Horne Lake Connector Updated Assessment

Final Summary Report

Ministry of Transportation and Infrastructure

South Coast Region

JULY 27, 2012

1. Background

The provision of an alternate access to Port Alberni was initially examined in 1993 as part of the Vancouver Island Valley Link Study in 1993. This study was updated in 2004. At that time the cost of the Horne Lake Connector was estimated to cost $57M and was predicted to have a benefit to cost ratio of 0.37.

In 2005 the Ministry retained ND Lea Associates to develop alternative alignments to Highway 4. The attributes of the new route were to include: a 60km/h speed limit with minimal speed reductions; a maximum elevation of 422 m; and maximum grades of 10%. This study produced two alignment options for a two lane highway that traversed the north and south sides of Horne Lake. The costs (in 2012$) ranged from $44M to $52M with a benefit to cost ratio of 0.6.

In 2007, the Alberni-Clayoquot Regional District (ACRD) commissioned a study of a slightly shorter route than the one developed by the ND Lea Associates. This route was estimated to cost $55M (2012$) and based on Ministry assessment had a benefit to cost ratio of 0.14.

Figure 1 describes the various alignments discussed above.

2. 2012 Horne Lake Connector Updated Assessment

At the request of the Alberni Connector Working Group, comprised of representatives of the Port Alberni Port Authority, the City of Port Alberni, the ACRD, the Tseshaht First Nation, and the Alberni Chamber of Commerce, the Ministry undertook an updated assessment of a Horne Lake Connector (HLC) Route. The Ministry retained Urban Systems to:

- Review all previous alignments developed;
- Develop an alignment for a new connector that would encourage 50% or more of the existing traffic from Highway 4 to divert to this new route; and
- Provide updated cost estimates for the construction of such a route.

Travel Demand

Figure 2 describes the 2012 Average Annual Daily Traffic (AADT) on Highways 4 and 19. Out of a total of approximately 10,000 vehicles per day travelling both directions on Highway 4 between Port Alberni and Highway 19, about 300 (3%) consists of all types of truck traffic. Traffic varies significantly by time of year. Summer Average Daily Traffic (SADT) is roughly 30% higher than the AADT. Figure 3 describes the peak travel patterns in the study area. The major demand destinations are the Nanaimo and Qualicum areas, with only 10% of peak traffic travelling to the North via Highway 19.

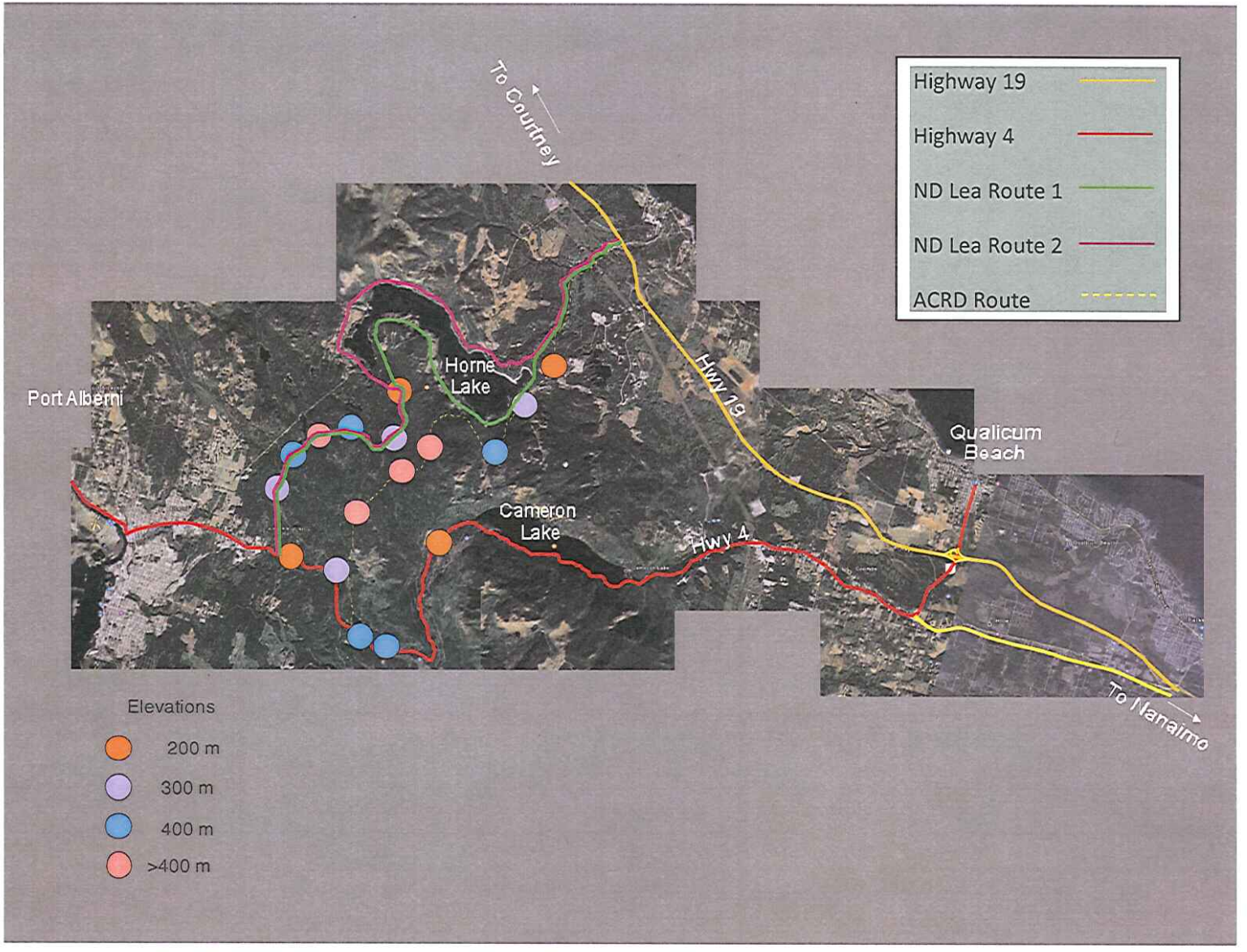

Figure 1: Horne Lake Connector Route Alignment

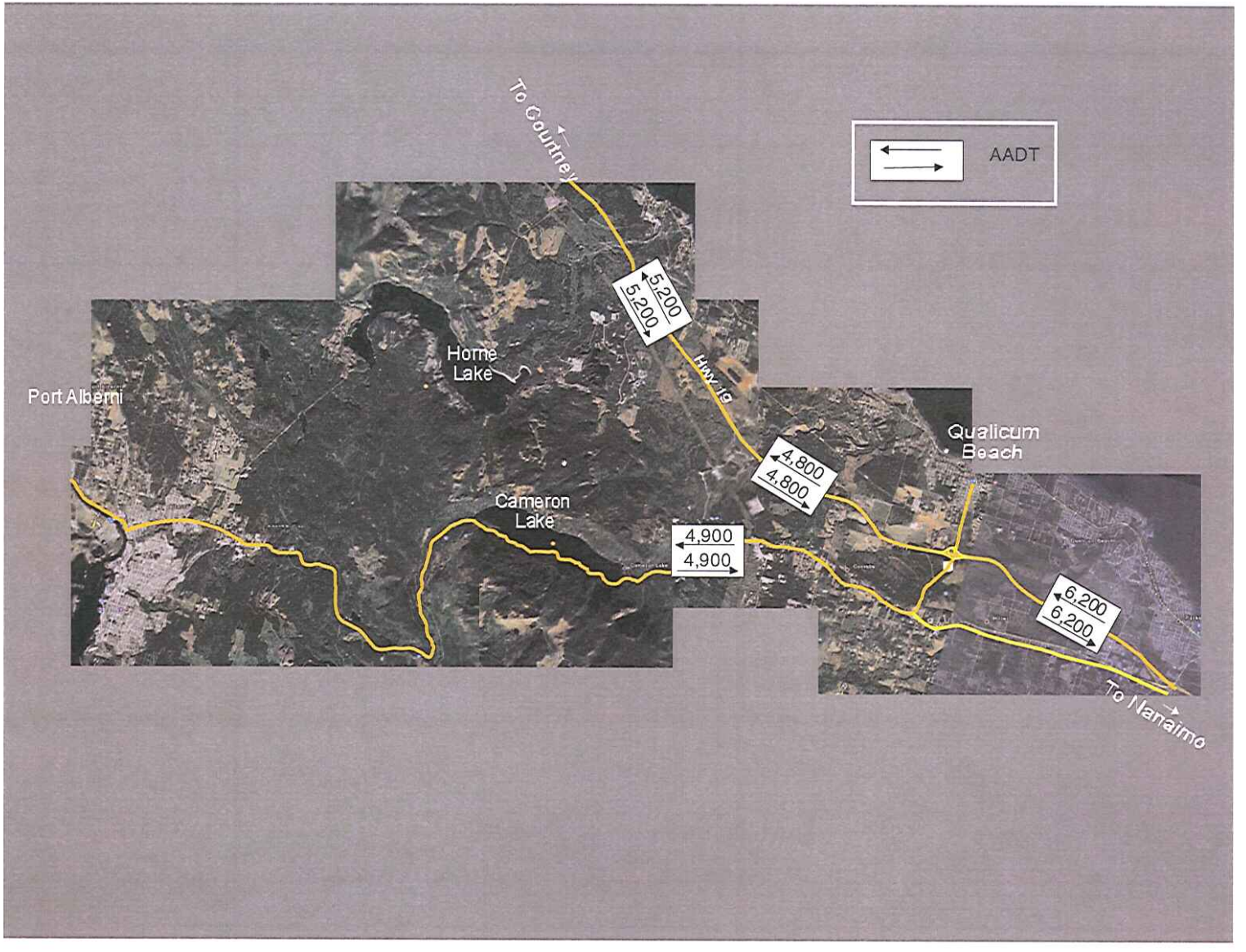

Figure 2: Highway 4 and Highway 19 Average Annual Daily Traffic (AADT)

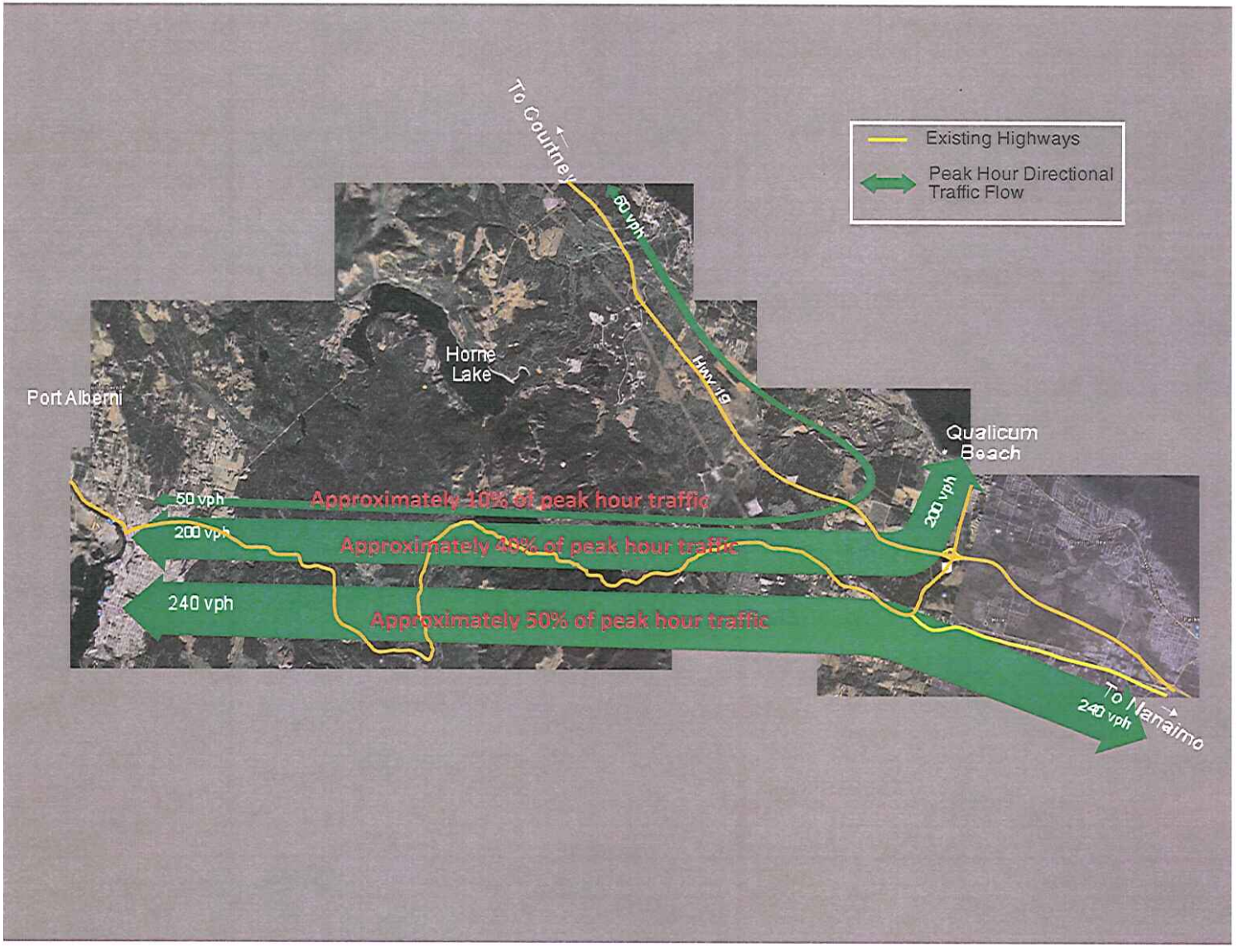

Figure 3: Highway 4 Peak Hour Travel Demands

Alignment Review

All previously developed alignments for the Horne Lake Connector were reviewed to:

- Assess and identify major differences in the assumptions and design criteria between previous concepts;
- Assess the warrant for climbing lanes required in each concept based on previous design work;
- Complete preliminary evaluation of where climbing lanes would be required in each option; and
- Prepare associated order of cost magnitude estimates for each option.

The cost estimates for each climbing lane are summarized in Table 1, along with the original cost estimates, estimated cost escalation, and the combined total estimated project cost with climbing lanes included.

Table 1: Updated Cost Estimates (All Values in Million Dollars)

Option	Previous Cost Estimate		Climbing Lane Cost ((2012 Dollars)	Combined Project Cost (2012 Dollars)
	Original Dollar Value	2012 Dollars		
ND Lea Route 1 (2005)	$41.53M	$58.94M	$5.97M	$64.91M
ND Lea Route 2 (2005)	$45.51M	$64.59M	$7.48M	$72.07M
ACRD (2008)	$37.59M	$54.97M	$10.21	$65.18M

The ACRD Alignment with truck climbing lanes was found to have the best potential for provision of travel speeds that can meet the 50% diversion target and would produce the best cost benefit. Therefore the ACRD alignment with the addition of truck climbing lanes was advanced for further analysis. It must be noted that all new alignments developed will result in some sections of roadway having challenging geometry and terrain similar to the existing Highway 4.

Traffic Assessment

In order to provide an un-biased assessment of traffic diversion and a quantification of travel effects associated with the diversion, a micro-simulation modeling was utilized. Previous analysis of the Horne Lake connector utilized the INTEGRATION model.

The INTEGRATION model is an assignment model that allocates traffic demand to available routes based on comparative travel times from a defined origin-destination trip table. It is capable of accurately reflecting freeways, arterial roadways, and collector roadways. The INTEGRATION model can consider continuous time varying traffic demands on an individual lane basis and is fully capable of simulating both auto and truck demands, with their performance provided on an individual basis.

The INTEGRATION model roadway network is represented by a set of nodes and links which can be further characterized into individual lanes with specific movements and intersection control including traffic signals, stop and yield signs, and ramp meters. Traffic demand is generated from vehicle trip matrices and a route choice assignment model.

The model consists of: a description of the network and its attributes; network traffic controls; and a trip table defining hourly demand by vehicle type.

Network Demand

Traffic demand is represented by peak hour vehicle and truck trip tables. The trip tables describe the peak hour demand between all of the origins and destinations in the model. The 2012 trip table demands were developed from existing traffic counts on Highway 4. Approximately 9,800 vehicles travel Highway 4 between Port Alberni and Highway 19 on average per day throughout the year, with about 4,900 travelling each direction. About 300 of these vehicles are trucks (3%). Given the seasonal variance in traffic demand throughout the year, a peak hour variance of plus and minus 15% from the average annual daily traffic was assessed, reflecting an overall variance of 30%.

For 2037, total traffic volume on Highway 4 between Port Alberni and Highway 19 is estimated to reach approximately 11,300 vehicles on average per day, with about 5,600 total vehicles travelling in each direction. This increased demand was developed by applying the historic traffic growth rates for this area (about 0.5% per year). For truck traffic, the model

assumed that truck traffic would increase on Highway 4 by another 350 vehicles per day, for a total of 650 trucks travelling this section of Highway 4 per day (over 100% increase).

This estimated level of 100%+ increase for truck traffic on Highway 4 between Port Alberni and Highway 19 by 2037 was done to ensure all potential future economic development initiatives in the area were accounted for in the modeling process. This 100+% increase in truck traffic assumed by this model exceeds current estimates publicly available for truck traffic generated from the Raven Coal Mine proposal, which is estimated to be 4-6 trucks per hour or 40-60 additional trucks per day.

Scenarios Modeled

The following three scenarios were modeled:

- Highway 4 – Existing Network
- 2008 ACRD Alignment
- 2012 ACRD Alignment with truck climbing lanes

The performance of the various scenarios is described by: travel time and estimated traffic diversion to the new route.

Table 2 provides a performance comparison of the three scenarios under all demand assumptions.

The addition of truck climbing lanes resulted in greater travel speeds and increased rate of diversion (to the new route) under all demand assumptions. Unlike previously developed routes, the 2012 ACRD route with climbing lanes now accommodates not only trips originating and terminating to the north but also a small portion of travel originating or destined from the south (mostly to Qualicum). This results in an overall reduction of total time travelled, however a slight increase in kilometers travelled. Although, the rate of utilization from the new route increases with traffic demand, the significant difference in demand between destinations to the north (Courtenay) and south (Nanaimo/Qualicum) restricted route diversion to a maximum of 43%. Unless, there is significant increase in demand between Port Alberni and locations north of Qualicum it will be unlikely to achieve diversion rates over 50%.

Table 2: Scenario Performance Comparison

Scenario	Peak Hour veh-hrs	Peak Hour veh-km	Avg. Network Speed	% Diversion to HLC
Average Demand (average annual daily traffic)				
Highway 4	687	54,400	79 km/h	N/A
2008 ACRD	640	52,683	82 km/h	32%
2012 ACRD with climbing lanes	632	52,930	84 km/h	41%
Low Demand (15% less than the average annual daily traffic)				
Highway 4	548	44,655	82 km/h	N/A
2008 ACRD	521	43,818	84 km/h	32%
2012 ACRD with climbing lanes	520	43,935	85 km/h	36%
High Demand (15% greater than the average annual daily traffic)				
Highway 4	780	60,316	77 km/h	N/A
2008 ACRD	736	59,439	81 km/h	37%
2012 ACRD with climbing lanes	727	59,664	82 km/h	43%

3. Economic Assessment

The economic feasibility of all three routes was assessed for a 25 year investment period using discount rates of 4%, 6%, and 8%. The discount rate is the interest rate that the Province incurs when borrowing money.

Costs included initial capital costs, rehabilitation costs (20% of initial capital costs every 15 years) and annual maintenance costs ($5,000/lane km/year). Table 3 identifies the quantified annual traveler time costs, vehicle operating costs, and collision costs for all three routes.

Benefits included travel time ($13.50/hr), vehicle operating costs ($0.61/km for automobiles and $1.44 for trucks) and collision costs ($0.92/km for automobiles and $0.20/km for trucks).

The benefit to cost ratio for both the 2008 ACRD alignment and the 2012 ACRD alignment (including truck climbing lanes) was calculated for all demand assumptions and discount rates. Table 4 provides a summary of economic performance.

The benefit to cost ratios are higher for the 2012 ACRD route (including truck climbing lanes) under all demand assumptions varying between 0.2 and 0.48 with the average benefit to cost ratio at 0.41. This indicates that the investment is unable to recover the capital costs required to construct and operate the new route.

Table 3: Present Value Annual Traveler Time Costs, Vehicle Operating Costs and Collision Costs (Million $)

Scenario	Traveler Time Cost	Vehicle Operating Cost	Collision Cost
Average Demand			
Highway 4	$26.60	$80.15	$12.10
2008 ACRD	$25.50	$79.43	$11.75
2012 ACRD with climbing lanes	$25.18	$79.80	$11.80
Low Demand			
Highway 4	$21.19	$65.79	$9.94
2008 ACRD	$20.22	$65.66	$9.75
2012 ACRD with climbing lanes	$20.00	$65.58	$9.79
High Demand			
Highway 4	$30.16	$88.86	$13.43
2008 ACRD	$28.55	$88.57	$13.23
2012 ACRD with climbing lanes	$28.11	$88.59	$13.25

Table : Benefit to Cost Summary

Scenario	4% Discount Rate	6% Discount Rate	8% Discount Rate
Average Demand			
2008 ACRD	0.44	0.38	0.34
2012 ACRD with climbing lanes	0.47	0.41	0.36
Low Demand			
2008 ACRD	0.27	0.23	0.20
2012 ACRD with climbing lanes	0.29	0.25	0.22
High Demand			
2008 ACRD	0.46	0.40	0.35
2012 ACRD with climbing lanes	0.48	0.42	0.37

4. Conclusions

Per the objectives of the 2012 Horne Lake Connector updated Assessment, described at the beginning of this report, all previous alignments were reviewed by Urban Systems and capital costs updated to reflect 2012 costs.

The ACRD Alignment with truck climbing lanes was found to have the best potential for provision of travel speeds that can meet the 50% diversion target and would produce the best cost benefit. Therefore the ACRD alignment with the addition of truck climbing lanes was advanced for further analysis. It must be noted that all new alignments developed will result in some sections of roadway having challenging geometry and terrain similar to the existing Highway 4.

The updated capital costs for the ACRD Alignment with truck climbing lanes was estimated by Urban Systems to be $65 Million in 2012 dollars.

The analysis indicates the enhanced Horne Lake Connector (ACRD Alignment with the addition of truck climbing lanes) would likely divert approximately 43% of existing Highway 4 traffic to the new route (this reflects travel in both directions). However, the cost to construct and maintain the roadway significantly exceeds the travel time benefits that would be derived from the new route. Assuming current continued traffic growth rates, a positive benefit to cost ratio will likely not be achieved for 15 to 20 years.

The analysis supports the continued use of Highway 4 as a safe and reliable corridor between Port Alberni and Highway 19, which will be capable of supporting general and commercial traffic growth that could arise from economic development activities in the region.