INTELLIGENT TRANSPORTATION BORDER CROSSING SYSTEMS

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ABSTRACT

There are seven international highway crossings on the Niagara, St. Clair and Detroit Rivers at the Michigan-Ontario-New York border. These crossings are at the beginning/end of the Ontario strategic highway network and are the key transportation links to the United States. The crossings account for over $125 billion per year of commercial trade. Over 5.5 million trucks and 31.5 million passenger vehicles annually use these border crossing facilities for movements between Canada and the United States.

At these crossings there are toll plazas located on one side of the border and customs - immigration plazas located on the other side of the border. When vehicles cross the bridges, they are subject to delays while paying toll manually and subject to further delays while being inspected by customs and immigration agencies to ensure that cargos, and drivers meet the regulations imposed by the host country. Further downstream of the crossings, province/state transportation agencies usually have commercial vehicle inspection stations to ensure vehicle and driver safety on the highway. These delays, while necessary, have increased the cost of doing business for truckers, shippers, manufacturers, retailers, and eventually cost consumers more to buy goods and services.

The government transportation agencies, border crossing agencies, and toll operators on both sides of the border jointly initiated a project to deploy an Intelligent Transportation Border Crossing System (ITBCS) at the Michigan-Ontario border crossing, Ambassador Bridge, and at the Ontario-New York border crossing, Peace Bridge. This system will support the North American Trade Automation Prototype initiative and will use compatible DSRC transponder technology to test the concept of a seamless border to facilitate the flow of international trade and passenger traffic.

This presentation will discuss the international border crossings, international and institutional cooperation, ITS technology application planning, automated border crossing operational requirements, transponder interoperability, ITBCS functions, field operational test, related institutional issues, and future perspective.
The International Border Crossings

The Michigan-Ontario and New York-Ontario international highway border crossings serve a wide range of economic and transportation needs. These include major international goods and people movements and localized border crossing traffic. The U.S.-Canada Free Trade Agreement and NAFTA have further contributed to the dramatic increases in trade flow across these international highway crossings. There are seven international highway crossings at the Niagara, St. Clair and Detroit Rivers on the Michigan-Ontario-New York border. These crossings are at the beginning/end of the Ontario strategic highway network and are the key transportation links to the United States. The crossings account for over $125 billion per year of commercial trade equivalent to 47% of all Canadian-US-Mexican commercial trade. Over 5.5 million trucks and 31.5 million passenger vehicles annually use these border crossing facilities for movements between Canada and the United States. This travel represents a significant economic base for each country and the communities served by these border facilities.

At these international crossings and in both crossing directions, a toll plaza is usually located on one side of the border and a customs-immigration plaza is located on the other side of the border. When commercial vehicles cross the bridges or tunnel, they are subject to delay while paying the toll manually. After the crossing, they are inspected by customs and immigration authorities to ensure that cargos and drivers meet the regulations imposed by the host country. Passenger vehicles are also subject to similar delays at border crossings. Further downstream of the crossings, provincial/state transportation agencies usually have commercial vehicle inspection stations to conduct truck inspections to ensure highway safety. The delays, caused by inspection and clearance while necessary, have increased the cost of doing business for truckers, shippers, manufacturers, retailers, and eventually cost consumers more to buy goods and services.

International and Institutional Cooperation

The transportation agencies, customs and immigration agencies, toll operators and other stakeholders on both sides of the border have jointly formed a Michigan-Ontario-New York (MONY) International Highway Border Crossings Committee to initiate the application of Intelligent Transportation System (ITS) technology to expedite border crossing operations and movements. The Ministry of Transportation of Ontario (MTO) is a key participant of the MONY Project Steering Committee. MTO serves to focus the multi-phase, multi-agency international efforts in pursuing a seamless border through ITS technology applications. The international Committee includes representatives of MTO, New York State DOT, Michigan DOT, New York State Thruway Authority, Transport Canada, U.S. Federal Highway Administration, Customs and Immigration services of both countries, and toll facility operators at the Peace Bridge and Ambassador Bridge.

On behalf of the international Committee, MTO engaged a consultant team to conduct a Phase 1 automated border crossing institutional issues study and a Phase 2 system planning and design. This effort has resulted in the current Phase 3 field operational test for the Intelligent Transportation Border Crossing System (ITBCS) that would facilitate speedy customs and immigration inspection and electronic toll collection for qualified border crossing users at the Peace Bridge and Ambassador Bridge.

ITS Technology Applications Planning

ITBCS will enable electronic clearance by customs and immigration authorities, provide transportation agencies with safety data, and allow electronic toll collection by the bridge
operators. Compliant and safe commercial vehicles or passenger cars equipped with compatible electronic transponders will cross the border with minimum or no delay at the border crossing plazas. Through a two-way vehicle-to-roadside communications system and utilizing automatic vehicle identification technology/EDI, ITBCS will facilitate commerce and passenger traffic flow, reduce crossing congestion and shipping costs, streamline business processing, and increase productivity and competitiveness. ITBCS will interface with facility operators' toll account system, customs commercial system including North American Trade Automation Prototype (NATAP) deployment, immigration/customs traveler system, and transportation CVO safety & regulation system to form an integrated border crossing system. Ultimately, ITBCS will meet the following project objectives:

- enhancing overall border crossing system efficiency,
- promoting transportation safety,
- supporting industrial development,
- encouraging tourism,
- enhancing producer access to international and regional markets, and
- improving the level of service provided to all transportation users.

To achieve the above objectives and define the required system functions, Phase 2 system planning and design document outlines the system concept, operational requirements, and system functional requirements.

Automated Border Crossing Operational Requirements

**Truck Operation** - To improve the border crossing process, the Customs agency must receive the electronic information before the truck's arrival at the border. Through the effort of three NAFTA countries, Canada, U.S.A. and Mexico, the three governments have agreed to a standard set of border crossing data for both Customs and Immigration processing. While the truck is in transit to the border, the government systems will receive the border crossing data through EDI network and will process and store the data and decision, pending actual arrival of the truck.

The truck will carry a dedicated short range communication (DSRC) electronic transponder. There will be a unique trip/load number stored on the transponder. This trip/load number is a unique number identifying the particular trip of a specific truck. Since the same truck may cross the border several times a day, a unique trip/load number must be assigned each time the truck crosses the border. The trip/load number will be entered into the transponder electronically through a bar code wand device by carrier/brokers. The detailed cargo information, driver information and trip/load number will be transmitted separately in advance through EDI network and stored on a government system. The trip/load number carried by the transponder will be the key to find the decision of the government system.

As a transponder equipped truck approaches the border crossing, an advance export DSRC antenna/reader of the ITBCS will read the trip/load number and transmit the number to the exporting country's government system. The government system will send back the decision via ITBCS to the in-cab transponder display with a red/green light. If green, the truck will go on and leave the exporting country. An exit antenna/reader at the point of actual export will confirm that the truck actually left the country. This confirmation will be sent back to the exporting country's government system. If red, the truck must go to the Custom's secondary inspection area where the exporting government can change the in-cab transponder display from red to green after inspection. In Canada, the trucks will not be referred to the secondary inspection area.

As a symbol of international cooperation, ITBCS can be designed to allow the exporting
country's exit antenna/reader to serve as an advance import antenna/reader for the importing country and transmit the trip/load number to the importing country's government system.

After the truck crosses the border and enters the importing country, an import decision antenna/reader of the ITBCS will read the trip/load number and transmit the number to the importing government system. The government system will query the border crossing database and send back the green/red decision via the ITBCS to the in-cab transponder display and to an external traffic light. If green, the truck will proceed to exit the primary booth. An exit import antenna/reader will read the trip/load number from the truck transponder and confirm to the government system that the truck exits the importing country’s customs-immigration plaza. If red, the truck must go to the secondary inspection area for examination. After inspection, the importing government will be able to change the in-cab transponder display from red to green to signal to the truck driver to leave the secondary inspection area. Customs/Immigration inspectors can also override a green light to a red light at the primary booth to prevent the system from being abused.

**Car Operation** - Car drivers/passengers who want to participate in the automated border crossing processing will be selected by the Immigration agencies. Each enrolled car will have a DSRC transponder with a unique number and possible additional unique numbers assigned by Immigration. At the immigration dedicated commuter lane (DCL), an advanced auto DSRC antenna/reader will read car transponder identification number/s and transmit the number/s to the Immigration government system and the Immigration inspector in time for a visual check. The Immigration government system will send back a green/red decision via ITBCS at the DCL to the car transponder display and to an external traffic light. If green, the car proceeds to leave the primary booth. If red, further inspection is required.

**Toll Operation** - Only those trucks approved by Transportation, Customs and Immigration for the field operational test can participate in the electronic toll collection transactions. They will use the same DSRC transponder for customs-immigration clearance as well as for toll collection. Initially one mixed type toll truck lane will be used for electronic toll collection in each direction, i.e., into Canada or into the United States. The electronic truck toll will be based on the number of axles. The toll DSRC antenna/reader of ITBCS will read the truck transponder identification number and associate this with the truck axles measured by an automatic vehicle classification system. This information will be sent to the existing toll plaza computer for toll processing. Once the transponder on the truck is read and determined valid, the boom gate will lift and the truck can go.

Cars will use a token-only lane for electronic toll collection. Cars, using this lane, will be the same cars enrolled to use the Immigration DCL. An Electronic Toll Traffic Management Service Center for cars is also required to perform program education, account establishment, transponder distribution, patron inquiries, payment processing, account maintenance and report generation.

**Transportation Operation** - Trucks participating in this project must continue to have a good safety performance record and all necessary registration and credentials. Enrolled trucks will have a type III DSRC transponder with a carrier identification number along with other identification numbers as required on it. The carrier identification number will be read by authorized transportation agency facilities located along the connecting strategic highway network to perform safety and credential checks. The ITBCS will also provide a cost-effective, password-activated, electronic mail or file transfer facility to allow government agencies to retrieve border crossing data.
DSRC Transponder/Reader and Interoperability

For field operational test, 500 type III DSRC transponders for commercial vehicles are required. For cars registered in the test, 1500 transponders of at least type II are required. The transponder will have a green/red visual display to signal drivers to pass or stop. The DSRC transponder/reader will have the capability to be interoperable with the adjacent ITS and NATAP locations: Advantage I-75 project, AVION 401 project, Ontario 407 Express Toll Route, IAG E-Z Pass Deployment, Customs and Immigration government systems. This capability will be enhanced by making DSRC transponder/reader design compatible with the latest ASTM specification Draft 6, Dedicated Short Range Two-way Vehicle to Roadside Communications Equipment and with the Commercial Vehicle Information System and Network (CVISN) DSRC Requirements.

ITBCS Functional Requirements

One of the key functions of ITBCS is to provide a linkage between the crossing vehicles and the systems of border crossing agencies/stakeholders. The decision to grant electronic clearance of a vehicle will originate from these border crossing agency systems. A truck is electronically cleared if its driver and cargo satisfy all customs, immigration, toll, and transportation safety requirements. A passenger vehicle is electronically cleared if its driver and passengers satisfy all immigration, customs and toll requirements. ITBCS will interface with each of these external agency systems to provide the vehicle identification, to receive the decision from the agency systems and to communicate the decision to the crossing vehicle.

ITBCS will provide the above capability for nonstop, electronic clearance of vehicles at the border crossing through a dedicated short range two-way vehicle to roadside communication system. The key components, DSRC antennas and readers, of ITBCS will be deployed at selected commercial import truck lane, commercial export truck lane, immigration dedicated commuter lane, truck toll lane and auto toll lane of a border crossing plaza to communicate with crossing vehicles. A local area network will connect ITBCS with other border crossing agency systems such as NATAP government systems, Immigration government systems, toll operator systems, and transportation systems to function as an integrated system. The ITBCS of one country will be connected to the other country's ITBCS through a wide area network to facilitate the use of an exporting country's vehicle identification data by the importing country's system.

Field Operational Test

Following the Phase 1 Institutional Impact Study of New Technology Applications, the Phase 2 system planning and design of ITBCS, the international Committee is now pursuing the Phase 3 Field Operational Test at Peace Bridge, the Ontario-New York border crossing, and at Ambassador Bridge, the Ontario-Michigan border crossing. These are the two busiest highway border crossings between Canada and the United States.

The Committee approved RFPs for ITBCS deployment were released by the bridge facility operators in 1996. The RFPs are required to develop a detailed design, build, install, operate and maintain an intelligent transportation border crossing system for field operational test at the two crossings initially. As a contracting agent for the international Committee, two toll operators at Peace Bridge and Ambassador Bridge will enter into a contract with the selected Contractor/s to deploy ITBCS for the field operational test. The field operational test will last one and half years. During this period, the Contractor will operate and maintain ITBCS for the international Committee. During the field operational test, participating vehicles may still need to stop briefly at the primary or toll booth. It is important to note that
ITBCS design will allow nonstop border crossing operation for qualified vehicles/drivers/cargos.

**Related Institutional Issues**

In order to move forward on this beneficial international cooperative project, several international and institutional issues need to be resolved along the way. These issues include, but not limited to, shared border crossing vision, shared system concept, shared funding, shared deployment approach, shared technology and equipment, and shared contractor/s. Over the past couple of years, these issues were resolved one by one by members of the international Committee after overcoming their own organizational barriers, and resolving the conflicts among heterogeneous Committee members. In addition, various inter-agency funding agreements are required for channeling project fund from federal to provincial/state level and to the two contracting agents, the toll operators at Peace Bridge and Ambassador Bridge. The process of drafting, reviewing, and reconciling various interrelated agreements has also demand a great deal of effort of the funding Committee members. A valuable lesson in terms of international and institutional cooperation for the ITS deployment is being learned by the international Committee members through this ITBCS project.

**Future Perspective**

As this project moves into field operational test at the two busiest border crossings, and as the users, including both public and private sectors, begin to experience the convenience of electronic clearance, and paperless business processing, and to receive the benefit of savings in time and cost, there can be no turning back to the current time consuming manual border crossing operations. This initial application will lead to a vision of an automated, seamless, nonstop, transparent, smart border crossing for safe and legal commercial vehicles and passenger cars across the entire border between Canada and the United States.