to a partial diamond interchange configuration, with the southbound on and off-ramps as well as the northbound off-ramp being provided. Drought Road is extended north to Seclusion Bay Road, where the existing intersection with Highway 97 acts as the northbound on-ramp to the highway.

5.4 Future Steps for Long-Term Options

Through the screening assessment conducted as part the *Highway 97 Peachland Transportation Study – Phase I* report (Parsons, 2019), the three long-term options documented in this section were all retained as feasible options for the long-term solution to improve the Highway 97 corridor. These long-term options were evaluated in a separate report, however at this time no recommendation is made regarding a potential long-term solution. Following this study, the Ministry of Transportation and Infrastructure will continue to monitor the performance of the highway. Once the highway is determined to be nearing capacity, the Ministry plans to undertake additional transportation analysis to further investigate and evaluate these options, and subsequently identify a long-term solution to improve the Highway 97 corridor through Peachland. This future work may involve further refinement of each long-term option based on the envisioned analysis to identify the implications of each option with respect to climate change resiliency, Indigenous reconciliation, transit and active transportation provisions, changing traffic volumes and travel patterns, new vehicle technologies, land claims, costs versus funding availability, and local development. In addition, any further work will include continued engagement with Indigenous groups, the District of Peachland, other key stakeholders, and the general public.

6. INPUT FROM PUBLIC ENGAGEMENT PROCESS

During a three-week period in August and September 2020, the Ministry of Transportation and Infrastructure undertook a public engagement process that provided Peachland community members with information on the candidate short and medium-term improvement options as well as to solicit feedback on these options.

The most frequent concern cited by respondents was congestion relating to traffic lights, other choke points, and increased highway volumes associated with summertime tourism. Other concerns included speeding and road safety, challenges associated with turning at intersections, broader concerns about the study approach, and a preference to focus on long-term options rather than short-term improvements. Several comments also noted concerns relating to pedestrian safety, sight lines and curves in the existing road, and property impacts associated with the candidate short and medium-term improvement options.

Specific examples of feedback heard from respondents included:

- Traffic volumes on Highway 97 are higher in the summertime, and several Peachland residents noted that access on to, off of, and across the highway is substantially more challenging during this time of year and can create extended delays and safety concerns. Even though these access issues are less acute at other times of the year, there was still a strong interest in improving the reliability and safety of access to / from the highway. There was an interest in addressing these during other times of the year.
- Some respondents queried whether the impacts of future development and population growth in the Peachland area had been fully incorporated into the study analysis.
- In general, transit related measures (particularly transit priority measures) received less support compared to measures related to traffic operations, safety, and pedestrian connections. Although transit improvements were generally still supported by respondents, they were seen as being a lower priority than other types of improvements.
- Some respondents were concerned about potential impacts if only some scope elements of a particular improvement option were implemented.
- Speeds in excess of the posted speed limit were noted as a potential concern.
- Although in many instances respondents agreed that the locations for which the candidate improvement options were developed represented the key issue locations along the highway corridor, some respondents noted that Drought Hill is also an area of concern.
- In some cases, respondents did not have confidence that the candidate short and medium-term options would provide any benefit, or that the focus should instead be to accelerate the implementation of a long-term solution for the highway corridor.

Further information regarding the feedback obtained through the public engagement can be found in the *Highway 97 Peachland Transportation Planning Study - Phase II: What We Heard Report* (Argyle, October 2020).

7. POTENTIAL IMPLEMENTATION STRATEGY

In Section 3 and Section 4 of this document, an assessment of the improvement options for consideration in the short-term and medium-term timeframes was summarized. All improvement options are anticipated to provide some safety and operational benefits although in some cases, particularly those relating to sustainable transportation modes, benefits were not readily able to be quantified and monetized. A further key consideration identified through the evaluation process was that while improvement options identified as being candidates for implementation in the short-term time frame can (in principle) be implemented prior to a potential long-term solution, improvement options that were identified as being candidates for implementation in the medium-term time frame have some level of inter-dependency with respect to the decision associated with identifying a long-term solution. In addition, the value of and / or design approach for these candidate medium-term improvement options is contingent on what long-term solution may ultimately be selected. Therefore, for the purposes of developing a strategy to prioritize the timing for possible implementation of one or more improvement options over the next 15+ years, the improvement options were either grouped into those highway improvements that can be implemented prior to a decision associated with identifying a long-term solution or those highway improvements that should be informed by the decision associated with identifying a long-term solution.

For Potential Implementation Prior to Making a Decision on a Long-Term Solution

This section includes the four improvement options that were initially identified as candidates for potential implementation in the short-term time frame. While all improvement options were shown to provide value, it is necessary to prioritize among these improvement options such that they can be implemented as funding envelopes allow. In identifying a relative level of priority between these improvement options, consideration was given to:

- The anticipated extent of benefits to project costs (as described above in Section 3 and 4), with the caveat that "not all that counts can be counted", and qualitatively-evaluated benefits are also a valid basis for recommending improvement options.
- Input from the public engagement process (as described above in Section 6).
- Urgency of the issue, in terms of whether the improvement options are addressing an existing issue or an issue that is anticipated to emerge in the future as a result of further growth in traffic volumes along the corridor. Section 2 of the *Highway 97 Peachland Transportation Planning Study Phase I Final Report* was referenced to identify the issues as either existing or anticipated future issues. It is acknowledged that in many instances, locations may have more than one type of issue, and even if an issue already exists, it could still become more severe in the future.

Based on the above considerations, the proposed prioritization for implementation of the candidate improvement options is ranked as follows:

1. The **Trepanier Bench Road Signalization and Access Management Upgrades**, including turn restrictions at the Highway 97 / Buchanan Road West and the Highway 97 / Huston Road / Buchanan Road intersections is the highest priority. This option provides significant road safety benefits and reduced delay for cross-street traffic. While the traffic signal at Highway 97 / Trepanier Bench Road adds some delay to highway through traffic, the forecasted safety benefits associated with the cross-street traffic tend to outweigh the disbenefits to the highway. All three intersections were also noted in the Phase I

report as having issues relating to extended delays associated with access onto the highway. and residents have also expressed concern about these delays, particularly in summertime.

2. The **Clements Crescent Intersection Transit and Pedestrian Improvements** is the second priority. This option will provide regional transit access for Peachland residents, and improved pedestrian connectivity for residents of the Ponderosa neighbourhood to access the Peachland Elementary School and the Peachland Centre. The launch of the Route 70 service in 2019 has transformed the lack of a suitable bus stop location from an anticipated future issue into an ongoing issue. The lack of a direct pedestrian connection between Ponderosa Drive and Clements Crescent was also noted by stakeholders as being a concern, particularly with respect to safety of students walking to and from school.
3. The **Renfrew Road Intersection Safety Improvements** are recommended third, as this potential project provides significant safety benefits and modest reductions in traffic delay. Access onto the highway from Renfrew Road was also noted as being an existing issue.
4. The **Princeton Avenue Intersection Transit and Safety Improvements**, including proposed bus stops, bus queue jumper lanes, and a southbound right-turn lane, are collectively recommended, as this potential project provides moderate safety benefits and reduced delay for highway traffic. However, with the Clements Crescent Intersection Transit and Pedestrian Improvements already in place (per the second priority recommendation), Peachland residents will already have access to the Route 70 service and this option will simply serve to provide an incremental improvement to that access. Some safety benefits were noted for this option although the magnitude of these benefits is significantly smaller than those associated with the other potential improvement options. Should this improvement option be advanced in the future, it is noted that a potential addition to the scope to also address the northbound right turn slip lane should be considered.

For Potential Implementation Subsequent to Making a Decision on a Long-Term Solution

The following medium-term improvement options should be considered for implementation prior to the long-term corridor wide improvement, but after a decision has been made identifying a long-term solution:

- The **Lang Road – McKay Lane Walking and Cycling Connection** option significantly improves active transportation connectivity and level of service in the area, as well as improves access to and from the Route 22 bus service. However, the sizing of the overpass structure is contingent on the decision to widen the highway to four lanes along the existing route or to construct an alternate route in the future. If the long-term existing route option is selected, then the structure must be future-proofed to provide clearance to span a four-lane corridor. Conversely, if a long-term alternate route option is selected, the structure will only need to span the existing corridor.
- The **Chidley Road Intersection Safety Improvements and Clements Crescent Connection** are recommended in the event that Highway 97 were to remain along the existing alignment in the long-term planning horizon (e.g. Option ER-A). This potential project provides modest road safety benefits and reductions in traffic delay. However, in the event that Highway 97 traffic were to be diverted to an alternate route in the future, this potential project is unlikely to provide significant value due to both lower traffic volumes and lower posted speeds along the existing roadway corridor.

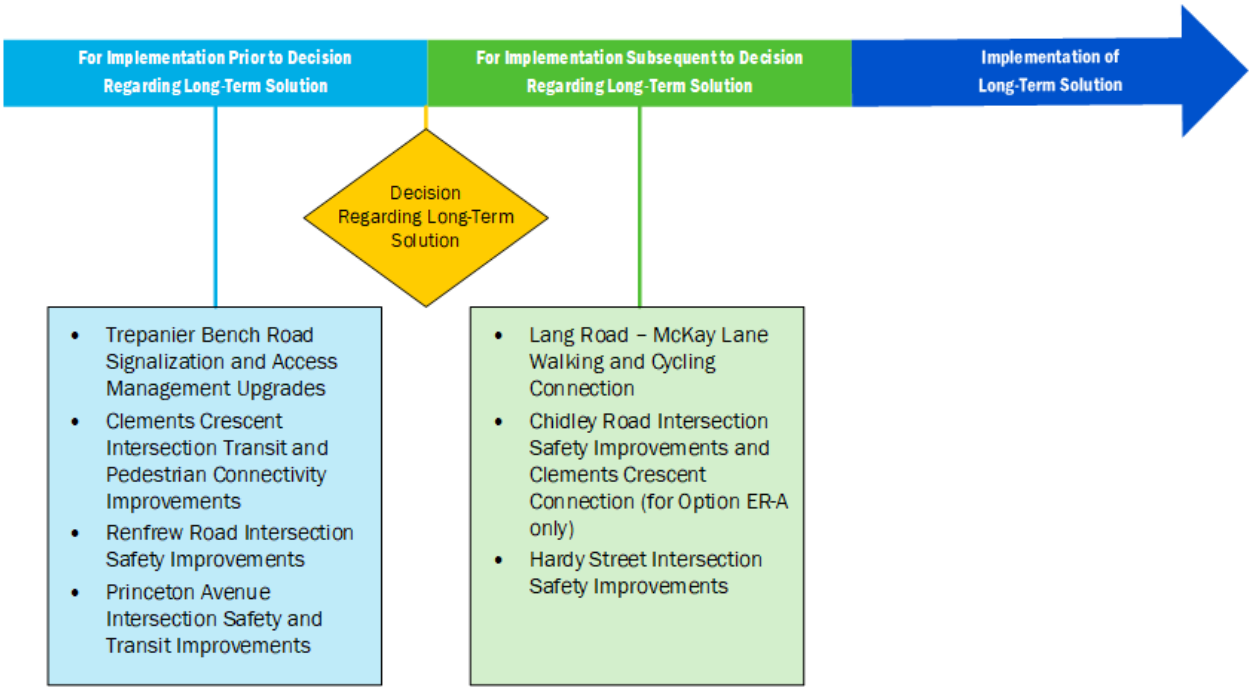
- The **Hardy Street Intersection Safety Improvements** provides modest road safety benefits and reductions in traffic delay. The timing of any improvements at this location may also need to consider the condition of the existing bridge structure and further investigation would be recommended, within the context of the life cycle of the existing highway bridge over Peachland Creek and climate resiliency considerations related to flood-proofing. If a Peachland Creek bridge replacement is incorporated into the project scope of this medium-term improvement option, then the configuration of this bridge structure should incorporate the configuration of the highway as per the long-term existing route option. If the long-term existing route option is selected, then the structure must be future-proofed to enable a parallel two-lane structure to be constructed in the future (as part of a four-lane corridor); conversely, if a long-term alternate route option is selected, then no such future-proofing of a bridge replacement is necessary.

Long-Term Options

The three long-term options summarized in this report, namely alternate route Option AR-4, alternate route Option AR-5, and existing route Option ER-A, are all feasible options to be considered for the long-term improvement of the Highway 97 corridor. As noted previously, at this time no recommendation is made regarding a long-term solution.

A summary of the timeline for the recommended implementation of the various corridor improvements / potential projects is shown graphically in ***Figure 7.1***.

Figure 7.1: Potential Implementation Timeline



Appendix A

Expansion Factors for Benefit Monetization

The purpose of this appendix is to summarize the expansion factors used to convert peak hour traffic operations benefits (i.e. vehicular travel time savings) into daily and subsequently annualized values. Road safety benefits are already calculated on an annualized basis, and do not require application of these expansion factors. However, both the vehicular travel time savings and road safety impacts require conversion from singular analysis years to a longer (i.e. multi-year) benefits accrual period. The definition of the benefit accrual period(s) and the approach to estimating benefits over the course of the accrual period is also summarized below.

Count Data and Review

Base year William R. Bennett Bridge count data collected by BC MoTI was used in the expansion. Other locations, some even closer to Peachland, were considered but were not used as continuous data was not available for the entire year. It is important that a whole year of traffic count data is used to develop the expansion factors such that seasonal variations are captured.

Traffic count data used in the analysis was collected by permanent vehicle detectors located at the south end of the William R. Bennett Bridge. The traffic data set, obtained for the year 2014, were summarized by vehicle class in 15-minute intervals.

The regional travel demand model, which is based on fall season weekday travel, was previously calibrated to October 2014 counts. As such, the October weekday daily profile was employed to be consistent with the regional travel demand model outputs. The typical October weekday daily profile over the William R. Bennett Bridge is shown in ***Figure A.1.***

Figure A.1: Typical October weekday daily profile over the William R. Bennett Bridge

Hourly to Daily Expansion

The document *TransLink Transportation Evaluation Guidelines (T Partridge & Associates, October 2000)* guided the method used to develop the peak hour to daily expansion factors. The method was expanded to cover the application of all model scenarios.

Particularly, when an off-peak model does not exist, the Evaluation Guidelines document describes that a project such as road widening has benefits only in the five (5) peak hours, and no benefits in the off-peak when volumes are low enough not to need the extra lanes, while a new project such as an alternate route may save time all day long due to a more direct or shorter distance regardless of capacity considerations. However, considering the various proposed short and medium-term improvement options, none of them are solely capacity improvements that only benefit the peak periods. For the purposes of the benefit estimates herein, the results from the modelled AM hour will apply to 12 AM peak hours, while the modelled PM hour will apply to the rest of the day.

The percentages of daily traffic for each time period used are illustrated in ***Table A.1***. The resulting expansion factors to be used for each model scenario are summarized in ***Table A.2***.

Table A.1: Percentages of William R. Bennett Bridge Daily Traffic

Data Type	Time Period	Auto	LGV	HGV
Model Volumes	Modelled AM Hour (730-830)	7.7%	8.7%	7.0%
	Modelled PM Hour (1630-1730)	8.7%	7.2%	5.0%
2014 Oct TWTh Avg Counts	12 AM Peak Hours (0000-1200)	38.8%	47.3%	51.4%
	12 PM Peak Hours (1200-2400)	61.2%	52.7%	48.6%

Table A.2: Expansion Factors

Time Period	Auto	LGV	HGV
AM Hour (0730-0830)	5.1	5.4	7.4
PM Hour (1630-1730)	7.0	7.3	9.4

Daily to Annual Expansion

Table A.3 presents a summary of the count data in different day-of-week count periods and the annual average daily traffic (AADT).

Table A.3: William R. Bennett Bridge October Daily Average and AADT

Count Period	Auto	LGV	HGV
2014 Oct TWTh	51600	4900	1700
2014 Oct MF	50200	4700	1500
2014 Oct SS	42500	2600	700
2014 AADT	47800	4000	1300

The relationships between an October weekday and the AADT would be the daily to annual expansion factors, shown in ***Table A.4.***

Table A.4: Daily to Annual Expansion Factors

Count Period	Auto	LGV	HGV
2014 Oct TWTh	338	299	269