

Windsor Regional Construction Traffic Management System

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ABSTRACT

In March of 2004, the Federal Government and the Government of Ontario committed \$300 million to invest in infrastructure improvements to the Windsor Gateway under the *Lets Get Windsor-Essex Moving Strategy*. Construction activities were proposed to improve the transportation infrastructure within the Windsor area including CP Rail grade separation projects for Walker Road and Howard Avenue, widening of Manning Road, Tunnel Plaza improvements, the widening of Highway 401 through Windsor as well as a number of other infrastructure improvement projects by the City and County of Essex.

It was foreseen that these activities would have a significant impact on the already congested traffic conditions in the City of Windsor. Given the strategic importance of these locations because of their proximity to border crossings, or service as a major economic corridor and transportation thoroughfare, managing traffic effectively and in a timely manner is of immediate importance. The Windsor Regional Construction Traffic Management System plan was proposed and implemented to address these concerns via the proposed usage of Intelligent Transportation Systems (ITS). The plan consists of four separate initiatives: City/Ministry-owned Mobile ITS, ITS on the Approaches to the Windsor-Detroit Tunnel, ITS on E.C. Row, and Improved ITS on the Windsor Arterials.

These initiatives were successfully implemented providing: improved incident response times, heightened degree of safety near the approaches to the border crossings, and providing motorists with advance border crossing delay information. The initiative also serves as an excellent example of how three levels of government worked together to improve the overall manner in which major construction effort is executed in the context of improved driver awareness of traffic conditions, improved safety through the construction work-zones, reduced traffic grid-lock and, reduced driver frustration.

BACKGROUND

At over \$531 billion in 2003, Canada and the U.S. enjoy the largest bi-national trading relationship in the world. Windsor is the single most important border crossing between Canada and the U.S. and the most prominent border crossing for Ontario exports. Trade between the Province of Ontario and the U.S. contributed nearly 60%, or approximately \$343 billion, of the total Canada-U.S. trade. The Windsor-Detroit Gateway is therefore vital to the Canadian, Ontario and Windsor-Essex economy. It is estimated that in 2004, the Canadian economy lost \$13.6 billion due to delays at the border.

The Problem

The Windsor-Detroit is an incomplete gateway. Highway 401 does not connect to the Ambassador Bridge. Instead, international traffic must use local roads including Talbot Road and Huron Church Road to access the Ambassador Bridge. Traffic volumes on Huron Church Road greatly exceed the volumes that such an arterial within Windsor would be anticipated to carry due to international traffic bound for the crossing.

Slowdowns or stoppages at the Ambassador Bridge have upon occasion caused international traffic to back up such that queues have extended back 11 kilometres along Huron Church Road and Talbot Road to Highway 401. These delays significantly impact local traffic and cause a grid delay effect on other major and minor roads within Windsor. Delays in border processing at the Windsor-Detroit Tunnel can cause extensive queues on local downtown roads, creating difficulties for local travellers and businesses.

Windsor, in addition to being the host community for an international gateway, is also a local community that has local needs and requirements. The congestion caused by international traffic is a source of frustration for Windsor-Essex residents and businesses. Regular truck traffic delays and queuing on Windsor streets result in economic costs for local industry and present safety and environmental concerns.

Unique challenges in the Windsor area that affect commercial and passenger traffic and the local economy include:

- high volumes of commercial and passenger border traffic that originate outside of the Windsor-Essex region traveling through the area to access the border
- large numbers of local residents that are employed across the border using local arterial roads to access border crossing points and requiring speedy border processing to reach job locations
- large volumes of international truck traffic that originates within the Windsor area (mainly associated with the automotive industry) use local arterial roads to access border crossing points and,
- a highly integrated economy between Windsor and Detroit, where unpredictable border crossing times impact local industries and recreational activities.

The border crossing delays within Windsor impact the City and its transportation network in a number of ways:

- increased safety concerns, including increased collision potential at intersections, entrances and queue ends
- lost economic opportunities
- increased air pollution due to queuing
- reduced ability to fully utilize adjacent lands near border crossings
- infiltration of cross-border traffic into local neighbourhoods
- reduced ability to meet incident/emergency response time goals
- increased vehicle operating costs and fuel consumption and
- increased driver frustration.

As the crossings are vital to the local, regional and national economies on the both sides of the border, it is vital that these concerns be addressed through improvements to the local transportation network. However, as a medium-sized municipality with an average annual capital

budget of approximately \$70 million dollars¹, Windsor is not in a position to fund several hundred million dollars of needed infrastructure improvements.

Support from the Federal and Provincial Governments

The Border Infrastructure Fund, as announced in 2001, is a ten year program that has been implemented as a cost-shared contribution program between the federal government and provincial, territorial and municipal governments to:

- Reduce border congestion;
- Enhance infrastructure capacity;
- Improve coordination with adjacent U.S. border facility and road authorities;
- Enhance safety and security at the border crossings; and,
- Support implementation of the Smart Borders Action Plan.

As part of the Border Infrastructure Fund initiative, the federal and provincial governments undertook two studies to assist in identifying opportunities for improvements:

- The Detroit River International Crossing (DRIC) Environmental Assessment, to determine a new crossing between the two countries in the Detroit –Windsor area; and
- The *Let's Get Essex-Windsor Moving* (LGWEM) Strategy, to address short and medium term issues and impacts of international traffic on the host community's traffic and infrastructure.

The LGWEM projects are intended to improve the existing crossings and support the work being undertaken to identify a new crossing through the DRIC environmental assessment process. The LGWEM projects also address short and medium term capacity and infrastructure needs.

Let's Get Windsor Essex Moving Strategy

In March 2004, the Governments of Canada and Ontario jointly committed \$300 million to invest in improvements to the Windsor Gateway, under the *Let's Get Windsor-Essex Moving* strategy. The \$150 million federal contribution is part of the Border Infrastructure Fund. Intelligent Transportation Systems (ITS) initiatives are expected to be an important part of this government investment in infrastructure at the Windsor Gateway in support of these objectives. The main emphasis is to manage traffic as it approaches the Windsor Gateway border crossings, within the Greater Windsor Essex area and Windsor itself, and to utilize these technologies to support border agency activities.

Most recently, that commitment was reaffirmed by the provincial government. The Premier of Ontario has stated that border congestion is the Ontario government's top economic priority and further that Windsor is the number one economic infrastructure priority. The March 23, 2006 budget speech reconfirmed the government's commitment to border crossings and the \$300 million investment in the Windsor Essex gateway.

¹ City of Windsor approved Capital Budget for 2005

Role of Intelligent Transportation Systems

As part of the funds committed under the *Let's Get Windsor-Essex Moving* strategy, Transport Canada and the Ontario Ministry of Transportation (MTO) initiated the *Action Plan for the Intelligent Border Crossing*. The project is based on the premise that ITS encompass a broad range of sensing, communications, information, control and electronics technologies that can be applied to all of Ontario's road-based border crossings with the U.S. While the focus of the immediate needs may be on the higher volume crossings such as the Windsor Gateway, there was a recognized need to develop a comprehensive plan that defines what an Intelligent Border Crossing is, what ITS elements are included and how it should operate within an overall Ontario context. The scope of the project was therefore established to include all of Ontario's 14 road-based international border crossings and strategic ferry crossings and the development of an ITS deployment strategy for each, that is consistent with the ITS Architecture for Canada and the Border Information Flow Architecture (BIFA).

Unlike new border infrastructure projects (a new bridge or tunnel) that are costly and long term, ITS solutions can be deployed relatively quickly. ITS applications can also be integrated into other border improvement initiatives and build on and enhance existing ITS applications already in place. In an effort to address immediate needs and improve operations at the border-crossings in the Windsor Gateway as quickly as possible, MTO and Transport Canada (as part of the Action Plan for the Intelligent Border Crossing project), have initiated a series of early deployment ITS projects. These early deployment projects were selected on their ability to be deployed quickly, address immediate needs and serve as a solid foundation on which the ITS deployment plan for the Windsor Gateway can be implemented. As such, these early deployment projects are key elements of the long term ITS strategy for the Windsor Gateway as well as Ontario's plan for Intelligent Border Crossings province-wide.

RATIONALE FOR THE WINDSOR REGIONAL CONSTRUCTION TRAFFIC MANAGEMENT SYSTEM

From the spring of 2007, and continuing for the next four to five years, three major roadway construction projects associated with improving access to the international border in the Windsor Gateway are or will be underway as part of the *Let's Get Windsor Essex Moving* strategy:

- **Highway 401 Widening – Highway 3 to Manning Road:** Highway 401 is one of Ontario's primary trade corridors serving the major population and employment centres across Southern Ontario and providing a direct link from Ontario's eastern border with Quebec through to the Windsor Gateway. The proposed widening of the westerly most portion of Highway 401 between Manning Road and Highway 3 in the City of Windsor will have a major impact on the capacity of this major trade corridor starting in the Spring 2007 and extending over the 3 year construction period.
- **Walker Road/CPR Grade Separation:** At the same time, the Walker Road/CPR grade separation project will be underway, severely impacting traffic within the City of Windsor due to the resultant closure of Walker Road at the rail crossing for the duration of construction (estimated to be 12-14 months). This arterial roadway serves as the primary access route between the EC Row Expressway and the automobile assembly plants in the

area and provides a direct connection between downtown Windsor and the Highway 401 corridor. The proposed detour plan includes the use of the Walker Road exit ramp for all eastbound EC Row traffic destined to Walker Road and Central Avenue (i.e. closure of the eastbound exit ramp from EC Row at Central Avenue) and utilizes Tecumseh Road, Chrysler Centre/Grand Marais/Central Avenue/Foster Avenue, Howard Avenue and the EC Row Expressway to route traffic around the closed section of Walker Road. The traffic management plan includes static signing indicating the detour routes for traffic to follow. **Figure 1** illustrates the detour plan for the Walker Road/CPR grade separation project; and



Figure 1 - Plan showing proposed Walker Rd. /CPR Grade Separation Detour Route

- **Howard Avenue/CPR Grade Separation:** Following completion of the Walker Road/CPR grade separation project, a similar project will be undertaken on Howard Avenue at the CPR line. This may require the closure of Howard Avenue that is anticipated to have a significant impact on traffic circulation in the area. A four-lane on-site detour is being evaluated as part of the environmental assessment process..

These three major infrastructure projects will have a significant impact on traffic circulation throughout the City and in particular those key routes leading to Ontario’s international border as illustrated in **Figure 2**. They present an immediate need to deploy ITS systems in order to manage traffic on these key routes during construction.

Under Ontario’s Action Plan for the Intelligent Border Crossing project, a number of ITS initiatives were identified to assist in the near and long-term traffic management needs of the Windsor-Gateway. In light of the construction initiatives proposed to improve the Windsor-Essex gateway several of these ITS applications were identified for early deployment to manage traffic, detect and respond to incidents, monitor conditions and disseminate traveller information.



Figure 2 - Construction Impacts on Border-Related Traffic at the City of Windsor: A Network Perspective

The most significant of these ITS projects is the Windsor Regional Construction Traffic Management System. This project was intended as a means to develop a foundation for a comprehensive traffic management program in the Windsor Gateway while providing the City of Windsor and the MTO the necessary tools required now to manage traffic within the construction zone, along detour routes and on major arterials and commuter routes that will be impacted by the roadway construction.

PROPOSED ITS ELEMENTS

To provide the City of Windsor and the MTO the necessary tools to manage traffic within the construction zone, along detour routes and on major arterials and commuter routes that will be impacted by the roadway construction, a number of ITS components are proposed. These ITS components will be located to supplement the static detour signing and include:

- CCTV cameras and vehicle detectors to monitor traffic conditions;
- Use of advanced traffic signal management strategies to alter traffic signal operations (e.g., signal phasing, timing plans, etc.) in response to incidents, traffic fluctuations or periods of recurring traffic congestion using the City’s traffic signal management system;
- Use of Variable Message Signs (VMS) to provide information on traffic conditions and delay and warn motorists of conditions ahead and allow them the opportunity to alter their route; and,

- Provide easy access to traveller information to major traffic generators in the area (e.g., auto assembly plants) and the general public through the use of a traveller information website.

The ITS components identified are of value to the City and the MTO over the long term to manage traffic at the border and on its approach roads. To maximize the long term potential of this project, all of the proposed ITS components were analyzed to determine those which should be installed on a permanent basis for long term traffic management applications, and those that are specific to the construction projects and therefore should be deployed on a moveable basis to accommodate the various stages of construction activities or where traffic is to be diverted.

Four Separate Contract Initiatives

To implement the proposed ITS elements, four separate contracts were initiated:

- ***Portable ITS under the City of Windsor Control*** – including the use of trailer mounted VMS to provide route diversion information on arterial streets and, trailer mounted Vehicle Detection Systems (VDS) to provide traffic data for monitoring of traffic queues and estimation of delays
- ***Portable ITS under the MTO Control*** – including the use of trailer mounted VMS for incident management and route diversion during construction activities on Highway 401 during the widening initiative and trailer mounted CCTV to provide MTO staff with the ability to view and confirm incidents occurring on Highway 401 during construction
- ***City of Windsor Arterial Street ITS*** – includes the addition of CCTV cameras at critical intersections within the City of Windsor, interconnection of traffic signals for centralized traffic signal control, and improved central software to facilitate traffic responsive control of signals as well as control of trailer mounted VMS
- ***ITS for Traffic Management on EC Row*** – includes permanently installed cantilever VMS, CCTV, and VDS on EC Row to provide full traffic management functionality for the City of Windsor traffic operations staff

The following sections describe each of the four initiatives in greater detail.

PORTABLE ITS UNDER CITY AND MTO CONTROL

The additional ITS components required to manage traffic during construction will include the use of mobile field elements. These elements include:

- Full matrix LED portable variable message signs (PVMS) with solar panels;
- Mobile (trailer mounted) CCTV cameras with solar panels;
- Vehicle detectors using above-ground vehicle detection technology to monitor traffic queues and estimate delay time; and,
- Wireless communications links.

Portable Variable Message Signs (PVMS)

The equipment is designed to be mobile and flexible allowing it to be able to adapt to the various traffic staging schemes required by the construction works and the resultant congestion that may occur.

The locations of the PVMS will depend on the final construction staging and detour design plans, as well as the resultant traffic patterns and congestion problems that will occur. PVMS were proposed at the following locations:



Figure 3 - PVMS used for Route Diversion and Incident Messaging

Highway 401 Widening (to be under MTO Control):

- Southbound on Huron Church Road north of EC Row Expressway providing advance warning of the construction/congestion on Highway 401 and congestion on EC Row Expressway (2 signs);
- Eastbound on Highway 401 on Highway 3 providing advance warning of the construction/congestion;
- Westbound on Highway 401 east of Manning Road providing advance warning of the construction/congestion;
- Eastbound on Highway 401 within the construction zone to provide warning of queues and/or congestion and provide travel time estimates; and,
- Westbound on Highway 401 within the construction zone to provide warnings of queues and/or congestion and provide travel time estimates.

Walker Road/CPR Grade Separation (to be under City of Windsor Control):

- Southbound on Walker Road north of Tecumseh Road to provide advance warning of construction/congestion;
- Westbound on Tecumseh Road east of Chrysler Centre to provide advance warning of construction/congestion;

- Eastbound on Tecumseh Road west of Howard Avenue to provide advance warning of construction/congestion;
- Northbound on Walker Road south of Cabana Road to provide advance warning of construction/congestion;
- Southbound along Chrysler Centre to provide advance warning of queues and/or congestion and provide travel time estimates;
- Northbound on Central Avenue to provide advance warning of queues and/or congestion and provide travel time estimates; and,
- Eastbound on Walker Road exit ramp (two signs, one east and one west of Walker Road) to provide advance warning of queues and/or congestion and provide travel time estimates.

CCTV Camera Coverage

CCTV coverage is recommended throughout the Walker Road and Highway 401 construction zones. The permanent camera installations identified above is anticipated to provide adequate coverage throughout the Walker Road/CPR construction site. Permanent cameras are also planned for installation in the Highway 401 corridor at the beginning of construction. There are however locations within the Highway 401 corridor where permanent cameras will not be able to be located until completion of the road works due to the extent of construction. Mobile cameras are therefore recommended for placement during construction to supplement the permanent camera installations. These cameras will be mounted on trailers and utilize solar panels and wireless communications.



Figure 4 - Portable CCTV Trailer: in Transit Mode/with Camera Arm Extended

Vehicle Detectors

Vehicle detection equipment utilizing above ground detection technology is recommended for deployment within the Highway 401 (eastbound and westbound), Chrysler Centre/Central

Avenue and the EC Row eastbound exit ramp corridors to monitor queues and estimate travel times. The procurement of a software package will be required to analyze the data and interface directly with the PVMS located within these corridors to inform drivers of the length of delay they will experience.



Figure 5 - Portable Vehicle Detection

CITY OF WINDSOR ARTERIAL STREET ITS

This initiative included improvements to the City’s CCTV camera coverage, traffic signals, and centralized traffic control software as described in more detail through the following sections.

CCTV Coverage

CCTV cameras provide a valuable resource to a City in the management of their traffic signal network by enabling them to monitor traffic conditions and verify incidents as well as serve as a valuable source of traveller information for the general public and emergency response agencies. The installation of CCTV cameras on a permanent basis also enables higher mounting heights to increase camera coverage and a more stable support structure for a clearer image (e.g., less camera movement under windy conditions). Permanent camera installation is therefore recommended at key signalized intersections on the Walker Road detour routes and other intersections that will be impacted. This involves the following permanent ITS measures:

- Deployment of CCTV cameras on poles at the following intersections:
 - Chrysler Centre at Grand Marais Road;

- Central Avenue at Grand Marais Road;
 - Walker Road at Cabana Road;
 - Tecumseh Road at Central Avenue, Chrysler Centre, Walker Road, Hall Avenue and Howard Avenue; and,
 - Wyandotte Street at Walker Road, Hall Avenue and Howard Avenue.
- Installation of conduit and fibre optic cable in the following corridors to extend the City’s existing fibre network and provide transmission of the video images to the City of Windsor and MTO traffic operation centres:
 - Chrysler Centre from Tecumseh Road to Grand Marais Road;
 - Grand Marais Road from Walker Road to Central Avenue (fibre cable only);
 - Walker Road from EC Row Expressway to Cabana Road;
 - Tecumseh Road from Howard to Central Avenue; and,
 - Wyandotte Street from McDougall Avenue to Walker Road (fibre cable only).

Traffic Signal Management

The City of Windsor operates a central traffic signal management system providing the ability to monitor and control traffic signal operations from a central location. It also allows the City to implement advanced traffic signal management strategies that are responsive to fluctuations in traffic demand. Currently due to limitations in the extent of their communications network, the City does not have all intersections under central control. It is recommended that the City twisted pair communications network be expanded to provide central control of key intersections impacted by the Walker Road construction works. These intersections include the signalized intersections within the following corridors:

- Walker Road from EC Row to Provincial Road (10 signalized intersections); and,
- Chrysler Centre from Tecumseh Road to Grand Marais Road (six signalized intersections).

As part of this ITS component, an allowance is included to provide vehicle detection at strategic locations to monitor traffic conditions and traffic engineering to develop signal timing plans and calibrate the traffic signal system to operate in a traffic responsive manner. This signal timing development and calibration effort for traffic responsive control is anticipated to involve four to six timing plans for 40 to 50 traffic signals.

Central Software

The dissemination of traveller information will be under the control of both the City of Windsor and the MTO under a mutually agreed upon operational protocol, currently under discussion. MTO currently have central software to monitor and control their variable message signs through the London CommCentre. The City of Windsor will require similar central software to monitor and control the operation of the variable message signs. Assuming the signs will utilize standard NTCIP communications protocol, it is recommended that the control software be integrated into the City’s existing traffic signal management system.

A website is recommended to provide information on the extent of congestion on the detour routes and provide easy access to current images (still shots) of traffic conditions. It will be valuable to dispatchers at the auto assembly plants in the area as well as local travellers before they leave their point of origin, both during construction and afterwards, providing general traveller information on the various routes serving the international border crossings. The recommended approach is to assemble the information and develop display graphics for dissemination through both City and MTO websites. A webserver has been utilized for this purpose. The provision of the website will be essential to facilitate the dissemination of timely information relating to the construction zones and the associated detour routes.

It should be noted that the video equipment provided under the Windsor-Detroit Tunnel Approaches Traffic Management System Early Win ITS Project will provide the ability to share the video images directly with City emergency response agencies, as well as the various agencies directly involved in the management of the border crossings (e.g., crossing operators, customs agencies, etc.).

ITS FOR TRAFFIC MANAGEMENT ON EC ROW

The EC Row Expressway is a key component of the City of Windsor's transportation network and serves as a key route to two of the Windsor Gateway's international border crossings; Ambassador Bridge and the Windsor-Detroit Tunnel. This key role of EC Row and the impacts of the Walker Road/CPR line grade separation indicate that any traffic management measures implemented for purposes of traffic management during construction should be deployed on a permanent basis. These permanent ITS measures include:

- Deployment of CCTV cameras at each major interchange between Howard Avenue in the west to Banwell Road in the east. Five cameras recommended at Walker Road, Central Avenue, Jefferson Boulevard, Lauzon Parkway and Banwell Road. These cameras will supplement the existing four cameras within the EC Row Expressway and provide full coverage of the EC Row corridor from Huron Church Road to the eastern City limits for traffic monitoring and verification of incidents. These cameras will also provide coverage of these key north-south City arterials in the vicinity of the EC Row Expressway and portions of the detour routes associated with both the Walker Road and the Howard Avenue/ CPR line grade separation projects.



Figure 6 – Dome CCTV Camera on EC Row

- Deployment of two variable message signs; one east of Lauzon Parkway for westbound traffic to provide warning of traffic conditions ahead and allow motorists the opportunity to exit at Lauzon Parkway and one west of Dougall Avenue for eastbound traffic to provide them the opportunity to exit at either Dougall Avenue or Howard Avenue. With the closure of the Central Avenue eastbound off ramp and increased traffic using the Walker Road westbound on ramp during the Walker Road/CPR line grade separation project, increased congestion levels and possible queuing back onto EC Row eastbound are expected to occur. It is recommended that these variable message signs be roadside mounted using a sign of smaller size than those used for overhead mounting;



Figure 7 - Cantilever Variable Message Sign on EC Row

- Installation of vehicle detectors at strategic locations (4 locations, 2 eastbound and 2 westbound) to monitor traffic conditions (e.g., volume, speed, occupancy) on EC Row and the presence of queues. Software will be required to monitor data, identify queues and notify

the operator of the need to initiate a response plan (e.g. display a new message on the VMS); and,

- Installation of conduit and fibre optic cable on EC Row from Howard Avenue to Banwell Road to provide transmission of the video images to the City of Windsor and MTO traffic operation centres. This cable is an extension of the fibre optic cable installed along EC Row between Huron Church Road and Howard Avenue under a previous Early Win ITS Project.

SUMMARY

The Highway 401 widening and the Walker Road/CPR grade separation projects will severely impact traffic within the City of Windsor. The provision of regional traffic management will provide MTO and the City of Windsor a valuable tool to actively monitor conditions, manage traffic operations and provide traveller information in and around the construction zones throughout the duration of the projects.

The provision of regional traffic management on the detour routes for the Highway 401 widening and the Walker Road/CPR grade separation projects resulted in the following benefits:

- Reduced congestion and delay on the detour routes;
- Improved safety and travel time reliability on the detour routes;
- Reduced the impact of the road construction on the local community, the environment and the economy of the region; and,
- Maintained accessibility to the international border crossings in the Windsor area.

These benefits are realized throughout the construction period as well as afterwards with the ITS components remaining to assist MTO and the City in their efforts to manage traffic movements and provide traveller information on the approach roads leading to the international border crossings in the Windsor Gateway.

The Windsor Regional Traffic Management System has allowed drivers to make route choices in and around the construction zones and help MTO and City of Windsor staff to better manage the resultant traffic congestion on the designated detour routes. Any reduction in traffic congestion and maximization of capacity along the detour routes will have a direct impact on the accessibility of the international border crossings in the Windsor Gateway. It has also provided valuable traffic management and traveller information capabilities that can be utilized to better manage the Windsor Gateway's international border crossings and their approach roads.

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