CAMBRIDGE SYSTEMATICS

Buffalo-Niagara Integrated Corridor Management

Proposed Changes to NITTEC's
ICM System Operations Concept Report

final

report

prepared for

Niagara International Transportation Technology Coalition &
Greater Buffalo-Niagara Regional Transportation Council

prepared by

Cambridge Systematics, Inc.

June 5, 2017

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1.0 Introduction

The I-190 Integrated Corridor Management (ICM) initiative can be traced back to 2007, when the Niagara International Transportation Technology Coalition (NITTEC) completed the Strategic Plan 2007. In this document, NITTEC described the long-term vision for the region's transportation future. One of the recommendations defined was the development of the concept of Transportation Operations for the Niagara region. In response to the Strategic Plan 2007, NITTEC initiated a Transportation Operations study. This study was divided in two parts:

- NITTEC Regional Concept for Transportation Operations (RCTO). This study describes a management tool, defining a path for a collaborative and sustainable operations and management strategy across different regional stakeholders.
- NITTEC Integrated Corridor Management (ICM). This study defines the region's initiative to promote operational coordination across multiple transportation networks and institutions, and to improve mobility and safety, among other transportation objectives for travelers and goods in the region.

As a result of this study, three different reports were developed in the 2009 to 2010 timeframe:

- NITTEC RCTO Final Report
- NITTEC ICM Requirements Document
- NITTEC ICM System Operational Concept

1.1 REPORT PURPOSE

This report provides a brief summary of the existing NITTEC ICM documents. It also identifies sections and topics to be considered important to be updated for the current I-190 Integrated Corridor Management AMS project

2.0 ICM Objectives

The overall objective of the current I-190 Integrated Corridor Management study is to develop a decision support tool and perform the required Analysis, Modeling, and Simulation (AMS) assessments of the potential operational and environmental benefits that could be realized from an ICM deployment in the region. This project is currently being supported by grants from the Federal Highway Administration (FHWA) and the New York State Energy Research and Development Authority (NYSERDA) grants.

To reach the aforementioned overall objective, this report aims to provide a brief description of the current institutional, operational, and management framework in the Niagara region, and the ICM initiative as initially conceived. This initial description will help identify sections, concepts, technologies, and measures that require changes to reflect the latest updates in the ICM concept and incorporate best-practices in cross-border activities.

Additional separate reports serving as the foundation for this project include the Project Management Plan (PMP) and the System Engineering Management Plan (SEMP).

3.0 Institutional Framework

An important characteristic of this region lies on the complexity of collaboration within multiple regional stakeholders involved. This section aims to provide a brief description of how current stakeholders are collaborating to provide transportation services. The institutional framework described is based on the NITTEC Regional Concept for Transportation Operations (RCTO). The purpose of this document is to describe the regional framework that allows transportation agencies in the area to work together, and determine future needs for the Buffalo-Niagara 2015 ICM study.

3.1 REGIONAL STAKEHOLDERS

The Niagara region is a particularly complex area for transportation activities due to the interaction of different entities and activities. One of the main characteristics of the region is that it encompasses the Niagara River border crossings, a strategic international gateway for trade and tourism flows between the United States and Canada. The Niagara River, flowing from Lake Erie to Lake Ontario, forms the frontier between both countries.

On the Canadian side, the Niagara region covers approximately two-thirds of the Niagara Peninsula, across twelve local municipalities, as shown in Table 3.1.

Table 3.1 Canadian Municipalities Included in the Niagara Region

Municipality	Population
Niagara Falls	82,997
Port Colborne	18,424
St. Catharines	131,400
Thorold	17,931
Welland	50,631
Fort Erie	29,960
Grimsby	25,325
Lincoln	22,487
Niagara-on-the-Lake	15,400
Pelham	16,598
Wainfleet	6,356
West Lincoln	13,837

Source: Statistics Canada Census Profile 2011

On the United States side, the Buffalo-Niagara Frontier region corresponds to the New York State border with Ontario. The region consists of three counties: Erie, Niagara, and Cattaraugus. The region can be further segregated in 64 local municipalities, and Native American lands. According to the United States Census Bureau, the Buffalo-Niagara Falls Metropolitan Area had a population of 1,135,509 in 2010. Table 3.2 shows the main U.S. Cities in the region, along with their population.

Table 3.2 United States Main Cities in the Buffalo-Niagara Frontier Region

City	Population
Buffalo	261,310
Lackawanna	18,141
Lockport	21,165
Tonawanda CDP	58,144
Niagara Falls	50,193
North Tonawanda	31,568
Olean	14,452
Tonawanda	15,130

Source: United States Census Bureau, 2010 Census Data.

The complexity of the transportation network in the region is not solely determined by the vast number of stakeholders involved, but by the interactions between transportation modes too, consisting primarily of 5 main transportation networks:

Border Crossings Network

The border crossings network in the region consists of 4 international border-crossing bridges across the Niagara River international border. All four bridges are tolled one-way in the Canada-bound direction.

Highway Network

The region contains an extensive highway network which includes Queen Elizabeth Way, Highway 405, Highway 420, among other important highways in Canada; and Interstate 190, Interstate 290, and Interstate 90, among other important State Routes in the United States.

Rail Network

The rail network in the region includes passenger and freight services, through a service provided by major rail carriers.

Bus Network

The existing bus network in the Niagara Frontier Corridor includes inter-urban transit and municipal transit service.

Air Transportation Network

The existing air transportation network within the corridor includes international and regional airports.

3.2 NIAGARA INTERNATIONAL TRANSPORTATION TECHNOLOGY COALITION

Niagara International Transportation Technology Coalition (NITTEC) is a road management system used in the Niagara Falls-Buffalo region, allowing transportation agencies to collaborate and manage the multi-modal transportation systems, making it possible to reach mobility, reliability and safety improvements in the region. NITTEC helps coordinate and facilitate communication between regional transportation agencies, in both Canada and the United States.

NITTEC Regional Concept for Transportation Operations

NITTEC was formed in 1995, with 14 members, each holding a Policy Board seat. In 2008, NITTEC set forth a new membership, committee, staff, and funding structure for the organization. Table 3.3 shows current NITTEC member agencies and related organizations.

Table 3.3 NITTEC Stakeholders

Member agencies	Other related organizations
Buffalo and Fort Erie Public Bridge Authority (PBA)	Canada Border Services Agency (CBSA)
City of Buffalo	Federal Highway Administration (FHWA)
City of Niagara Falls, New York	Greater Buffalo-Niagara Regional Transportation Council (GBNRTC)
City of Niagara Falls, Ontario	New York State Police (NYSP)
*Erie County	Ontario Provincial Police (OPP)
*Ministry of Transportation, Ontario (MTO)	United States Customs and Border Protection (USCBP)
*New York State Department of Transportation (NYSDOT)	State University of New York at Buffalo
*New York State Thruway Authority (NYSTA)	Other local and regional police and emergency services agencies
Niagara County	Recovery companies
Niagara Falls Bridge Commission (NFBC)	
*Niagara Frontier Transportation Authority (NFTA)	
Niagara Parks Commission	
Niagara Region	
Town of Fort Erie	

* Agencies included in the Policy Board

Source: NITTEC Transportation Operations – Integrated Corridor Management Requirement Document

Table 3.3 shows all member agencies of NITTEC, identifying the five current members of the Policy Board. The importance of the Policy Board members is that each has one vote on the Board of Directors (BOD). The rest of the member agencies are required to participate in the different Committees, and may attend BOD meetings as non-voting participants. Other related organizations may participate in Committees and BOD meetings as non-voting participants.

NITTEC's governing structure consists of the BOD and eight committees. The BOD provides overall program and policy direction to NITTEC. It also establishes operating procedures and oversees NITTEC's annual budget. It accepts new members to the Policy, General, and Affiliate Member classes.

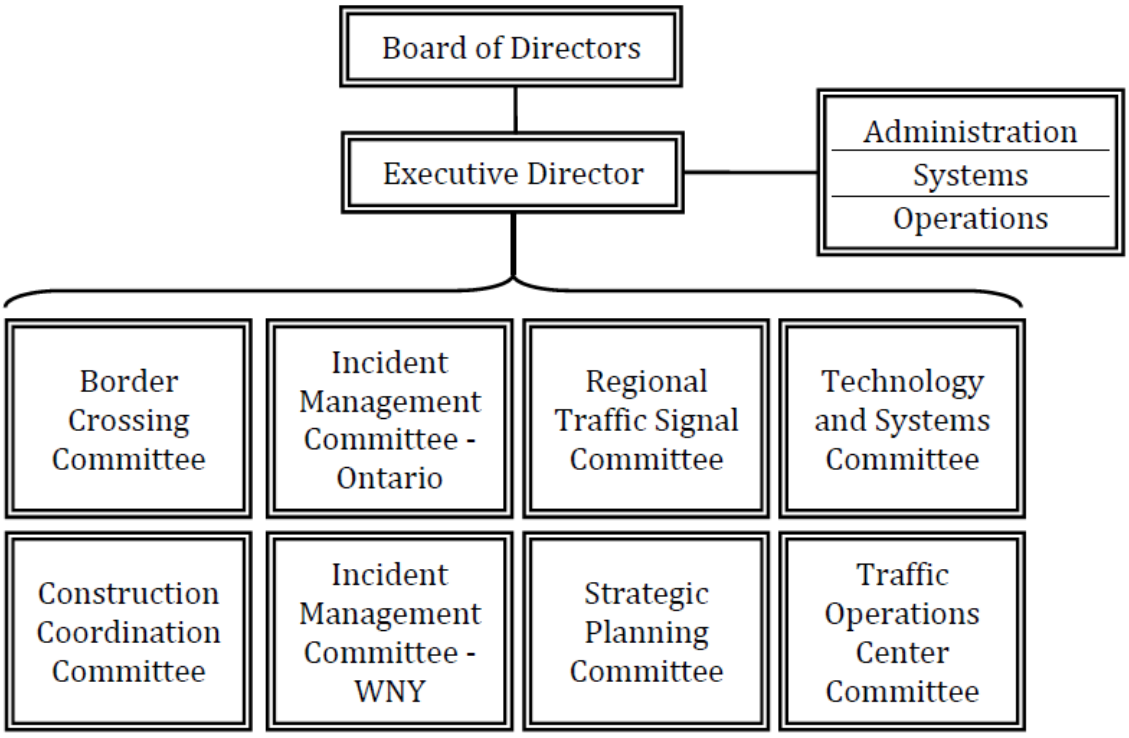
The BOD facilitates the coordination of capital and operational issues among the NITTEC Members. It provides oversight and approval responsibilities for the activities of the NITTEC Executive Director. The BOD provides oversight and approval responsibilities for the activities of all Committees.

There are eight Committees currently operating in NITTEC. Each Committee prepares and submits individual Committee accomplishments and work plans. The eight committees include:

- Border Crossing Committee,
- Construction Coordination Committee,
- Ontario Incident Management Committee,
- Strategic Planning Committee,
- Traffic Operations Center Committee,
- Technology and Systems Committee,
- Western New York Incident Management Committee.
- Regional Traffic Signal Committee

Figure 3.1 shows the organizational structure of NITTEC.

Figure 3.1 NITTEC Organizational Chart



Source: NITTEC Regional Concept for Transportation Operations

For funding, the NITTEC Executive Director prepares an annual budget for the fiscal year. The BOD reviews the proposed budget, and once approved, NYSDOT incorporates the budget into its presentation to the Greater Buffalo-Niagara Regional Transportation Council on behalf of NITTEC for inclusion in the region's Transportation Improvement Program (TIP).

A detailed description of NITTEC Transportation Operations functionality and activities can be reviewed in the NITTEC Regional Concept for Transportation Operations Report. This report shows operational goals and performance measures set for short and long-term horizons, as well as policies and procedures for day-to-day activities.

4.0 Integrated Corridor Management

An important product from the NITTEC Transportation Operations study, besides the aforementioned ***Regional Concept for Transportation Operations Report***, was the development of the Integrated Corridor Management (ICM) regional initiative. This initiative is described in detail in the ***ICM Requirements Document***, and the ***ICM System Operational Concept Report***. The objective of this section is to describe the ICMS initiative as it was initially conceived, identifying strengths and areas where concepts need to be updated to ensure a successful state-of-the-art ICM deployment strategy.

Generally, an ICM initiative consists of "the operational coordination of multiple transportation networks and cross-network connections comprising a corridor, and the coordination of institutions responsible for corridor mobility. The goal of ICM is to improve mobility, safety, and other transportation objectives for travelers and goods."[1] Based on this general vision, NITTEC developed specific goals and objectives for the Niagara Frontier ICM initiative

4.1 GOALS AND OBJECTIVES

The overall purpose of the ICM is to achieve the combined stakeholder vision of efficient transportation operations within the corridor. The ICM is intended to provide improved integration of operational procedures, facilitate improved emergency response, and dissemination of traveler information.

Based on this general purpose, Table 4.1 shows the specific goals set for each category of action.

[1] From FHWA, FTA, Integrated Corridor Management – Concept Development and Foundational Research, Task 2.3 –ICMS Concept of Operations for a Generic Corridor (2006).

Table 4.1 ICM Goals and Objectives

Category	Objective	Short Term Goal	Long Term Goal	Performance Measure
I. Agency Coordination	Improve center-to-center communications	1. Center-to-center (C2C) communications is functioning among all transportation related agencies in the corridor	1. Center-to-center (C2C) communications is functioning among all transportation related agencies in the corridor	1. Evaluate the use of established center-to-center communication links a. Number of agencies b. Monthly activity c. Monthly down time
II. Traveler Information	A. Improve accuracy of congestion (travel time) information reliability	1. Reduce the variation in travel times experienced by travelers throughout the corridor by 25 percent 2. Posted travel times are within 20 percent of measured travel times 3. Travel time information sources have an up-time of 99 percent 4. System element down time averages less than 12 hours per element failure 5. System (as a whole) down time averages less than four hours per system failure	1. Reduce the variation in travel times experienced by travelers throughout the corridor by 35 percent 2. Posted travel times are within 10 percent of measured travel times 3. Travel time information sources have an up-time of 99.9 percent 4. System element down time averages less than 10 hours per element failure 5. System (as a whole) down time averages less than four hours per system failure	1. Monthly variation for selected times and links 2. Compare posted travel times with measured travel times for selected time periods and links 3. Monthly up-time 4. Monthly down time per element 5. Monthly system down time
	B. Enable intermodal choices through improved traveler information	1. Transit information has been integrated into the highway information network 2. Traveler information usage has increased by 150 percent 3. An 85 percent customer traveler information satisfaction rating has been achieved among local commuters and border crossing commuters receiving information 4. Travelers are provided with various modal and route options to effectively travel throughout the corridor that enable them to make choices regarding: Departure time, Mode and route	1. Transit information has been integrated into the highway information network 2. Traveler information usage has increased by 200 percent 3. An 90 percent customer traveler information satisfaction rating has been achieved among local commuters and border crossing commuters receiving information 4. Travelers are provided with various modal and route options and are also provided with the current conditions facing each option	1. Traveler information is integrated 2. Evaluate the use of traveler information monthly a. Traveler surveys are conducted b. Web site hits c. 511 telephone service calls 3. Yearly traveler surveys 4a. Static traveler information is in place 4b. Dynamic traveler information is in place

Table 4.1 ICM Goals and Objectives (con't)

Category	Objective	Short Term Goal	Long Term Goal	Performance Measure
II. Traveler Information (con't)	C. Improve integration of weather information/data for traveler information, and for maintenance operations	1. Weather information/data sources is integrated into all traveler information services 2. Relationship with weather information/data sources has increased by 5 percent 3. Weather information/data is integrated into all maintenance call-out procedures and systems for managing operations	1. Weather information/data sources is integrated into all traveler information services 2. Relationships with weather information/data sources has increased by 10 percent 3. Weather information/data is integrated into all maintenance call-out procedures and systems for managing operations 4. Integration of the RWIS between the region and the province is functioning 5. RWIS is integrated into all traveler information services	1. Successful integration has been accomplished 2. Number of relationships with weather information/data sources 3. Successful integration has been accomplished 4. Successful integration has been accomplished 5. Successful integration has been accomplished
	D. Improve integrated operations based on real-time data	1. Use of real-time data has been determined 2. The system has an up-time of 99 percent 3. New technology is integrated at least every four years	1. Real-time data is used to improve operations 2. The system has an up-time of 99 percent 3. New technology is integrated at least every four years	1. Use of real-time data has been determined and is in use 2. Monthly up-time 3. Frequency of system element updates
III. Mobility (Arterial, Border, Freeway, Transit)	A. Maximize the free flow of traffic and reduce congestion	1. 50 percent of the identified arterials within the ICM corridor are coordinated across jurisdictions. 2. A central source directly or indirectly manages and operates 50 percent of the corridors in the ICM 3. Key signals in the corridor are retimed every three years	1. All identified arterials within the ICM corridor are coordinated across jurisdictions 2. A central source directly or indirectly manages and operates all corridors in the ICM 3. Key signals in the corridor are retimed every three years	1. The percentage of coordinated corridors 2. Percentage of the ICM corridors operated by a central source 3. Number of key signals retimed every three years
	B. Provide transit alternative and park-and-ride facilities	1. Transit ridership has increased 1 ½ times the percent of traffic volume increase 2. The number of park-and-ride facilities has increased by 10 percent	1. Transit ridership has increased 2 times the percent of traffic volume increase 2. The number of park-and-ride facilities has increased by 20 percent	1. Percentage of ridership increase 2. Number of park-and-ride facilities

Table 4.1 ICM Goals and Objectives (con't)

Category	Objective	Short Term Goal	Long Term Goal	Performance Measure
III. Mobility (con't)	C. Enhance border crossing clearance	1. Total border delay time has decreased by 5 percent from existing demand levels	1. Total border delay time has decreased by 15 percent from existing demand levels	1. Monthly total border delay time during selected times and periods
	D. Facilitate ITS and operational improvements that will facilitate ICM mobility	1. The VMS, Travel Time readers and CCTV have been deployed in accordance with the ICM	1. The VMS, Travel Time readers and CCTV deployed is maintained 2. The HAR system fully covers the ICM corridor	1. Number of VMS, Travel Time readers and CCTV deployed per year 2. HAR system coverage in the ICM corridor
	E. Enhance alternative route management capabilities	1. Develop one arterial signal system and integrate with related freeway management systems 2. Operate signals and freeways in one corridor as a system 3. Provide additional instrumentation on three primary arterials 4. Provide additional instrumentation on one parallel arterials that may be designated as diversion routes	1. Develop three arterial signal systems and integrate with related freeway management systems 2. Operate signals and freeways in three corridors as systems 3. Provide additional instrumentation on five primary arterials 4. Provide additional instrumentation on three parallel arterials that may be designated as diversion routes	1. Number of integrated systems 2. Number of corridors operating as a system 3. Number of arterials instrumented 4. Number of parallel arterials instrumented
IV. Incident Management	A. Establish incident classifications and severity guidelines	1. Develop agreed upon definitions for minor, intermediate, and major incidents 2. Define incident severity guidelines based on: Incident Severity, Field Conditions, Resources needed, and Estimated incident duration	1. Utilize agreed upon definitions for minor, intermediate, and major incidents 2. Utilize incident severity guidelines	1a. Incident definitions agreed upon 1b. Incident definitions universally used 2. Incident severity guidelines are defined

Table 4.1 ICM Goals and Objectives (con't)

Category	Objective	Short Term Goal	Long Term Goal	Performance Measure
IV. Incident Management (con't)	B. Improve and coordinate incident management	1. Meetings are held among transportation agencies monthly	1. Meetings are held among transportation agencies every month	1. The number of meetings held per year
		2. Average incident detection to arrival time is less than 8 minutes	2. Average incident detection to arrival time is less than 6 minutes	2. Monthly average incident detection to arrival time
		3. Average incident detection to lane clearance time is reduced by 20 percent	3. Average incident detection to lane clearance time is reduced by 30 percent	3. Monthly percentage reduction of average incident detection to lane clearance time
		4. Average time from detection to back to normal conditions is reduced by 15 percent	4. Average time from detection to back to normal conditions is reduced by 20 percent	4. Monthly percentage reduction of average time from detection to back to normal conditions
		5. All incident measures are uniform for all jurisdictions	5. All incident measures are uniform for all jurisdictions	5. Incident measures are uniform
		6. Responder training exists, which provides guidance on relaying accurate information on what equipment is needed for various incidents	6. Responder training exists, which provides guidance on relaying accurate information on what equipment is needed for various types of incidents	6. The number of training and exercise sessions held yearly
		7. An integrated corridor approach is established for:	7. An integrated corridor approach is provided during:	7. An integrated corridor approach is functioning for:
		a. Incident management	a. Incident management	a. Incident management
		b. Special or planned events	b. Special or planned events	b. Special or planned events
		c. Emergencies within the corridor	c. Emergencies within the corridor	c. Emergencies within the corridor

Source: NITTEC Transportation Operations Integrated Corridor Management Requirements Document, January 2010

Recommendations

Table 4.1 shows a clearly defined set of goals and objectives for the ICM initiative. The short and long-term goals have been set based on the performance measures identified. In reviewing the existing goals and objectives with respect to the current I-190 ICM AMS effort, it is generally agreed that they are still valid.

However, as part of the current I-190 ICM AMS effort, there may be value in synthesizing the set goals across the different categories. Additionally, some categories have a large number of performance measures, increasing the complexity of the future evaluation procedures. It may be determined advisable that goals are further simplified for an easier implementation and evaluation strategy.

4.2 SYSTEM COMPONENTS

This section provides a brief summary of existing and planned systems that the ICM initiative considers for its operations. Table 4.2 provides the details of the stated existing and planned system devices, according to the Requirements Document.

Table 4.2 Existing and Planned System Devices

System Device	Owning Agency	Existing or Planned
Bridge Border Crossing Systems	CBSA/USCBP	Existing
Canadian Border Inspection Sensor Systems	CBSA	Planned
Canadian Border Inspection Systems	CBSA	Existing
City of Buffalo Coordinated Traffic Signal System	City of Buffalo	Planned
City of Buffalo Parking Management System	City of Buffalo	Existing
EcoTrafiX	NITTEC	Planned
Managed Reversible Lane System	PBA	Existing
MPO Data Collection and Reporting System	GBNRTC	Existing
Local Traffic Signal Control Systems	Local DPW	Planned
MTO Asset Management System	MTO	Planned
MTO TRIP (Traveler Road Information Project)	MTO	Existing
MTO TRIS (Traveler Roadway Information System)	MTO	Existing
COMPASS System	MTO	Existing
MTO Road Weather Information System (RWIS)	MTO/Niagara Region	Existing
Queue End Warning System	MTO	Existing
Managed Reversible Lane System	NFBC	Existing

System Device	Owning Agency	Existing or Planned
NITTEC TOC Archive Management System Communications Log	NITTEC	Existing
TRANSMIT (TRANSCOM's System for Managing Incidents & Traffic)	NITTEC	Existing
CROSSROADS (NITTEC's Advanced Traffic Management System)	NITTEC	Existing
NYSDOT Asset Management System	NYSDOT	Existing
NYSDOT Conditions Acquisition Reporting System (CARS)	NYSDOT	Existing
NYSDOT Public Information Office System	NYSDOT	Planned
NYSDOT Road Weather Information System	NYSDOT	Planned
NYSDOT Traffic Signal Inventory System and Maintenance System	NYSDOT	Existing
NYSDOT 511 System	NYSDOT	Existing
Queue End Warning System	NYSDOT	Planned
NYSTA Lane Closure Reporting System	NYSTA	Existing
NYSTA Maintenance Management System (MMS)	NYSTA	Existing
NYSTA Statewide Operations Center Archive Management System	NYSTA	Existing
NR Asset Management System	Niagara Region	Planned
ITS Field Elements	NYSDOT/NFBC/ NYSTA/MTO/ PBA	Existing

Source: NITTEC Transportation Operations Integrated Corridor Management Requirements Document, January 2010

Recommendations

A review of Table 4.2 was undertaken to understand the current state of the system, and to identify possible new systems that may be considered under the current I-190 ICM initiative. The following transportation systems can be considered for the I-190 corridor, as smart corridors across the country continue to implement them to enhance traffic operations:

- **Ramp Metering System**. "Ramp meters are traffic signals installed on freeway on-ramps to control the frequency at which vehicles enter the flow of traffic on the mainline."[2] Ramp metering reduces overall freeway congestion by

[2] US Department of Transportation, Federal Highway Administration, Office of Operations, http://www.ops.fhwa.dot.gov/publications/fhwahop14020/sec1.htm

managing the amount of traffic entering the mainline and by breaking up platoons that make it difficult to merge onto the freeway.

- **Travel Time Monitoring System.** This system allows the continuous real-time monitoring of speeds and travel time on corridors that are not currently monitored through the TRANSMIT program. There are different alternatives to monitor travel times, including Bluetooth monitoring devices and probe vehicle information from public sources, such as the National Performance Management Research Data Set (NPMRDS), or private vendors like Inrix, HERE, and TomTom.
- **Vehicle Video-detection System**. Smart corridors across the US are currently implementing traffic vehicle video-detectors, substituting loop detection technology in particular. This technology provides a cost-effective solution to maintenance and construction activity or permanent changes in lane or road configuration.

4.3 INSTITUTIONAL FRAMEWORK

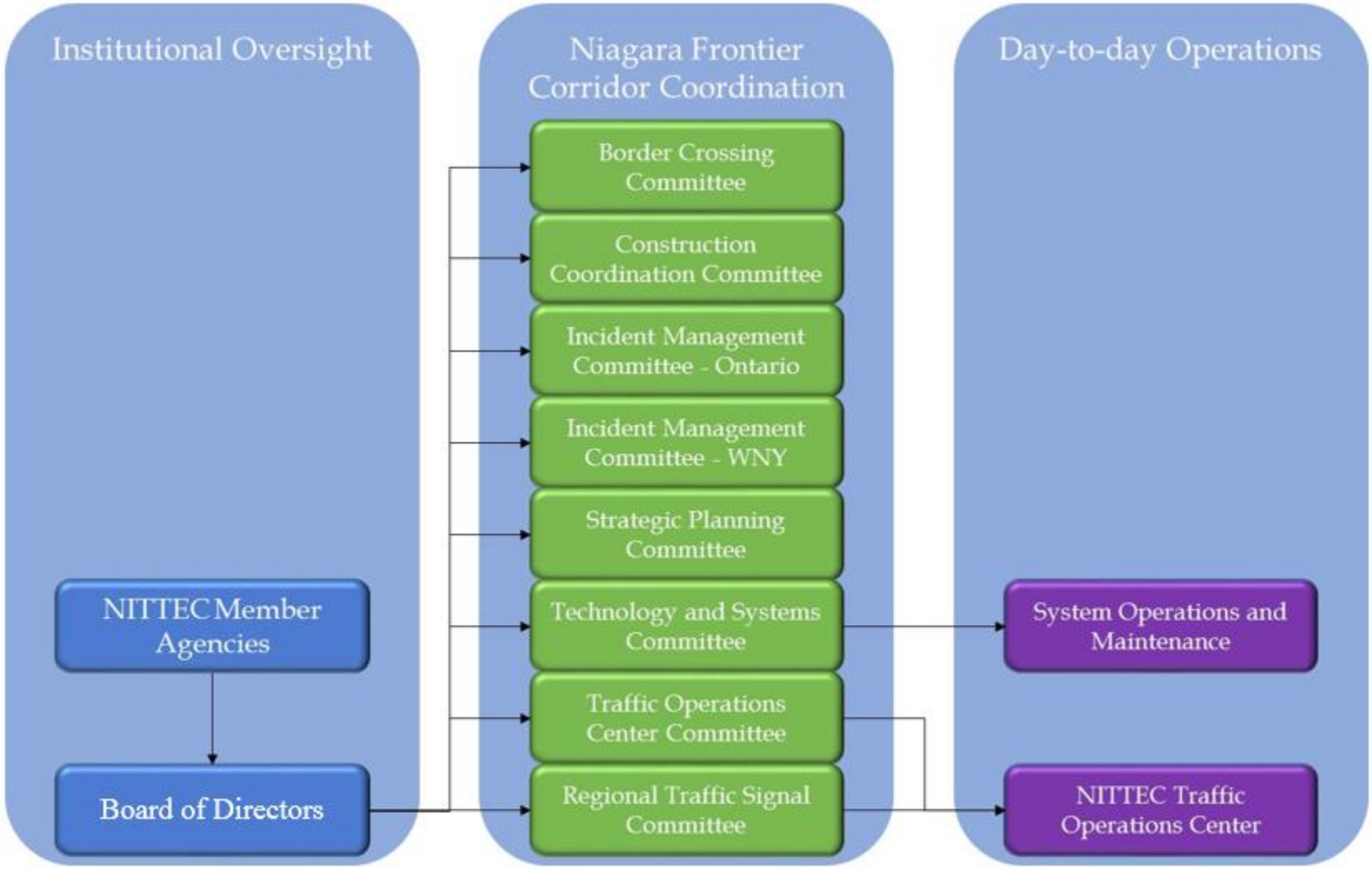
This section summarizes the proposed institutional framework described in the NITTEC Systems Operational Concepts Report. Three key roles were envisioned in the Operational Concepts report to manage the ICM initiative:

- **"Institutional Oversight –** Responsible for the ICM concept leadership, overall management, commitment monitoring, and stakeholder relationships and will include NITTEC member agencies, Board of Directors).
- **Niagara Frontier Corridor Coordination** - The institutional oversight of the BOD shall designate the corridor coordination to the respective NITTEC Committee. The designated Committee will manage the distribution of responsibilities, the sharing of control, and related functions among the corridor agencies. The body will also be responsible for recommending the necessary inter-agency and service agreements, budget development, project initiation and selection, corridor operations policies/procedures, and overall administration for the corridor.
- **Day-to-Day Operations** - This designation will include the NITTEC Traffic Operations Center as the central source for handling daily operations of the Niagara Frontier Corridor at the local level."[3]

The integration of the ICM institutional framework can be observed in Figure 4.1.

[3] The description of the institutional framework was obtained from the NITTEC Systems Operational Concepts Final Report.

Figure 4.1 Niagara Frontier ICM Institutional Framework



Source: Updated from NITTEC Transportation Operations Integrated Corridor Management System Operational Concept Final Report, September 2009

To further detail the operational concept of the ICM operations, the Operational Concept Report describes specific responsibilities for each agency/service involved. Table 4.3 shows a brief summary of these responsibilities; further detail can be seen in the Operational Concept Report.

Table 4.3 ICM Stakeholders' Responsibilities

Agency/Service	Responsibilities
NITTEC Traffic Operations Center	– Corridor coordinated operations – Corridor administration activities – Corridor performance monitoring – Corridor technical management and development – VMS – ITS device management (VMS, HAR, CCTV, etc.) – Enact/implement response plans
Bridge agencies • Buffalo and Fort Erie Public Bridge Authority • Niagara Falls Bridge Commission (NFBC)	– Daily corridor operations – Monitoring bridge traffic flow – Bridge surveillance – Enact response plans – Maintenance
Ministry of Transportation, Ontario (MTO)	– Daily corridor operations – Freeway management – Signal systems – ITS device management (VMS, CCTV, etc.) – Enact/implement response plans – Maintenance
New York State Department of Transportation (NYSDOT)	– Daily corridor operations – Freeway management – Signal systems – Maintenance
New York State Thruway Authority (NYSTA)	– Daily corridor operations – Freeway management – Maintenance
Niagara Frontier Transportation Authority (NFTA)	– Daily operations – Monitor bus on-time levels – Monitor train schedules – Monitor parking conditions – Enact response plans
Local municipalities within: • Erie County, New York • Niagara County, New York	– Daily Operations – Arterial surveillance – VMS on arterials

Agency/Service	Responsibilities
• Niagara Region, Ontario	– Enact response plans
Local municipalities that maintain traffic signals	– Daily Operations – Signal systems
Emergency agencies • Erie County Emergency Services • New York State Police (NYSP) • Niagara Falls Fire Department • Niagara Parks Police • Ontario Provincial Police (OPP) • NITTEC Incident Management Committee Members WNY & Ontario	– Emergency management – Coordination of law enforcement activities – Coordination of emergency services activities – Incident response management – Integration of Computer Aided Dispatch (CAD)

Source: NITTEC Integrated Corridor Management System Operational Concept Final Report

Recommendations

It is recommended through the current ICM AMS initiative that stakeholders involved review Table 4.3 and determine if stakeholders' responsibilities are still valid and appropriate, or if an update is required.

4.4 SYSTEM OPERATION

The NITTEC ICMS Operational Concept Report describe in detail not only the overall operational activities of the ICMS, but the day-to-day responsibilities for a successful operational strategy. This section presents an overall summary of this operational strategy. Further detail can be seen in the NITTEC ICMS Operational Concept Report.

The ICM operations can be summarized in the following strategies:

- Information Sharing/Distribution
  - Center-to-center (C2C) communications is functioning among agencies
  - Increase in traveler information services (web, 511, TV, radio)
  - Increase in traveler information usage
  - Reduce travel time variation
  - Integration of weather information into traveler information services
  - Integration of RWIS between the region and the province
  - Increase number of VMS, travel time readers, and CCTV deployed
  - Integrate transit information into the highway information network
- Improve the Operational Efficiency of Network Junctions and Interfaces

  - Facilitate ITS and operational improvements
  - Reduce system and system element down-time
  - Improve integrated operations based on real-time data
  - Integrate new technology
  - Develop uniform incident classifications and severity guidelines
  - Decrease detection, arrival, clearance and recovery times
  - Hold coordination meetings among agencies
  - Implement uniform incident measures
  - Conduct responder training
  - Utilize ICM approach for events
- Accommodate/Promote Cross-Network Route and Modal Shifts
  - Enable intermodal choices through improved traveler information
  - Provide travelers with various modal and route options
  - Increase transit reliability
  - Increase transit ridership
  - Increase the number of park-and ride facilities
- Manage Capacity/Demand Relationships within the Corridor on a "Realtime"/Short-term basis
  - Increase transit capacity
  - Increase corridor traffic signal coordination
  - Retiming of key signals in the corridor
  - Provide additional instrumentation on primary arterials
- Manage Capacity/Demand Relationships within the Corridor on a "Realtime"/Long-term basis
  - Enhance alternative route management capabilities
  - Appointment of a central source to manage and operate corridors in the ICM
  - Decrease total border delay time
  - Operate signals and freeways as a system

To follow these strategies, changes and additions have been set across the different set of stakeholder. Table 4.4 shows the changes and additions considered.

Table 4.4 Changes and Additions Considered for ICM Implementation

Stakeholder	Changes and Additions
Bridge agencies • Buffalo and Fort Erie Public Bridge Authority • Niagara Falls Bridge Commission (NFBC)	• Deployment of additional cameras • Vehicle processing technology for travel time reporting • Border Wait Time System reported wait times and delays on the Peace Bridge, the Queenston-Lewiston Bridge, and future deployment on the Rainbow Bridge, as a single source for real time traveler information.
Ministry of Transportation, Ontario (MTO)	• Additional CCTV coverage on the QEW, Highway 406, Highway 420 • Additional VMS sign locations on the QEW and Highway 406, and upstream of key decision points, especially on arterial highways • Additional TRANSMIT readers on Highway 406 • HAR on QEW • Automated data exchange interface with city, regions, and transit agencies • Expanded information dissemination system (increased information and corridor-wide view) • Expanded information dissemination (increased field dissemination devices) • GPS on service patrol/incident response/construction/maintenance vehicles (including subsystem for tracking) • Additional two-way communications linkages to support videosharing and other incident-related data • Border specific static/dynamic travel time signs
New York State Department of Transportation (NYSDOT)	• Additional CCTV coverage on I-190 • Additional VMS sign locations on I-190, Route 400, and upstream of key decision points, especially on arterial highways • Additional TRANSMIT readers on I-190, I-290, I-90, I-990, and Route 5, 400, 219 • Additional HAR on I-290 • Automated data exchange interface with city, county, and transit agencies • Expanded information dissemination system (increased information and corridor-wide view) • Expanded information dissemination (increased field dissemination devices) • GPS on service patrol/incident response/construction/maintenance vehicles (including subsystem for tracking) • Additional two-way communications linkages to support videosharing and other incident-related data • Border specific static/dynamic travel time signs
New York State Thruway Authority (NYSTA)	• Additional CCTV coverage

Stakeholder	Changes and Additions
	• Additional VMS sign locations, especially upstream of key decision points • Additional TRANSMIT readers • Additional HAR • Border specific static/dynamic travel time signs
Niagara Frontier Transportation Authority (NFTA)	• Monitor and communicate parking space availability within park-and ride facilities • Transit signal priority system • VMS for parking information dissemination • Interface with ATIS for providing and extracting real-time information • Additional spaces at park & ride lots • On-board devices for signal transit priority, including connection to schedule adherence system
Local municipalities within: • Erie County, New York • Niagara County, New York • Niagara Region, Ontario	• Enhanced controller software and communications with adjacent freeway ramp meters • Additional arterial VMS and cameras • Arterial VMS interface to freeway messages
Local municipalities that maintain traffic signals	• Upgrade traffic controllers and communications • New coordination timing of traffic signals
Emergency Agencies	• Enhancements to Computer Aided Dispatch (CAD) software to identify "best" routes • Interface to CAD, including protection/security of sensitive information
Corridor-wide	• Expanded travel information system to include additional information (transit travel times, arterial travel times, parking information, etc.) • ITS standards for center-to-center communications • Communications linkages between transportation management and emergency service centers (connect to existing subsystems)

Source: NITTEC Integrated Corridor Management System Operational Concept Final Report

Recommendations

It is recommended that stakeholders involved review Table 4.4 to confirm that all ICM operations are covered. If new ICM operations are being considered (such as ramp metering coordination or travel time collection via Bluetooth, among other possible technologies), they need to be added to the changes and additions required, and these changes need to be reflected on the I-190 ICM Plan and regional ITS Architecture.

4.5 SYSTEM EVALUATION

A set of performance measures has been defined to measure the ICM initiative's success.

Table 4.5 shows a list of all performance measures, and their short and long-term targets.

Table 4.5 Performance Measures and Targets

Performance Measures	Target
Accuracy of Travel Times	Short Term: • 25 percent reduction in travel time variation • Posted travel times within 20 percent of measured travel time • 95 percent up-time of travel time sources Long Term: • 35 percent reduction in travel time variation • Posted travel times within 10 percent of measured travel time • 98 percent up-time of travel time sources
System (as a whole) Down-Time (per system failure)	Short Term: Less than 4 hours (average) Long Term: Less than 3 hours (average)
System Element Down-Time (per element failure)	Short Term: Less than 12 hours (average) Long Term: Less than 10 hours (average)
Traveler Information Usage	Short Term: 150 percent increase Long Term: 200 percent increase
Customer Satisfaction	Short Term: 85 percent Long Term: 90 percent
Weather Information/Data Sources	Short Term: 5 percent increase in relationships Long Term: 10 percent increase in relationships
Transit Ridership	Short Term: 1 ½ times the percent of traffic volume increase Long Term: 2 times the percent of traffic volume increase
Park-and-ride Facilities	Short Term: 10 percent increase Long Term: 20 percent increase
Arrival Time (Average incident detection to arrival time)	Short Term: Less than 8 minutes Long Term: Less than 6 minutes
Clearance Time (Average incident detection to lane clearance time)	Short Term: 20 percent reduction Long Term: 30 percent reduction
Back to Normal Conditions Time (Average time from detection to back to normal conditions)	Short Term: 15 percent reduction Long Term: 20 percent reduction

Table 4.5 Performance Measures and Targets (con't)

Performance Measures	Target
Total Border Delay Time	Short Term: 5 percent decrease from existing demand levels Long Term: 20 percent decrease from existing demand levels
Arterial Coordination (within the ICM corridor)	Short Term: 50 percent are coordinated across jurisdictions Long Term: 100 percent are coordinated across jurisdictions
Signal Systems	Short Term: • One arterial signal system developed and integrated (with related freeway management systems) • Signals and freeways in one system operating as a system • Key corridor signals retimed every three years Long Term: • Three arterial signal systems developed and integrated (with related freeway management systems) • Signals and freeways in three systems operating as systems
Additional Instrumentation	Short Term: • On three primary arterials • On one parallel arterial (may be designated as a diversion route) Long Term: • On five primary arterials • On three parallel arterials (may be designated as diversion routes)

Source: NITTEC Integrated Corridor Management System Operational Concept Final Report

Recommendations

As suggested previously, the performance measures shown in Table 4.5 may be revisited with stakeholders and potentially reduced through the current ICM AMS efforts. Currently, there is a set of 15 performance measures. The ICM initiative may benefit from reducing the number of performance measures, but at the same time making sure that all modes of transportation are evaluated. As the current AMS effort proceeds, lessons learned from other ICM initiatives across the country regarding performance measures will be brought to the stakeholders for discussion. As part of these stakeholder discussions, the following suggestions for reducing and combining performance measures will be discussed:

- **Traveler Information Usage**. Although it is desirable to measure the effectiveness of traveler information systems, the set goals of 150% increase in the short-term horizon, and a 200% increase in the long-term horizon, maybe to be high considering the changing technology paradigm of wide-spread smartphones and with it increased access to traveler information. In the long-term traveler information is becoming increasingly available through private sources, and this is likely to continue as these capabilities are increasingly available in vehicle telematics systems. This performance measure also requires on baseline usage, which might be complicated to obtain from

privately owned information distribution means. Through the current ICM AMS efforts, these goals may be recommended to be reconsidered.

- **Back to Normal Conditions Time.** This performance measure seeks to describe the overall average time from detection to back-to-normal conditions. Back-to-normal conditions may need to be defined more clearly, as conditions on different times of day may show different "normal" conditions. Instead, the metric may be renamed 'Time to Return to Acceptable Operations' or 'Time to Return to Expected Operations' or even another term may be considered. While other influences will certainly influence this time, it is noted that this metric is directly influenced by the 'Arrival Time' and 'Clearance Time' metrics that are already evaluating the effectiveness of incident management improvements.
- **Arterial Coordination.** This performance measure targets the number of jurisdictions coordinated, and acts as a metric of interagency collaboration. An additional metric more purely related to the performance of the arterial and/or signal system may be warranted or desirable.