Canada | U.S. Department of Transportation Federal Highway Administration | Ontario | MDOT Michigan Department of Transportation

Canada-United States-Ontario-Michigan Border Transportation Partnership

Draft Technical Considerations Work Plan

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Version 1

PREFACE

The Canada - U.S. – Ontario - Michigan Border Transportation Partnership (The Partnership) is composed of the Federal Highway Administration and Transport Canada representing the federal levels of government, and the Ontario Ministry of Transportation and the Michigan Department of Transportation representing the provincial/state level. The purpose of the Partnership is to improve the movement of people, goods, and services across the United States and Canadian border within the region of Southeast Michigan and Southwestern Ontario.

The partnership is moving forward with technical and environmental work leading to the selection of a new or expanded border crossing, to address cross-border transportation demands for a 30-year planning period.

The Ontario, Ministry of Transportation (MTO) is leading the Canadian work program in coordination with Transport Canada. The Michigan, Department of Transportation (MDOT), in coordination with the Federal Highways Administration (FHWA), is leading the U.S. work program.

This international transportation improvement project will require approvals from governments on both sides of the border. The Partnership has developed a coordinated process that will enable the joint selection of a recommended river crossing location that meets the requirements of *Ontario Environmental Assessment Act* (OEA), *Canadian Environmental Assessment Act* (CEAA), and *National Environmental Policy Act* (NEPA).

The goal of the partnership is to:

- obtain government approval for a new or expanded crossing with connections to the provincial highway system in Ontario and the interstate freeway system in Michigan, including provisions for processing plazas to improve traffic and trade movements at the Windsor-Detroit border;
- completion of comprehensive engineering to support approvals, property acquisition, design and construction; and,
- submit environmental assessment documents to request approval by December 2007.

The Partnership completed a *Planning/Need and Feasibility Study* (P/NF) in January 2004 to address cross-border transportation demands for a 30-year planning period. Included in the documentation for that study was an Environmental Overview Report which provided an inventory of the existing condition in a Focused Analysis Area. Subsequently, in accordance with the *Ontario Environmental Assessment Act,* MTO prepared and submitted in May 2004 an environmental assessment Terms of Reference to the Ontario Ministry of the Environment for review and approval. The Terms of Reference was approved by the Ontario Minister of the Environment on September 17, 2004. The Terms of Reference outlines the framework that MTO and Transport Canada will follow in completing the Detroit River International Crossing Environmental Assessment (DRIC EA).

As an initial step in the DRIC EA process and to build upon the work completed in-depth secondary source data collection has been conducted. This work has been focused within the Preliminary Analysis Area (PAA) identified in the Environmental Overview Report, (as Amended January 2005). The noted data collection effort has been documented in a series of Working Papers. Working Papers have been prepared for the following topics: social impact assessment; economic assessment; archaeological resources; cultural resources; natural heritage; acoustics and vibration; air quality; waste and waste management; and technical considerations.

The purpose of the Working Papers is to document the secondary source data collection by: describing the data collection/sources used; providing an overview of study area conditions; identifying significance/sensitivity of features in the study area; identifying gaps in study area data and developing Work Plans to fill identified data gaps.

A Work Plan for each of the topics identified above has been prepared to structure the filling of identified data gap, provide a scope for future work requirements, provide rationale for further data collection methodologies, data sources, methods of assessment, criteria, indicators and measures, consultation strategies, and the integration of each work plan with the work plans of other disciplines.

The Work Plans have been developed based on current knowledge of existing conditions within the PAA and therefore, should be considered to be living documents which will be subject to agency and public review. The partnership is aware that the assessment and evaluation of alternatives at all phases will require applying the requirements of three pieces of legislation, the OEA, CEAA, and NEPA. Therefore, in preparing the Work Plans, the partnership has sought to integrate the most rigorous requirements from each piece of legislation.

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1. INTRODUCTION

Generation and development of the Illustrative and Practical Alternatives will be completed using accepted MTO practices, standards and guidelines.

The applicable guidelines include:

- Geometric Design Standards for Ontario Highways; and
- Highway Capacity Manual.

Engineering in the technical disciplines will be done (at an appropriate level of detail) during each stage to support the basic feasibility of the alternatives.

Illustrative and Practical Alternatives will be evaluated based on a number of factors including impacts to the natural environment, socio-economic environment, cultural environment, and technical considerations. The Technical Considerations Work Plan documents the technical factors that will be used to assess the Illustrative and Practical Alternatives (the remaining environmental criteria, including impacts to the natural, socio-economic and cultural environments, have been documented in other work plans). Technical factors have been grouped according to the following two categories. These are:

- Improve Regional Mobility, which considers transportation operations, network compatibility, and border processing; and
- Cost, which considers construction, operating, maintenance and property costs, as well as an assessment of constructability and risks.

These factors are discussed as follows:

1) Improve Regional Mobility

The purpose of the Detroit River International Crossing Project is, in part, to provide safe, efficient and secure movement of people and goods across the Canadian-U.S. border in the Detroit River area to support the economies of Michigan, Ontario, Canada and the U.S. Within this purpose, the regional transportation and mobility needs include: new border crossing capacity; improved system connectivity; improved operations and processing capabilities; and reasonable and secure crossing options. Therefore, the degree to which the options under consideration assist in efficient operation of the overall highway network will be evaluated. This evaluation will in part be based on standard methodology of the Highway Capacity Manual 2000 (e.g., level of service, capacity). Total vehicle miles, vehicle hours of travel, and travel distances will also be calculated on the border road network. Also included will be an assessment of the ability of an alternative 1) to provide continuous/ongoing river crossing capacity (i.e. redundancy); and, 2) to meet the operational requirements for the plaza and crossing including considerations of security, accessibility, and flexibility for expansion.

The degree to which the alternatives under consideration assist in the efficient operation of the overall highway network will be based on the following criteria:

- *Transportation Operations* – Examines how well each alternative will allow traffic to move through the study area;
- *Network compatibility* – Examines how compatible each alternative is with the existing road network and the ability to upgrade each alternative to meet future needs; and
- *Border Processing* – Examines how transportation solutions impact existing border crossing services and infrastructure, as well as their ability to accommodate required border crossing services and infrastructure.

2) Cost

Construction of a new or expanded Detroit River International Crossing will represent a major financial investment. While it is recognized that the crossing serves an important trade corridor between Canada and the U.S., the costs to construct, operate and maintain it are eventually paid for by the users of the crossing, whether by individual users through tolls, or by governments through the use of public funds derived from taxpayers. Minimizing costs, while balancing the natural, social, economic, cultural, and technical aspects will be considered. Construction risks can lead to unforeseen delays and significant additional costs. Therefore assessments will also be made based on the constructability of the proposed crossing, plaza, and roadway system alternatives. Consideration will be given to site constraints, geotechnical constraints, construction staging/duration, traffic maintenance, and a construction implementation risk assessment.

The degree to which the alternatives under consideration minimize cost will be based on the following criteria:

- *Constructability* – Examines the ability to simplify construction, minimize construction duration, and reduce the likelihood of construction claims; and
- *Construction, Operating, Maintenance and Property Costs* – Examines short and long-term costs associated with each alternative.

The remainder of this document details what specific measurements will be made, how these measurements will be conducted, and which technical disciplines will conduct these measurements, to evaluate Illustrative and Practical Alternatives. Table 1: Transportation Criteria for the Evaluation of Route Alternatives presented at the end of this report, provides a summary description of the individual measures that will be used to evaluate Illustrative and Practical Alternatives according to how well the alternatives improve Regional Mobility in a cost effective manner.

2. BACKGROUND

2.2 Purpose of the Undertaking

The purpose of this Undertaking is to provide for the safe, efficient and secure movement of people and goods at the Canada-U.S. border in the Detroit River area, through the identification of a new or expanded border crossing; this includes Route Planning, Preliminary Concept Design and Environmental Assessment based on a 30-year planning horizon. This Undertaking is being conducted by the Canada–U.S.–Ontario–Michigan Border Transportation Partnership (The Partnership).

2.3 The Process

As a requirement of the Ontario Environmental Assessment Act, in May 2004 the Ministry of Transportation of Ontario (MTO) prepared and submitted an Environmental Assessment Terms of Reference (TOR) to the Ontario Ministry of the Environment (MOE) for their review and approval. The TOR, approved by MOE on September 17, 2004, outlines the framework that MTO and Transport Canada will follow in completing this environmental assessment.

This environmental assessment includes the following key steps:

1. Finalizing the purpose and need for the undertaking;
2. Assessing planning alternatives;
3. Defining the environmental assessment study area;
4. Identifying study area conditions;
5. Developing, assessing, and evaluating route alignment and border crossing alternatives;
6. Selecting a recommended alternative and developing the preliminary design for that alternative;
7. Documenting the environmental assessment process and findings; and
8. Obtaining approvals.

This Technical Work Plan addresses Item 5. by providing the framework by which the route alignments and border crossing alternatives will be evaluated from a Technical Considerations viewpoint.

2.3 Technical Disciplines

The following technical disciplines will provide the input to be used during the evaluation of the Illustrative and Practical route alternatives according to the factors “Improve Regional Mobility” and “Cost”:

- Transportation (Systems) Planning – This is the main technical discipline providing measures used in evaluating alternatives according to improved Regional mobility. The Transportation (Systems) Planning component of the Study involves the development of travel demand forecasts and the estimation of the transportation and traffic impacts for each border-crossing alternative under consideration;
- Foundation Engineering – The scope of services generally includes the determination of potentially adverse ground conditions, structure options and construction concerns. This assessment will be carried out using available subsurface and geological information together with field reconnaissance;
- Pavement Engineering – The Pavement Engineering components are to provide the required geotechnical and pavement design input to the required level of detail to support overall planning and preliminary design;
- Bridge Engineering – The Bridge Engineering / Structural Planning component of this EA project will support the Route Planning for Illustrative and Practical Alternatives, Preliminary Concept Design and Environmental Assessment by providing feasible bridge and tunnel solutions tailored for each alternative, including cost information, construability assessment and aesthetic development; and
- Highway Planning – Working with the Environmental and Consultation Teams, the Highway Planning Component ties together virtually all aspects of the engineering work for this EA project.

The remainder of this Technical Considerations Work Plan provides an overview of how these engineering disciplines will contribute to the evaluation of Illustrative and Practical route alternatives.

3. ILLUSTRATIVE ALTERNATIVES

The Illustrative Alternatives are those initial routes identified in response to the study objectives, and developed according to the following "guiding principles" used to identify viable route alternatives:

1. Utilize existing infrastructure to the maximum extent –taking advantage of existing transportation and other linear corridors may improve usage of the transportation network and/or reduce impacts to other land uses;

2. Seek areas or land uses that are compatible, or areas in transition to compatible land uses – compatible areas are those that are less impacted by new route alignments than other land uses; areas in transition allow the opportunity to incorporate new route alignments in the area planning;

3. Minimize impacts to significant natural features – such features are usually regionally unique and protected by legislation/designations that may preclude a transportation facility; and

4. Minimize impacts to city centres – such areas generally provide a focus for cultural, social and economic activities.

The generation of alignments will be a collaborative effort based on the technical expertise and experience of both Canadian and U.S. Teams, as well as input received from stakeholders and the public at early consultation activities. Key personnel will conduct field reviews and meetings with agencies, municipalities and utility companies. Information gathered will be documented and incorporated into constraints / opportunities mapping. With the constraints and opportunities mapping prepared and design criteria developed, the Illustrative Alternative route alignments will be generated. Approximately 15 routes will be identified and technically evaluated according to how well they improve regional mobility and to their cost.

3.1 Evaluating Illustrative Alternatives by Regional Mobility

The degree to which each Illustrative alternative improves regional mobility will be determined through analysis undertaken using a transportation systems approach. The Transportation (Systems) Planning component of the Study involves the development of travel demand forecasts and the estimation of the transportation and traffic impacts for each border-crossing alternative under consideration.

3.1.1 Approach

The modelling approach for this Study will build extensively on the Planning/Need and Feasibility Study Report, January 2004 (P/NF Study), but with a review of key assumptions given that the original work had to rely on pre-9/11 data. The open structure of the model process, with the detail and market segmentation (e.g. by commodity type and trip purpose) that was provided in the P/NF forecasts, will allow it to be carried forward to prepare 2035 projections with modifications reflecting current data, assumptions and the latest U.S.-Canada trade projections.

The Travel Demand Model forecasts will be updated to reflect new knowledge and data that have become available since the previous P/NF study. Existing travel patterns and characteristics will be updated to reflect more recent data, which better incorporates the impacts of 9/11 and other extreme events (the War in Iraq, and SARS), the opening of casinos in the Detroit area, changing socioeconomic trends (e.g. Canada-US exchange rate, fuel prices), and attitudes on cross-border travel behaviour. Commercial vehicle and car trip matrices, transportation network representation, and crossing choice models will be updated from a 2000 Base Year to a 2004 Base Year to reflect these changes. Trip matrices will be updated from survey-based 2000 data by analyzing a variety of trends influencing commercial and passenger traffic. Transportation network representation will be updated to include greater disaggregation in southern Essex County to accommodate analysis of a south-crossing alternative. The updated 2004 Base Year model will be validated using traffic counts at crossings and along screenlines within the urban areas.

A Level 1 Analysis will be undertaken for Illustrative Alternatives (this analysis will also be conducted as a first level analysis of the Practical Alternatives, in addition to a Level 2 and

Level 3 analysis, see Section 4.). The Level 1 Analysis will entail, for the crossing alternatives and all affected highways and major roads in the study area, the application of the updated Travel Demand Model. Specific performance measures may include:

- Link Volume-Capacity (V/C) Ratio - the ratio of the flow rate (the equivalent hourly rate at which vehicles, etc. pass a point on a roadway, computed as the number of vehicles) to capacity for the transportation facility;
- Peak Hour Traffic - the volume of traffic that uses the facility during the hour of the day that sees the highest traffic volumes;
- Change in Total Vehicle-Kilometres of Travel vs. No-Build - which will measure total distance travelled in kilometres over the network for a fixed (i.e. peak hour) period for auto, local truck, and international truck and auto;
- Change in Total Vehicle-Hours of Travel vs. No-Build - which will measure total travel duration in hours over the network for a fixed (i.e. peak hour) period for auto, local truck, and international truck and auto;
- Continuous/ongoing River Crossing Capacity (Redundancy) – this measure will assess the degree to which each alternative provides reliability / choice in the network;
- Operational Considerations of Crossing System (Crossing and Plaza) – a measure of plaza/crossing operations during peak travel periods; and
- Operational Considerations of Crossing System (Network) – Potential impacts to network during periods of congestion at border, based on storage capacity at plazas and to freeway connection.

In addition, the transportation assessment of alternatives will examine international commercial vehicle and passenger car and domestic travel markets individually, with overall network performance statistics. It will also include a network analysis for both passenger cars and freight movements that will include an examination of travel paths, description of capacity deficiencies and traffic impacts, and identification of major splits in vehicle movements.

Other measures may be added to the evaluation if appropriate.

3.1.2 Plaza Design

In tandem with the development of route alternatives, potential plaza locations will be identified. Layouts will be developed to be consistent with the Canada Border Services Agency's "Custom Operations Land Border Facilities Design Guide", or the U.S. General Services Administration Design Guide, "U.S. Land Port Of Entry" for any alternative considered for reverse inspection of "Share U.S. / Canada Facilities."

A new inspection plaza will most likely require at least 80 to 100 acres of land. The impact of expanding into a new area will need to be compared to the impacts of expansion of an existing inspection plaza to meet current and future inspection and travel needs. These designs must also consider a changing inspection environment, both the

opportunities presented and the future constraints that they may impose. These include, but are not limited to, the following:

- Traditional Inspection Plaza;
- FAST and NEXUS Lane(s);
- Off-site Staging And Targeting of Commercial Vehicles Away from the Border;
- Reverse Inspection;
- Joint Facilities;
- Technology Changes and Impacts; and
- Inspection Staffing at Multiple Locations.

Plaza designs and their associated environmental and operational impacts may vary greatly, depending on site conditions and whether or not traditional inspections are considered and/or allowed. Many of these alternatives may require changes to each country's policies and laws. The approach that will be used to identify environmental effects will be to lay out traditional inspection plazas, while accounting for changing technology and future area requirements for increased inspection and staffing.

Objectives of the plaza design work include the following:

- Meeting the inspection needs in each country to protect the security and well-being of citizens;
- Moving people and goods safety across the border in a reasonable manner without causing additional environmental impacts such as air pollution and energy use from idling vehicles;
- Meeting the laws and policies of both countries, including the U.S. Bill of Rights and the Canadian Charter of Rights and Freedoms;
- Working closely with the U.S. Consultant team to identify how and/or if any non-traditional inspection activity layouts might reduce the environmental effects in either country for a given alternative; and
- Working closely with the inspection agencies in both countries to ensure alternatives considered will be acceptable to meet their needs.

The scope of the assessment of the local and regional impacts associated with the various Illustrative and Practical Alternatives of this work is addressed under the Socio-economic/Agriculture Work Plan, and is provided under separate cover.

3.2 Evaluating Illustrative Alternatives by Cost

In addition to evaluating Illustrative Routes according to how well they improve regional mobility, routes will be evaluated according to cost, based on constructability, as well as their associated short and long-term costs. Engineering disciplines providing input will include Foundation, Pavement, and Bridge Engineering, as well as Highway Planning.

3.2.1 Foundation Engineering

The scope of services requiring foundation design input will include an assessment of each alignment alternative with respect to the potential for difficult ground conditions (i.e. swamp, areas of soft ground), potential structure options, and potential construction concerns. This assessment will be carried out using available subsurface and geologic information together with a field reconnaissance.

The foundations and geotechnical engineering work will include a literature search for existing information, and the preparation of a design briefing report that summarizes major geotechnical, hydrogeological, geologic, or historical salt extraction activities that could significantly influence the choice of crossing locations, and will be used in the development of the Illustrative Alternatives. Evaluation will be based on professional judgement.

3.2.2 Pavement Engineering

The Pavement Engineering component of this assignment will provide the required geotechnical and pavement design input to the project team to the required level of detail to support the overall planning and preliminary design of this EA project. Work will include a literature search for existing information and available subsurface information together with a field reconnaissance. Any evaluation of Illustrative Alternatives in terms of pavement engineering will be based on professional judgement, if necessary.

3.2.3 Bridge Engineering

The Bridge Engineering / Structural Planning component of this EA project will support the route planning, preliminary concept design and Environmental Assessment, by providing feasible bridge and tunnel solutions tailored for each alternative, including cost information, constructability assessment and aesthetic development. Work will include office study, field study, detailed bridge study, DRIC alternatives development, and documentation and reporting.

The initial planning stage will require an assessment of viable structure configurations and costs. We will establish structure design requirements including clear span, number of traffic lanes, alignments and profiles, environmental issues, construction limitations and other applicable factors. For each of the Illustrative Alternatives, both bridge and tunnel options will be investigated. Costs will be based on per square metre for similar structures, with appropriate adjustments for special construction and design features. Cost comparisons will be prepared for new complex structures (multi-span), new single span structures and for the rehabilitation, widening and/or replacement of existing structures as required to select the most appropriate structure type. The Bridge Engineering discipline will evaluate Illustrative Alternatives according to the following performance measures:

- Construction Cost (Crossing) – Cost estimates will be based on per square metre of deck area of each type of structure. The preferred alternative for each structure will

be determined based on the most cost-effective alternative satisfying the required design criteria; and

- Length of River Crossing – a measure of the crossing's cost based on length of crossing.

3.2.4 Highway Planning

The Highway Planning discipline ties together virtually all engineering aspects of this EA project. Illustrative Alternatives will be evaluated according to the following performance measures:

- Construction Cost (Plaza and Highway) – at a general level, a broad measure of construction highway capital costs; and
- Property Costs – cost of property requirements based on preliminary plans.

4. PRACTICAL ALTERNATIVES

Both qualitative and quantitative assessments of Illustrative Route Alternatives, as noted above, will be conducted to determine the set of Practical Route Alternatives. The degree to which each Practical alternative improves Regional mobility will similarly be determined through analysis undertaken using a transportation systems approach.

4.1 Evaluating Practical Alternatives by Regional Mobility

As the list of Illustrative Alternatives is reduced to the list of Practical Alternatives, the Level 1 Analysis will be repeated if necessary to reflect any refinements made to the Alternatives as a result of their evaluation. In addition, Level 2 (see below) and Level 3 (see Section 5.1) analyses will also be conducted.

A Level 2 – Highway Capacity Analysis will be conducted. Detailed traffic capacity and Level of Service (LOS) analyses will be undertaken, and will focus on links and facilities connecting the border-crossing plaza to the local road network and/or provincial road network. The analysis will be carried out using the Synchro/SimTraffic Traffic Capacity Software (compatible with Highway Capacity Manual Procedures).

Synchro models will be developed to include existing and proposed lane geometry and turning movement volumes. Turning movement volumes for existing facilities will be obtained from the City of Windsor, where recent counts exist. Where counts are unavailable or out of date, this data will be collected as part of the study. Turning movement counts for new facilities will be estimated using the updated Travel Demand Model (TDM) as well as manual trip generation procedures for major generators along the route, for example a remote truck inspection centre or staging area.

The Level 2 Traffic Analysis Report will include a summary of the analysis undertaken, key assumptions and descriptive performance measures for each of the Practical Alternatives and their respective sub-options.

In addition to the performance measures identified for Illustrative Alternatives, based on a more detailed level of information, the following performance measures of regional mobility for Practical Alternatives may be evaluated:

- Highway Network Effectiveness – Detailed Service Levels (LOS) - by major facility type, a qualitative measure describing operational conditions within the traffic stream;
- Detailed Volume-Capacity (V/C) Ratio - the ratio of the flow rate (the equivalent hourly rate at which vehicles, etc. pass a point on a roadway, computed as the number of vehicles) to capacity for the transportation facility;
- Peak Hour Traffic – the volume of traffic that uses the facility during the hour of the day that sees the highest traffic volumes;
- Change in Total Vehicle-Kilometres of Travel vs. No-Build - which will measure average distance in kilometres travelled for auto, local truck and international truck and auto;
- Change in Total Vehicle-Hours of Travel vs. No-Build - which will measure average travel duration in hours travelled for auto, local truck and international truck and auto;
- Queue Length – a measure of the line of vehicles waiting to be served by the system in which the flow rate from the front of the queue determines the average speed within the queue;
- Average Link Speed - by major facility type;
- Average Delay - by major facility type;
- Average Travel Time – by major facility type;
- Continuous River Crossing Capacity (Redundancy) – this measure will assess the degree to which each alternative provides reliability / choice in the network;
- Operational Considerations (Plaza Accessibility) – a measure of crossing and plaza operations based on plaza accessibility including emergency access and serviceability, security, and flexibility for joint inspections and future needs;
- Operational Considerations of Crossing System (Crossing and Plaza) – a measure of plaza/crossing operations during peak travel periods; and
- Operational Considerations of Crossing System (Network) – Potential impacts to network during periods of congestion at border, based on storage capacity at plazas and to freeway connection.

4.2 Evaluating Practical Alternatives by Cost

4.2.1 Foundation Engineering

Feasibility-level engineering analyses of Practical Alternatives will be conducted to support prioritization of various route and structure alternatives. Tables will be prepared to compare alignment alternatives on the basis of foundation considerations. A scoring system will be developed in consultation with the engineering team and MTO / the Partnership which will allow assessment of the key foundation aspects such as embankment stability, tunnelling risks, mining subsidence risks, and structure foundations. Evaluation will be based on professional judgement.

The presentation of subsurface conditions along the routes will be refined, and a complete feasibility-level engineering analysis of Practical Alternatives will be conducted, to support prioritization of various route and structure alternatives. The results of the assessment will be compiled into a report, leading to the selection of a Preferred Alternative.

4.2.1 Pavement Engineering

The Pavement Engineering discipline will provide support and documentation for the development of the capital cost estimates for the project.

4.2.2 Bridge Engineering

For each viable structural alternative, a Structural Planning Report will be developed and will include a General Arrangement Drawing. The General Arrangement drawing will provide preliminary details of the structure type, size and location.

For each of the practical alternatives where new, single span, complex (multi-span), and tunnel structures are required, we will carry out more detailed preliminary structural planning. The more detailed planning studies will include, but not be limited to, reviews of structural surroundings, number of traffic lanes required on municipal roads at overpasses and underpasses, number of future tracks required at Railway crossings, geometric alignments and profiles for overpasses and underpasses, horizontal and vertical structural clearances, navigable water requirements, site accessibility, hydrology requirements, environmental issues and mitigation, available foundation information, property requirements, existing utilities over and under the complex structures (multi-span) and single span structures, traffic constraints, road and railway detours, temporary watercourse diversions, and preliminary cost estimates.

A Structural Planning Report will be prepared for the Practical Alternatives. This report will include recommendations with respect to the preferred alternative for each new complex structure (multi-span), each single span structure and for the rehabilitation, widening and/or replacement of each existing structure. The report will address any unusual requirements, such as traffic, property, environmental, access, construction staging etc.

Bridge components of the Practical Alternatives will be evaluated according to the following:

- Cost (Bridge/Tunnel) – Preliminary cost estimates will be developed. Capital, operating and maintenance costs will be considered.

4.2.3 Highway Planning

Highway Planning Activities tie together virtually all aspects of the engineering work for this EA project. Throughout the process, the principles of Context Sensitive Solutions (CSS) will be used to seek out public input and endorsement while meeting the technical merits of the project. Although in many instances the performance measures will be similar to those used to evaluate Illustrative Alternatives, the evaluation of Practical Alternatives will require and be based on a greater level of detail. Performance measures by cost conducted by this engineering discipline will include the following:

- Construction Staging/Duration;
- Construction Cost (Plaza and Highway);
- Operating/Maintenance Costs/Life-Cycle Costs – at a detailed level, operating, maintenance and life-cycle costs; and
- Property Costs – cost of property requirements based on preliminary plans.

Comments received from the stakeholders and the public will be used to refine the Practical Alternatives. Together with the U.S. Consultant, our Team will agree on the alignment of the Practical Alternatives at the river crossings, co-ordinate the technical and environmental disciplines and maintain liaison with the Consultation Team. During the analysis of Practical Alternatives, ongoing co-ordination between the two Consultant Teams will be established to maintain a unified approach to dealing with common design issues at the crossing (e.g. tunnel vs. bridge, approach grades, foundation issues) as well as to maintain a common work schedule. The Teams will also co-ordinate key agency meetings requiring bi-national representation (e.g. U.S. Army Corps of Engineers and/or U.S. and Canadian Coast Guard).

Design and refinement of Practical Alternatives to a level of detail that will enable the selection of a Preferred Alternative that can gain approval from the Partnership will be largely dependent on the knowledge of the study area. We expect that in order to respond to issues raised during consultation, aspects of the Practical Alternatives will need to be defined at a level of detail that is just short of the level expected for a typical preliminary design for an MTO facility. As such, we will need to acquire an intimate knowledge of details such as curbs, utility pole locations, impacts to driveways, driveway grades, tangent rollover etc. to refine the Practical Alternatives and to recommend a Preferred Alternative.

5. REFINING THE PREFERRED ALTERNATIVE

Following the evaluation of Practical Alternatives, one Preferred Alternative will be identified. This preferred route will then be improved and refined to reduce impacts to the environment.

5.1 Transportation (Systems) Planning

Following the Level 2 analysis, a Level 3 – Micro-simulation will be conducted. The purpose of the Level 3 Analysis component is to apply the VISSIM software tool to micro-simulate the Preferred Alternative (PA). VISSIM is a microscopic, time-step and behaviour-based simulation tool developed to model urban traffic operations. It is a highly sophisticated and complex tool that can be configured with a high level of detail related to lane configurations and geometry, traffic composition, traffic signal control operations, transit operations and commercial vehicle operations. It can generate highly useful statistics for the derivation and quantification of detailed measures of effectiveness. For this project, the VISSIM micro-simulation tool will be part of a layered analytical approach that will build on the preceding Level 1 and Level 2 analyses and help in the generation of detailed statistics associated with the PA, along with three-dimensional visualization of operations.

The Level 3 Traffic Analysis Report will also include a summary of the analysis undertaken, key assumptions and descriptive performance measures for each of the Practical Alternatives and their respective sub-options. Supporting traffic animations from VISSIM illustrating the findings will supplement the Report.

Building on the Level 3 analysis of the Preferred Alternative (PA), an Analysis of Preferred Alternative Report will be prepared presenting the travel demand forecasts, travel paths and routings, traffic simulations and traffic analyses, discussing the implications on domestic and cross-border commercial vehicle and passenger car traffic. The report will provide a detailed analysis of the LOS and link/intersection volumes, as well as queuing characteristics at all sections of the border-crossing system.

5.2 Bridge Engineering

Once the Preferred Alternative has been identified, we will support the route planning with a more detailed structure evaluation for a new or expanded crossing.

Also, for each Preferred Alternative, three-dimensional renderings of the viable structure alternatives will be professionally prepared showing the proposed alternative, pertinent roadway information, and other field data.

5.3 Highway Planning

Through this phase of the work, the Preferred Alternative (PA) will be refined to develop a Concept Design. From a Highway Planning perspective, this will require co-ordination and liaison between the Engineering, Environmental and Consultation Teams. We have scheduled a Value Engineering Assessment of the PA, to provide the Partnership a "peer review" of the PA and identified mitigation measures / strategies. As part of the consultation on the PA identified by the Consultant Teams, the Partnership could point to the VE Assessment as a check of the work done to date and a means of having another look at the Alternatives and mitigation measures to reduce even further any potential impacts.

Mitigation strategies, measures and commitments will be identified in the Concept Design, as appropriate. It is likely that some of the mitigation measures will result in the development of Concept Design Alternatives.

5.3.1 Development of the Concept Design

The Concept Design plan will be undertaken to a level of engineering detail necessary to support:

- The development of mitigation measures in consultation with the appropriate agencies;
- A decision under CEAA by each Federal Regulatory Authority (RA) on whether adverse environmental effects (after mitigation) are significant or not;
- MOE approval under OEAA; and
- U.S. Federal Highway Administration (FHWA) approval under NEPA.

Concept Design alternatives will be assessed based on consideration of natural, socio-economic and cultural impacts as well as technical considerations. Mitigating measures will be developed during the concept design phase and, upon selection of the preferred Concept Design, these measures will be incorporated to alleviate the anticipated environmental effects.

Concept Design will require additional co-ordination and liaison with the U.S. Consultant to verify the level of design detail required of common elements (e.g. the crossing and plazas), as it is possible that the decision under NEPA will require a greater level of decision detail of the crossing than is normally associated with Concept Design in Ontario /Canadian Environmental Assessments.

A number of Concept Design alternatives will be considered as part of improving the PA. Such alternatives would include:

- Reconfiguration of the plaza layout;
- Evaluation of replacing a large culvert or existing structure over a watercourse with a new / larger structure; and
- Minor revisions to the plan and/or profile in specific areas along the PA.

The Concept Design, including the description of the PA, the impacts and associated mitigation strategies and measures, will be documented in the DRIC Concept Design Alternative and Assessment Report.

6. TECHNICAL CRITERIA AND INDICATORS FOR THE EVALUATION OF ILLUSTRATIVE AND PRACTICAL CROSSINGS, INSPECTION PLAZAS AND ROUTE ALTERNATIVES - SUMMARY

Table 1, Transportation Criteria for the Evaluation of Route Alternatives, provides a description of the individual measures that will be used to evaluate Illustrative and Practical Alternatives. As the study progresses, criteria/measures may be added to better understand, analyse, and evaluate alternatives.

TABLE 1. TRANSPORTATION CRITERIA FOR THE EVALUATION OF ROUTE ALTERNATIVES

Criteria	Engineering Discipline	Illustrative Route Alternatives			Practical Route Alternatives		
		Measure	Unit	Data Sources (Range of Detail)	Measure	Unit	Data Sources (More Detailed)
Improve Regional Mobility Through Improved Transportation Operations Rationale: Examines how well each alternative will allow traffic to move through the study area.	Transportation System Planning	• Link Volume Capacity Ratio on Key Roadway Segments	• V/C	• Updated Travel Demand Model	• Highway Network Effectiveness – Detailed Service Levels (LOS)	• A – F	• Updated Travel Demand Model
					• Detailed Volume-Capacity (V/C) Ratio	• V/C	• Synchro/SimTraffic
		• Peak Hour Traffic	• Numeric	• Updated Travel Demand Model	• Peak Hour Traffic	• Numeric	• Updated Travel Demand Model
		• Change in Total Vehicle-Kilometres of Travel vs. No-Build	• km	• Updated Travel Demand Model	• Change in Total Vehicle-Kilometres of Travel vs. No-Build	• km	• Updated Travel Demand Model
		• Change in Total Vehicle-Hours of Travel vs. No-Build	• hours	• Updated Travel Demand Model	• Change in Total Vehicle-Hours of Travel vs. No-Build	• hours	• Updated Travel Demand Model
					• Queue Length	• km	• Synchro/SimTraffic
					• Average Link Speed	• km/hr	• Updated Travel Demand Model
					• Average Delay	• hours	• Updated Travel Demand Model
					• Average Travel Time	• hours	• Updated Travel Demand Model
Improve Regional Mobility Through Improved Network Compatibility Rationale: Examines how compatible each alternative is with the existing road network and the ability to upgrade each alternative to meet future needs.	Transportation System Planning	• Continuous/ongoing river crossing capacity (Redundancy)	• Judgment	• Based on levels of service at crossings with/without options; aerial mapping, base plans	• Continuous/ongoing river crossing capacity (Redundancy)	• Judgment	• Based on levels of service at crossings with/without options; aerial mapping, base plans
Improve Regional Mobility Through Improved Border Processing Rationale: Examines how transportation solutions impact existing border crossing service and infrastructure / ability to accommodate required border crossing services and infrastructure.	Transportation System Planning				• Operational considerations (Plaza Accessibility) including emergency access and serviceability, security, and flexibility for joint inspections and future needs	• Judgment	• Consultation with Public Border Agencies (Canadian Border Services Agency) and U.S. Customs Border Protection Agencies; private border agencies; border users; Federal Standards and Specifications, aerial photos; base mapping
		• Operational considerations of crossing system (Crossing and Plaza) – Plaza/crossing operations during peak travel periods	• V/C at Crossing	Updated Travel Demand Model	• Operational considerations of crossing system (Crossing and Plaza) – Plaza/crossing operations during peak travel periods	• V/C at Crossing	Updated Travel Demand Model
		• Operational considerations of crossing system (Network) – Potential impacts to network during periods of congestion at border, based on storage capacity at plazas and to freeway connection	• Judgment	Consultation with Public Border Agencies (Canadian Border Services Agency) and U.S. Customs Border Protection Agencies; private border agencies; border users; Federal Standards and Specifications, aerial photos; base mapping	• Operational considerations of crossing system (Network) – Potential impacts to network during periods of congestion at border, based on storage capacity at plazas and to freeway connection	• Judgment	• Consultation with Public Border Agencies (Canadian Border Services Agency) and U.S. Customs Border Protection Agencies; private border agencies; border users; Federal Standards and Specifications, aerial photos; base mapping
Minimize Cost According to Constructability Rationale: Examines the ability to simplify construction to reduce the likelihood of construction claims.	Foundation Engineering	• Geotechnical characteristics of potential constructability impacts	• Judgment	• Available subsurface and geologic information; field reconnaissance; literature review	• Geotechnical characteristics of potential constructability impacts	• Judgment	• Available subsurface and geologic information; field reconnaissance; literature review

TABLE 1. TRANSPORTATION CRITERIA FOR THE EVALUATION OF ROUTE ALTERNATIVES

Criteria	Engineering Discipline	Illustrative Route Alternatives			Practical Route Alternatives		
		Measure	Unit	Data Sources (Range of Detail)	Measure	Unit	Data Sources (More Detailed)
Minimize Construction, Operating, Maintenance and Property Costs Rationale: Examines short and long-term costs associated with each alternative.	Bridge Engineering	• Construction Cost (Crossing)	• $	• per m^2 of deck area	• Cost (Bridge/Tunnel)	• $	• per m^2 of deck area
		• Length of River Crossing	• km	• Base Mapping			
	Highway Planning				• Construction Staging/Duration	• Years	• Judgment
		• Construction Cost (Plaza and Highway)	• $	• Unit costs for construction	• Construction Cost (Plaza and Highway)	• $	• Unit costs for construction
					• Operating, Maintenance and Life-Cycle Costs	• $	• Unit operating, maintenance and life-cycle costs
		• Property Costs	• $	• Base mapping; field reviews; literature review; existing conditions data; field reconnaissance	• Property Costs	• $	• Base mapping; field reviews; literature review; existing conditions data; field reconnaissance

Note: The evaluation criteria listed represents the minimum requirements. The evaluation criteria, indicators and measures are subject to refinement and modification during this study based on study findings and input received from stakeholders.