New York State Department of Transportation

Intelligent Transportation System (ITS) Study for the Buffalo and Niagara Falls Metropolitan Area Erie and Niagara Counties, New York

STRATEGIC PLAN
Working Paper # 7

June 18, 1997

Prepared by: DE LEUW, CATHER & COMPANY OF NEW YORK, INC.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION AND SCOPE

This document has been prepared as part of the New York State Department of Transportation (NYSDOT) Buffalo and Niagara Falls Intelligent Transportation System Study. This working paper utilizes input from the previous working papers to generate an overall plan for implementing an ITS regionally. This report provides a description of the area ITS projects, both underway and proposed, and relates each to the user services that they provide. The relationship of these projects to the necessary institutional structure is also presented.

1.1 PURPOSE OF STRATEGIC PLAN

The purpose of the strategic plan for the Buffalo/Niagara Falls region is to present a unified "roadmap" of ITS projects as well as identify project participants. By indicating participants, the groundwork for needed institutional relationships is laid.

1.2 METHODOLOGY

To develop a complete ITS plan for the Buffalo/Niagara Falls region, two key steps have been taken. The first step is to integrate existing ITS elements with proposed near term elements, creating an infrastructure foundation for future deployment initiatives. The second step is to lay out an implementation schedule that builds on the interrelationships among the various ITS elements. Supporting these steps, a discussion of qualitative benefits is included along with capital, operating and maintenance costs for each proposed near term and mid term project.

This page intentionally left blank.

2.0 TECHNICAL SCREENING

To identify particular ITS projects for the Buffalo/Niagara Falls region, the user services, as presented in Working Paper #3 (based on input from the User Services Workshop), are re-visited. The user services, together with available technologies, have been reviewed to create a list of proposed ITS projects, categorized by near, mid, and long term implementation time frames.

A summary of transportation problems and major impact factors in the region (as identified by the critical stakeholders in the User Services Workshop and subsequently throughout the project) is presented below. These problems are the basis for determination of user services and the subsequent development of the proposed projects.

- Funding - Funding needs include both operating dollars and capital improvement dollars for ITS projects. The difficulty in acquiring program funding for operations and maintenance leads to an inability to develop, operate or maintain an ITS infrastructure. Funding was ranked as the top immediate priority.

- Congestion - Relieving roadway congestion was cited as the number one way to improve the movement of people and goods in the area. Congestion ranked second only to funding in overall priority by the critical stakeholders. Influences on area congestion include (1) lack of staffing for incident management, service patrols and police, which cause response delays; (2) disabled or parked cars and special events as contributors to traffic delays, queuing and, ultimately, congestion; (3) manual toll collection; (4) major activity center destinations; (5) increasing volumes during the peak hours; and (6) an inability to build more capacity or divert traffic.

- Weather Related Conditions - Critical stakeholders were concerned about road surface (e.g. icing), high winds, and blowing/drifting snow on the raised portions of NY 5 along Lake Erie where lake effect snows and winds create a hazard. Workshop respondents added fog, heavy rains, floods, ice blockages, disabled/abandoned vehicles and parked cars to the list of weather related conditions over the entire region.

- Safety/Incidents - Several high accident locations exist in the region. Most are concentrated on the eastern half of the inner loop (NY 33 and NY 198) as well as on NY 33 from the inner loop out to the airport. A high number of accidents was also cited along the Queen Elizabeth Way (QEW) and PH 405, PH 420, and PH 3 in Ontario. Probable causes for safety problems and incidents include geometric problems and vehicular breakdowns resulting in primary and secondary accidents, personal insecurity, and congestion.

- Border Crossings - Congestion occurs at the four international border crossings during the morning and evening peak periods as well as weekend peaks. Customs and immigration processing has contributed to these delays. Customs/immigration pre-clearance is considered as one of the top system objectives for improving the movement of people and goods.

- Interorganizational / International Cooperation - Improved interagency coordination is required to allow sharing of relevant information, beyond phone and fax. Critical stakeholders indicated that achieving full interorganizational/international cooperation would be challenging, and thus was given a high priority.

- Transit Services - Several respondents commented on the need or desirability of improving transit service in Buffalo. The transit system includes park-and-ride facilities, bus routes and one light rail transit line. Transit in most areas, however, is not heavily utilized. The Niagara Frontier Transit Authority (NFTA) is currently restructuring the transit system to better serve their clients.

- Operations and Maintenance - Operation and maintenance problems consist of on-going activities such as snow and ice removal, pothole repairs and the impact of reconstruction activities on traffic. It is considered difficult to increase the work load of existing operations and maintenance personnel to include ITS.

- Recreational Travel / Tourism - The region is a major tourist destination due to the presence of Niagara Falls. In addition, several other existing and proposed attractions generate tourist trips, including a new gaming casino in downtown Niagara Falls, Ontario, just over the international border. Recreational trips and tourists trips are often made by drivers who are unfamiliar with the area.

- Privacy - Agencies were concerned over autonomous operation of regional facilities and protection of proprietary data. At a broader national level, ITS technology that can identify individual travelers and their location is a serious privacy concern.

- Public Support - There is a perceived lack of knowledge of ITS benefits among the general public. Additionally, with the staged installation of Variable Message Signs (VMS) for an en-route traveler information system and its currently limited data display, the traveling public currently doubts the value of a variable message sign system. The result has been some negative press and a drain on public support for future spending for additional similar installations.

2.1 PERFORMANCE CRITERIA

It is important that the ITS industry as a whole provide comprehensive system performance monitoring as a part of each deployed project. ITS projects must be cost accountable in order to sustain continued support and investment on the part of program stakeholders.

Some ITS features return benefits which are well demonstrated and easily quantifiable. For example, a number of toll road authorities throughout the U.S. have documented operational cost savings and improved throughput/revenues attributed to electronic toll collection. Other ITS features, such as reduced motorist delay due to incident management, are more difficult to quantify in monetary terms.

In order to help expedite the demonstration and quantification of benefits from ITS features, the user services planning approach established by FHWA incorporates the establishment of performance criteria. Table 2-1, on the following pages, summarizes performance Measures of Effectiveness (MOE) for each of the candidate user service objectives.

It is intended that ITS for the Buffalo/Niagara Falls area be developed with consideration of the performance criteria and associated monitoring approach. To the greatest extent possible, system processing should include automated monitoring, record keeping analysis, and reporting for the identified parameters. Program administrators can use this performance monitoring to track system benefits as a function of the ITS features introduced. The criteria table illustrates that there are a number of monitoring parameters which address the performance criteria for multiple goals/objectives. High priority monitoring functions include:

- collection and storage of network volume and speed data from which several measures can be derived;
- monitoring of incident response times/logs;
- analysis of accident trend data;
- monitoring of transit system schedule adherence;
- transportation infrastructure, operations and maintenance costs.

A key challenge in demonstrating system performance is the assembly of "before" data for purposes of comparison after ITS features are operational. To the greatest extent possible, existing automated monitoring features, such as permanent count stations and the NYSDOT Accident Surveillance System, should be used to assemble a "before" data set. The experience in integrating large scale ITS deployments in other areas such as Long Island, Toronto, and San Antonio suggests that there is an opportunity to use system components to collect "before" data during the system integration process, just before formal operations commence. This opportunity lasts three to nine months while various field subsystems are being tested, calibrated, and integrated to function as a complete system. The ITS program management process for Buffalo/Niagara Falls should emphasize a structured approach to collecting "before data" as part of the system integration process. The NYSDOT Accident Surveillance System will be used to measure "before" and "after" conditions. In addition, proposed vehicle detector stations and/or upgrades will be the first ITS elements to be up and running. This will allow the vehicle detectors to be used to collect data representative of the "before" condition.

TABLE 2-1
PERFORMANCE CRITERIA SUMMARY

PROBLEM/NEED CATEGORY	GOAL/OBJECTIVES	USER SERVICE(S)	PERFORMANCE MOE
Congestion	*Manage and Reduce Congestion*		
	Increase operational capacity	Traffic Control	increased throughput reduced delay reduced demand reduced incident response time reduced peak demand volumes reduced recurring and non-recurring congestion delay reduced fuel consumption reduced cost improved reliability
	Reduce delays, fuel consumption	En-Route Driver Information	
		Incident Management	
	Manage peak period vehicle demand Manage peak "person" demand	Pre-Trip Travel Information	
		Commercial Fleet Management(Freight Mobility)	
		Demand Management and Operations	
	Reduce unnecessary vehicle miles traveled (VMT)	Route Guidance	
	Expedite toll collection	Electronic Payment Services	
	Improve incident management	Incident Management	
	Manage/plan special event/destination traffic	Pre-Trip Travel Information	
		En-Route Driver Information	
		Traffic Control	
		Public Transportation Management	
	Improve environmental/air quality	Emissions Testing & Mitigation	
	Better inform public on congestion / incidents	En-Route Driver Information	

TABLE 2-1
PERFORMANCE CRITERIA SUMMARY

PROBLEM/NEED CATEGORY	GOAL/OBJECTIVES	USER SERVICE(S)	PERFORMANCE MOE
Weather-Related Conditions	*Minimize Adverse Weather Effects on Travel*		
	Provide reliable road/weather information to travelers	***Road/Weather Information Service***	reduced accident rate during inclement weather reduced traffic volumes accurate reporting of weather conditions and road events reduced event response times reduced incidence of inappropriate response
	Standardize travel messages; equipment/devices & policies		
	Reduce accident frequency	En-Route Driver Information	
		Pre-trip Travel Information	
		Collision Avoidance/Vision Enhancement/Automated Highway Systems	
	Control known trouble locations	Traffic Control	
	Effectively deploy maintenance/incident management/emergency equipment	Emergency Vehicle Management	
		Demand Management & Operations	

TABLE 2-1
PERFORMANCE CRITERIA SUMMARY

PROBLEM/NEED CATEGORY	GOAL/OBJECTIVES	USER SERVICE(S)	PERFORMANCE MOE
Safety/Incidents	*Improve Safety*		
	Reduce accident frequency	En-Route Driver Information	reduced property damage, injury, and loss of life reduced personal security violations, increased apprehension of violators reduced incident delays reduced travel times, during/after incidents
		Collision Avoidance/Vision Enhancement/Automated Highway Systems	
	Reduce accident severity	Emergency Notification and Personal Security	
		Safety Readiness	
		Pre-Crash Restraint Deployment	
	Improve response/removal time to incidents	Incident Management	
	Improve incident reporting & information sharing	Emergency Vehicle Management	
	Increase personal security & personnel security	Emergency Notification and Personal Security	
		Public Travel Security	
	Improve hazardous material monitoring and incident response	Commercial Fleet Management(Freight Mobility)	
		Hazardous Materials Incident Response	
	Inform public	Pre-Trip Travel Information	
		En-Route Driver Information	

TABLE 2-1
PERFORMANCE CRITERIA SUMMARY

PROBLEM/NEED CATEGORY	GOAL/OBJECTIVES	USER SERVICE(S)	PERFORMANCE MOE
Border Crossings	*Increase Processing Efficiency (border crossings)*		
	Expedite on-site and off-site credential processing	***Customs/Immigration Inspection and Clearance***	increased throughput decreased operating costs decreased payment handling losses reduced delay, reduced fuel consumption reduced emissions
		Traffic Control	
		Emergency Notification and Personal Security	
		Commercial Vehicle Electronic Clearance	
	Enhance collection handling	Electronic Payment Services	
	Automate border crossing devices	Commercial Vehicle Electronic Clearance	
	Provide adequate staff Enhance Risk Assessment	***Interorganizational/ International Management and Coordination***	
	Eliminate unnecessary processes	Demand Management and Operations	
	Coordinate functions/processes between sites	Commercial Vehicle Administrative Processes	
	Improve hazardous material monitoring and spill response	Hazardous Material Incident Response	
	Mitigate localized emissions pollution	Emissions Testing & Mitigation	

TABLE 2-1
PERFORMANCE CRITERIA SUMMARY

PROBLEM/NEED CATEGORY	GOAL/OBJECTIVES	USER SERVICE(S)	PERFORMANCE MOE
Interorganizational/International Cooperation	*Ensure Cooperative Spirit/Elevate Interorganizational/International Interaction*		
	Develop common goals/terminology	***Interorganizational/ International Management and Coordination***	reduced infrastructure costs increased information exchange reduced operations costs improved service responsibility improved incident response
	Coordinate plans/programs/ activities/processes		
	Reduce overlap in roles/ responsibilities/functions		
	Maintain autonomy		
	Promote/improve public agency image; better inform the public		
	Increase/maximize use of ITS capabilities		
	Resolve institutional barriers		
	Develop common terminology		
	Liberalize union work rules		
	Share resources		
	Establish an information exchange network		

TABLE 2-1
PERFORMANCE CRITERIA SUMMARY

PROBLEM/NEED CATEGORY	GOAL/OBJECTIVES	USER SERVICE(S)	PERFORMANCE MOE
Transit Services	*Increase Transit Use*		
	Reduce SOV use Provide "competitive" travel options Improve multimodal access and information Improve schedule adherence	Public Transportation Management En-Route Transit Information Traffic Control	improved service reliability reduced costs increased revenues improved travel times
	Alter public perceptions Coordinate regional service providers: public and private Enhance traveler security Enhance transit services	***Interorganizational/ International Management and Coordination***	increased average occupancy reduced personal security violations
	Improve traveler security	Public Travel Security	increased apprehension of violators

TABLE 2-1
PERFORMANCE CRITERIA SUMMARY

PROBLEM/NEED CATEGORY	GOAL/OBJECTIVES	USER SERVICE(S)	PERFORMANCE MOE
Funding	*Leverage Financial Resources*		
	Identify funding mechanisms	***Financial Management***	increased benefit/cost reduced costs
	Secure non-traditional financial partners		
	Investigate opportunities to create cost efficiencies (procurement, contracting)		
	Increase priority of transportation funding		
	Balance capital and operating expenditures		
	Demonstrate economic benefit		
	Promote cost sharing	***Interorganizational/ International Management and Coordination***	
	Change enabling legislation as needed		
	Improve public/agency awareness of needs		
	Increase staffing for critical needs		
	Improve labor agreements		

TABLE 2-1
PERFORMANCE CRITERIA SUMMARY

PROBLEM/NEED CATEGORY	GOAL/OBJECTIVES	USER SERVICE(S)	PERFORMANCE MOE
Operations and Maintenance	*Enhance Productivity and Performance (Services and People)*		
	Maintain "driveable" roadway surfaces	***Operations Management***	reduced operations cost reduced maintenance costs
	Eliminate redundant functions		
	Cross-train existing staff		
	Reduce site-to-site travel		
	Streamline work processes		
	Manage construction schedules		
	Promote resource sharing	***Interorganizational/ International Management and Coordination***	

TABLE 2-1
PERFORMANCE CRITERIA SUMMARY

PROBLEM/NEED CATEGORY	GOAL/OBJECTIVES	USER SERVICE(S)	PERFORMANCE MOE
Recreational Travel/Tourism	*Facilitate Traveler Mobility (Residents and Visitors)*		
	Reduce unnecessary trip-making Provide border crossing information	En-Route Driver Information	reduced tourist and special event congestion increased throughput
		Pre-Trip Travel Information	
		Route Guidance	
	Provide reliable/accurate travel information	En-Route Driver Information	
		Pre-Trip Travel Information	
		En-Route Transit Information	
		Public Transportation Management	
		Personalized Public Transit	
	Capture economic benefits	Traveler Services Information	
Privacy	*Maintain Privacy*		
	Define / protect proprietary data	***Interorganizational/ International Management and Coordination***	increased public acceptance
	Safeguard individual liberties		
Public Support	*Inform / Educate the Public*		
	Use the media to promote a positive / proactive approach	***Interorganizational/ International Management and Coordination***	increased public knowledge of traffic and traveler management increased funding for ITS projects
	Develop and implement marketing strategies		

2.2 TECHNOLOGY ALTERNATIVES

The technical alternatives developed in Working Paper #6 provide some guidance to project implementation. These technologies are applied toward the solutions of the transportation problems identified earlier.

The following initial recommendations were made:

- Non-intrusive vehicle detection system - EIS RTMS microwave radar unit. (Needs to be confirmed by field testing.)
- Video detection system (intersection) - Autoscope Video Imaging 2004.
- In pavement detection system - Inductive loop (near term).
- CCTV, as needed - Details to be determined in design; color CCD for base technology, digital signal processor cameras recommended for further evaluation during design.
- Communications - SONET fiber optic backbone; spread spectrum for remote locations.
- Processing - Distributed - RISC or advanced PC based
- Variable Message Signs - LED
- Highway Advisory Radio - 10 Watt transmitter.

It must be recognized that virtually all of the technologies discussed are constantly evolving and improving. They were presented to provide a baseline for applying technology to the applicable user services in identifying future potential projects, and are subject to revision in the design stage.

This page intentionally left blank.

3.0 IMPLEMENTATION PRIORITIES

The ITS for Buffalo/Niagara Falls is being implemented on a project-by-project basis. This section provides a listing and description of all projects foreseen in the development of the ITS. Projects are categorized by their implementation time frame. Near term projects include all of the projects in the region that will be in place within 0 to 2 years (1996 to 1998). Mid term projects are those projects set for the 3 - 7 year time frame (1999 - 2003). Long term projects are those considered for the 8+ year time frame (2004 to 2010+).

Table 3-1 provides a summary listing of the ITS projects organized by ITS elements. Figures 3-1 through 3-8, located at the end of Chapter 3, provide geographical representations of the ITS elements provided by these projects. These figures are referenced as appropriate throughout the sections that follow.

Table 3-1 Project Summary

PROJECT NAME	IMPLEMENTATION TIME FRAME	PROJECT STATUS
Electronic Fare Collection (Dynamic Toll/Parking Fee Management Market Packages)[1]		
NYSTA EZ Pass	Near Term	In place
Common Smart Cards for Thruway, transit systems, Peace Bridge, etc.	Mid Term	Proposed
Signal Coordination (Surface Street Control Market Packages)		
Signal Coordination Projects (Franklin & Linwood & Others)	Near Term	In place
NYSDOT Video/Microprocessor Controlled Signals (with F/O interconnect) NY 5 Fuhrmann Blvd thru Woodlawn)	Near Term	Hardware in place 1996
NYSDOT Signal Coordination Project (219 Signals) (PIN5803.39)	Near Term	1997
Signal Coordination and Closed Loop Signal Applications projects	Mid Term	Proposed
Signal Coordination and Closed Loop Signal Applications projects	Long Term	Proposed
Bus Priority on Local Arterial - Demonstration Project	Mid Term	Proposed

[1] Market Packages are defined in detail in Section 2.1 of Working Paper # 4, *Functional Requirements*.

Table 3-1 Project Summary

PROJECT NAME	IMPLEMENTATION TIME FRAME	PROJECT STATUS
Electronic Clearance (Electronic Clearance Market Packages)		
Peace Bridge Intelligent Transportation Border Crossing System (PIN5804.35)	Near Term	1997
Expand Intelligent Transportation Border Crossing project to all crossings	Mid Term	Proposed
Monitoring/Information Dissemination (Network Surveillance Market Packages & Traffic Information Dissemination Market Packages)		
NYSTA & NYSDOT Permanent Vehicle Detector Stations (PVDS)	Near Term	In Place
Metro Networks Traffic Conditions Monitoring/Reporting (e.g., *TIP Cellular call-in)	Near Term	In Place
Niagara Parks Commission/NFBC TAR - 91.9 FM	Near Term	In Place
U.S. Department of Commerce Weather Advisory Radio - 1625.5 AM	Near Term	In Place
NFTA Automatic Vehicle Location (AVL)	Near Term	1997
NYSDOT Installation of Vehicle Detection Stations	Near Term	1997
NYSTA Installation of CCTV & VMS (I-190 Carolina interchange; I-190 Skyway) (TAB 95-63S)	Near Term	1997
NYSDOT Early Implementation of ITS (6 VMS, 7 RWIS, & 3 FMS - Skyway) PIN5803.38 D256835	Near Term	Fall 1996
Freeway Traffic Management System - Stage I (CCTV, PVDS Upgrade, VDS, COM SYSTEM, VMS, & HAR)	Near Term	Proposed
Staged expansion of FTMS (CCTV, AVI Readers, PVDS Upgrade, VDS, COM SYSTEM, VMS, & HAR)	Mid Term	Proposed
Staged expansion of FTMS (CCTV, AVI Readers, PVDS Upgrade, VDS, COM SYSTEM, VMS, & HAR)	Long Term	Proposed
NYSTA Highway Advisory Radio	Near Term	In Place
Traffic Operations Centers (Regional Traffic Control Market Package)		
NYSTA	Near Term	In Place
PBA	Near Term	In Place

Table 3-1 Project Summary

PROJECT NAME	IMPLEMENTATION TIME FRAME	PROJECT STATUS
NFBC	Near Term	In Place
NFTA Transit Control Center	Near Term	In Place
NYSDOT Traffic Operations Center	Near Term	In Place
NITTEC Interim Regional Operations Center	Near Term	In Place
NITTEC Regional Operations Center Upgrade (5804.08)	Near Term	Proposed
NITTEC ROC Information Exchange Network (5804.08)	Near Term	Proposed
Incident Management Program (Incident Management System Market Packages)		
Roving Service Patrol	Mid Term	Proposed
Interconnect to Mayday System	Mid Term	Proposed
Advanced Vehicle Control System (Collision Avoidance)	Long Term	Proposed
Multimodal Traveler Information (Broadcast Traveler Information Market Package & Interactive Traveler Information Market Package)		
Pre-Trip Traveler Information (WEB page, radio, TV, kiosks in transit areas)	Mid Term	Proposed
Road Weather Information System Interconnect	Mid Term	Proposed
Support for in-vehicle route guidance systems TRIS, Toronto expansion to Buffalo	Long Term	Proposed
En-Route Transit Information	Long Term	Proposed

User Services are defined in the national ITS Program Plan.
The user services provided by the ITS projects listed in this section are summarized by implementation time frame in Table 3-2 below.

Table 3-2 User Service Implementation Time Frame

USER SERVICE	NEAR TERM	MID TERM	LONG TERM
Electronic Payment Service		•	
Traffic Control	•	•	
Incident Management	•	•	
Interorganizational/International Management & Coordination*	•	•	
Commercial Vehicle Electronic Clearance	•	•	
Customs & Immigration Inspection & Clearance*	•	•	
Financial Management*[2]			
Hazardous Materials Incident Response	•		
Road/Weather Information Service*	•	•	•
Commercial Vehicle Administrative Processes	•		
Operations Management*	•	•	
En-Route Driver Information	•	•	•
Commercial Fleet Management	•		
Emergency Vehicle Management	•	•	
Emergency Notification and Personal Security	•		
Public Travel Security	•		
Pre-Trip Travel Information	•	•	
Route Guidance	•	•	•
Traveler Services Information		•	•
En-Route Transit Information	•		•

[2] This user service requires reorganization of the existing financial acquisition process. The development of projects to provide this user service are beyond the scope of this study.

Table 3-2 User Service Implementation Time Frame

USER SERVICE	NEAR TERM	MID TERM	LONG TERM
Public Transportation Management	•		
Safety Readiness**			
Railroad Crossing Protection			
Pre-Crash Restraint Deployment**			•
On-Board Safety Monitoring**			•
Intersection Collision Avoidance**			•
Emissions Testing & Mitigation			
Automated Roadside Safety Inspection			
Vision Enhancement for Crash Avoidance			•
Automated Highway Systems**			•
Lateral Collision Avoidance**			•
Longitudinal Collision Avoidance**			•
Ride Matching & Reservations			
Personalized Public Transit			

* New Buffalo Area Specific User Service

** User Service most probably will be implemented by others. Public agency interaction will be required.

3.1 NEAR TERM PROJECTS

A description for each of the near term (e.g. immediate term, early action) projects follows. Note that this project list includes existing, committed and proposed projects. For those projects that have not yet received approval or gone through the planning process (i.e., those that are being introduced here for the first time), a discussion of the potential benefits and a listing of the estimated capital, operating and maintenance costs is provided. The labor costs provided herein are unburdened costs (i.e., no markup for benefits is included).

3.1.1 Existing and Committed Near Term ITS Projects

Descriptions follow for those projects that are presently planned and funded. Start Year here defines the year the project will become operational, or the project is listed as "in place."

Number: TAB 95-63s
Name: Installation of VMS and CCTV
Start Year: 1997 (VMSs are in place)
Participants: NYSTA

Description: This project, described below, includes the installation of 9 VMS and 2 CCTV within the Buffalo area. The CCTV and VMS will be owned and maintained by NYSTA, however the NYSDOT is being provided with viewing capabilities of the CCTV.

CCTV Subsystem
The 2 CCTV cameras as shown in Figure 3-1 (see p. 3-57; one at the Virginia/Carolina Interchange along I-190 and the other at the top of the William J. Donovan Building - to view the southerly approach to the Peace Bridge, the elevated section of the I-190 and the northern section of the Skyway) are to be linked via fiber optic cable to a 64 input / 16 output matrix video switcher / controller at the ROC. The video information will be shared with the NYSTA via 28.8 kbs modems (one link to the local NYSTA Division Headquarters and another to the NYSTA Headquarters in Albany).

VMS Subsystem
As shown in Figure 3-2, four (4) VMSs are in place along the I-190 (southbound approaching the Buffalo Barrier, southbound approaching the NY 198 interchange, southbound approaching the Skyway / downtown Buffalo area, and southbound approaching the I-290 interchange). The remaining five (5) VMSs were placed along the I-90 (westbound approaching the NY 78 (exit 49), westbound and eastbound approaching the NY 33 interchange, westbound approaching the US 219 interchange, and eastbound approaching the NY 400 interchange). Via modem, the VMSs along the Thruway are controlled from the NYSTA local division headquarters, others will be controlled from the ROC.

It is recommended that a study be undertaken to assess the need for additional traffic devices, portable (VMS) and permanent (CCTV & HAR), to accommodate traffic resulting from the new casino in Niagara Falls, Ontario.

Primary User Services: Traffic Control
Incident Management
Roadway Weather Information Services
En-route Driver Information

Number: Not Assigned
Name: Installation of Permanent Vehicle Detector Stations
Start Year: 1996
Participants: NYSDOT

Description: The project to install Permanent Vehicle Detector Stations is 100% state funded and will result in a total of 137 permanent vehicle detector stations (PVDS) at various locations throughout the four county region.[1] This project provides for the installation of 97 PVDS. Of these 97, 75 are in Erie and Niagara Counties, with 47 of these on primarily controlled access facilities (freeways and major expressways) and 28 on lower classification roadways as shown in Figure 3-3b.

As this project is currently underway, NYSDOT already has 5 of these 97 permanent vehicle detector stations installed along the Kensington Expressway (NY 33) and 8 along the I-290. These 13 count stations currently consist of loops embedded in the pavement in a speed trap configuration. The loops feed into an empty cabinet. No intelligence (counters or controllers), power supplies, or data transmission devices currently exist at these locations. As part of this project, loops and cabinets will be installed at the remaining 84 locations throughout the region. Of these 84, 10 will be installed on the Kensington Expressway, bringing the total number of permanent vehicle detector stations along the Kensington Expressway to 15. Once installed, the stations will be used for short duration traffic counts, by temporarily hooking up count intelligence.

A future project will include the installation of intelligence, power and data transmission devices (modem, RF, or F/O cable) to link the stations to the ROC. Communications and data recovery software is expected to be obtained from NYSDOT Region 10.

Primary User Services: Traffic Control
Incident Management
En-route Driver Information

[1] There are 40 existing two-way permanent traffic count locations (Figure 3-3a) included in this total, however most are not in working order.

Number: PIN 5803.38, D256835
Name: Early Implementation of Intelligent Transportation Systems
Start Year: Early 1997 (VMSs are in place)
Participants: NYSDOT

Description: This project will include the installation of six (6) Variable Message Signs (VMS) as shown in Figure 3-2, seven (7) Roadway Weather Information System (RWIS) stations as shown in Figure 3-4 (note that two are off the map and are not shown) and three (3) Fixed Message Signs (FMS) as described below.

VMS Subsystem
Two VMSs are in place along the I-290 (westbound approaching the I-190 interchange, and eastbound approaching the I-90 interchange); one VMS was placed along the I-990 (southbound approaching the I-290 interchange); one VMS was placed along the NY 198 (westbound approaching the I-190 interchange). The remaining two VMSs were placed along the NY 33 (westbound and eastbound of the I-90 interchange). The VMSs are controlled from the ROC via modem. These VMSs are shown in Figure 3-2.

RWIS Subsystem
RWIS stations are to be placed along the I-290 (east and west of the I-990 interchange). Another RWIS station is to be placed at the south end of NY 33, along NY 5 (Fuhrmann Boulevard just north of Tift Street), along US 219 (at the NY179 and Genesee Road interchanges), and along I-190 (north of the NY 31 interchange in the Town of Lewiston). The weather stations record: humidity, atmospheric pressure, temperature, visibility, wind speed, and wind direction and utilize roadway sensors to determine the solidity of water mixture on the pavement and as well as subsurface sensors to determine the temperature. The temperature/solidity information will be used to determine the potential of freezing. The stations will be used to send data to the planned ROC via modem. Five of these RWIS locations are shown in Figure 3-4.

FMS Subsystem
The Fixed Message Signs (FMS) will be an addition to the existing Skyway closing system to include signs which will notify motorists from the Southtowns. Two signs will be installed in the Town of Hamburg along US 20 and NY 75 as they approach the I-90 interchange. Another sign will be placed along US 62 as it approaches NY 179 in Blasdale.

Primary User Services:	Traffic Control	En-route Driver Information
	Incident Management	Emergency Vehicle Management
	Roadway Weather Information Services	

Number: Not Assigned
Name: Electronic Toll Collection and Traffic Management
Start Year: 1996
Participants: NYSTA

Description: The New York State Thruway Authority's (NYSTA) EZ-Pass consists of a module (windshield mount) which transmits information to/from the EZ-Pass station. The system allows users to pass through the toll plaza at speeds of up to 5 mph. The system collects information such as toll plaza used, lane used, and time of pass and automatically charges the toll amount to the user's account. The existing system is for automobiles only. A truck and bus system is presently under development. Currently, EZ-Pass lanes are in use at all 63 toll barriers on the Thruway. Within the project area EZ-Pass is located at the Grand Island Bridges (North & South), the Black Rock Toll Barrier, the Buffalo Toll Barrier, the Lackawanna Toll Barrier, and the Williamsville Toll Barrier.

As part of the EZ-Pass Interagency Group (a coalition of seven toll authorities in New York, New Jersey, Delaware, and Pennsylvania), the NYSTA is deploying electronic toll collection and traffic management on its facilities. The NYSTA's aggressive program has resulted in the application of Automatic Vehicle Identification (AVI) technology to all 63 toll plazas of the Thruway's 641 mile system (completed early December 1996).

The location of the existing and proposed EZ-Pass equipped toll barriers throughout the study area are shown in Figure 3-5.

Primary User Services: Traffic Control
Incident Management
Electronic Payment Service

Number: Not Assigned
Name: Video/Microprocessor Controlled Signals
Start Year: 1996
Participants: NYSDOT

Description: A NYSDOT coordinated signal system is currently under construction along NY 5 (Fuhrmann Boulevard through Woodlawn, New York). This system will utilize cameras, fiber optic cable and microprocessors to control the signal timing. Two units are planned to be placed along Furhmann Boulevard. The approximate locations of these as well as other coordinated traffic signals are shown in Figure 3-1.

Primary User Services: Traffic Control
Incident Management

Number: PIN 5803.39
Name: Signal Coordination Project
Start Year: 1996
Participants: NYSDOT

Description: A major NYSDOT signal coordination study and implementation plan is currently being conducted by the NYSDOT for 219 signalized intersections throughout the region. The study will propose a system to be implemented in 1997, using time based coordination. Major roadways within the study include NY 5, NY 277, NY 20A, NY 78, NY 62, NY 324, NY 263, NY 354, and NY 384 in Erie County and NY 31, NY 62, NY 265, NY 425, and Rainbow Boulevard in Niagara County. NYSDOT is also performing a coordinated signal study for 100 signals in the Buffalo Central Business District (CBD). Sere-Brown is providing the timing plans for these 100 signals. The approximate locations of the coordinated traffic signals are shown in Figure 3-1.

Primary User Services: Traffic Control
Incident Management

Number: Not Assigned
Name: Signal Coordination Projects
Start Year: Existing
Participants: City of Buffalo, City of Niagara Falls, NYSDOT

Description: The NYSDOT has several coordinated signals along the Elm / Oak section of NY 33 in the City of Buffalo. The Walden / Ferry and Niagara Falls Boulevard sections along US 62 in Niagara Falls, New York also has a series of coordinated signals. Other small sections of interconnected signals exist throughout the project area. Some of these systems are in need of maintenance for optimal operation. The approximate locations of coordinated traffic signal systems are provided in Figure 3-1.

There are several local municipality Transportation Systems Management (TSM) projects underway. These TSMs include signal systems along the following corridors:

- Franklin/Linwood (West Chippewa to West Delavan),
- Michigan Avenue (Main Street to Broadway),
- Porter Avenue (Lakeview to Symphony Circle),
- William Street (Harlem Road to Union Road),
- Borden Road (French Road to Como Park Boulevard),
- Dick Road (Walden Avenue to Route 33), and
- various equipment replacements in Niagara Falls.

Primary User Services: Traffic Control
Incident Management

Number: PIN 5804.35
Name: Peace Bridge Intelligent Transportation Border Crossing System (ITBCS)
Start Year: 1996
Participants: Peace Bridge

Description: This pilot study (originally "Michigan-Ontario-New York Border Crossing Initiatives") is being conducted to eliminate the need for exchange of "pre-cleared" paperwork at the border crossing. The commercial traffic will electronically transmit the documentation prior to arrival to the border crossing so that an instantaneous clearance can be made at the border crossing. Trucks will be equipped with a transponder which will store and transmit data regarding the shipment, origin, and destination. The transponder would also allow the commercial vehicle to be traced throughout its journey. It is anticipated that the pre-clearance operational test will commence at the Peace Bridge during 1996.

This border crossing system will demonstrate the North American Trade Automation Prototype (NATAP) and upgrade the existing toll system to incorporate an Automatic Vehicle Identification (AVI) system with axle counters, interoperable Dedicated Short Range Communication (DSRC), and an AVI service center.

Primary User Services:
Traffic Control
Incident Management
Interorganizational/International Management & Coordination
Commercial Vehicle Electronic Clearance
Customs & Immigration Inspection & Clearance
Hazardous Materials Incident Response
Commercial Vehicle Administrative Processes
Commercial Fleet Management

Number: Not Assigned
Name: Traffic Conditions Monitoring/Reporting
Start Year: Existing
Participants: NFTA
Metro Networks
Erie County Sheriff
American Automobile Association (AAA)
NYSTA
NITTEC

Description:

NFTA. The NFTA Traffic Data and Information Dissemination is a free traffic information service. Information is gathered from Metro bus operators, New York State Police, Erie and Niagara County Sheriff Departments, and local police (from scanners). The traffic information is provided to one television station and ten small market radio stations.

Metro Networks. Metro Networks Traffic Reporting is a privately owned national company. Metro Networks generates funds by purchasing airtime on local radio and television stations for its traffic reports and selling a portion of this airtime to sponsors. Information is gathered from a traffic reporter located in a fixed wing aircraft, the New York State Police, the Erie and Niagara County Sheriff Departments, local police (by use of a scanner) and from private vehicles with cellular phones (*TIP - sponsored by NYNEX). *TIP is the cellular phone number that drivers dial to report an incident on the roadway. The phone call is free to the drivers. Metro Networks provides traffic reporting services to major television stations and most of the radio market in Western New York.

Others. Beside *TIP there are several sponsors of telephone call-in services in the project area.

- 911 - Erie County Sheriff
- *AAA (Cellular) - American Automobile Association (AAA)
- 1-800-847-8929 - NYSTA
- 1-888-648-3262 - NITTEC (USA & Canada)
- 1-716-847-3973 - NITTEC (Local Buffalo Area).

Primary User Services: Traffic Control
Incident Management
Roadway Weather Information Services
En-route Driver Information
Pre-trip Travel Information

Number: Not Assigned
Name: Existing Traffic Operation Centers
Start Year: In Place
Participants: PBA

Description: The Buffalo and Fort Erie Public Bridge Authority (PBA) operates out of the American Plaza at the Peace Bridge in Buffalo. Surveillance cameras and CCTV are used to identify incidents at the approaches to, and along the Peace Bridge. The center controls one VMS and several fixed message signs. The VMS can also be operated by the NYSTA.

Video Surveillance & Closed Circuit TV (CCTV) Component
The PBA has eleven cameras located at the Peace Bridge. Cameras are located at the approach ramp (Ramp B) to the US side, Porter Avenue, at the US Plaza, along the bridge, at the Canadian Plaza, and Canadian truck yard.

Variable Message Sign (VMS) Component
The PBA owns and operates VMSs located along the northbound Interstate 190 just south of the Porter Avenue exit. Two fixed message signs are located along the access ramp to the Peace Bridge. There are also fixed message signs along the bridge which regulate the peak hour bi-directional lane use. Fixed message signs are also used to direct traffic to appropriate tolls and customs inspection booths. The VMS locations are shown in Figure 3-2.

Primary User Services: Traffic Control
Incident Management

Number: Not Assigned
Name: Existing Traffic Operation Centers
Start Year: In Place
Participants: NYSTA

Description: The New York State Thruway Authority (NYSTA) operations are controlled from the local NYSTA headquarters in Cheektowaga. The regional traffic supervisor has the responsibility of operating the VMSs and HAR. TOC based modems are used to communicate between the TOC and the existing NYSTA owned VMS. The NYSTA has plans to allow for remote operation of the VMS through the use of a lap top computer. Incidents are identified by the New York State Police and NYSTA employees. No CCTV or loop detectors are part of the current system. The NYSTA is working toward a "dual controlled facility" by creating a central TOC that could operate their system on a statewide basis, while also allowing for local operation.

MFS Communications Company has contracted with the NYSTA to install fiber optic cable within NYSTA right-of-way. MFS will design, integrate and support a fiber optic communications system along the Thruway's entire length. And in return for right-of-way access, NYSTA will be provided with access to some of the fibers which will be used to accommodate NYSTA toll collection and traffic management systems.

Variable Message Sign (VMS) Component
The NYSTA owns and operates thirteen (13) VMSs; upstream of the Lackawanna Toll Barrier (I-90), upstream of the westbound Williamsville Toll Barrier (I-90), upstream of the Buffalo Toll Barrier (I-190), across from the Dunlop Building (I-190) and the nine new VMSs installed under TAB 95-63s (discussed in Section 3.1.1 on Page 3-6) . The VMS locations are shown in Figure 3-2.

Highway Advisory Radio (HAR) Component
Described on page 3-22.

Primary User Services: Traffic Control
Incident Management
En-Route Driver Information

Number: Not Assigned
Name: Existing Traffic Operation Centers
Start Year: In Place
Participants: NYSDOT
Buffalo Police

Description: When unsafe driving conditions are determined to exist on the Skyway elevated expressway by the Buffalo Police, the Skyway is closed. Via modem, a message is sent from a workstation at the NYSDOT interim ROC by the Buffalo Police Department to the fixed message signs and flashing amber lights at both ends of the Skyway. The police department then dispatches a patrol car to block the entrances and ensure the Skyway is clear. The fixed message signs redirect traffic to an alternate route. As part of the government's Emergency Management System, redundancy of such operating systems is encouraged. It should be noted that evolving technology will allow for eventual central and distributed operation.

This interim ROC compiles information on NITTEC roadway construction activity to provide monthly construction activity reports to the media. NYSDOT will be one of the agencies participating in upgrading the ROC in conjunction with NITTEC members (see Project 1 description, Section 3.1.2).

Primary User Services:
Traffic Control
Incident Management
Roadway Weather Information Services
Operations Management
En-route Driver Information
Emergency Vehicle Management
Pre-trip Travel Information

Number: Not Assigned
Name: Existing Traffic Operation Centers
Start Year: In Place
Participants: NFBC

Description: The NFBC utilizes surveillance cameras, CCTV and VMS to identify and report incidents along the Rainbow Bridge. This system is operated from the Canadian side of the Rainbow Bridge.

Primary User Services: Traffic Control
Incident Management

Number: Not Assigned
Name: Existing Transit Control Center
Start Year: In Place
Participants: NFTA

Description: The NFTA operates a transit control center located on Oak Street in downtown Buffalo. The center includes train (Light Rail Rapid Transit-LRRT) operation controls, signal controls, CCTV and an extensive communications system. The LRRT system informs train operators of headways and preempts signals located along the 1-mile at grade section of LRRT. The control center maintains constant communications with bus operators within the region. The control center monitors route times and dispatches buses to assist in routing performance and emergency situations as well. The buses are used as probes to identify traffic and incident conditions and to report delays in service.

The NFTA's automated pre-trip notification system is used for NFTA bus and light rail. The automated system can be used by connecting to the service by phone (855-7211) and punching in the route number (touchtone), starting location and destination. The next available departure and arrival times are reported to the user.

Primary User Services:
Public Travel Security
Incident Management
Pre-trip Travel Information
Public Transportation Management
Emergency Notification & Personal Security

Number: Not Assigned
Name: Automatic Vehicle Location System
Start Year: 1996
Participants: NFTA

Description: The NFTA has a contract to install Automatic Vehicle Location (AVL) devices on all NFTA buses, paratransit vehicles, internal police cars, supervisor cars, and money trucks (over 370 vehicles total). Using Global Position Satellite (GPS) technology over microwave radio, the AVL system will locate vehicles and yield travel time at one-minute resolution. This information will be used to provide "on-time" performance records and emergency response, with public phone-in access slated as a future improvement. Travel times on freeways and expressways could also be derived, as "real-time" traffic information.

Primary User Services: Pre-rip Travel Information
En-Route Transit Information
Public Transportation Management

Number: Not Assigned
Name: Existing Travel Advisory Radio (TAR)
Start Year: In Place
Participants: Niagara Parks Commission and NFBC

Description: The Niagara Parks Commission and the Niagara Falls Bridge Commission jointly operate a Traveler Traffic Information Radio Station (Travel Advisory Radio), CFLZ 91.9 FM. The station broadcasts from the Skylon Tower in Niagara Falls, Ontario at 35 watts. This station has been cleared to double its wattage, which would enable it to reach into the Southtowns of Buffalo.

In addition to the coverage of this station, existing HAR coverage as well as HAR coverage that would be provided by the proposed FTMS is shown in Figure 3-7.

Primary User Services:
Traffic Control
Incident Management
Roadway Weather Information Services
En-route Driver Information
Pre-trip Travel Information

Number: Not Assigned
Name: Existing Highway Advisory Radio
Start Year: In Place
Participants: NYSTA

Description:

Highway Advisory Radio (HAR)

The NYSTA also operates an HAR on 1610 AM. Broadcast coverage includes I-90 from the Hamburg area to east of the Buffalo International Airport, I-190 from Buffalo through Niagara Falls, the north ends of US 219 and NY 400, the west end of I-290, and the ends of NY 33. The HAR system can be operated remotely. These HAR transmission coverage areas are shown in Figure 3-7.

Primary User Services: Traffic Control
Incident Management
En-Route Driver Information

Number: Not Assigned
Name: Existing Weather Advisory Radio(WAR)
Start Year: In Place
Participants: U.S. Department of Commerce

Description: The National Oceanic and Atmospheric Administration weather radio station (funded/operated by the United States Department of Commerce) at the Buffalo Airport (KEB98 @ 1625.5AM) reports weather conditions for the area with a coverage of approximately a 40 mile radius. This weather radio station provides coverage to the complete area shown in Figure 3-7.

Primary User Services: Traffic Control
Incident Management
Roadway Weather Information Services
En-route Driver Information
Pre-trip Travel Information

3.1.2 Proposed Near Term ITS Projects

These projects include those recommended for implementation in the near term which are neither existing nor previously committed namely the proposed Regional Operations Center Upgrade project and Stage I of the Freeway Traffic Management System. The proposed projects (Near Term, Mid Term, and Long Term) are numbered from 1 to 15 solely for use in identifying the various projects for discussion in this ITS Study.

Number: 1 - PIN 5804.08
Name: Upgrade Regional Operations Center
Start Year: 1998
Participants: NITTEC Members

Description: The interim Regional Operations Center (ROC) integrates the New York State Department of Transportation (NYSDOT), New York State Thruway Authority (NYSTA), Buffalo and Fort Erie Public Bridge Authority (PBA), Ontario Ministry of Transportation (MTO), and the Niagara Falls Bridge Commission (NFBC) systems. This project will upgrade the interim ROC to provide joint operational integration of the Niagara Region's existing VMSs, CCTV, HAR, weather stations, and emergency response systems.

The primary function of the ROC will be to collect and disseminate information and operate selected ITS elements. The ROC will operate NYSDOT and NYSTA ITS elements during regular hours of operation (weekdays 6 A.M. to 7 P.M.); control would be switched over to individual agencies during nights, weekends, holidays, etc.

Specifically, this project networks the existing workstations to provide a transparent interface to the operator. Capacity for the future workstations will be built-in. A new server with an uninterruptible power supply will also be provided. In the future, the ROC will be connected to ITS elements as they are constructed including additional VMSs, CCTV, RWIS, and traffic signal controllers.

Also included in this project is the rewiring of the ROC to include provision for the following:

- connections to the automated 911 systems (NYSDOT provides hardware/software at the remote 911 site); and
- connections to the closed loop traffic signal systems.

The ROC will be expanded to include an incident management center for major incidents (collisions, spills, weather, event management, etc.). The incident management center will require multiple phones, desks, RF capability and full scan video from freeways, the Thruway and bridges. Software will be provided for automatic incident detection. The ROC will also be expanded to include a public/tour viewing area, computer console tables and a furniture upgrade.

Primary User Services:
Traffic Control
Interorganizational/International Management & Coordination
Roadway Weather Information Services
Operations Management
Incident Management
En-route Driver Information
Emergency Vehicle Management
Pre-trip Travel Information

Benefits: An integrated system is expected to provide significant cost savings to the transportation providers and travel time savings for the transportation system users. Recent integrated systems, when implemented as part of a Freeway Transportation Management System (FTMS), have shown a 20 to 48% decrease in travel times and a 17 to 25% increase in highway capacity. The result is reduced incident delays, decreased fuel consumption and lowered vehicle emissions. For each vehicle hour traveled on the instrumented freeway, the integrated ROC and FTMS could save between 12 and 30 minutes. Assigning a value of time of $10 per hour and assuming a person travels 25 hours per month, the average cost benefit would be $87.50 per person per month.

Costs:

CAPITAL COSTS

Supply/Install	$640,000
Design	$96,000
Const. Oversight/Impl.	$64,000
Contingency	$96,000
SUB-TOTAL	$896,000

OPERATION COSTS

Assumptions: Hours of Operations: 6 AM to 7 PM, Monday through Friday
Minimum of 2 operators + 1 supervisor
Salary: Operator $10/hour

Minimum Costs:[1]
19 person hours/day x 5 days/week x $10/hr x 52 weeks = $49,400

Maximum Costs:[1]
32 person hours/day x 5 days/week x $10/hr x 52 weeks = $83,200

Supervisor $30/hour
40 hours/week x $30/hr x 52 weeks = $62,400

MAINTENANCE COSTS
$50,000 per year maintenance contract (assuming $100/hour)

[1]Actual costs dependent on staffing strategies

Number: 2 - PIN 5804.08
Name: Freeway Traffic Management System - Stage I
Start Year: 1998
Participants: NITTEC Members

Description: Stage I of the Freeway Traffic Management System (FTMS) includes the design and installation of the following: VDS, CCTV, and HAR elements and a COM system along the Kensington Expressway (NY 33) between the Elm/Oak arterials and I-90(6.9 mi.); along I-90 between NY 33 and I-290 (1.7 mi.); and along NY 198 between NY33 and the Parkside Interchange(0.85 mi.), as well as the upgrade of four NYSTA VDS located along I-90 between NY 33 and the vicinity of US 219. Cummunications to these four are assumed to be dial-up until the mid term staged expansion of FTMS provides fiber optic link. The limits of the FTMS are shown in Figure 3-8.

Stage I also includes permanent vehicle detector station upgrades on other area freeways; design and installation of 3 VMSs on other area freeways; and a communications(COM) link between the Peace Bridge and the ROC. With this COM link, the ROC will have access to CCTV (full motion video) and VMSs located on the Peace Bridge.

The system will provide detector surveillance capability, CCTV verification capability, a communications system to transport information to the upgraded ROC for processing[1] and a distribution capability to provide information to the users. Existing and proposed Variable Message Signs as well as existing and proposed HAR will be used for distribution. The key goal of the FTMS will be to improve incident detection and management. This FTMS will allow real-time congestion information to be obtained by the ROC.

It should be noted that Ramp Metering was also considered as a component of the FTMS, however due to the physical constraints (i.e. inadequate ramp storage and subsequent acceleration distance) and generally low public acceptance (only acceptable under extremely congested conditions), this item was dropped from consideration.

[1] Footnote: The communication system would have a fiber optic backbone designed to provide security and redundancy throughout the system. During design the ability to use existing or currently committed fiber optic cable from the Thruway Authority will be fully examined. Any cost savings resulting from this will be used to enhance the FTMS.

Kensington Expressway Elements (6.9 mi.):

Vehicle Detection Subsystem (VDS)
The installation of the vehicle detection subsystem along the Kensington Expressway will be performed in two steps. The first step is to upgrade twelve of the fifteen permanent vehicle detector stations on the Kensington which have been installed in other projects (as described on Page 3-7 of this report) and are within the limits of this stage of the FTMS. For all of these, the upgrades include appropriate intelligence (counter/controller), modem and power supply (as necessary) to make these real-time detector stations.

For the second step, three (3) new vehicle detector stations will be designed and installed in order to obtain an approximate 1/2 mile spacing between stations. The new stations will include loops installed in a speed trap configuration (3 lanes x 2 directions x 2 loops/lane = 12 loops per station). Appropriate intelligence (counter/controller), cabinet and modem will be included at each station.

These 15 detector stations will be connected to the fiber optics communications system.

Closed Circuit Television Subsystem (CCTV)
This subsystem includes design and construction of 16 CCTV cameras at an average of one- half mile spacing on the Kensington Expressway. The limits of coverage include the NY 33 - Elm/Oak arterials on the west and the NY 33/I-90 Interchange on the east.

Highway Advisory Radio Subsystem (HAR)
The HAR subsystem will include design and installation of radio transmitters placed to complement the existing NYSTA HAR System. The design stage will include RF integration for existing and proposed HAR and frequency propagation design. The intended freeway coverage is shown on Figure 3-7. A minimum of 2 transmitters are needed to complete coverage currently provided with the NYSTA system: one on NY 33 in the vicinity of Bailey Avenue and another on I-290 in the vicinity of I-990 (see Figure 3-7). A detailed analysis during design will determine the exact number needed. Communication to the I-290 HAR station is assumed to be via telephone until the mid term staged implementation of the FTMS.

The NFBC/NPC TAR transmitter (see page 3-21) could be used for dissemination of regional information.

I-90 Elements (1.7 mi.):

Vehicle Detector Stations (VDS) & Permanent Vehicle Detector Station Upgrades (PVDS)

Install four vehicle detection stations along the New York State Thruway (I-90) from Kensington Expressway to I-290 (1.7 mi.) at an approximate 0.5 mile spacing. The new stations will include loops installed in a speed trap configuration (3 lanes x 2 directions x 2 loops/lane = 12 loops per station). Appropriate intelligence (counter/controller), cabinet & modem will be included at each station. Upgrade one existing PVDS along I-90 between NY33 and I-290. This upgrade will include power and communications only.

Closed Circuit Television (CCTV)

This subsystem includes the design and construction of 3 CCTV cameras at an average of 0.5 mile spacing on the I-90. These 3 cameras will be used to view the I-90/I-290 Interchange and the I-90/NY 33 Interchange.

NYSTA will assume the maintenance responsibilities for proposed FTMS elements along NYSTA owned roadways.

NY 198 Elements (0.85 mi.):

Vehicle Detector Stations (VDS)

Install one new PVDS located between Parkside and Main. The new station will include loops installed in a speed trap configuration (3 lanes x 2 directions x 2 loops/lane = 12 loops per station). Appropriate intelligence (counter/controller), cabinet and communications will be included at each station.

Closed Circuit Television (CCTV)

This subsystem includes design and construction of 2 CCTV cameras at an average of 0.5 mile spacing on the Scajaquada Expressway. This subsystem will be used to view the

NY198/Parkside Interchange, the NY198/Main Street Interchange and the NY 198/NY 33 Interchange).

Permanent Vehicle Detector Station Upgrade (PVDS)

Provide upgrade of 26 permanent vehicle detector stations located on area freeways. These stations have been installed as part of other projects. The upgrade includes the design and installation of appropriate intelligence, modem and power supply (as necessary) for each of the stations. These 26 upgrades include:

- Eight (8) PVDS on I-290
- Two (2) PVDS on NY5

- Two (2) PVDS on NY400
- Two (2) PVDS on US219
- Four (4) PVDS on I-190
- Five (5) PVDS on NY198
- Three (3) PVDS on I-90 (power and communications only).

The assumed method of communication between these stations and the ROC is leased telephone lines. Locations of freeway permanent vehicle detector stations are provided in Figure 3-3a and 3-3b.

Variable Message Sign Installation (VMS)

This subsystem includes design and installation of 3 VMS signs. The signs will be located on the following freeways: US-219 as it approaches the I-90 interchange; NY400 as it approaches the I-90 interchange; and NY 5 as it approaches the Skyway. Leased telephone line communications are assumed for initial purposes. The signs will be 2 line, 20 characters per line. A field controller, cabinet and modem are included. Locations of VMS are provided in Figure 3-2.

Communications Subsystem (COM)

Fiber Optic
This subsystem will be designed for NYSDOT owned fiberoptic cable and will interconnect FTMS field elements to the ROC. During design, the use of available F/O cable along the Thruway will be considered. The FTMS field elements included in Stage I consist of the VDS, CCTV, HAR, and VMS located on the Kensington Expressway (Elm/Oak to I-90), I-90 (NY 33 to I-290), NY 198 (NY 33 to Parkside) as well as local roads (Elm/Oak to the ROC)

The fiber optic system will also provide cable in conduit between the ROC and the Peace Bridge. It is assumed that existing conduit is available along all but one mile of this link. Appropriate interfaces will be developed at both ends of the link (ROC and PBA TOC).

Leased Services Communications
Stage I will also contain a dial-up communications system that will connect those FTMS field elements that are located on other area freeways. These elements include the 26 upgraded PVDS and the three VMS that are being installed during Stage I (US-219 @ I-90, NY400 @ I-90, and NY5 @ the Skyway).

Primary User Services:
Traffic Control
Interorganizational/International Management & Coordination
Incident Management
Operations Management
En-route Driver Information

Emergency Vehicle Management
Pre-trip Travel Information

Benefits: An integrated system, such as the transportation management system provided by the upgraded ROC and FTMS described in Projects 1 & 2 above, is expected to provide significant cost savings to the transportation providers and travel time savings for the transportation system users. Recent integrated systems, when implemented as part of a Freeway Transportation Management System (FTMS), have shown up to a 48% decrease in travel times and up to a 25% increase in highway capacity. The result is reduced incident delays, decreased fuel consumption and lowered vehicle emissions. For each vehicle hour traveled on the instrumented freeway, the integrated ROC and FTMS could save between 12 and 30 minutes. Assigning a value of time of $10 per hour and assuming a person travels 25 hours per month, the average cost benefit would be $87.50 per person per month.

Costs: CAPITAL

Kensington Expressway Elements

VDS	
Supply / Install 12 upgrades	
@$12,200 + 3 new @$25,300=	$222,300
Design	$33,345
Constr. Oversight/Impl.	$22,230
Contingency	$33,345
Sub-Total	$311,220
CCTV	
Supply / Install	
16@$20,000	$320,000
Design	$48,000
Constr. Oversight/Impl.	$32,000
Contingency	$48,000
Sub-Total	$448,000
HAR	
Supply / Install	
2@$32,000	$64,000
Design/Licensing	$9,600
Constr. Oversight/Impl.	$6,400
Contingency	$9,600
Sub-Total	$89,600

I-90 Elements

VDS	
Supply / Install 4 new @$25,300=	$101,200
Design	$15,180
Constr. Oversight/Impl.	$10,120
Contingency	$15,180
Sub-Total	$141,680
PVDS	
Supply / Install 1 @$7,000	$7,000
Design	$1,050
Constr. Oversight/Impl.	$700
Contingency	$1,050
Sub-Total	$9,800
CCTV	
Supply / Install 3 @$20,000	$60,000
Design	$9,000
Constr. Oversight/Impl.	$6,000
Contingency	$9,000
Sub-Total	$84,000

NY 198 Elements

VDS	
Supply / Install	
1 new @$25,300=	$25,300
Design	$3,795
Constr. Oversight/Impl.	$2,530
Contingency	$3,795
Sub-Total	$35,420
CCTV	
Supply / Install 2 @$20,000	$40,000
Design	$6,000
Constr. Oversight/Impl.	$4,000
Contingency	$6,000
Sub-Total	$56,000

PVDS (other freeways)

Supply / Install	
26 upgrades 23@$12,200	
+3@7,000	$301,600
Design	$45,240
Constr. Oversight/Impl.	$30,160
Contingency	$45,240
Sub-Total	$422,240
Annual Operation	
Power @ $50/mo.	$15,600

VMS (other freeways)

Supply / Install	
3 @ $133,500	$400,500
Design	$60,075
Constr. Oversight/Impl.	$40,050
Contingency	$60,075
Sub-Total	$560,700
Annual Operation	
Power @$50/mo.	$1,800

COMMUNICATIONS

Supply / Install F/O

6.9 mi NY 33(Elm/Oak to I-90) @ $115,000	$793,500
1.7 mi I-90(NY 33 to I-290) @ $115,000	$195,500
0.85 mi NY198(NY 33 to Parkside) @ $115,000	$97,750
1.3 mi local (city street new conduit) (Elm/Oak to ROC)	
@ $264,000	$343,200
COM Link (ROC to Peace Bridge)	
0.3 mi(1584ft) local @$5.00/ft	$7,920
2.4 mi(12,672ft) I-190 @$5.00/ft	$63,360
1 mi. new conduit (city street new conduit)	
@ $50/ft x 5280 ft	$264,000
Sub-Total	$ 1,765,230
Design	$265,000
Constr. Oversight/Impl.	$176,523
Contingency	$265,000
Sub-Total *Supply/Install F/O*	$2,471,753

Leased Services @ ROC	
26 PVDS (modems) @ $500 ea.	$13,000
3 VMS (modems) @ $500 ea.	$1,500
1 HAR (modems) @ $500 ea.	$500
Design	$1,950
Constr. Oversight/Impl.	$1,300
Contingency	$1,950
Sub-Total *Leased Services @ ROC*	$20,200
Total Communications	$2,491,953

TOTAL CAPITAL STAGE I - FTMS

Kensington Expressway Elements	
VDS	$311,220
CCTV	$448,000
HAR	$89,600
I-90 Elements	
VDS	$141,680
PVDS	$9,800
CCTV	$84,000
NY 198 Elements	
VDS	$35,420
CCTV	$56,000
Other Stage I Elements	
PVDS	$422,240
VMS	$560,700
COM System	$2,491,953
TOTAL CAPITAL	$4,650,613
TOTAL ANNUAL OPERATION	$17,400
ANNUAL MAINTENANCE(10%)	$464,080

Number: 3 - PIN 5804.08
Name: ROC Information Exchange Network (IEN)
Start Year: 1998
Participants: New York State Department of Transportation (NYSDOT)
New York State Thruway Authority (NYSTA)
Buffalo & Fort Erie Public Bridge Authority (PBA)
Niagara Falls Bridge Commission (NFBC)
Ontario Ministry of Transportation (MTO)
Niagara Frontier Transportation Authority (NFTA)
Other NITTEC Members as required

Description: Establish an electronic information system to interconnect the primary operations and information centers at the intraregional level. The ROC will act as the communications hub. This system will include one work station at each agency.

Primary User Services:
Traffic Control
Incident Management
International/Interorganizational Management & Coordination
Operations Management
En-Route Driver Information
Emergency Vehicle Management
Pre-Trip Travel Information
Route Guidance

Costs:

CAPITAL	
Supply / Install	
T-1 Link (NYSTA, PBA, NFBC, NFTA, 911)	
5@15,000	$75,000
Design	$11,250
Constr. Oversight/Impl.	$7,500
Contingency	$11,250
Sub-Total	$105,000
OPERATING	
$1000/mo. x 5 x 12 mo	$60,000

3.2 MID TERM: PROJECTS

Mid term projects are those projects set for the 3 - 7 year time frame (1999 - 2003). These projects are suggested to further the Buffalo/Niagara Falls regional ITS. Each of these projects is listed below followed by a project description. The mid term projects are grouped together for the purposes of the benefit discussion. A discussion of the benefits is provided for groups of the proposed projects. The groups are as follows:

Freeway Traffic Management Systems:
- Mayday System Support (tie Mayday Information Service Provider to 911)
- Staged expansion of FTMS (areas chosen by level of congestion/accidents plus input from critical stakeholders)
- Convert permanent count stations to real time detectors
- Roving Service Patrol
- Signal Coordination and Closed Loop Signal Applications.

Electronic Fare Payment Systems:
- Provide common Smart Cards for Thruway, transit systems, Peace Bridge, etc.

Traveler Information Systems:
- Provide road weather information service.
- Provide Pre-Trip Travel Information (Web page, radio, TV, Kiosks in transit areas).

Electronic Clearance
- Expand Intelligent Transportation Border Crossing System (ITBCS) to all crossings.

Transit
- Arterial Bus Priority

Number: 4
Name: Interconnect to Mayday System
Start Year: 1999+
Participants: New York State Department of Transportation (NYSDOT)

Description: The Mayday System is currently undergoing demonstration as the Automated Collision Notification system in Erie County. The vehicles are equipped with sensors which will determine crash severity and vehicle location.

This project will provide a communications interface between the Automatic Collision Notification System and the 911 emergency system. The Erie County Emergency Services operates the 911 dispatch center. Included in the interface would be software and hardware integration.

Primary User Services: Emergency Notification and Personal Security

Costs:

CAPITAL COSTS	
Supply / Install	
Workstation	$10,000
T-1 Line	$10,000
Design	$1,500
Constr. Oversight/Impl.	$1,000
Contingency	$1,500
Sub-Total	$24,000
OPERATIONS/MAINTENANCE	
($1000/mo. x 12mo.)	$12,000

Number: 5
Name: FTMS Staged Expansion
Start Year: 1999+
Participants: New York State Department of Transportation (NYSDOT)
New York State Thruway Authority (NYSTA)

Description: This project expands upon the existing, committed and near-term FTMS elements described previously in this report. The FTMS expansion routes were chosen on the basis of accidents and level of congestion with input from the critical stakeholders. FTMS elements will be designed and installed to integrate and complement any elements already in place. Vehicle detection, traffic monitoring, and data dissemination will be provided. The ability to perform vehicle detection with data from the TRANSMIT project in lieu of loops will be investigated.

I-290 (I-990 to I-90)

This 3.7 mile link includes the design and installation of the following FTMS elements along the Youngmann Expressway:

- 7 PVDS spaced approximately every 1/2 mile
- 7 CCTV cameras to provide coverage every 1/2 mile
- 4 AVI Readers.

These elements will be connected to the ROC via a fiber optic communication subsystem. Fiber will be designed and installed along the I-290 (I-990 to I-90) and will connect to the F/O subsystem created during the near term FTMS. The existing VMS located along southbound I-290 approaching Main Street will be connected to the ROC with this fiber optic subsystem.

NY 33 (I-90 to Buffalo International Airport)

FTMS elements for this 1.5 mile section of the Kensington Expressway include:

- the upgrade of 3 PVDS located on NY 33 near the Airport
- design and installation of 2 CCTV cameras to view the NY 33/I-90 Interchange as well as the Airport entrances.
- 2 AVI readers

These elements will be connected to the ROC via a fiber optic communication subsystem. The subsystem will be designed and installed along NY 33 from I-90 to the Airport and will connect to the F/O subsystem created during the near term FTMS.

NY 198 (I-190 to Parkside)

An additional link of the FTMS (mid term) will extend along the Scajacquada Expressway for 2.4 miles. FTMS along this link includes the design and installation of:

- Three VMS (one for each approach to the NY 198/NY 33 Interchange);

- 4 PVDS upgrades along with one new PVDS to obtain approximately 1/2 mile spacing;
- 5 CCTV cameras to achieve approximately 1/2 mile spacing;
- 2 AVI readers to achieve approximately 1 mile spacing.

These elements will be connected to the ROC via a fiber optic communications subsystem. The COM link here will be located along NY 198 (I-190 to Parkside) and will include a connection to the existing VMS located on westbound NY 198 approaching I-190.

I-90 (Kensington Expressway south to US-219)
The staged expansion of the FTMS (mid term) also includes FTMS elements for 8.6 miles of the I-90 (Kensington Expressway south to US-219). FTMS elements include VDS, CCTV, AVI, and a COM link. Vehicle detection will be provided by installing thirteen new VDS (two-way) and upgrading 6 existing NYSTA PVDS (one-way). The PVDS upgrades on the Thruway include power, COM and counter. All 6 existing have cabinets. These 19 detectors will provide approximately 1/2 mile spacing. The CCTV subsystem along this link includes 17 CCTV cameras spaced approximately 1/2 mile. Eight AVI readers will be installed to provide approximately one every mile.

These elements will be connected to the ROC via a fiber optic communications subsystem designed and installed along the I-90 (NY 33 to US 219). This COM subsystem will connect to the fiber optic subsystem created during Stage I of the FTMS. The three VMS currently located along this section of the I-90 will be connected to the fiber optic COM subsystem.

A long term project is proposed to provide an FTMS system along I-190. As shown in Figure 3-8, the Buffalo/Niagara Falls Regional FTMS would then consist of an inner and outer ring with intersecting spurs. Additional spurs or branches could be added in the future.

Primary	Traffic Control	Pre-trip Travel Information
User Services:	Roadway Weather Information Services	
	Interorganizational/International Management & Coordination	
	Incident Management	Operations Management
	En-route Driver Information	Emergency Vehicle Management

Costs: **I-290 (I-990 to I-90) (3.7 miles)**

CAPITAL

VDS	
Supply/Install 7 new@$25,300	$177,100
Design	$26,565
Constr. Oversight/Impl.	$17,710
Contingency	$26,565
Sub-Total	$247,940
CCTV	
Supply / Install	
7 @$20,000	$140,000
Design	$21,000
Constr. Oversight/Impl.	$14,000
Contingency	$21,000
Sub-Total	$196,000
AVI	
Supply / Install	
4 @$30,000	$120,000
Design	$18,000
Constr. Oversight/Impl.	$12,000
Contingency	$18,000
Sub-Total	$168,000
COMMUNICATIONS	
Supply / Install	
3.7 miles @$115,500	$427,350
Design	$64,100
Constr. Oversight/Impl.	$42,735
Contingency	$64,100
Sub-Total	$598,290
TOTAL CAPITAL I-290 (I-990 to NY 33)	
VDS	$247,940
CCTV	$196,000
AVI	$168,000
COMMUNICATIONS	$598,290
Total Capital (I-290)	$1,210,230

ANNUAL MAINTENANCE 10% $121,020

NY 33 (I-90 to Airport) (1.5 miles)

CAPITAL	
PVDS	
Supply/Install 3 Upgrades	
@$12,200	$36,600
Design	$5,490
Constr. Oversight/Impl.	$3,660
Contingency	$5,490
Sub-Total	$51,240
CCTV	
Supply / Install	
2 @$20,000	$40,000
Design	$6,000
Constr. Oversight/Impl.	$4,000
Contingency	$6,000
Sub-Total	$56,000
AVI	
Supply / Install	
2 @$30,000	$60,000
Design	$9,000
Constr. Oversight/Impl.	$6,000
Contingency	$9,000
Sub-Total	$84,000
COMMUNICATIONS	
Supply / Install	
1.5 miles @$115,500	$173,250
Design	$25,990
Constr. Oversight/Impl.	$17,325
Contingency	$25,990
Sub-Total	$242,550
TOTAL CAPITAL NY 33 (I-90 to Airport)	
VDS	$51,240
CCTV	$56,000
AVI	$84,000
COMMUNICATIONS	$242,550
Total Capital (I-290)	$433,790
ANNUAL MAINTENANCE 10%	$43,380

NY 198 Scajaquada Expressway (I-190 to Parkside) (2.4 miles)

CAPITAL	
VMS	
Supply / Install	
3 @ $133,500	$400,500
Design	$60,075
Constr. Oversight/Impl.	$40,050
Contingency	$60,075
Sub-Total	$560,700
PVDS	
Supply/Install 4 upgrades @ $12,200 +	
1 new @$25,300	$74,100
Design	$11,115
Constr. Oversight/Impl.	$7,410
Contingency	$11,115
Sub-Total	$103,740
CCTV	
Supply / Install	
5@$20,000	$100,000
Design	$15,000
Constr. Oversight/Impl.	$10,000
Contingency	$15,000
Sub-Total	$140,000
AVI	
Supply / Install	
2 @$30,000	$60,000
Design	$9,000
Constr. Oversight/Impl.	$6,000
Contingency	$9,000
Sub-Total	$84,000
COMMUNICATIONS	
Supply / Install	
2.4miles @$115,500	$277,200
Design	$41,580
Constr. Oversight/Impl.	$27,720
Contingency	$41,580
Sub-Total	$388,080

TOTAL CAPITAL (NY 198 Scajaquada Expressway)		
VMS	$560,700	
VDS	$103,740	
CCTV	$140,000	
AVI	$84,000	
COMMUNICATIONS	$388,080	
Total Capital (NY 198)		$1,276,520
ANNUAL MAINTENANCE(10%)	$127,650	

I-90 (NY 33 to the vicinity of US-219) (8.6 miles)

CAPITAL	
VDS	
Supply/Install	
13 VDS@$25,300	$328,900
Design	$49,335
Constr. Oversight/Impl.	$32,890
Contingency	$49,335
Sub-Total	$460,460
PVDS (Full upgrades)	
Supply/Install	
6 PVDS@$12,200	$73,200
Design	$10,980
Constr. Oversight/Impl.	$7,320
Contingency	$10,980
Sub-Total	$102,480
CCTV	
Supply / Install	
17@$20,000	$340,000
Design	$51,000
Constr. Oversight/Impl.	$34,000
Contingency	$51,000
Sub-Total	$476,000
AVI	
Supply / Install	
8 @$30,000	$240,000
Design	$36,000
Constr. Oversight/Impl.	$24,000
Contingency	$36,000
Sub-Total	$336,000

COMMUNICATIONS	
Supply / Install	
8.6miles @$115,500	$993,300
Design	$148,995
Constr. Oversight/Impl.	$99,330
Contingency	$148,995
Sub-Total	$1,390,620

TOTAL CAPITAL I-90 (NY 33 to US 219)	
VDS	$460,460
PVDS	$102,480
CCTV	$476,000
AVI	$336,000
COMMUNICATIONS	$1,390,620
Total Capital (I-290)	$2,765,560

ANNUAL MAINTENANCE 10% $276,560

Total for FTMS Staged Expansion

I-290 (I-990 to NY 33)	$1,210,230
NY 33 (I-90 to Airport)	$433,790
(NY 198 Scajaquada Expressway)	$1,276,520
I-90 (NY 33 to vicinity of US 219)	$2,765,560
	$5,686,100

ANNUAL MAINTENANCE (10%) $568,610

Number: 6
Name: Signal Coordination and Closed Loop Signal Applications Project
Start Year: 1999+
Participants: New York State Department of Transportation (NYSDOT)
City of Buffalo

Description: Provide ability to coordinate signals and to coordinate FTMS and local roadway traffic management strategies in the vicinity of on/off ramps and along diversion routes as well as event management.

Primary User Services: Incident Management
Traffic Control
International Interorganizational Management & Coordination

Costs: CAPITAL

Supply / Install	
AVI Priority System	$142,860
Design	$21,425
Constr. Oversight/Impl.	$14,290
Contingency	$21,425
Sub-Total	$200,000

MAINTENANCE	
(10%)	$20,000

ANNUAL OPERATION	
(10%)	$20,000

Number: 7
Name: Arterial Bus Priority Demonstration Project
Start Year: 1999+
Participants: New York State Department of Transportation (NYSDOT)
Niagara Frontier Transportation Authority (NFTA)

Description: Provide bus priority for the signalized intersections along a 5 mile arterial corridor in the Buffalo/Niagara Falls region. Priority schemes will be developed and analyzed for this project. The scheme with the greatest cost/benefit ratio will be implemented in an operational test on 5 miles of a local arterial. The project will include system evaluation.

In order to estimate a cost for this project various assumptions will need to be made. First, it will be assumed that 15 intersections will be utilized in this demonstration and 3 of the controllers at these intersections will need to be replaced. An infrared emitter/receiver system will be used. Finally there will be 15 buses used in this demonstration and each one will require an emitter.

Primary User Services: Public Transportation Management
Traffic Control

Costs: CAPITAL

Supply / Install	
AVI Priority System	$142,500
Design	$21,375
Constr. Oversight/Impl.	$14,250
Contingency	$21,375
Sub-Total	$199,500
MAINTENANCE	
(10%)	$19,950

Number: 8
Name: Common Smart Card Project
Start Year: 1999+
Participants: New York State Thruway Authority (NYSTA)
Buffalo & Fort Erie Public Bridge Authority (PBA)
Niagara Falls Bridge Commission (NFBC)
Niagara Frontier Transportation Authority (NFTA)
NITTEC

Description: This project will evaluate, recommend and implement a single smart card medium for use within the region for all transportation related tolls and fares. This would include parking, transit and tolls. The system recommended should be compatible with the EZ-Pass system currently in use.

Primary User Services: Electronic Payment Service

Costs:

CAPITAL	
Supply/Install Magnetic Card Readers w/RF modems	
6 P&R, 240 Transit, 4 Train = 250 @ $2,700 =	$675,000
23 sets of Toll Lane Equipment @ $75,500 =	$1,736,500
5000 Transponders @ $500	$2,500,000
5000 Debit Cards @ $50	$250,000
Software @ $1,500,000	$1,500,000
Interface @ $50,000	$50,000
Hardware @ $50,000	$50,000
Subtotal	$6,761,500
Design	$1,014,225
Constr. Oversight/Impl.	$676,150
Contingency	$1,014,225
Total	$9,466,100
MAINTENANCE	
(10%)	$946,600

Number: 9
Name: Road Weather Information System Interconnect
Start Year: 1999+
Participants: New York State Department of Transportation (NYSDOT)
New York State Thruway Authority (NYSTA)
U.S. Department of Commerce
Niagara Parks Commission

Description: This project would interconnect all weather / data stations in the project area and integrate with the ROC.

Primary User Services: Road Weather Information System
Pre-Trip Traveler Information
En-Route Driver Information

Costs:

CAPITAL	
Supply / Install	
Workstation	$30,000
Interface	$50,000
Design	$12,000
Constr. Oversight/Impl.	$8,000
Contingency	$12,000
Sub-Total	$112,000
MAINTENANCE	
(10%)	$11,200

Number: 10
Name: Pre-Trip Traveler Information
Start Year: 1999+
Participants: New York State Department of Transportation (NYSDOT)
other NITTEC members as required

Description: This project develops the interfaces that would allow users access to travel information before they travel. The project includes development of traveler kiosks as well as creates the information interfaces between the ROC and the Kiosks, TV and Radio. Traveler information could include travel times, congestion, incident data and transit information.

Primary User Services: Pre-Trip Travel Information
Road/Weather Information Service

Costs:

CAPITAL	
Supply / Install	
5 kiosks@$20,000	$100,000
Interfaces	$614,500
Design	$107,175
Constr. Oversight/Impl.	$71,450
Contingency	$107,175
Sub-Total	$1,000,300
MAINTENANCE	
(10%)	$100,000

Number: 11
Name: Intelligent Transportation Border Crossing System (ITBCS) Expansion Project
Start Year: 1999+
Participants: New York State Thruway Authority (NYSTA)
Buffalo & Fort Erie Public Bridge Authority (PBA)
Niagara Falls Bridge Commission (NFBC)
New York State Department of Transportation (NYSDOT)

Description: This project utilizes the ITBCS project (Peace Bridge) as a base to expand the system to all four border crossings in the region. Included would be communication links and necessary processing functions. Interconnection with the ROC will also be provided.

Primary User Services: Commercial Vehicle Electronic Clearance
Customs and Immigration Inspection and Clearance

Costs:

CAPITAL	Minimum	Maximum
Supply / Install		
1 to 2 M / bridge X 3	$3,000,000	$6,000,000
Design	$450,000	$900,000
Constr. Oversight/Impl.	$300,000	$600,000
Contingency	$450,000	$900,000
Sub-Total	$4,200,000	$8,400,000
MAINTENANCE		
(10%)	$420,000	$840,000

Number: 12
Name: Roving Service Patrol
Start Year: 1999+
Participants: New York State Department of Transportation (NYSDOT)
NITTEC

Description: This emergency/incident response program will schedule 4 roving vehicles to traverse the 2 ring roads and NY 33 in the AM and PM peak periods. The vehicles will be equipped to service most stalled vehicles (gasoline, flat tires, fluids, belts) and also have a pushbumper to quickly clear the roadway. Each vehicle will have AVI/AVL transponders to facilitate emergency vehicle management.

Primary User Services: Incident Management
Emergency Vehicle Management

Costs:

CAPITAL

Purchase	
5@$100,000	$500,000
Design/Spec	$75,000
Contingency	$75,000
Sub-Total	$650,000

OPERATION
Minimum:
6 hours/day x 4 drivers x $20/hour x 5 days x 52 weeks = $124,800

Maximum:
8 hours/day x 4 drivers x 2 shifts x $20/hour x 5 days x 52 weeks = $332,800

MAINTENANCE

(10%)	$65,000

3.2.1 Relative Benefits

The following mid term projects will be coordinated with other incident management activities during design and implementation:

- Roving Service Patrol
- Mayday System Support
- FTMS Staged Expansion.

These projects will be related to the proposed near term FTMS (VDS, CCTV, VMS and incident detection software at the ROC). With a full implementation of incident detection such as this, the savings to transportation users should be considerable. Automated incident detection programs lead to faster incident response time. Incident management programs have been able to achieve response times up to 8 minutes faster, leading to a significant decrease in motorist delay and inconvenience. The Institute of Transportation Engineers estimates a 10 to 42% decrease in travel times for incident management programs. The State of Maryland CHART incident management program is predicted to have a 10:1 benefit cost ratio.

Provided with travel information and road/weather information to motorists before they make a trip (pre-trip), motorists are twice as likely to use an alternative route. By avoiding a congested area, motorists improve overall system performance. Travel time decreases of up to 20% under incident conditions can be expected.

Electronic Fare Payment Systems like the Common Smart Card project described above offer convenience to not only the service user, but the service provider. By using the same electronic media for transit, parking, and tolls, non-cash transactions ease money handling by the service providers and provide improved database tracking capabilities of personal trip and origin-destination patterns.

3.3 LONG TERM PROJECTS

These long term projects should be considered for the 8+ year time frame (2004 to 2010+). These projects are suggested to further the Buffalo/Niagara Falls regional ITS. Brief project descriptions are provided below.

- Staged Expansion of the FTMS
- Advanced Vehicle Control System (Collision Avoidance, automated vehicle)
- Support for in-vehicle route guidance systems - Traffic Roadway Information System (TRIS) Toronto, expansion to Buffalo
- En-Route Transit Information.

Number: 13
Name: Staged Expansion of the FTMS (Long Term)
Start Year: 2004+
Participants: NYSDOT
NYSTA
NITTEC

Description: As shown in Figure 3-8 it is proposed that the FTMS be expanded in the long term to provide a complete FTMS. This project includes the design and installation of VDS, CCTV, HAR, VMS and AVI plus a communications system possibly along the following Roadways: I-190, I-990, I-290, I-90, NY 400, NY 5, US 219 and the Robert Moses Parkway. Two VMSs are proposed for this project, one along southbound NY 425 as it approaches I-290 and another along westbound I-290 as it approaches NY 425. The proposed VMSs for this project can be seen in Figure 3-2. It should be noted that these locations may change as the system evolves.

The long term Staged Expansion of the Buffalo/Niagara Falls region will include integration with arterial signal systems.

Primary User Services:	Traffic Control	Pre-Trip Travel Information
	Interorganizational / International Management & Coordination	
	Incident Management	Operations Management
	En-route Driver Information	Emergency Vehicle Management

Number: 14
Name: Advanced Vehicle Control System (Collision Avoidance)
Start Year: 2004+
Participants: NITTEC
Other Private Entities

Description: This project utilizes the developments of the automotive industry and other private design firms. It is unknown at this time what technologies will be available or what the state-of-the-practice will be.

Primary User Services:
Pre-Crash Restraint Deployment
On-Board Safety Monitoring
Intersection Collision Avoidance
Vision Enhancement for Crash Avoidance
Automated Highway Systems
Lateral Collision Avoidance
Longitudinal Collision Avoidance

Number: 15
Name: Support for in-vehicle route guidance systems
Start Year: 2004+
Participants: NITTEC
Private Information Service Providers

Description: This project is the expansion of the Traffic Roadway Information System (TRIS) project in Toronto, Canada. The project consists of in-vehicle equipment and wireless messaging to provide drivers with travel advisories. It will also include support for similar efforts in the U.S.

Primary User Services: Road/Weather Information Service
En-route Driver Information
Route Guidance

Number: 16
Name: En-Route Transit Information
Start Year: 2004+
Participants: Niagara Frontier Transportation Authority (NFTA)
New York State Department of Transportation (NYSDOT)

Description: This project will utilize the Automatic Vehicle Location system that is currently being installed. Individual vehicle statistics will be collected and processed at the ROC. The communications interface will be provided to transmit bus arrival times and travel times to transit riders while en-route as well as in the bus terminals via kiosks.

Primary User Services: En-route Transit Information

Number: 17
Name: Signal Coordination and Closed Loop Signal Applications
Start Year: 2004+
Participants: New York State Department of Transportation (NYSDOT)
City of Buffalo
Other local Municipalities Adjacent to Staged Expansion FTMS Freeways.

Description: Provide ability to coordinate signals and to coordinate FTMS and local roadway traffic management strategies in the vicinity of an on/off ramp and along diversion routes as well as for event management.

Primary User Services: Traffic Control
Incident Management
International Interorganizational Management & Coordination

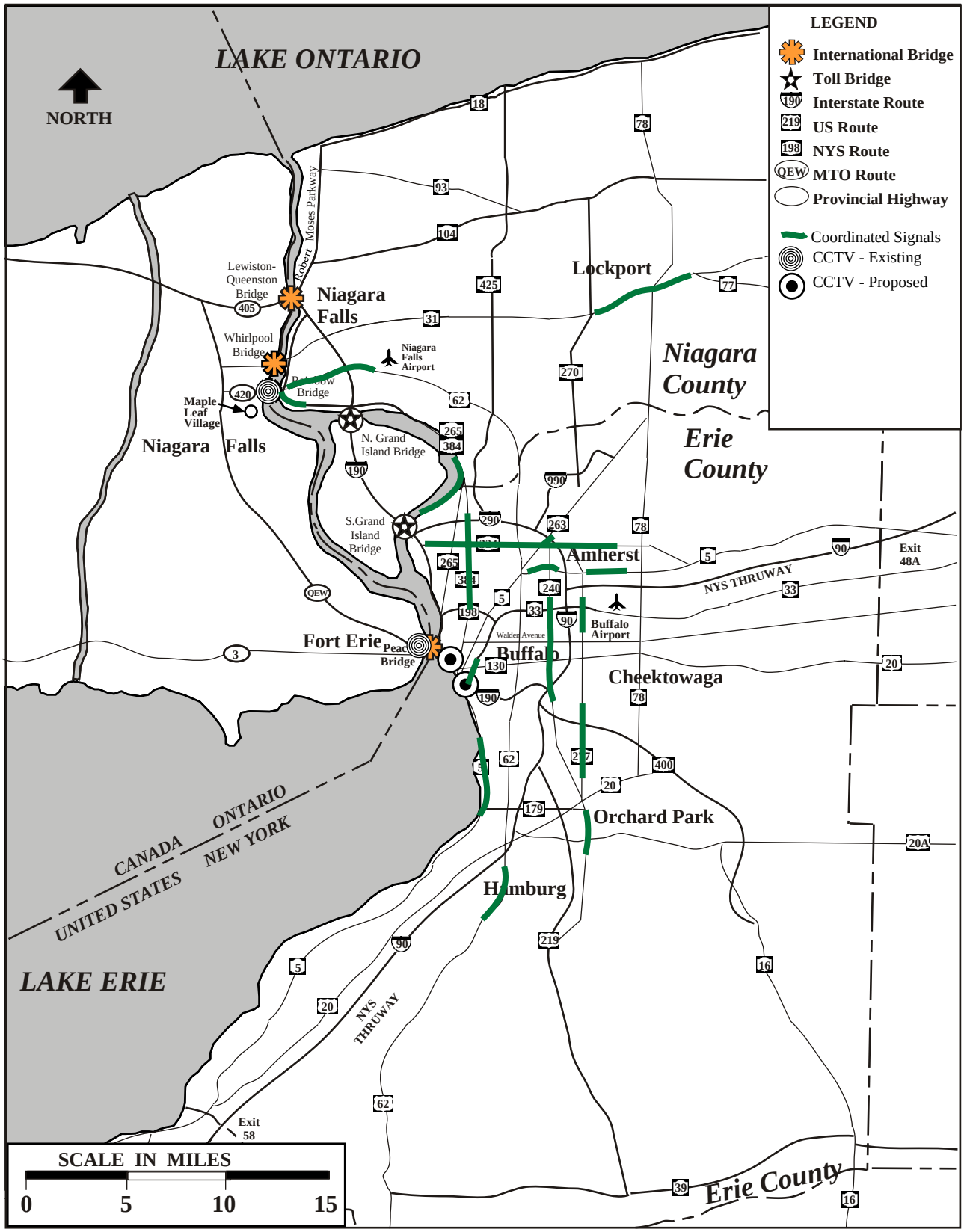

Figure 3-1 Coordinated Traffic Signals & CCTV Locations

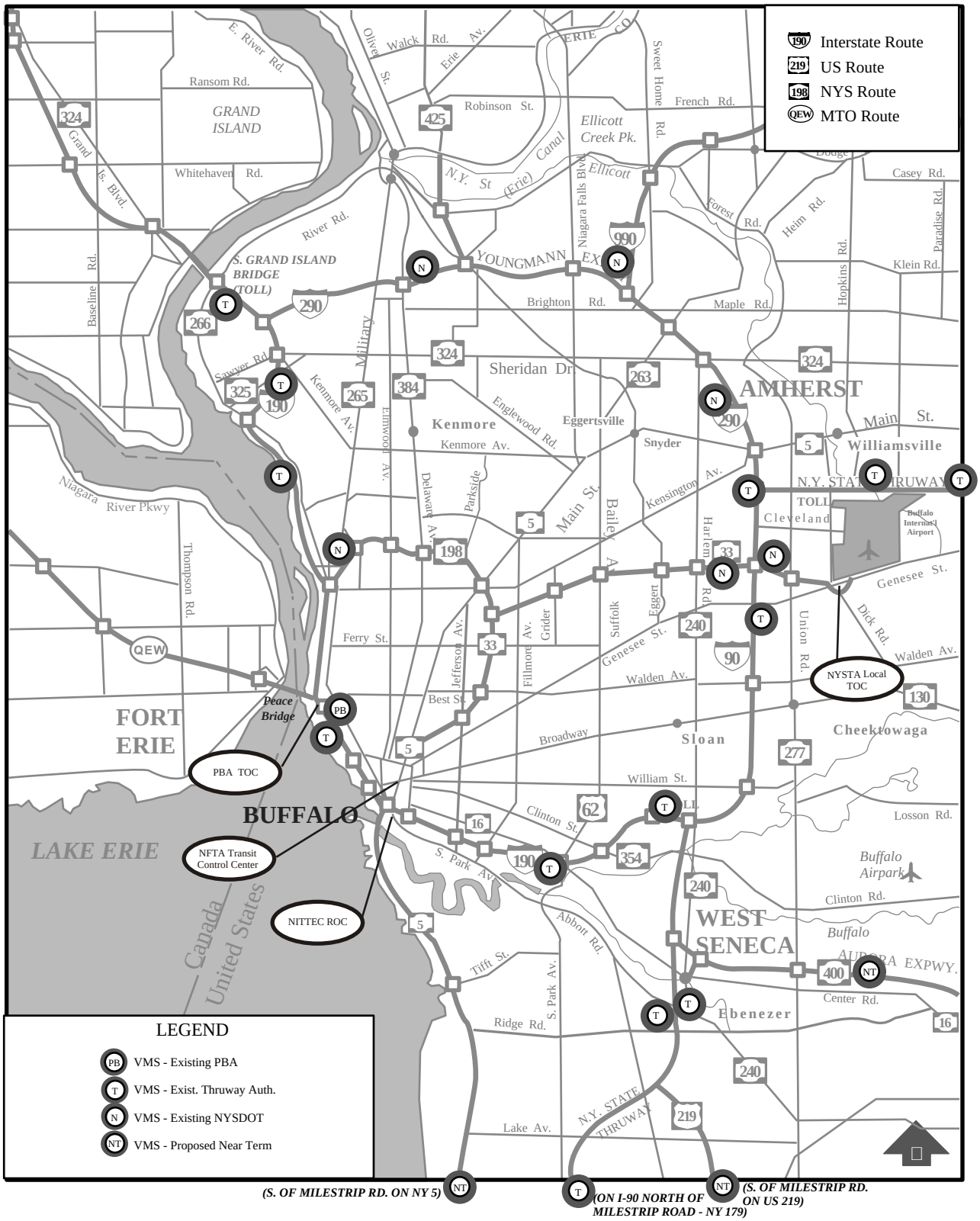

Figure 3-2 Variable Message Signs (VMS)

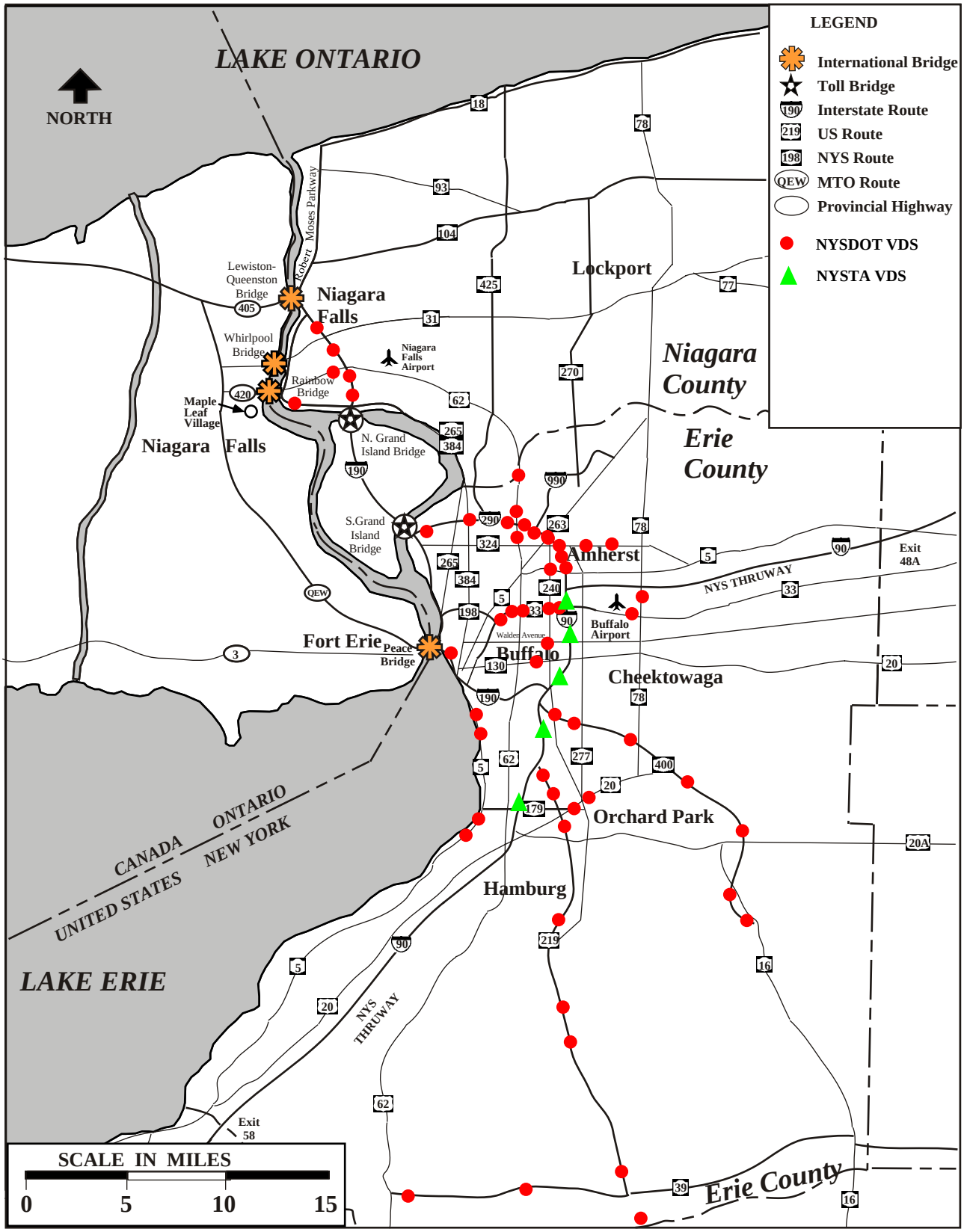

Figure 3-3a Existing Vehicle Detector Stations (VDS)

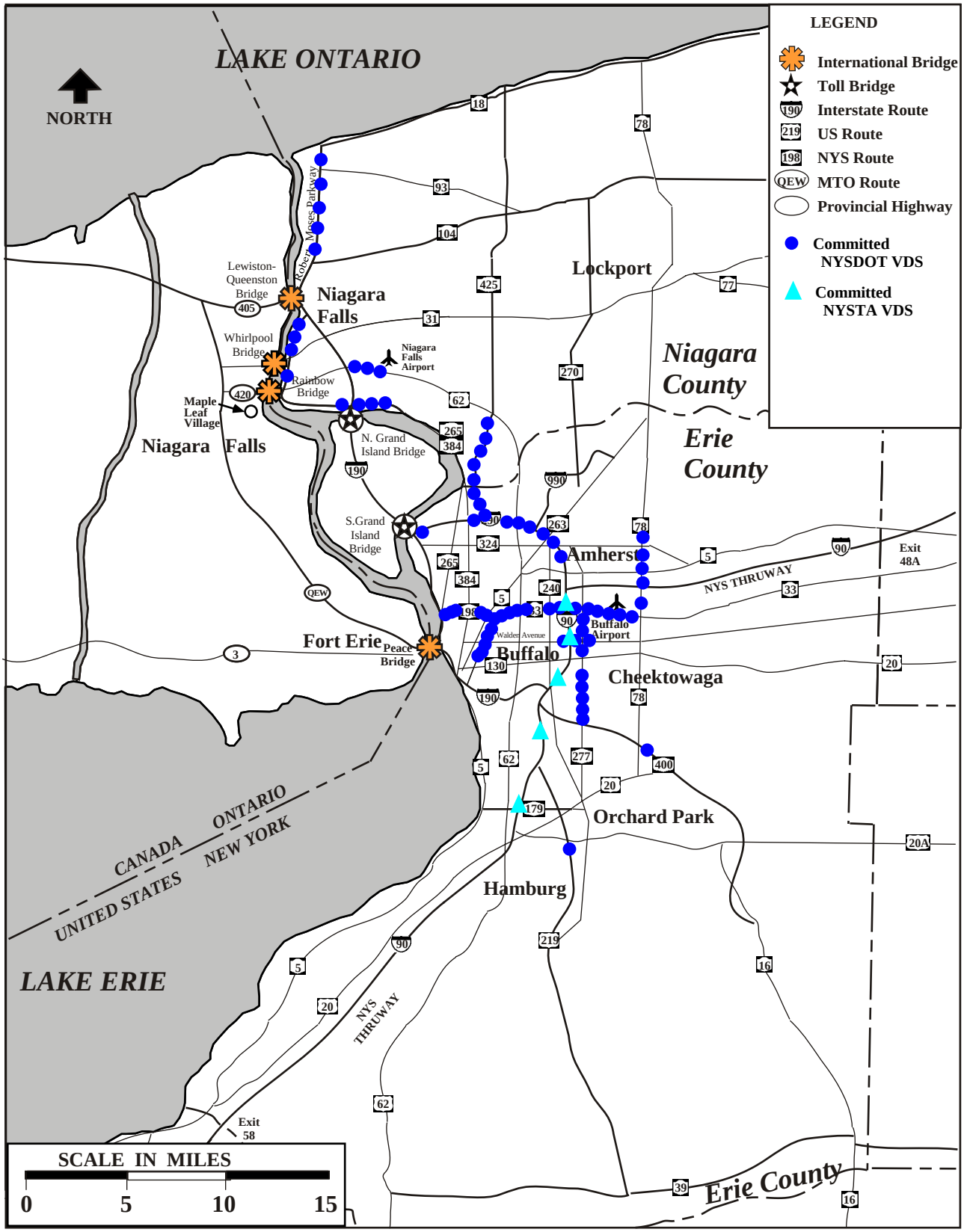

Figure 3-3b Committed Near Term (PIN 5803.38) Permanent Vehicle Detector Stations (PVDS)

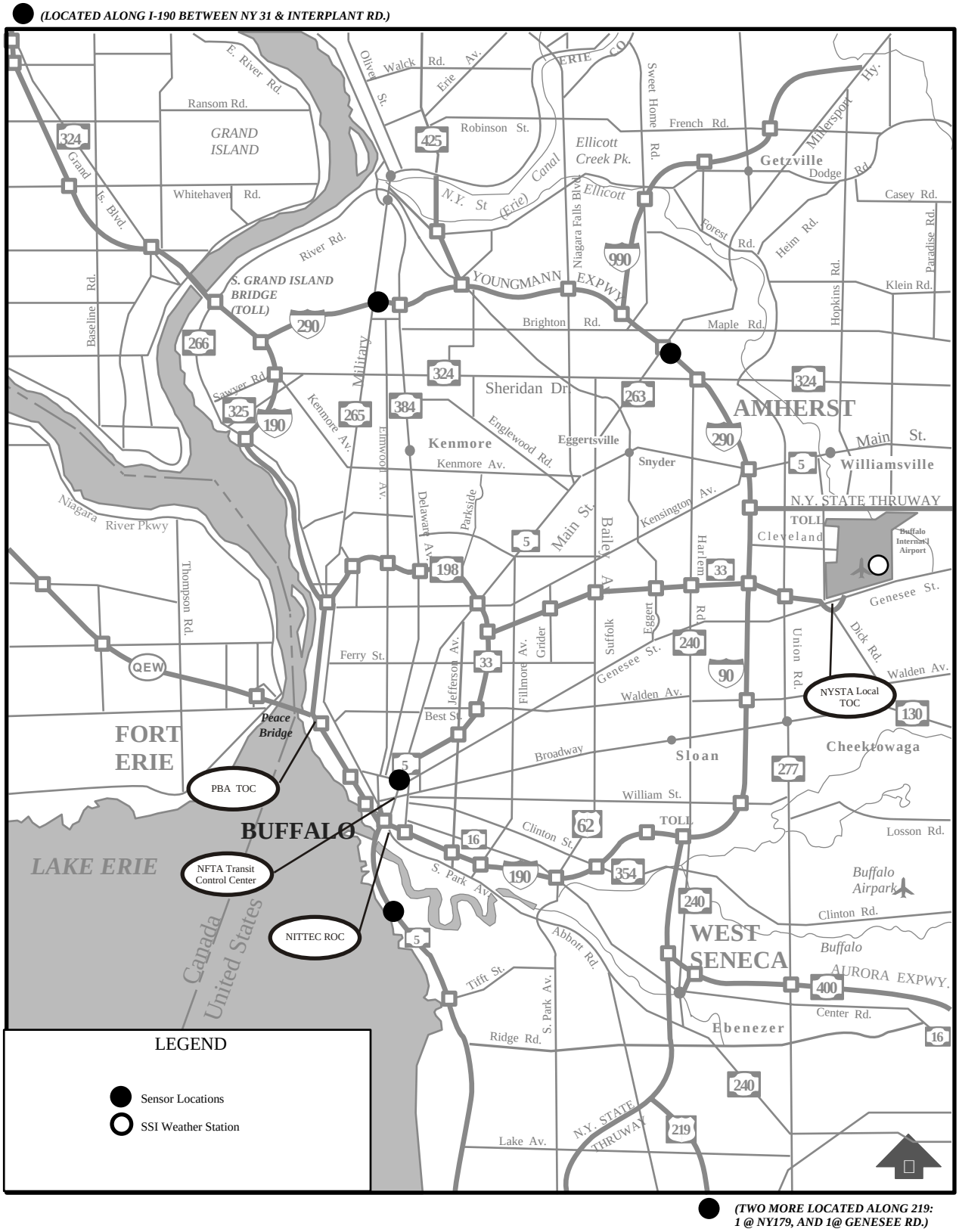

Figure 3-4 Road Weather Information Stations (RWIS)

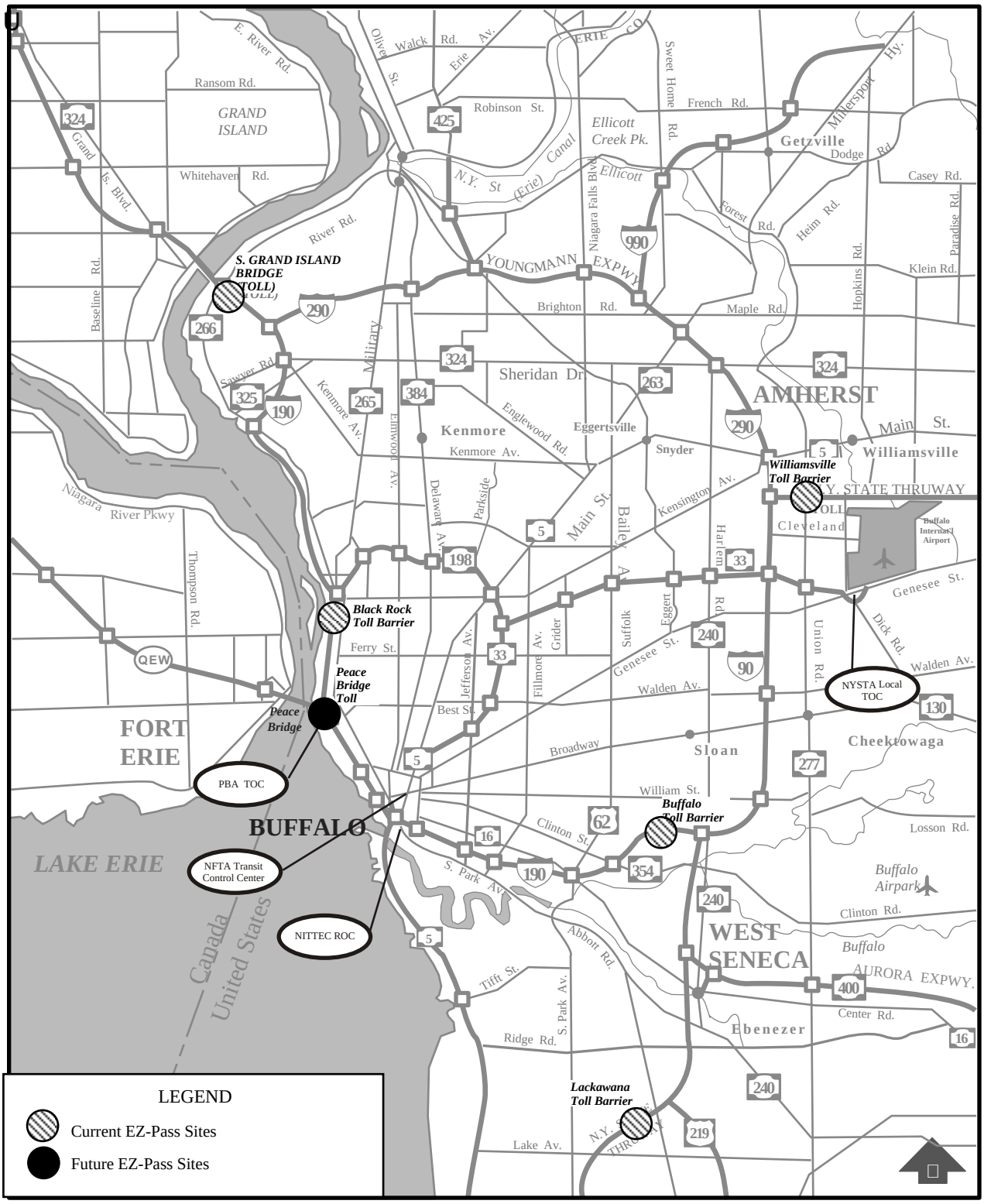

Figure 3-5 Electronic Toll Collection (ETC)

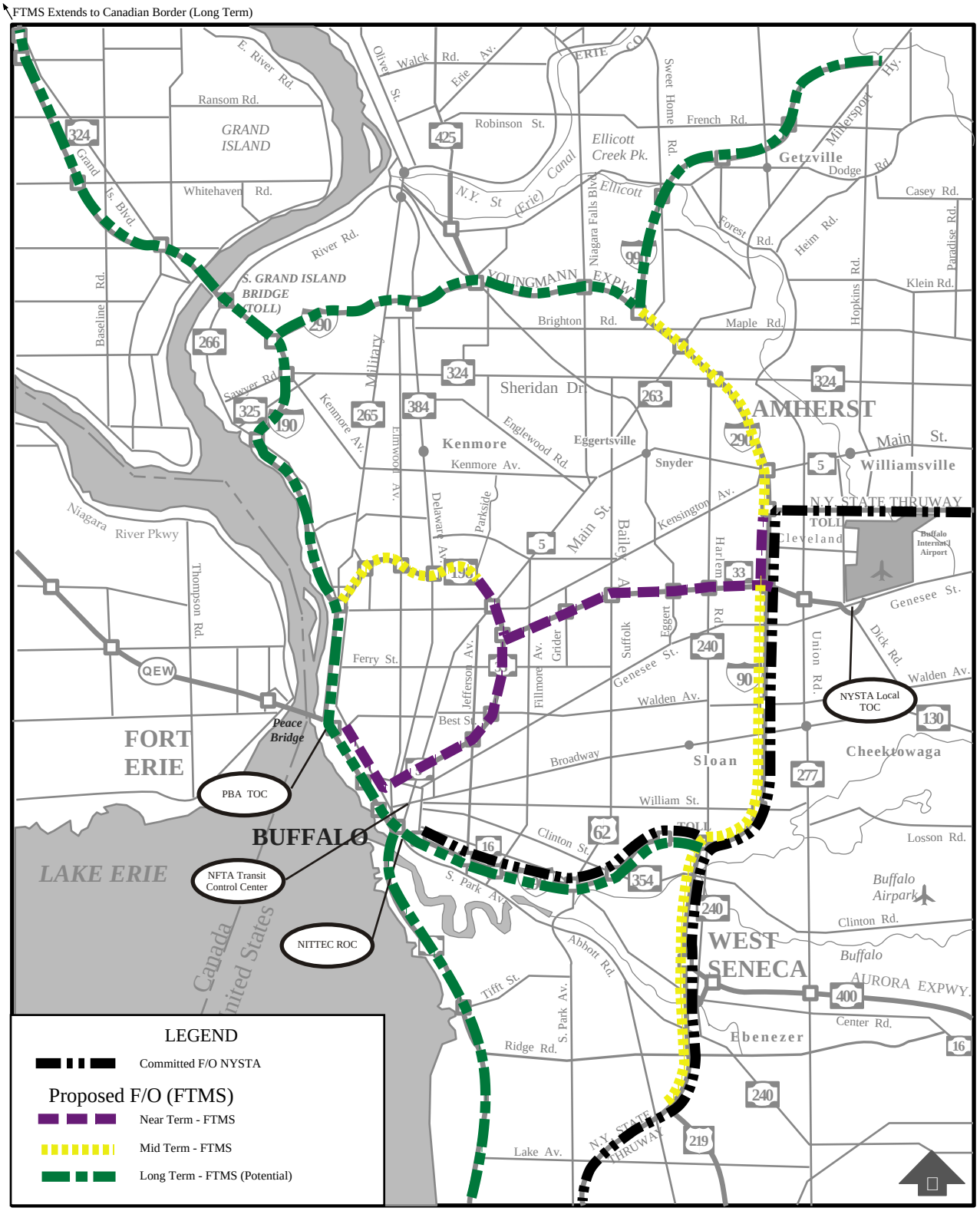

Figure 3-6 Fiber Optic Communication Links

Figure 3-7 Highway Advisory Radio (HAR)

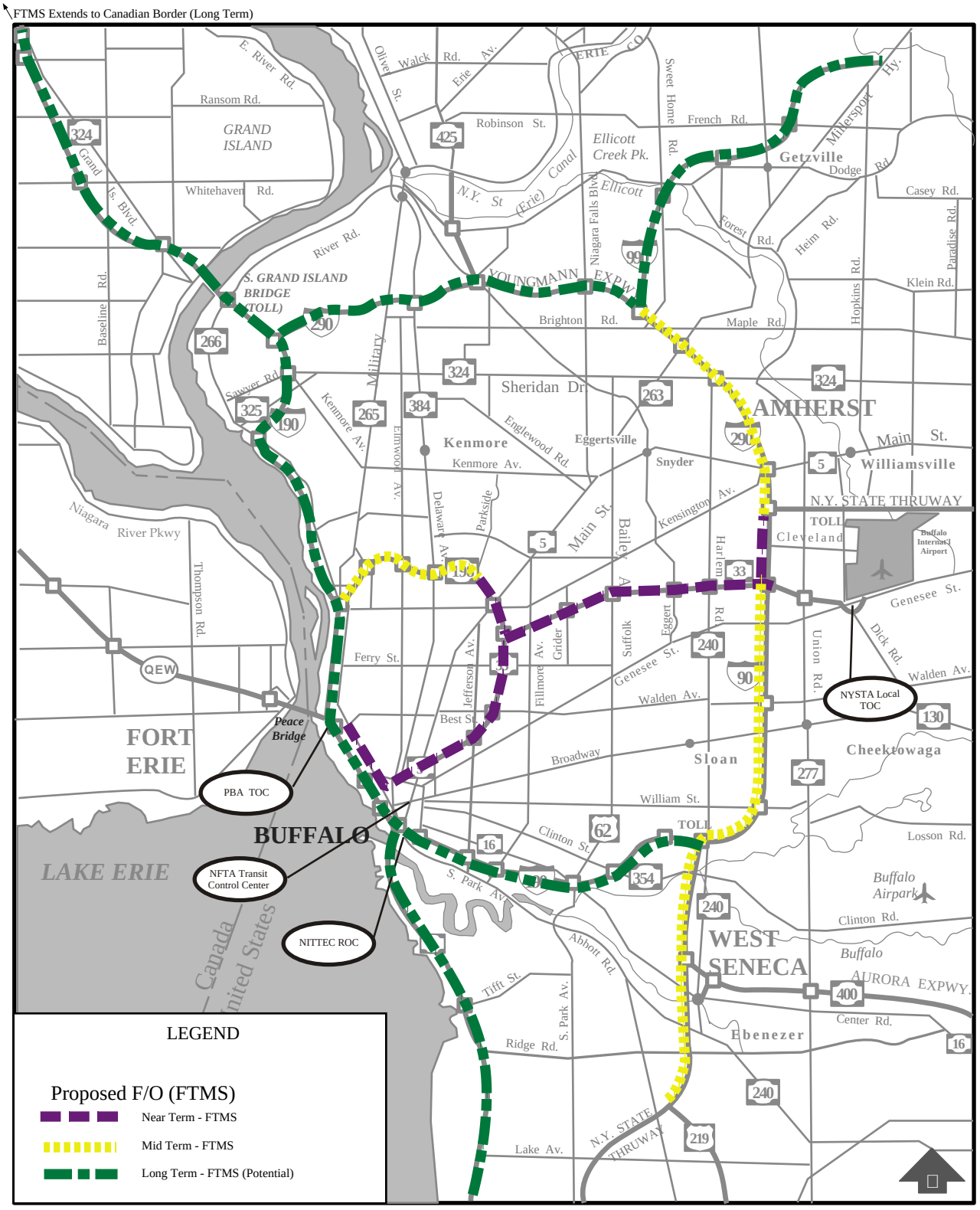

Figure 3-8 Freeway Traffic Management System (FTMS)

This page intentionally left blank.

4.0 INSTITUTIONAL PERSPECTIVE

This section summarizes the institutional considerations and perspective to implement the basic Intelligent Transportation Infrastructure (ITI) initiatives in the region. Rather than a detailed list of actions, the focus is on key elements for program and process success. Perhaps the most important point is that successful ITS implementation requires incremental, evolutionary steps that are phased in over a number of years. Working relationships between large public and private entities with vested interests can only be addressed in this way. There will always be a balancing act between a high degree of cooperation between such entities on the one hand, and the need for autonomy on the other. Working relationships will change over time, adjusting to both the demands of users and the technical requirements of the equipment.

4.1 FUNCTIONAL REQUIREMENTS AND SYSTEM ARCHITECTURE

Working Papers 4 and 5 in particular have discussed functional requirements and recommended system architecture in some depth. The following is a summary of basic points.

4.1.1 Functional Requirements

For Advanced Transportation Management Systems (ATMS) implementation, required elements are:

- Real-time monitoring of traffic flow to evaluate congestion and detect incidents as quickly as possible.
- Traffic control optimization and coordination capabilities to achieve the most efficient and safest traffic flow possible.
- Supporting wireless and wireline communications are needed for incident and congestion management.
- Standard traffic control devices (signals and signs) plus variable message signs and eventually in-vehicle signs needed to control traffic, disseminate traffic information and offer route guidance advice.

In the area of Advanced Traveler Information Systems (ATIS), key elements are similar, including:

- Broadcast capabilities to variable message signs and highway advisory radio.
- Communication links relating congestion, incident and event status.
- Associated databases and interfaces to store and display these status data.

For Commercial Vehicle Operations (CVO), major requirements are:

- Transmission/reception of "911" and "Mayday" calls, plus vehicle classification data (weight, height, width, HAZMAT payload).
- Information collection, flow and management to expedite border crossings, and track HAZMAT and oversize vehicle movement, including HAZMAT incident response.
- Electronic toll and fee payment capabilities.

Emergency Management (EM) requirements are comprehensive, covering:

- Incident detection and precise location.
- "Mayday" signal reception and subsequent communication between the emergency vehicles and emergency management centers, possibly including route guidance.
- Selective use of preemption controls to expedite emergency vehicle travel.

Major requirements for Advanced Public Transportation Systems (APTS) are:

- Transit vehicle presence detection for possible preemption.
- Full two-way communication between transit vehicle operators and the dispatcher.
- Both station and in-vehicle "911" notification and management capabilities.

At the institutional level, there is a need to improve interorganizational management and coordination, financial management and operations management. The presence of an international border adds another dimension to these issues.

In short, area critical stakeholders have emphasized the need to reduce both recurrent (volume related) and non-recurrent (incident related) congestion. Expediting border crossings is included as a basic goal.

4.1.2 System Architecture

The recommended system architecture for the region uses a partially decentralized configuration in which related logical functions are physically grouped together, and in which all data flows are to and from driver/traveler services. Ultimately all ITS elements in the region may be controlled by the NITTEC Regional Operations Center (ROC) during the core hours of 6 AM to 7 PM, Monday through Friday. The operation would not preclude dual control by physical subsystem operators, such as the New York State Thruway Authority and the Niagara Frontier Transportation Authority. Institutional arrangements must be worked out to precisely define day-to-day operations and control.

4.2 PLANNING AND DESIGN ASPECTS

To a large extent, the region should build on the interagency coordination efforts of both the Niagara International Transportation Technology Coalition (NITTEC) and the Western New York Incident Management Team (WNYIMT). These two organizations comprise a broad cross-section of transportation planners, designers and operators, including fire and police emergency personnel (see Working Paper #1 for a more detailed discussion of both organizations). They form the foundation for continuing, evolutionary growth in ITS implementation. Coordination of incident management across multiple jurisdictional levels has proven to be a major challenge in metropolitan areas across the U.S. Success in this area can serve as the handhold for technology implementation as well. The emphasis needs to be a long-term, step-by-step process to realize the benefits of ITS.

The collective vision of NITTEC and WNYIMT will need to be expanded to encompass other viewpoints. At a practical level, design agencies need to become more dedicated to the concept of removing features from the driving environment that cause incidents. Another need is the incorporation of spare conduit in all roadway projects of any length, for potential use in providing the fiber optic communications link. This feature is analogous to traditional efforts to reserve right-of-way for road construction; here the concept is applied to information flow paths, instead of vehicle flow paths.

Several communities and states are investigating the potential for shared communications facilities, sometimes involving public/private partnerships. An example is to allow a private company to install conduit and communication lines in public right-of-way. The private entity then would sell or lease communications capacity to other private entities, but provide the public agency free communication services such as is currently underway with NYSTA and the MFS Communications Company. Another approach is for several public agencies with possibly different missions (e.g., schools and transportation agencies) to jointly develop and share communications facilities.

Another important planning activity relates to potential private sector involvement and public/private partnerships. Due to both the key role of the private sector in supplying ITS technology and the shrinking financial resources of public agencies, private sector involvement is crucial to success. Private sector involvement in automated border crossing developments is the basic building block for the in-vehicle components. Thus, the planning process needs to continually investigate opportunities to work with the private sector.

A final base area for planning relates to needed legislative changes to advance ITS and ITI initiatives. Various ITS areas require such changes, for example, to redefine liability issues, to expand capabilities of public/private partnerships and to fully enact "move-it" laws for disabled vehicles.

As a first step, NITTEC should consider adding a Legal Issues Subcommittee that could first "brainstorm" such issues in depth and then develop the enabling legislation.

Other institutional aspects of planning and design have been discussed in previous working papers, but are briefly reviewed here for completeness. First, all planning and design efforts need to be in

broad conformance with evolving National Systems Architecture concepts. A key point in this regard is the use of open architecture to maximize interoperability and interchangeability of hardware and software. In the communications area, the National Transportation Communications for ITS Protocol (NTCIP) is coming into clearer focus, with initial emphasis on traffic signal controllers, variable message signs and pan-tilt-zoom control of CCTV cameras. Use of NTCIP is recommended to the maximum degree possible. Similarly, common message sets for display on variable message signs should be pursued, as the number and use of such signs increases in the near future.

4.3 IMPLEMENTATION

Implementation must continue to build on the institutional coordination framework set up in planning and design. At this stage, given the move towards open standards and interoperability, operating agencies should consider joint training sessions for key personnel. While each agency will continue to have a distinct mission and constituency, the procedures and tasks for executing that mission should become more similar across agencies. Especially where new technologies are being tried in the region, agencies should agree on a standard approach to project evaluation. This will ensure that a reasonable basis is developed for selecting which elements of new technology are implemented on a wider basis. Evaluation needs to cut across several fronts, including not only engineering performance and benefit/cost, but also product liability, public perception and institutional impacts.

A unique implementation issue to the region relates to the role and function of the two international bridge authorities (the Buffalo & Fort Erie Public Bridge Authority and the Niagara Falls Bridge Commission). Particularly as new technology is added to expedite border crossings, conscious efforts to coordinate on at least a technical level will be needed. These authorities by their nature are somewhat competitive in trying to attract and keep traffic. The challenge is to work within this institutional reality while advancing the common goal of interoperability and open architecture. Toll and revenue collection procedures in particular need to be compatible so that a truck or auto properly equipped can ultimately utilize any of the four border crossings with equal ease.

4.4 OPERATIONS AND MAINTENANCE ASPECTS

In the operations and maintenance area, mechanisms must be set up to constantly fine-tune system management. As high technology approaches to congestion and incident management evolve, personnel will have the means to implement an ever-increasing number of procedures for different incident locations and scenarios. As the capability to reroute or guide traffic from one facility type to another evolves, all involved must agree on acceptable routings and volume diversion levels. Much of the accumulated information on operations and maintenance will be stored at the NITTEC Regional Operations Center (ROC). The ROC will be the focal point from both the operator's viewpoint and from the user's viewpoint to obtain reliable real-time travel information.

Perhaps more than with prior transportation system components, ITS items will require a realistic, ongoing commitment to operations and maintenance. Federal requirements for an Implementation Plan in the Federal-Aid Policy Guide, 23 CFR 655.409 explicitly recognize the need for a

comprehensive operations and maintenance program, in part because this area has sometimes been neglected in the past.

At a pragmatic level, operations and maintenance rely on basic procedures to keep performance at a high level. Thus, a regular program of preventive maintenance is required, including periodic inspection, cleaning and replacement, documented by good record keeping. Record keeping should be automated to the maximum degree possible, to ease the burden of data entry and retrieval. Similarly on the response maintenance side, notification and response time records should be handled electronically. Again, with several agencies participating in the work, they must share common procedures to make the execution as simple as possible.

The NITTEC ROC operating agencies should explore all possible avenues for joint maintenance of ITS facilities. As ITS elements are constructed throughout the region, potential economies of scale can be achieved by shared maintenance responsibilities. The increasing guiding rule should be that the agency that can most efficiently take care of a problem should handle it, based on proximity, technical expertise and staff availability. The NITTEC ROC should take increasing responsibility for identifying problems and assigning maintenance or repair crews. This approach will require careful operations and maintenance planning, including investigation of the need to rewrite and amend agency operating charters and regulations.

4.5 REGIONAL BENEFITS

The proposed project will assist in improving traffic flow. Although many of the projects are located on the freeways, if traffic flow improves there, some traffic from the local road system will be attracted to the freeway system. It is also expected that traffic flow will improve on the local road system during special events due to the incident/special event management systems being incorporated on the freeway system.

With the addition of a Regional Road Weather Information System (RWIS), local traffic agencies will be able to dial-in to the database and determine pavement conditions for their roadways close to a regional RWIS station (Figure 3-4). This will help improve the application of deicing materials and/or sand.

An Incident Management program should help local roads. Cell phone "eyes and ears", more available emergency vehicles and coordinated responses will all affect a quicker detection and clearance time. Which in turn means less congestion on both the freeway and local roads.

This page intentionally left blank.

5.0 PROCUREMENT STRATEGIES

The procurement of system elements can occur through several different options. The regional system may be implemented using the following:

- Procurement of system elements through the independent efforts of individual agencies.
- Procurement of system elements through a cooperative effort of all agencies identified as project participants.
- Institution of a state procurement contract.

5.1 INDEPENDENT AGENCY EFFORTS

Due to the similarity in efforts and the variety of hardware/software applications available as solutions for the Buffalo ITS, the procurement of system elements through independent efforts of individual agencies is not recommended. This approach will perpetuate the problems of the past with respect to advanced systems deployment by continuing individual system(s) expansion. The potential result is installation of incompatible equipment, a slow down in the proposed regional ITS deployment schedule, and increased administrative costs for each agency.

5.2 COOPERATIVE AGENCY EFFORTS

Procurement through a cooperative effort of the participating agencies would allow for staged delivery dates, identical equipment, and reduced costs (through bulk purchase of the system components).

A central committee capable of providing standardization guidance for NITTEC members is key to ensuring consistent, compatible equipment. The NITTEC Technology and Operations Subcommittee is currently charged with this role and should be retained.

The cooperative effort option, however, may be restricted due to budget allocations and internal organizational preferences of the participating agencies. Public/private partnership opportunities under this option provide a potential to reduce budgetary constraints for the Buffalo / Niagara Falls Regional ITS deployment.

5.3 STATE PROCUREMENT CONTRACT

Through the institution of a state procurement contract, equipment could be procured by requesting a bid for a given system component (e.g., CCTV cameras). Once the contract is awarded to a specific vendor, the State and any participating agency(ies) within the State would purchase the equipment under an agreement at a specified price. Each agency could standardize on a specific make and model of item and thereby obtain identical systems.

Given that “out-of-state” entities provide transportation services in the region, this approach would require compact or multi-agency agreements that satisfy all relevant state regulations, and could become quite burdensome to implement. This approach is also time sensitive. Existing and near-term system expansion is already underway within the study area along with other areas of the State. As a result, large-scale procurement would not be cost-effective at this time.

5.4 RECOMMENDATION

Since many of the stakeholders have demonstrated a commitment to uniting personnel and financial resources (by the formation of NITTEC), the second option -- procurement through the cooperative efforts of all participating agencies -- is recommended, to the extent practical. Agency restrictions in deployment participation which have resulted from current and near-term budget allocations could be lessened through multi-agency cost sharing, as defined in inter-agency agreements.

The adoption of the project priorities of this ITS Implementation Plan by the primary tier of jurisdictions/agencies should overcome individual agency preferences regarding system improvements. This plan advocates a qualified region-wide system and does not limit the prerogatives of each jurisdiction/agency. Each individual agency could still pursue independent ITS initiatives, however it is recommended that coordination with the NITTEC take place to assure a "uniform/united" transportation system and to avoid incompatibilities.

In addition to procurement through cooperative efforts, public/private ventures could provide significant additional funds. There are numerous opportunities for private businesses to share in the financial burden of the ITS and realize a profit. For example, advertising opportunities exist in the implementation of the ROC providing traffic condition reports through kiosks and VMSs. Both the practical and legal implications of such involvement need to be investigated further.

6.0 IMPLEMENTATION PLAN

This section provides an overview of the implementation options for the Buffalo/Niagara Falls Region ITS, and an order of magnitude implementation cost.

6.1 EXISTING TIP & STIP STRUCTURE

The Niagara Frontier Transportation Committee (NFTC) is the designated Metropolitan Planning Organization (MPO) responsible, together with the State, for the comprehensive, continuous, cooperative transportation planning process for the Buffalo/Niagara Falls Region. In accordance with Federal regulations, it is required that each MPO develop a Transportation Improvement Program (TIP) as a staged multi-year program of transportation improvement projects and services consistent with the transportation plan.

The TIP is the capital programming component of the overall planning process. This program consists of a listing of specified federally funded highway and transit projects being considered for implementation in the next five-year period. It is updated each year based on the continual re-evaluation of long and short range planning activities. Those projects of high priority are selected, each year, for funding and implementation.

The Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) provide the majority of the financing for transportation projects in the TIP. The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) consolidated the major highway programs into the National Highway System (NHS), the Surface Transportation Program (STP) and also the Bridge Program. Federally funded components of the TIP are termed the “Required” program. Other projects are included in the TIP for “informational purposes” to insure the coordination of all major transportation projects within the region, as well as provide a comprehensive picture of regional transportation improvements.

The current TIP for the Buffalo / Niagara Falls Region was approved in April of 1994, which covers the Federal fiscal years October 1, 1995 through September 30, 1999. Typically, the TIP is updated on an annual basis and passed on to the NYSDOT, Albany where it is combined with TIPs from other Regions to form the State Transportation Implementation Program (STIP). However, since there has been much uncertainty in State and Federal funding levels, there has been no annual approval of the TIP since April of 1994.

It is noteworthy to mention that although the TIP is based on a five year transportation program, the Federal government only recognizes the plan for three years. Therefore, projects which appear on the current TIP that have not been approved for Federal funding by October of 1997 will not be recognized until a new TIP is in place.

6.2 REQUIRED TIP & STIP MODIFICATIONS

Projects which do not appear on the TIP will not be considered for federal funding. However, there are two options to get projects added to an existing TIP.

Annual TIP Update Process

Candidate projects are selected based on available funds, priorities, and negotiations which are carried out by the "TIP Working Group" (formed specifically to address TIP issues), which meets on a monthly basis. Negotiations begin in August each year and continue through March. The draft project list is reviewed by the Planning and Coordination Committee (PCC), which is basically comprised of Erie and Niagara County government officials, the NYSDOT and the NYSTA. The final draft project list is then passed on as a recommendation for review by the NFTC, and eventual approval of the TIP on April 1. As noted above, however, annual updates to the TIP have not occurred in 1995 and 1996, due to funding shortfalls.

TIP Amendment Process

The TIP amendment process is similar to the annual TIP update process in that projects are reviewed by the TIP Working Group, and then passed on to the PCC, approved by the NFTC, incorporated into the STIP, and then passed on to the Federal government. This process, however, is carried out on an individual project basis and without a structured time frame.

Since the Buffalo/Niagara Falls ITS is not included in the current TIP, and due to the uncertainty of the next TIP Update, the TIP amendment process is recommended for this project.

6.3 IMPLEMENTATION APPROACH

There are four basic categories of deployment approaches to be considered for the deployment of the Buffalo/Niagara Falls ITS. These include:

- Engineer/Contractor
- System Manager
- Program Manager
- Design/Build.

The fourth approach -- Design/Build -- is also considered a potential sub-category under the System or Program Manager approach. The four approaches are explained and summarized in more detail in the following sections.

6.3.1 Engineer/Contractor

Traditionally, this procurement approach has been used by most of the transportation agencies in the region for the implementation of transportation improvement projects. Typically, an engineering

entity (governmental entity or consultant to a governmental entity) prepares a single set of plans, specifications, and estimates (PS&E) for the project. The PS&E then constitutes the contract documents. The contract documents are then advertised, bids are received from contractors, and the project is awarded to the lowest responsible bidder. The successful bidder is responsible for providing a complete and fully operational system, including furnishing and installing all hardware and any required software, system integration, training and documentation. Depending on the specific project requirements, contractor development of implementation and operations plans may be included as the contractor's responsibilities.

The engineer, typically a consultant to the client/owner (administering agent), often continues involvement in the project after contract award by participating in reviews of contractor submittals, system tests (factory demonstration, stand-alone, integration, final acceptance testing), and development of system operations plans if not performed by the contractor. The client/owner generally retains the primary responsibility for ensuring conformance of the work with bid documents and for testing and accepting system elements. The client/owner is also generally responsible for coordination between prime contractors working on various stages of the program. Considerations in project implementation with this approach include the following:

- Generally there is one large contract to prepare.
- Often, no single contractor possesses the required experience and qualifications to fulfill all the work.
- Project success is dependent on the prime contractor's ability to coordinate and manage a large number of subcontractors.
- It is difficult to administer multiple layers of subcontractors and suppliers.
- The prime contractor will depend principally on bid price for selecting subcontractors and will place specification adherence responsibility on the subcontractor with primary compliance oversight by the client/owner.

The Buffalo / Niagara Falls ITS implementation will involve state-of-the-art hardware and software and include a wide range of technology applications, equipment, construction techniques, and related services. It will undoubtedly become an issue as to what type of contractor should be the prime. Interaction between the contracting agency and the contractor(s) is very important to the project success. Lack of such interaction has proven to be a problem for a few transportation agencies in past procurement activities.

Typically, the administering agency relies on the knowledge of the prime contractor to select the appropriate or qualified subcontractors, though often with the primary criterion being lowest cost. Experience with advanced technology applications to transportation systems in recent decades has left many transportation agencies with systems that are proprietary, maintenance-intensive, and prone to routine failures.

6.3.2 System Manager

With this approach, responsibility for administering the project(s) is typically shared between the client/owner and the System Manager. Each party's level of involvement is negotiated. The activities of the System Manager include preliminary engineering, preparation of specifications, supervision of final design preparation, construction engineering, construction inspection or supervision of others performing these services, development of required software, system integration, and training. Typically, early project activities at the client/owner level including developing the concept for a program, group of projects, or a single project are completed prior to procuring the System Manager.

The System Manager shares in administering the contracts with the client/owner and is primarily responsible for integrating the various subsystems into an operating system. Assistance is also provided to the client/owner in overall program management and quality control, however, primary responsibility for the overall program remains with the client/owner.

Depending on the negotiated terms of the agreement between the client/owner and the System Manager, the final PS&Es for all or portions of the work may be included as the System Manager's responsibilities.

6.3.3 Program Manager

This approach is similar to the system manager approach, except that the Program Manager becomes the entity with overall responsibility. Unlike the system manager approach, the Program Manager would have responsibility for contract administration and conceptual development of the deployment initiatives by project or sub-program. The contracting agency would only monitor the Program Manager. The Program Manager would then have responsibility for managing the work of all subcontractors and construction contractors. Services of the Program Manager may continue into the operations stage of any deployment activity with oversight and/or staffing responsibilities, depending on the negotiated terms of agreement between the client/owner and the Program Manager.

Again, similar to the system management approach, the design elements may be performed by the Program Manager or others. A design/build approach for some segments may be more applicable (e.g., fiber optic backbone expansion) and should be considered. With the design/build option, the Program Manager may serve as the prime contractor or administer all work relating to a design/build segment.

6.3.4 Design/Build

A turn-key method, the design/build approach would provide single point responsibility for all work associated with the deployment of the system. Similar to the program manager approach, the agency's role is in monitoring the activity of the Design/Builder. The Design/Builder performs all design work, contracts and/or constructs system elements, commissions the system, and eventually turns it over to the operating agency. A major sub-option to this approach includes extended operations period responsibility for the Design/Builder (design/build/operate/transfer) or continued

operations over an extended period of time (design/build/operate). Privatization initiatives and public/private partnership potentials will be key factors in the evaluation of the design/build opportunities.

Unlike the program management approach, design/build places a greater burden of supervision on the contracting agency to insure that quality is maintained. With this approach, the Design/Builder is usually provided a conceptual design and functional specification for the implementation activity. This level of documentation is provided by the client/owner, and it is either prepared internally or prepared under contract by an independent firm.

6.3.5 Recommendation

Trends in decentralization and downsizing of government services plus privatization of transportation service suggest that the Buffalo / Niagara Falls ITS implementation focus on softening the current level of administrative burden on the region's jurisdictions/agencies. The goal is to maximize the quality, effectiveness, and reliability of system deployment. While procurement must maximize the cost sharing potential among the participating agencies implementation must ensure quality and provide the needed enhancements in a timely manner to produce a reliable system.

For the Buffalo/Niagara Falls ITS, multi-agency participation is an overall prerequisite. These circumstances call for a mixed approach implementation. Therefore, it is recommended that deployment use a System Manager or Program Manager approach for the overall program, supported by smaller implementation projects using a traditional engineering/contractor approach or design/build initiatives. Larger defined projects should be considered for design/build deployment. NITTEC, or a private firm hired by NITTEC, could be considered system or program manager.

6.4 DEPLOYMENT COST ESTIMATES

The projects shown in Table 6-1 reflect those listed in Section 3 as proposed for the near and mid term.

Table 6-1 Capital and Annual Operating & Maintenance Costs

PROJECT	CAPITAL COSTS	ANNUAL OPERATING COSTS	ANNUAL MAINTENANCE COSTS
NEAR TERM			
5804.08 ROC Upgrade	$896,000	$112,000 to $146,000	$50,000
5804.08 FTMS Stage I	$4,650,600	$17,400	$465,060
5804.08 ROC IEN	$105,000	(1)	$60,000
Near Term Summary	$5,651,600	$129,400 to $163,400	$575,060
MID TERM			
Interconnect to Mayday	$24,000	$12,000	-
FTMS Expansion	$5,686,100	(1)	$568,610
Signal Coordination & Closed Loop Signal Applications	$200,000	$20,000	$20,000
Arterial Bus Priority	$199,500	(2)	$19,950
Common Smart Card	$9,466,000	(2)	$946,600
RWIS Interconnect	$112,000	(1)	$11,200
Pre-Trip Traveler Information	$1,000,300	(2)	$100,000
ITBCS Expansion Project	$4,200,000 to $8,400,000	(2)	$420,000 to $840,000
Roving Service Patrol	$650,000	$125,000 to $333,000	$65,000
Mid Term Summary	$21,537,800 to $25,737,900	$157,00 to $365,000	$2,151,360 to $2,571,360
TOTAL	$27,189,400 to $31,389,400	$286,400 to $528,400	$2,726,420 to $3,146,420

(1) Operating Cost included in ROC operating cost.
(2) Minimal annual operating cost included in maintenance cost.

7.0 SUMMARY

This document is the last of seven working papers that together constitute an ITS plan for the Buffalo/Niagara Falls region. This working paper focuses on specific staged actions to make ITS an integral part of the regional transportation system.

The paper first summarizes the transportation problems identified by critical stakeholders. Major areas of concern are congestion (both recurrent and incident-related), border crossing operations, interorganizational/international cooperation and funding. To assure ITS actions are effective, a comprehensive, rationale program to track impacts, through "before" and "after" studies, needs to be used. Preliminary recommended technologies are recapped, as well.

The paper next outlines a series of near term (1996 to 1998), mid term (1999 to 2003) and long term (2004 to 2010+) projects to implement ITS. Committed near term projects include:

- Installation of variable message signs and CCTV, primarily on the freeway system.
- Addition of 97 permanent vehicle detector stations.
- Selected roadway weather information systems and fixed message signs.
- "EZ-Pass" electronic toll collection on the New York State Thruway.
- Traffic signal coordination on 219 signals regionwide and 100 signals in the Buffalo Central Business District.
- A pilot study of the Intelligent Transportation Border Crossing System for commercial vehicles on the Peace Bridge.

It should be noted that there are several existing Traffic Operations Centers (TOC) for monitoring and managing traffic, operated by the New York State Department of Transportation, the New York State Thruway Authority, and the bridge authorities. The Niagara Frontier Transportation Authority runs a transit control center in downtown Buffalo. Traveler information or advisories are provided by the commercially operated Metro Networks Traffic Reporting service, weather advisory reports are broadcast over FM and AM radio from the Buffalo Airport, and travel advisory radio reports are broadcast on the FM band from Niagara Falls, Ontario. The NYSDOT has recently begun operation of a Regional Operations Center (ROC) for day to day traffic operations and construction/maintenance activity reporting.

Eleven specific projects that either integrate existing ITS elements or introduce new technologies are recommended for near term or mid term implementation. In the near term, the highest priority project is the upgrade of the (ROC) under the auspices of the Niagara International Transportation Technology Coalition (NITTEC). The goals of the ROC are to integrate the functions and activities of the several existing TOCs, coordinate incident management and provide real-time information

to the traveling public on congestion, weather and construction/maintenance activities. The ROC will also provide a foundation for several other ITS projects. The other near term priority is construction of the first stage of a Freeway Traffic Management System. Table 6-1 summarizes the estimated costs of all twelve projects. In total, the results are approximately:

- Capital Costs - $27,189,400 to $31,389,400

- Annual Operating & Maintenance Costs - $3,012,820 to $3,674,820.

From an institutional perspective, the region needs to build on the cooperative basis established by the NITTEC and the Western New York Incident Management Team (WNYIMT). Only through cooperative interagency efforts can ITS be successfully implemented regionwide. Overall, implementation requires evolutionary, step-by-step actions that are jointly planned, designed, constructed and operated. Participating ROC agencies should explore all possibilities for jointly constructing, operating and maintaining ITS facilities. Associated discussions will require balancing of agency views on autonomy vs. cooperative action, along with enabling policy directives or legislation.

All of the near term projects and the FTMS Expansion from the Mid-term are currently on the Transportation Implementation Program (TIP). The remaining nine mid-term projects will need to be added to the TIP. The most effective way to add them would be through the TIP amendment process.

Procurement of ITS elements should be achieved through cooperative agency efforts that take advantage of volume purchases. Potential public/private partnerships that subsidize key elements should be pursued as well. Overall procurement should be coordinated through NITTEC.

Due to the variety of agencies involved in ITS activities, it is recommended that deployment be based on a mix of approaches. The overall program should use a System Manager or Program Manager, but individual projects should be on a Design/Build or traditional Engineer/Contractor basis, as fits the size, scope and complexity of the work.