BRITISH COLUMBIA
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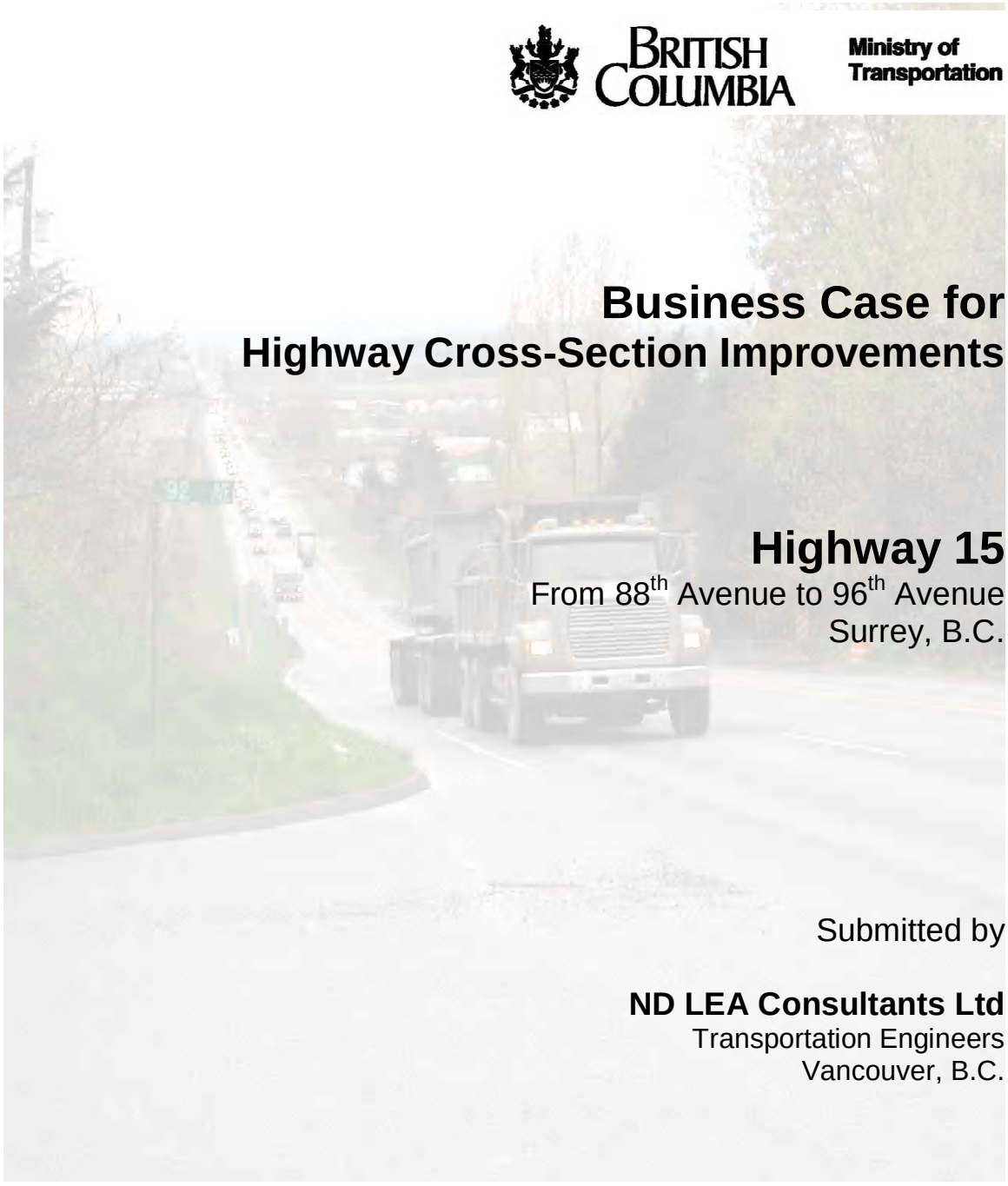

Business Case for
Highway Cross-Section Improvements

Highway 15
From 88th Avenue to 96th Avenue
Surrey, B.C.

Submitted by

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Transportation Engineers
Vancouver, B.C.

80011.601
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ND LEA

STANDARD LIMITATIONS

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EXECUTIVE SUMMARY

Project Rationale

The business case presented in this report is based upon a widening of the existing Highway 15 cross-section between 88th Avenue and 96th Avenue from a two-lane cross-section with an additional (second) truck-climbing lane northbound to a four-lane cross-section with an additional (third) truck-climbing lane northbound. The rationale for this project is:

- It will provide connectivity for the area Border Infrastructure Program (BIP), Gateway and Golden Ears projects. The second southbound lane would be carried through the intersection at 88th Avenue as part of the BIP four-laning project. The third northbound lane would be incorporated into the Golden Ears Project work at 96th Avenue.
- It will address the speed differential between passenger vehicles and heavy vehicles by providing a truck climbing lane in the northbound direction.
- It will achieve travel time benefits through added capacity in the southbound direction and the truck climbing lane in the northbound direction.
- It will achieve safety benefits by further separating heavy vehicles and passenger cars as well as by providing a median barrier.
- It achieves positive economic performance indicators.

Proposed Option

The proposed widening of the Highway 15 cross-section is recommended in the *Highway 15 Laning Review 88th Avenue to 96th Avenue* (Focus, 2005). This includes a four-lane cross-section between 88th Avenue and 96th Avenue with a third lane provided in the northbound direction for heavy vehicles (truck climbing lane). The second southbound lane would be carried through the intersection at 88th Avenue as part of the BIP four-laning project. The third northbound lane would be incorporated into the Golden Ears Project work at 96th Avenue.

The total project cost is estimated at $8.2 million, including estimated property acquisition costs.

Multiple Account Evaluation

The project achieves overall positive economic performance indicators. **Table E1** provides a summary of the analysis.

Customer Service Account – The project will result in positive travel time and safety benefits for roadway users. The addition of the second lane southbound provides greater travel time benefits than the third northbound lane. Safety benefits are associated with the provision of the truck climbing lane and with the median barrier provided with the new cross-section. Closure of 92nd Avenue at Highway 15 would provide further safety benefit as over 40% of collisions that occurred at or around the intersection between 1998 and 2002 were categorized

as either "Intersection 90" or "Rear-end" collisions in the Ministry HAS database.

Social/Community Account - This segment of Highway 15 crosses the City of Surrey's South Port Kells area. Concern has been raised with respect to access limitations resulting from area highway projects. Although a median barrier will be introduced with this project, it is anticipated that residential accesses will not be closed.

A potential archaeological site is located southwest of the intersection of Highway 15 and 92nd Avenue.

A total of 13 properties will be impacted by this project. No full property takings are required, and 8 residences will be impacted. Property acquisition south of 92nd Avenue may impact ALR land (west and east of the highway).

Environmental Account - Based upon discussions with members of the BIP project team, it is anticipated that there will be no significant adverse environmental impacts as a result of the adding a second southbound lane and a third northbound lane on Highway 15. An environmental screening assessment was prepared in association with the Highway 15 BIP project.

Economic Development Account - If constructed, this project will tie together Highway 15 improvements proposed between 32nd Avenue through 88th Avenue and 96th Avenue through the Trans Canada interchange, improving the movement of goods and people through the area. The project will create employment during the remainder of its design and during construction.

Table E1 – Benefit-Cost Analysis Summary

Project Element	Present Value ($M)
Property Acquisition	$ 3.82
Construction Cost	$ 4.38
Salvage Value	($ 1.08)
Rehabilitation and Maintenance Increase	($ 0.11)
Life Cycle Cost	**$ 7.01**
Travel Time Benefits	$ 5.93
Reduced Vehicle Operating Costs	$ 2.49
Safety Benefits	$ 5.39
Total Net Benefits	$ 13.81
Net Present Value	**$ 6.8**
Net B/C Ratio (= $13.81 / $7.01)	**2.0**

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1 INTRODUCTION

Highway 15 (176th Street) connects the Trans Canada Highway (Highway 1) and the Pacific Highway border crossing at the Canada / U.S. border in Surrey. Under existing conditions, the segment of Highway 15 from north of 88th Avenue to south of 96th Avenue (just south of Highway 1) consists of a two-lane cross-section with a second northbound lane (truck climbing lane). This segment is characterized by its vertical profile: there is a steep grade of 10% through this section. 92nd Avenue intersects the highway on the grade as a minor street stop controlled intersection. Approximately a dozen accesses are provided to residential properties along this section of highway. **Figure 1** illustrates the existing highway conditions at 92nd Avenue.

Figure 1 – Existing Hwy 15 at 92nd Ave (Looking South)

The business case presented in this report is based upon a widening of the highway cross-section as recommended in the *Highway 15 Laning Review 88th Avenue to 96th Avenue* (Focus, 2005). This includes a four-lane cross section between 88th and 96th Avenues with a third lane provided in the northbound direction for heavy vehicles (truck climbing lane).

1.1 Importance of the Project to Industry and Trade

The continuing economic and population growth of Greater Vancouver has sparked numerous road and bridge improvement programs within the Lower Mainland in order to improve the movement of people and goods throughout the region.

The Pacific Highway crossing is the primary commercial vehicle crossing for the Lower Mainland and is the fourth busiest commercial vehicle crossing along the entire Canada / U.S. border. Highway 1 plays a vital role in the connectivity within the region, the Province, Western Canada and beyond.

Highway 15 is the main north-south connection between the Pacific Highway crossing and Highway 1. Current projects to the immediate south and north of the subject area will see major improvements to the roadway network. The segment under consideration may, therefore, be seen as the missing piece, or potential bottleneck to the Highway 15 system. Descriptions of the adjacent projects are provided in Section 1.3.

1.2 Background Traffic Volumes and Growth

Highway 15 is a major north-south route connecting Highway 1 to the Pacific Highway border crossing. Traffic volumes through the segment considered in this analysis were in the range of 28,000 vehicles per day in 2003.

Background traffic volume data is available from two sources: Ministry of Transportation traffic count stations around the interchange at Highway 1 and Highway 15; and peak hour traffic counts performed at the intersection of Highway 15 and 96th Avenue during the fall of 2003 (Creative Transportation Solutions Ltd.).

The background traffic growth rate is estimated using the Ministry traffic count station data collected between 1997 and 2003. The historical data analysis suggests an annual traffic growth rate of approximately 3%.

The percentage of heavy vehicles was estimated using the peak hour traffic counts collected in November 2003 (Creative Transportation Solutions Ltd.). The results suggest an average of 6% heavy vehicles in the northbound direction and 4% in the southbound direction.

1.3 Other Area Projects

In 2003, the BC Ministry of Transportation announced the Border Infrastructure Program (BIP). This five-year, $210 million program is focused on improving the movement of goods to and from the Lower Mainland's four border crossings into the United States. Highway 15 will be widened to four lanes from 32nd Avenue through 88th Avenue as part of this program. The highway widening is scheduled for completion in 2008.

Figure 2 – Existing Hwy 15 Construction Looking South from 88th Ave

TransLink's Golden Ears Bridge Project, also estimated for completion in 2008, will impact Highway 15 in the vicinity of 96th Avenue. This $600 million project is focused on improving the movement of goods and people between Pitt Meadows

and Maple Ridge on the north side of the Fraser River and Surrey and Langley on the south side of the river. While the configuration and precise location of the proposed Highway 15 / 96th Avenue intersection is not confirmed, it is expected that a six-lane cross-section will be required in the vicinity of the intersection.

The Gateway Program, also focused on improving movement of goods and people in the Lower Mainland, is estimated in the range of $2.5 to $3 billion. The program includes improvements to Highway 1 from Vancouver to Langley, thereby impacting Highway 15 at the Trans Canada Highway.

2 PROPOSED ALTERNATIVE

As described above, the base condition consists of a two-lane cross-section with a second northbound lane for heavy vehicles. Highway laning for this segment of Highway 15 was reviewed in the *Highway 15 Laning Review 88th Avenue to 96th Avenue* (Focus, 2005). The report recommends that a northbound truck climbing lane be provided starting at the bottom of the hill, approximately 500m north of 88th Avenue to 96th Avenue. In the southbound direction, the report recommends two lanes down the 10% grade.

The second southbound lane would be carried through the intersection at 88th Avenue as part of the BIP four-laning described above. The third northbound lane would be incorporated into the Golden Ears Bridge project work at 96th Avenue. The limits of the proposed alternative, using the MoT Land Kilometre Index (LKI) are from segment 3187 km 3.22 (500m north of 88th Avenue) to 3187 km 4.01 (approximately 320m south of 96th Avenue) for a total distance of 790m.

A summary of the project costs is included in **Appendix A**.

3 MAE AND FINDINGS

A multiple-account evaluation (MAE) was conducted to compare the proposed four-lane highway cross-section with third northbound (truck climbing) lane to the base case. Proposed improvements were isolated from existing signalized intersections to the north and south of the subject segment. The proposed cross-section was assessed under five main accounts, namely:

- Financial – describes the financial cost implications of the project;
- Customer Service – describes the net benefit or value that users are expected to derive from the project. This account is combined with the financial account as a basis for benefit/cost analysis;
- Environmental – describes potential biophysical and natural resource impacts of the project;
- Economic Development – describes the nature, magnitude and significance of potential impact to local business and the ability of the improvements to generate a new economic development; and

- Social/Community – describes the impact that the project may have on the social fabric.

3.1 Methodology

The MAE for the proposed cross-section was based upon travel time analysis that estimated annual travel time costs associated with the base and proposed highway cross-sections. The travel time costs were annualized over a 25-year period, from 2005 to 2029 assuming a 2008 project completion. The analysis was based upon travel time results obtained from the Synchro/SimTraffic software package. The traffic models were checked against speed survey data contained within the *Highway 15 Laning Review 88th Avenue to 96th Avenue* (Focus, 2005). The base and proposed conditions assume 60% loaded trucks, with maximum speeds climbing the hill at 41 kilometres per hour and maximum speeds downhill of 53 kilometres per hour. Daily (24-hour) traffic volume distributions for both the northbound and southbound directions from the MoT 2003 traffic counts at the Highway 1 / Highway 15 interchange were applied to obtain annual travel time cost estimates for both the base and proposed conditions. MoT (MicroBenCost) default passenger car ($11.17 / hour) and average truck ($22.16 / hour) travel time costs were applied in the analysis.

The remaining indicators were evaluated using the MicroBenCost analysis software package, using Ministry defaults. Collision rates used in the analysis were derived from Ministry Highway Accident System data (1998-2002).

Additional analysis details for each account are provided in the following sections.

3.2 Financial Account

Summary of the financial account is summarized in **Table 1** below. The total discounted construction cost, including property acquisition, is $8.2 million. A complete cost estimate is provided in **Appendix A**.

Table 1 – Present Value of Financial Account

Project Element	Present Value ($M)
Property Acquisition	$ 3.82
Construction Cost	$ 4.38
Salvage Value	($ 1.08)
Rehabilitation and Maintenance Increase	($ 0.11)
Life Cycle Cost	**$ 7.01**

Annual maintenance costs for the highway segment were estimated using a rate of $3,967 per year per lane kilometre (Ministry MicroBenCost defaults) at a discount rate of 6% over the 25-year period from 2005 through 2029.

Rehabilitation costs for the highway segment were estimated using a rate of $30,000 per lane kilometre assuming resurfacing at 15 year intervals (Ministry defaults). A discount rate of 6% over the 25-year period was applied. It is assumed that the first resurfacing (base condition only) will occur in 2008, co-ordinating with area projects.

3.3 Customer Service Account

The customer service account was estimated using the results from the Synchro/SimTraffic software package (spreadsheet analysis) and from the MicroBenCost model as described above. The base case assumes that Highway 15 between 88th and 96th Avenues would consist of a two-lane section with an additional northbound truck climbing lane. The base case was compared against the proposed scenario that assumes a four-lane section with an additional northbound truck climbing lane. Key variables and assumptions include:

- Construction will be completed in 2008, co-ordinating with other projects in the area;
- As per Section 1.2 the background traffic growth rate used in the analysis is 3.0%;
- Given the significant improvements proposed for this area, the growth rate between 2008 (estimated completion year for the Golden Ears Bridge and BIP projects) and 2029 was calculated using traffic volume estimates (2021) quantified in these projects. The traffic growth rate used in the analysis between 2008 and 2029 is 3.9% based upon this comparison;
- Discount rate of 6% over a 25-year period (2005-2029);
- Value of time is $22.16 average for trucks and $11.17 for cars (Ministry MicroBenCost defaults); and
- Vehicle operating costs use the Ministry MicroBenCost default values for fuel, oil, tires, depreciation and maintenance & rehabilitation.

A summary of the customer service account, the project net present value and the B/C ratio value are provided in **Table 2**.

Table 2 – Present Value of Customer Account and B/C Ratio

Project Element	Present Value ($M)
Travel Time Benefits	$ 5.93
Reduced Vehicle Operating Costs	$ 2.49
Safety Benefits	$ 5.39
Total Net Benefits	$ 13.81
Net Present Value	**$ 6.8**
Net B/C Ratio (= $13.81 / $7.01)	**2.0**

The addition of the second lane southbound provides greater travel time benefits than the third northbound lane. Safety benefits are associated with the provision of

the truck climbing lane (CMF = 0.75) and with the median barrier provided with the new cross-section (CMF = 0.95). Closure of 92nd Avenue at Highway 15 would provide further safety benefit as over 40% of collisions that occurred at or around the intersection between 1998 and 2002 were categorized as either "Intersection 90" or "Rear-end" collisions in the Ministry HAS database.

The overall economic performance indicators are positive and support project advancement. The net present value is positive and the B/C ratio is greater than 1.0. Sensitivity analysis is provided in Section 3.7.

3.4 Environmental Account

Based upon discussions with members of the BIP project team, it is anticipated that there will be no significant adverse environmental impacts as a result of the adding a second southbound lane and a third northbound lane on Highway 15. An environmental screening assessment was prepared in association with the Highway 15 BIP project.

Environmentally Sensitive Areas, identified in South Port Kells (by Phoenix Environmental Services Ltd.), include two large forest areas east and west of Highway 15: south of 92nd Avenue east of Highway 15 and north of 92nd Avenue west of Highway 15. Class B streams (significant food or nutrient value without fish) have also been identified east of Highway 15, between 92nd Avenue and 96th Avenue.

3.5 Economic Development Account

If constructed, this project will tie together improvements proposed between 32nd Avenue through 88th Avenue and 96th Avenue through to the Trans Canada interchange, improving the movement of goods and people through the area. Even with the project in place, roadway users will experience delay at 88th Avenue and 96th Avenue as both intersections are signalized.

The project will create employment during the remainder of its design and during construction.

3.6 Social/Community Account

This segment of Highway 15 crosses the City of Surrey's South Port Kells area. Concern has been raised that current projects may limit access to properties in the area. The proposed cross-section improvements will restrict turning movements to and from existing residential accesses with the median barrier. Closure of existing residential accesses is not anticipated. It is noted that the proposed general land use plan (April 2005) for the area includes an overpass to replace the existing at-grade intersection of Highway 15 and 92nd Avenue. This is conceptual only, as a

transportation study is currently being undertaken (expected completion summer 2005) to establish the transportation network for South Port Kells. It is stressed that the impact of 92nd Avenue traffic on the value of the proposed cross-section improvements is minimal. Moreover, as stated in Section 3.3, closing 92nd Avenue at Highway 15 would provide further safety benefit.

Additional social/community indicators include:

- **Archaeological Issues** – a potential archaeological site is located southwest of the intersection of Highway 15 and 92nd Avenue; and
- **Property Acquisition** – a total of 13 properties will be impacted by this project. No full property takings are required, and 8 residences will be impacted. Property acquisition south of 92nd Avenue may impact Agricultural Land Reserve (ALR) land west and east of the highway.

3.7 Sensitivity Analysis

A sensitivity analysis was conducted based on the construction cost, discount rate and the percentage of loaded heavy vehicles. The results of this analysis are provided in **Table 3** below.

Table 3 – Sensitivity of Customer Account and B/C Ratio

Loaded Heavy Vehicles	Discount Rate	Construction Cost ($M)	B/C Ratio	Present Value ($M)
40%	6%	8.2	1.9	$ 6.2
40%	10%	8.2	1.0	$ 0.1
60%	**6%**	**8.2**	**2.0**	**$ 6.8**
60%	10%	8.2	1.1	$ 0.5
40%	6%	4.1	3.7	$ 9.7
40%	10%	4.1	2.0	$ 3.9
60%	6%	4.1	3.9	$ 10.2
60%	10%	4.1	2.1	$ 4.3
40%	6%	12.3	1.2	$ 2.5
40%	10%	12.3	0.7	-$ 3.9
60%	6%	12.3	1.3	$ 3.1
60%	10%	12.3	0.7	-$ 3.5

Highlights include:

- Using a 10% discount rate, the B/C ratio would be around 1.0, maintaining a positive net present value.
- With 40% loaded heavy vehicles, the project continued to show a positive B/C ratio and net present value.
- At a 50% construction cost, the project shows strong positive B/C ratios and net present value.

- High (150%) construction costs see the B/C ratio above 1.0 for a discount rate of 6%. At a discount rate of 10%, the B/C ratio is less than 1.0 and net present value is negative.

3.8 Risks

Few risks have been identified for this business case. Risks may affect travel time benefits, timing of this project, as well as the cost of implementation. These include:

- **Value of the Canadian Dollar -** Truck demand over time may be influenced by the value of the Canadian currency relative to the U.S. dollar. With a strong Canadian currency, southbound cross-border traffic may decline as U.S. consumers find alternatives to relatively more expensive Canadian goods.

- **Land Acquisition -** The timing and cost of land acquisition will be governed to a great extent by current landowners and their willingness to negotiate the sale of their property. It is noted that some residents may have already been subject to the land acquisition process for improvements around 88th Avenue and may be more unwilling to renegotiate further impacts to their property. Additionally, land may have to be removed from the ALR, which may affect the timing and cost of the project.

- **Archaeological -** As listed in Section 3.6, a potential archaeological site exists southwest of the intersection of Highway 15 at 92nd Avenue. This may affect the timing and cost of the project.

4 ADVANCEMENT OF TRANSPORTATION SYSTEM

4.1 Complementarity to Other Initiatives

As described throughout this report, the project provides the missing link between the area BIP, Gateway and Golden Ears Bridge projects. While the overall cost is low compared to these projects, the provision of the second lane southbound and third lane northbound will help gain maximum efficiency from these major projects through the project area.

4.2 Consistency with Federal-Provincial Transportation Strategies

The Highway 15 project is consistent with the Province's investment plan *Opening up BC: A transportation plan for British Columbia*. The document is available at: www.gov.bc.ca/bcgov/content/images/transportation_plan_web.pdf

As described on page 31, the federal government has committed $104.1 million and the province has committed $137.3 million to improve international border crossings

and related highway corridors including the Highway 15 corridor to the Pacific Highway border crossing.

The proposed project, including a northbound truck climbing lane and second southbound through lane, is a strong candidate to improve BC's "gateways to the world" given its role in connecting several significant projects (BIP, Gateway and Golden Ears Bridge) in the area of Highway 15 at Highway 1.

APPENDIX A

Preliminary Cost Estimate

Province of British Columbia

TOTAL TENDER AND ASSOCIATED MINISTRY CLASS 'D' COST ESTIMATE

Project 010734 - Highway 15 between 88th and 96th Ave

Schedule of Approximate Quantities and Unit Prices

Item#	Description of Work	Unit of Measure	Approx. Quantity	Unit Price	Extended Amount
1	**SECTION 1 - General**				
1.01	**General**				
1.01.01	Mobilization (5%)	L.S.	100%		$145,998.64
1.01.02	Quality Management	L.S.	100%		$110,000.00
1.01.03	Traffic Management	L.S.	100%		$93,000.00
	Sub-total for General				$348,998.64
2	**SECTION 2 - Grading**				
2.01	Stripping	Cubic Metre	8054	$12.00	$96,648.00
2.02	Type D Excavation - to Disposal	Cubic Metre	27798	$16.00	$444,768.00
2.03	75 mm Well Graded Sub-base (Supplied in Place)	Cubic Metre	3507	$50.00	$175,350.00
2.04	25 mm Well Graded Base Aggregate (Load, Haul, Place, Compact)	Cubic Metre	4060	$60.00	$243,600.00
2.05	Select Granular Sub-base	Cubic Metre	15221	$40.00	$608,840.00
	Sub-total for Grading				$1,569,206.00
3	**SECTION 3 - Drainage**				
3.01	Remove Existing Catch Basins	Each	7	$2,000.00	$14,000.00
3.02	Remove Existing 525mm Conc. Storm Sewer	Metre	325	$100.00	$32,500.00
3.03	Remove Existing Culverts	Metre	220	$110.00	$24,200.00
3.04	Install New 1200mm HDPE Culverts	Metre	220	$450.00	$99,000.00
	Sub-total for Drainage				$169,700.00
4	**SECTION 4 - Paving**				
4.01	Supply and Installation of Tack Coat	Litre	30771	$0.80	$24,616.80
4.02	Supply and Installation of 19mm SP - lower	Tonne	4500	$75.00	$337,500.00
4.03	Supply and Installation of 12.5mm SP - upper	Tonne	4500	$75.00	$337,500.00
4.04	Pavement Reclamation - 300mm depth	Square Metre	11437	$4.00	$45,748.00
4.05	Supply and Installation of Perm. Pavement Markings	L.S.	100%		$75,000.00
	Sub-total for Paving				$820,364.80
5	**SECTION 5 - Barriers and Walls**				
5.01	Supply and Installation of Precast Concrete Median Barrier	Metre	786	$107.00	$84,102.00
5.02	Supply and Installation of Type 1 Concrete Block Retaining Wall	Square Metre	184	$400.00	$73,600.00
5.03	Supply and Installation of Precast Concrete Roadside Barrier	Metre	146	$90.00	$13,140.00
	Sub-total for Barriers and Walls				$157,702.00
Part A	**TENDER CLASS 'D' COST ESTIMATE**				**$3,079,111.44**
	TOTAL TENDER CLASS 'D' COST (Tender CLASS 'D' Cost Estimate plus Site Occupancy (if applicable))				**$3,079,111.44**
901.00	Project Management (2%)	L.S.	100%	$61,582.23	
902.00	Contingencies (25%)			$769,777.86	
903.00	Engineering (12%)			$369,493.37	
904.00	Materials Supplied by MOT	-	-	$0.00	
905.00	Miscellaneous (please enter miscellaneous items below)	-	-	$0.00	
906.00	Utility Relocation	L.S.	100%	$100,000.00	
907.00	Property Acquisition	L.S.	100%	$3,815,581.00	
	ASSOCIATED MINISTRY CLASS 'D' COST ESTIMATE				**$5,116,434.46**
	TOTAL TENDER, SITE OCCUPANCY (if applicable) AND ASSOCIATED MINISTRY CLASS 'D' COST ESTIMATE				**$8,195,545.90**

Prepared by FOCUS
May 20, 2005