Canada-United States-Ontario-Michigan
Border Transportation Partnership

Detroit River International Crossing Environmental Assessment Study

Preliminary Construction Cost Estimate Report for Practical Alternatives (Access Road and Inspection Plaza)

May 2008

Preface

The Detroit River International Crossing (DRIC) Environmental Assessment Study is being conducted by a partnership of the federal, state and provincial governments in Canada and the United States in accordance with the requirements of the Canadian Environmental Assessment Act (CEAA), the Ontario Environmental Assessment Act (OEAA), and the U.S. National Environmental Policy Act (NEPA). In 2006, the Canadian and U.S. Study Teams completed an assessment of illustrative crossing, plaza and access road alternatives. This assessment is documented in two reports: *Generation and Assessment of Illustrative Alternatives Report - Draft November 2006)* (Canadian side) and *Evaluation of Illustrative Alternatives Report (December 2006)* (U.S. side). The results of this assessment led to the identification of an Area of Continued Analysis (ACA) as shown in Exhibit 1.

Within the ACA, practical alternatives were developed for the crossings, plazas and access road alternatives. The evaluation of practical crossing, plaza and access road alternatives is based on the following seven factors:

- Changes to Air Quality
- Protection of Community and Neighbourhood Characteristics
- Consistency with Existing and Planned Land Use
- Protection of Cultural Resources
- Protection of the Natural Environment
- Improvements to Regional Mobility
- Cost and Constructability

This report pertains to cost portion of the Cost and Constructability factor and is one of several reports that will be used in support of the evaluation of practical alternatives and the selection of the technically and environmentally preferred alternative. This report will form a part of the environmental assessment documentation for this study.

Additional documentation pertaining to the evaluation of practical alternatives is available for viewing/downloading at the study website (www.partnershipborderstudy.com).

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1. Introduction

The Detroit River International Crossing Study Team presented preliminary construction cost estimates for five practical alternatives at Public Information Open House (PIOH) 4 held in December of 2006.

The practical alternatives originally presented at PIOH 3, were refined based on public and stakeholder consultation. The cost estimates presented at PIOH4 reflected these refinements to the practical alternatives.

The Parkway was developed based on Practical Alternatives 1B, 2B and 3 to reflect the study goals and the community input received to date. This alternative was initially presented at PIOH 5 held in August of 2007 and subsequently refined based on community input. The Parkway provides approximately 1.8 km of tunnels.

This report documents preliminary construction cost estimates developed for the Access Road and Inspection Plaza practical alternatives in the Area of Continued Analysis (ACA) (refer to Exhibit 1). The construction cost estimates were based on a conceptual level of design, which is considered a reasonable basis for comparison of practical alternatives.

For costing purposes, the practical alternatives were divided into these segments:

- The Access Road alternatives from North Talbot Road to Malden Road;
- The Access Road alternatives from Malden Road to Inspection Plaza alternatives;
- The Inspection Plaza alternatives.

Quantities for major construction items were estimated from the conceptual plan, profile, and typical cross-section drawings. Unit costs were obtained from the Ontario Ministry of Transportation's unit cost database and other sources, as appropriate. The unit costs are in 2006 $CAD. The cost for minor items, contingencies and engineering were added as different percentages of the cost for major construction items. Costs for operation and maintenance, as well as property acquisition were considered separately.

As the Partnership expects the completion of construction by 2013, the preliminary construction costs were escalated to 2011 (which would be halfway during the construction). The cost increase was based on a projected annual growth rate of 3% to account for inflation to 2011, and the formula:

Year 2011 Construction Cost ($CAD)= Year 2006 Construction Cost ($CAD) X 1.03**5

Detailed calculations of preliminary construction cost estimates for the Access Road and Inspection Plaza practical alternatives are documented in Appendix A of this report.

The preliminary construction costs for the Crossing practical alternatives were developed jointly with the U.S. Study Team. Engineers from both Canadian and U.S. Teams undertook a Bridge Type Study that considered numerous options for cable stayed and/or suspension bridges at each crossing location. Based on this report, four bridge options were advanced through a Conceptual Engineering phase. Refer to *the Bridge Type Study Report, Second Revision, July 2007* and *Bridge Conceptual Engineering Report, Rev1, February 2008.*

The objective of this report is to provide reasonable basis for a construction cost comparison of practical alternatives for the Access Road and Plaza. This will provide useful input to the environmental assessment and evaluation.

Other Related Documents

The Study Team prepared a *draft Structural Planning Report for Practical Alternatives*, *May 2008.* The report included structural planning sheets showing structure type and associated preliminary cost estimate, for each structure proposed for the Access Road practical alternatives. These preliminary structural construction cost estimates were included in the overall cost estimates for the Access Road practical alternatives.

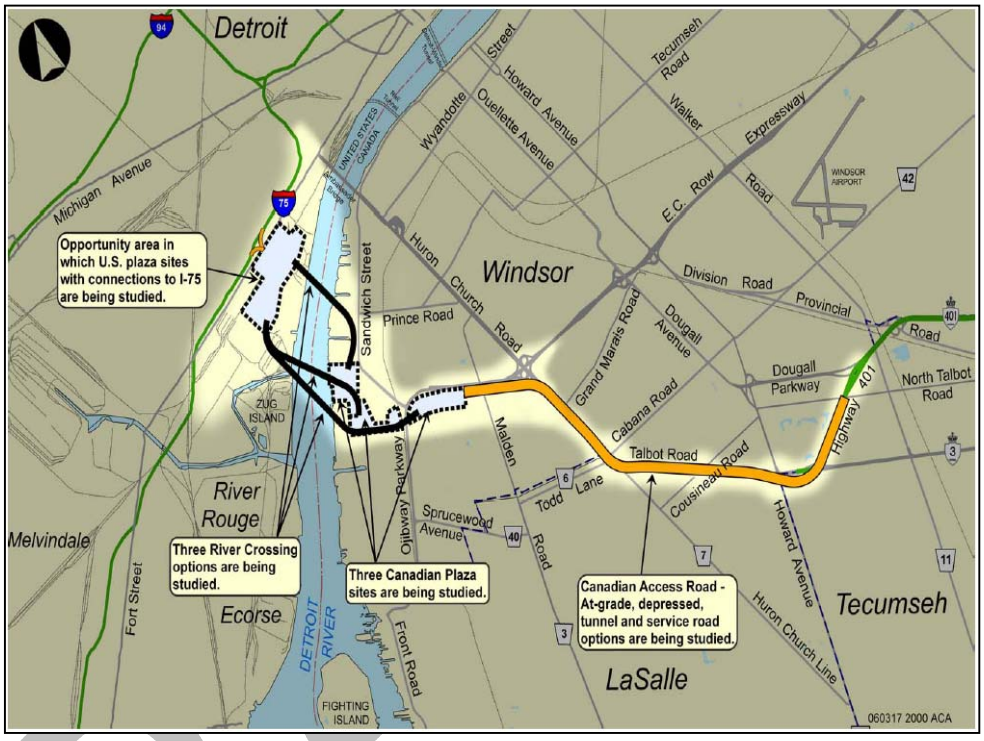
The Team prepared a *draft Stormwater Management Plan for Practical Alternatives, July, 2007, revised March 2008.* The Plan included conceptual drainage designs developed for the Access Road and Inspection Plaza practical alternatives with associated preliminary drainage cost estimates. The preliminary drainage costs were included in the overall cost estimates for the practical alternatives.

The Team also completed a draft *Constructability Report for Access Road Practical Alternatives, April 2008*. This report discussed constructability of the Access Road practical alternatives including construction methods, construction staging and utility relocation.

1.1 Area of Continued Analysis

The Area of Continued Analysis (ACA) is an area within which the Access Road, Inspection Plaza and Crossing practical alternatives were developed. More in-depth technical and environmental investigations were undertaken to support the generation and assessment of practical alternatives. Exhibit 1 depicts the ACA.

EXHIBIT 1: KEY PLAN OF THE AREA OF CONTINUED ANALYSIS



The western portion of the ACA on the Canadian side includes a portion of the west Windsor industrial area at the south end of the Sandwich community. East of that industrial area, the ACA includes a continuous transportation corridor including E.C. Row Expressway, Huron Church Road, Highway 3 and Highway 401. On the U.S. side, the Area of Continued Analysis extends from Zug Island to the vicinity of Ambassador Bridge, and from the I-75 to the Detroit River.

1.2 Access Road Practical Alternatives

The Access Road practical alternatives generally follow the existing Highway 3 and Huron Church Road corridor, and then run parallel and to the south of E.C. Row Expressway.

The Access Road will be a six-lane divided urban freeway with a 6.8m wide median. The median will include a Tall Wall concrete barrier and 3.0m wide shoulders. The outside shoulders are proposed to be 3.0m wide. Interchanges will be provided at Highway 3 and Huron Church Road (south of EC Row) for all alternatives. The Access Road practical alternatives will provide additional access at either St. Clair College or Todd Lane/Cabana Road. The Access Road alternatives will connect to the Inspection Plaza practical alternatives.

Two types of service roads are proposed for the Access Road practical alternatives. The first type includes a one-way service road on each side of the freeway whereas the second type includes a four-lane service road just on one side of the freeway.

Geometric design standards used for the Access Road practical alternatives are generally based on the MTO design standards and consultation with engineering specialists, agencies and stakeholders. The following is a summary of the six Access Road practical alternatives:

Alternative 1A includes an at-grade divided freeway along the Highway 3 / Huron Church Road corridor with below grade sections, and one-way service roads on each side of the freeway. Interchanges are proposed at Highway 3, St. Clair College and Huron Church Road.

Alternative 1B includes a below-grade divided freeway along the Highway 3 / Huron Church Road corridor, and one-way service roads on each side of the freeway. Interchanges are proposed at Highway 3, St. Clair College, and Huron Church Road.

Alternative 2A includes an at-grade divided freeway with below grade sections. This alternative is predominantly aligned west of the existing Highway 3 and Huron Church Road corridor. The existing section of Highway 3 and Huron Church Road will function as a service road to the freeway. Interchanges are proposed at Howard Avenue, Todd Lane/Cabana and Huron Church Road.

Alternative 2B includes a below grade freeway which is predominantly aligned west of the existing Highway 3 and Huron Church Road corridor. This section of Highway 3 and Huron Church Road would function as a service road to the freeway. Interchanges are proposed at Howard Avenue, Todd Lane/Cabana and Huron Church Road.

Alternative 3 is a cut and cover tunnelled freeway with service roads (Highway 3 and Huron Church Road) constructed on top of the tunnel. Interchanges are proposed at Highway 3, St. Clair College and Huron Church Road.

The Parkway is a below-grade freeway which includes eleven tunnel sections. The freeway is predominantly aligned southwest of the existing Highway 3 and Huron Church Road corridors. Highway 3 and Huron Church Road will function as service road along the freeway. Interchange ramps are proposed at Highway 3, Howard Avenue, St. Clair College, Todd Lane/Cabana Road and Huron Church Road. The pedestrian / cyclists trail is proposed along The Parkway with grade separation structures at major sideroad crossings to facilitate movements of pedestrians / cyclists along and across the Parkway.

Typical cross-sections for each alternative are presented in Appendix C.

It should be noted that Alternatives 1A and 2A include localized cross-sections which are below grade. The below grade cross-sections are primarily located at major crossing roads such as Howard Avenue, Cousineau Road / Sandwich Parkway, Cabana Road / Todd

Lane and Spring Garden Road. In addition, Alternative 3 includes localized below grade cross-sections, which function as a transition between the at-grade and tunnel cross-sections.

An exhibit of the Access Road practical alternatives is found in Appendix B.

1.3 Inspection Plaza Practical Alternatives

There are four Inspection Plaza practical alternatives. Plaza A is located south of EC Row Expressway, east of Ojibway Parkway. Plazas B and B1 are located in the Brighton Beach Industrial Park between Broadway Street and McKee Street. Plaza C is adjacent to the Detroit River, west of Sandwich Street and south of Prospect Avenue. All plaza locations are approximately 30-40 hectares (80 acres) in size, and have been designed to accommodate the future expansion need to 2035 and beyond.

An exhibit of the Inspection Plaza practical alternatives is found in Appendix B.

1.4 Crossing Practical Alternatives

The Crossing practical alternatives were developed jointly with the U.S. Study Team. Engineers from both Canadian and U.S. Teams undertook a Bridge Type Study that considered numerous options for cable stayed and/or suspension bridges at each crossing location. The study considered optional locations for piers, anchor blocks and touchdown points, as well as elements that affect the width of the bridge (lane widths, shoulder areas, medians, sidewalks and protection of the cables).
There are three Crossing practical alternatives: Crossing A, Crossing B, and Crossing C. In consultation with the Canadian and U.S. Coast Guards and representatives from the shipping industry, it has been determined that the placement of a pier in the Detroit River would have negative impacts on navigation and marine safety. Therefore, the recommended options clear span the river, and do not have piers in the water. Suspension and cable-stayed bridges are being considered for Crossing B and C. The clear span at Crossing A is over 1.2 km (0.7 miles), which is too long for a cable-stayed bridge. Therefore, only a suspension bridge is being considered for Crossing A. Refer *to the Bridge Type Study Report, Second Revision, July 2007.* Based on this report, four options were advanced through a Conceptual Engineering phase. The results of this work are documented in *a Bridge Conceptual Engineering Report Rev 1, dated February 2008.*

An exhibit of the Crossing practical alternatives is found in Appendix B.

2. Preliminary Construction Cost Estimates for Access Road Practical Alternatives

2.1 Highway Engineering

The Study Team developed preliminary construction costs for six-lane at grade, below grade and above grade divided urban freeway sections. Quantities were estimated from conceptual plans, profiles and typical cross sections for major items including concrete pavement, asphalt pavement on shoulders, open grade drainage layer, granular base, earthworks, tall wall median barrier, noise walls, and light poles. Unit prices for major items were obtained from the MTO's unit cost database. This information is included under Supporting Data as part of Appendix A. The unit prices are in 2006 Canadian Dollars. Cost of minor items was added as a percentage of the cost of major items. Speed change lanes and inside shoulder widening for sight distances were not quantified for each alternative, but are covered by an overall contingency of 20%. The Study Team also developed separate unit costs for 6-lane freeway tunnel section, municipal service road and interchange ramps. Refer to Appendix A of this report for calculations of these unit prices.

Preliminary construction costs for interchanges were based on the unit cost of interchange ramps, overall length of ramps, the number and cost of underpass and overpass structures at interchanges, and preliminary construction cost estimates for interchanges in the Windsor area provided by MTO. The preliminary construction cost for a new typical MTO interchange is estimated from $12M to $15M, and the cost of a reconstructed interchange is estimated from $8M to $12M. The cost of freeway-to-freeway style interchanges ($45M to $50M) was based on another MTO transportation project, the Highway 404 Extension. This estimate was used as a benchmark reference for similar types of interchanges on this project.

2.2 Structural Engineering

The Study Team prepared the *draft Structural Planning Report for Practical Alternatives* in July 2007. The report included structural planning sheets showing structure type and associated preliminary cost estimate, for each structure proposed for the original five Access Road practical alternatives. These preliminary structural construction cost estimates were included in the overall cost estimates for Access Road practical alternatives.

The Study Team also prepared a *draft Structural Planning Report for The Parkway*, *February 2008.* The report included structural planning sheets showing structure type and associated preliminary cost estimate, for each structure proposed for The Parkway

practical alternative. The preliminary structural construction cost estimate was included in the overall cost estimates for The Parkway practical alternative.

The preliminary structural cost estimates were based on a unit cost of $2000 / m^2 for a typical MTO structure with Canadian Precast Concrete Institute (CPCI) girders. This unit cost was obtained from the MTO's unit cost database. The cost is in 2006 $CAD. Unit costs for structures with greater complexities are shown below:

- $2000 / m^2: bridge with integral abutments
- $2100 / m^2: bridge with integral abutments and Cantilever Retaining Wall System (RSS)
- $2100 / m^2: bridge with semi-integral abutments
- $2200 / m^2: bridge with semi-integral abutments and RSS walls
- $2300 / m^2: post-tensioned bridge with semi-integral abutments
- $2500 / m^2: bridge with semi-integral abutments above Essex Terminal Railway (ETR) tracks

Below-Grade Freeway Section

The Study Team developed preliminary construction costs for the structural portion (retaining walls) of 6-lane below-grade freeway sections in Alternatives 1A, 1B, 2A and 2B, 3. It was assumed, after discussions with geotechnical engineering consultant, that, for planning purposes, retaining walls would be estimated based on 1.05m diameter reinforced concrete caissons with concrete facing. The total depth of caissons was assumed to be approximately 24m.

Details of structural unit cost estimates for the 7m and 12m deep below-grade freeway sections are given in Appendix D. Structural unit costs were based on MTO's unit cost database for caissons adjusted to 1.05m diameter caissons and large quantities required for this project. The structural unit costs are in 2006 Canadian Dollars. Earth excavation, construction staging, utility relocations, engineering costs, contingencies, etc. were estimated as part of the Highway Engineering component.

A summary of structural unit costs for caisson walls is given in Table 1:

TABLE 1: SUMMARY OF STRUCTURAL UNIT COSTS FOR CAISSON WALLS

	Below-Grade Freeway Section Depth	Unit length	Structural Unit Cost for Caisson Walls ($CAD / m)
1	7m	m	$45,000
2	12m	m	$65,000
3	Depth varies from 0 to 7m	m	$30,000
4	Depth varies from 0 to 12m	m	$45,000
5	Depth varies from 0 to 18m	m	$65,000
6	Depth varies from 7m to 12m	m	$65,000
7	Depth varies from 12m to 18m	m	$75,000

For The Parkway practical alternative, different unit costs were used for below-grade section because, unlike the other below-grade alternatives, The Parkway includes combinations of open cut and retaining (caisson) walls:

- $31,000/ m: variable depth from 7 to 12m with 7m deep open cut (type 'A')
- $29,500/ m: variable depth from 7 to 10m with 5m deep open cut (type 'B')
- $32,500/ m: variable depth from 7 to 12m with 4m deep open cut (type 'C')
- $27,000/ m: variable depth from 8 to 9m with 7m deep open cut (type 'D')
- $18,000/ m: variable depth from 0 to 1 m with 4m deep open cut (type 'E')
- $14,000/ m: variable depth from 0 to 8m with 5m deep open cut (type 'F')

Tunnel Freeway Section

Two basic types of tunnel construction have been considered, namely "bored" and "cut and cover". Cut and cover tunnels were selected over bored tunnels for the following reasons:

- A standard cross-section for a six-lane freeway would require a tunnel boring machine (TBM) with a diameter of over 18m. The largest TBM constructed to date in the world is just over 15m in diameter. Developing and using a TBM with a diameter of over 18m would entail considerable risk to the schedule and is not considered practical for this project.
- Soil conditions are not suitable for tunnel boring. A bored soft ground tunnel would result in a limited thickness of soil above the tunnel. This could cause unacceptable ground surface settlements that could impact structures (houses), utilities and roadways.

The preliminary construction cost estimate for the "cut and cover" six-lane freeway tunnel section was based on the conceptual plan, profile and typical cross section developed for the tunnel alternative (Alternative 3). The typical section was based on full transverse

ventilation in tunnel with two ventilation buildings, one located near each portal. Ventilation requirements are discussed in the "Ventilation Technical Memorandum-Phase 2, Proposed Highway 401 Tunnel (Talbot Road – Huron Church Road Corridor)" by RWDI, August 4, 2006.

In that memo, three options for ventilating the tunnel by full-transverse means were proposed. These options were:

- Two ventilation buildings located between the portals and midpoint of the tunnel. Ideal location would be 1.5km from either portal end;
- Two ventilation buildings located at the portals of the tunnel; and
- One ventilation building located at the midpoint of the tunnel.

For initial costing purposes, the option with two ventilation buildings located near the portals was selected. Two ventilation buildings would have much smaller footprints than the option with one ventilation building. Also, the size of ventilation ducts in tunnel would be smaller with two buildings as compared to one ventilation building.

The vertical profile control (which is the top of driving lanes in tunnel) is typically 10.5m below the original ground. The tunnel section will be a twin concrete box section with an overall width of approximately 58m and a height of approximately 11m. This means the bottom of excavation would be approximately 14m below the original ground surface.

The Study Team considered three different types of support of excavation walls for the tunnel alternative:

- Caisson walls with tiebacks;
- Slurry walls with tiebacks;
- Diaphragm walls with tiebacks.

The tunnel is proposed to be constructed in two stages to maintain existing traffic along the Talbot Road / Huron Church Road corridor. No closure of this major international transportation route will be allowed during the construction.

Structural unit costs developed for the tunnel freeway assumed that the base slab and walls would be cast in place concrete. However, top (roof) slab could be made of pre-cast concrete beams because they are more economical than cast-in-place concrete beams. Structural tunnel unit costs are based on the MTO unit price database, where applicable. They are adjusted for large quantities of concrete required on this project. The Project Team also contacted a major Ontario contractor to seek input into unit price for concrete on large-scale construction projects. These unit costs were then compared to those prepared by the Study Team tunnel specialists. The structural tunnel unit costs are in 2006 Canadian Dollars. Earthworks, drainage, construction staging, tunnel ventilation, electrical and mechanical systems in tunnel, engineering costs, contingencies, etc. are estimated as a part of the Highway Engineering component. Refer to Table 2 for Summary of Structural Unit Costs for different tunnel sections:

TABLE 2: SUMMARY OF STRUCTURAL UNIT COSTS FOR TUNNEL SECTION

	Type of supports of excavation walls	Unit length of tunnel	Unit cost for approx. 58m wide tunnel (CAD$ / m)
1	Caisson walls with tiebacks	m	$185,300
2	Slurry walls with tiebacks	m	$200,000
3	Diaphragm walls with tiebacks	m	$214,400
	Recommended unit cost for tunnel section	m	$215,000

Table 3 below shows the preliminary construction cost estimate developed for the tunnel section:

TABLE 3: UNIT COST (PER KM) FOR TUNNEL IN 2006 CAD DOLLARS

Item	Unit	Unit Price	Quantity	Total
Support of Excavation Walls	m^2	$432	215000.0	$92,840,909
Temporary Surface Traffic Lanes	m^2	$114	127300.0	$14,465,909
Excavation	m^3	$11	3300000.0	$37,500,000
Haul and Disposal	m^3	$25	4290000.0	$107,250,000
Temporary Bridge Decking	each	$1,704,545	5.0	$8,522,727
Concrete Tunnel	m	$215,000	5800.0	$1,247,000,000
Backfill	m^3	$73	1100000.0	$80,000,000
Final Surface Traffic Lanes	m^2	$114	174200.0	$19,795,455
Standpipe	L.M.	$455	12800.0	$5,818,182
Pump Station	each	$909,091	3.0	$2,727,273
Signs, Striping	L.S.	$3,409,091	1.0	$3,409,091
Sub-Total				$1,619,329,545
Misc. Fittings	%	2.0%		$32,386,591
Communication, Control, CCTV	%	4.0%		$64,773,182
Tunnel Lighting and Power	%	3.0%		$48,579,886
GRAND TOTAL COST				$1,765,069,205
TOTAL LENGTH OF TUNNEL (km)				5.8
Unit Cost per km				$304,322,277

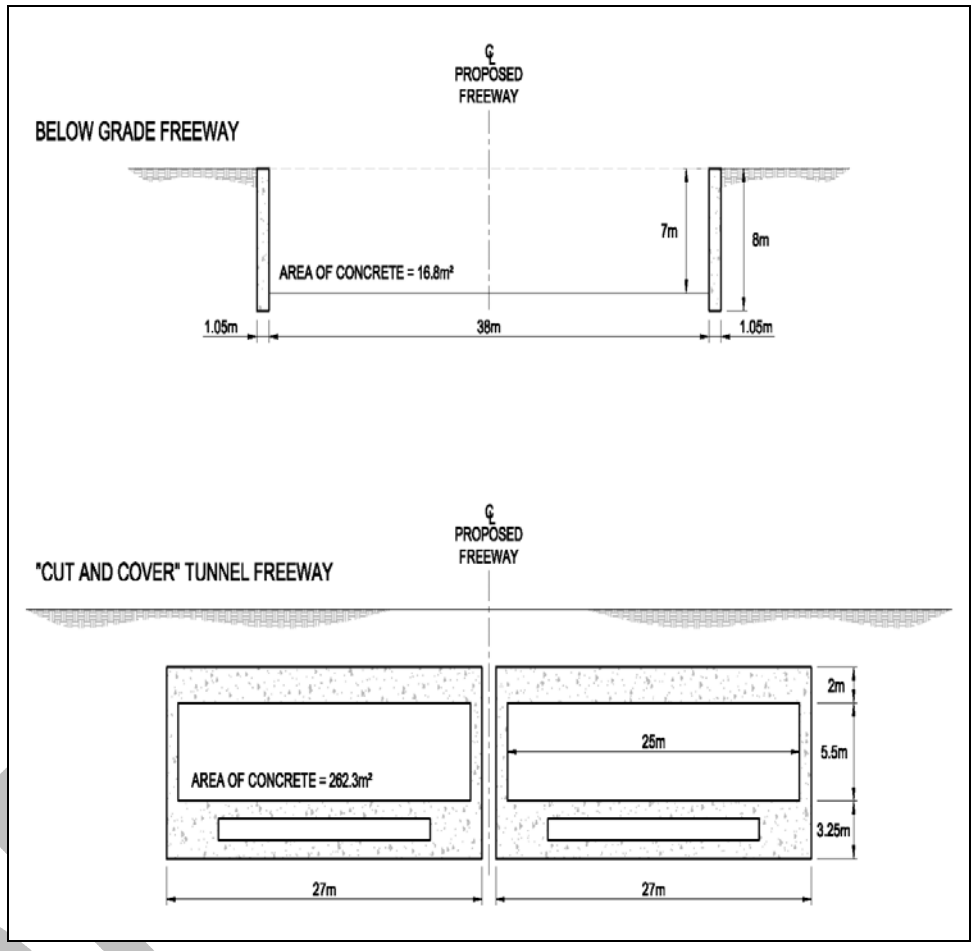
Concrete placed in tunnel boxes would be the single most expensive item affecting tunnel cost. As shown above, the preliminary cost estimate for the basic tunnel boxes was approximately $1.8 billion for the ±6km long tunnel section. The cost of concrete placed in tunnel boxes was estimated at approximately $1.3 billion, which is 72% of the total cost.

Items that could affect the size of tunnel boxes, like ventilation ducts, speed change lanes or increasing widths of shoulders at horizontal curves, would have a large impact on tunnel cost. As well, the cost will be very sensitive to changes in the cost of concrete.

The size of ventilation ducts will depend on the length of tunnel and number of ventilation buildings placed along its alignment. For a short tunnel with a large number of ventilation buildings, the size of ventilation ducts would be relatively small as compared to a long tunnel with small number of ventilation buildings. Two ventilation buildings are proposed, one at each portal for the tunnel alternative, which resulted in quite large size of ventilation ducts. The preliminary unit cost of placing concrete in two tunnel boxes with large ventilation ducts was estimated at $215,000 per linear metre.

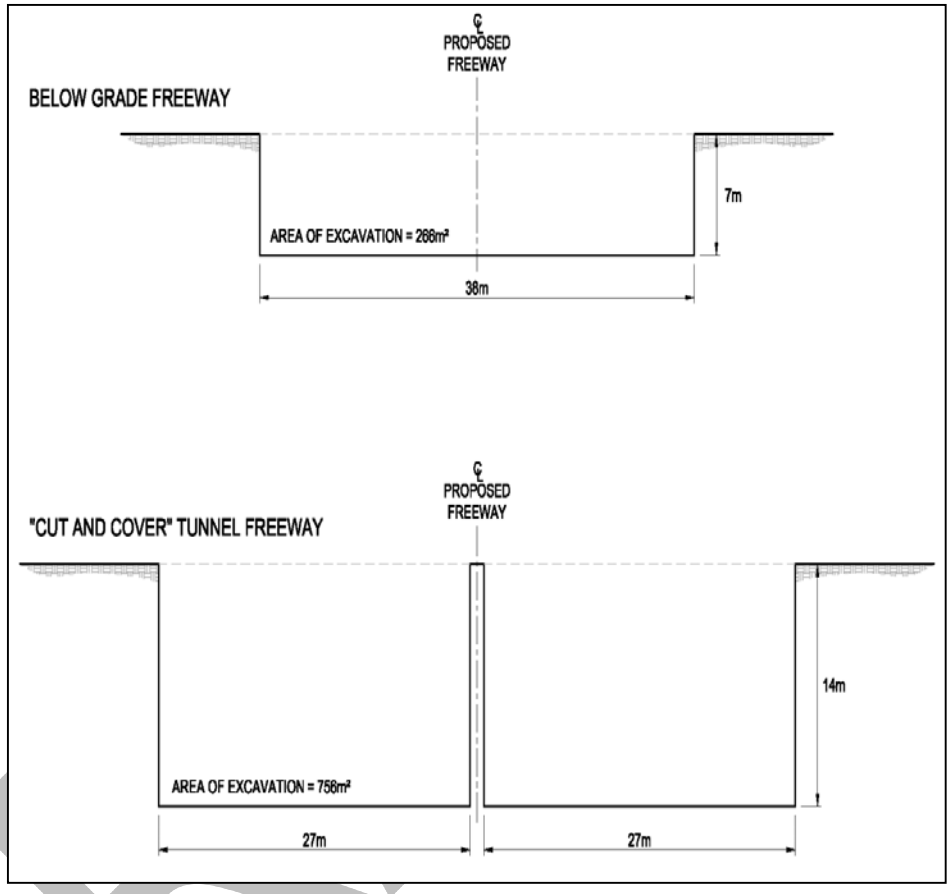
The cost of supplying and placing the reinforced concrete for tunnel boxes would be the single most expensive construction item for the tunnel option. Refer to Figure 1 below showing the difference in unit area of concrete required for below grade and tunnel freeway sections. The tunnel section will require approximately sixteen times more concrete than the below grade freeway section.

FIGURE 1 – UNIT AREA FOR CONCRETE



The difference in cost between tunnel and below-grade freeway sections can be also explained by the depth and area of excavation. Figure 2 shows an average depth of excavation for the freeway sections, as well as the unit areas of excavation. The quantity of excavation for tunnel section will be approximately three times larger than that for the below grade freeway section.

FIGURE 2 – DEPTH AND UNIT AREA FOR EXCAVATION



As noted previously, cost estimates are based on a conceptual level of design. Localized widenings for speed change lanes and sight distances have not been specifically designed at this stage. However, the need for widenings such as these would add considerable cost to the tunnel option.

Length of speed change lanes constructed in a tunnel will depend on a number of interchanges constructed along its alignment. Fewer interchanges would result in less speed change lanes. For the Tunnel alternative, the length of speed change lanes constructed in the tunnel would be approximately two kilometres, which is 33% of the total length. Cost difference between placing concrete in tunnel boxes for the six-lane cross section with speed change lanes and the section without speed change lanes would be approximately $40 million. This has not been explicitly allowed for in the current estimate.

Tunnel costs would be also affected in instances where shoulders are required to be widened at horizontal curves to accommodate lateral clearances for stopping sight distance. For example, for a design speed of 120 km/h, a horizontal curve with R=1700m will accommodate lateral clearance for stopping sight distance of 245m. However, two horizontal curves on the DRIC tunnel alignment have radii less than 1700m. The

approximate length of these two horizontal curves is 1.3km. Two shoulders (inside and outside) need to be widened approximately 3m to accommodate lateral clearance. The cost difference between the section which accommodates and the one which does not accommodate lateral clearance would be approximately $26 million. Again, this has not been included at this time.

In summary, there are several design parameters which would cause the cost of the tunnel to increase or decrease. However, the current level of estimating is considered sufficient for comparison and evaluation purposes.

Construction Staging Cost

Construction staging for the Access Road practical alternatives 2A and 2B will be the most simple and the least time-consuming as compared to other alternatives. Traffic will stay on Highway 3 / Huron Church Road while the new Access Road is being built.

Construction staging for the Access Road practical alternatives 1A and 1B will be more complex and time consuming as compared to alternatives 2A and 2B. Service roads need to be built first. Then the existing traffic on Highway 3 / Huron Church Road needs to be shifted to service roads so that the new Access Road could be built.

Construction staging for the tunnel alternative will be the most complex and time consuming as compared to any other alternative. It will involve extensive network of temporary detours placed along and across the site in order to maintain the flow of traffic and allow access to properties along the corridor. Additionally, more construction stages will be required for the tunnel alternatives because of the need to build the tunnel section in two halves.

Construction staging for The Parkway alternative will be more complex than that for the practical alternatives 1A, 1B, 2A and 2B but less complex than that for Alternative 3 (tunnel alternative).

Refer to *the draft Constructability Report for Access Road Practical Alternatives, April 2008* for more in –depth discussions on construction staging, construction methods and utility relocations.

3. Preliminary Construction Cost Estimates for Inspection Plaza Practical Alternatives

The Study Team developed the preliminary construction cost estimates for Inspection Plaza. The cost estimate did not include property or relocation costs, the environmental clean-up cost. It was also assumed that the inspection plaza would be constructed approximately at existing grade. For Plaza C, the cost of relocating Keith Transformer Station was not included. The capacity and facilities to be provided at each Plaza alternative are the same; therefore, at the Practical Alternatives stage, the cost of each plaza alternative is considered the same. Refer to Table 4 below for the Preliminary Construction Cost Estimate of the Inspection Plaza:

TABLE 4: PRELIMINARY CONSTRUCTION COST ESTIMATE FOR INSPECTION PLAZA

	Units	Unit Price	Estimate	Total	Comments
Primary Inspection Booths:					
Passenger (20 inbound, 3 outbound)	23	$48,000	$1,104,000		
Bi-Level (19 inbound, 2 outbound)	21	$72,000	$1,512,000		
Toll Booths (outbound)	12	$48,000	$576,000		
Gatehouses	3	$48,000	$144,000	$3,336,000	
Buildings	M2				
Main	3,080.4	$2,000	$6,160,821		
Commercial Office	3,045.4	$2,000	$6,090,764		
Commercial Warehouse	1,602.4	$2,000	$3,204,857		
Bus	273.5	$2,000	$547,012		
Outbound	28.0	$2,000	$55,900	$16,059,355	
Agricultural	1,000.0	$2,000	$2,000,000	$2,000,000	
Toll House			$100,000	$100,000	parking included
Operations/Maintenance	3,000.0	$2,000	$6,000,000	$6,000,000	
Broker	1,602.4	$2,000	$100,000	$100,000	
VACIS			$600,000	$600,000	NFBC add $1.6M for equipment
Duty Free			$4,500,000	$4,500,000	parking included
Curr. Exch. Public Washroom			$3,800,000	$3,800,000	parking included
Salt Storage			$550,000	$550,000	
Plaza					
Pavement Concrete	130000.0	$175	$22,750,000	$22,750,000	
Pavement Asphalt	130000.0	$50	$6,500,000	$6,500,000	

	Units	Unit Price	Estimate	Total	Comments
Canopy					
PILs					
Passenger	15300.0	$450	$6,885,000		
Bi-Level	0.0				
Passenger Secondary				$6,885,000	
		Sub-Total	$73,180,355		
Grading	$1,200,000				
Clearing	$130,000				
Slope and erosion Control	$4,000,000				
Landscaping	$2,000,000	25%	$18,295,089	$18,295,089	
Stormwater	$300,000				
Fencing/ sound walls	$1,000,000				
Signing	$1,000,000				
Lighting	$1,200,000				
Utilities	$350,000				
Total site prep	$11,180,000				
			TOTAL	$91,475,444	
Contingency 60%				$146,360,710	

Preliminary construction cost estimate for the Inspection Plaza was rounded to $150M (2006 $CAD) or $180M (2011 $CAD).

4. Lifecycle and Maintenance (L&M) Costs for Access Road Practical Alternatives

For the assessment purposes, the relative difference in the L&M costs between the Access Road alternatives are summarized below.

The at-grade Access Road alternatives would have the lowest lifecycle and maintenance costs as compared to the other alternatives.

The below-grade Access Road alternatives including The Parkway will require higher lifecycle and maintenance costs as compared to at-grade alternatives. The premium L&M costs will include the lifecycle cost for retaining walls, the replacement cost for drainage pumps, electrical and mechanical costs for pump houses, cost of sediment removal from syphons, cost of snow removal in winter, etc.

The highest lifecycle and maintenance costs will be required for the tunnel option. The cost premium will include lifecycle cost for concrete in tunnel and retaining walls, cost of replacing ventilation fans, mechanical and electrical maintenance costs, cost of replacing drainage pumps, communication, CCTV, Control Centre, fire & frost protections, emergency maintenance costs and energy costs to run the mechanical systems (ventilation), ventilation buildings, control centre and illumination.

Life cycle costs for each Practical Alternative were developed and are documented in a technical memorandum *Life Cycle Costing Analysis Memo for Practical Alternatives, March 2008*.

5. Overall Conclusions

Access Road Practical Alternatives – Preliminary Construction Cost Estimates

Preliminary construction cost estimates (2011 $CAD) for the Access Road Practical Alternatives from North Talbot Road to Malden Road range from approximately $620M to $3800M. Specifically:

- Preliminary construction costs of at-grade alternatives are estimated in the order of $620M – $920M
- Preliminary construction costs of below-grade options including The Parkway are about $1000M - $1600M
- Preliminary construction cost of the tunnel alternative is estimated between $3600M and $3800M.

The increased costs for the tunnel alternative relate directly to increase in quantities for concrete needed to build tunnel boxes and support of excavation walls as well as the excavation, ventilation, electrical, drainage, communication and Emergency Management System costs.

A summary of preliminary construction cost estimates for the Access Road Practical Alternatives is given in Table 5 below. The costs are in the 2011 Canadian Dollars:

TABLE 5: SUMMARY OF PRELIMINARY CONSTRUCTION COST ESTIMATES FOR ACCESS ROAD PRACTICAL ALTERNATIVES

Practical Alternatives		Preliminary Construction Costs $CAD 2011
Access Road	Inspection Plaza	North Talbot Road to Malden Road
1A	A	$920M
1B	A	$1,360M
2A	A	$790M
2B	A	$1,200M
3	A	$3,780M
The Parkway	A	$1,600M
1A	B & C	$750M
1B	B & C	$1,190M
2A	B & C	$620M
2B	B & C	$1,030M
3	B & C	$3,610M
The Parkway	B & C	$1,500M

Inspection Plaza Practical Alternatives – Preliminary Construction Costs

The preliminary construction cost estimate for the plazas is $180M (2011 $CAD). The preliminary construction cost estimates for the access road alternatives from Malden Road to the inspection plaza alternatives including the costs of the plazas range from $180M - $280M (2011 $CAD) depending on which plaza alternative is chosen (not inclusive of costs associated with the potential relocation of the Keith Transformer Station under plaza C).

For comparison purposes, access roadways from Malden Road to the Inspection Plaza alternatives are considered as part of the cost of the plaza.