NEW YORK STATE DEPARTMENT OF TRANSPORTATION

Intelligent Transportation Systems (ITS) Study

for the

Buffalo and Niagara Falls Metropolitan Area

Erie and Niagara Counties, New York

Executive Summary

June 18, 1997

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

In association with:
AE Group
Clough, Harbor & Associates
Calspan Corporation
IBI Group

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

FINAL REPORT
EXECUTIVE SUMMARY

June 18, 1997

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

In association with:
AE Group
Calspan Corporation
Clough, Harbour & Associates
IBI Group

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

This page intentionally left blank.

1.0 BACKGROUND AND PURPOSE

The primary goals of the Buffalo/Niagara Falls Intelligent Transportation System (ITS) study are to evaluate the transportation needs of the region, assess the ability of ITS to meet those needs and develop a Strategic Plan for ITS implementation. The project area, as shown in Figure 1, covers Erie and Niagara Counties plus the southern portion of Ontario, which together have a population of over 1.5 million people.

ITS is the use of modern computers, controllers, sensors and communications to improve traffic and transit system flow and safety. Examples of ITS are advanced traffic control systems to monitor and control flow, and incident detection and management systems to quickly locate and respond to accidents and breakdowns disrupting traffic operations.

Key study steps were to determine existing system deficiencies, identify current ITS elements, develop a critical stakeholder outreach program, determine functional needs and assess current technologies for addressing the needs. From these steps, a system architecture was developed, leading to a Strategic Plan. The heart of the Strategic Plan is a recommended project list for implementation in near term, mid term and long term horizons.

Throughout plan development, oversight and direction have been provided by the Niagara International Transportation Technology Coalition (NITTEC), a multi-agency organization working to apply advanced technology for the betterment of transportation in the region. Table 1 lists NITTEC membership, with related membership of the Western New York Incident Management Team (WNYIMT) and other ITS critical stakeholders. All of these have provided input to this study.

2.0 EXISTING TRANSPORTATION NETWORK AND ITS

The existing transportation system is fairly mature and serves a number of user populations, including commercial/business travelers and tourists. The regional industrial base is complemented by Niagara Falls, a major tourist attraction along the international border between the U.S. and Canada. The needs of the various user populations are normally quite different and must be carefully considered in regional planning.

Connecting the U.S. and Canada are four international bridges, three of which are owned and operated by the Niagara Falls Bridge Commission (the Rainbow Bridge, the Whirlpool Bridge and the Lewiston-Queenston Bridge) between Niagara Falls, N.Y. and Niagara Falls, Ontario. The Peace Bridge between Buffalo and Fort Erie, Ontario is owned and operated by the Buffalo and Fort Erie Public Bridge Authority. Both authorities have international representation, and they acknowledge a certain degree of competition to attract patrons for border crossings. Major freeways in the area include the New York State Department of Transportation (NYSDOT) Kensington Expressway (NY 33), the Scajaquada Expressway (NY 198) and the Youngmann Expressway (I-290), plus the I-90 and I-190 operated by the New York State Thruway Authority (NYSTA).

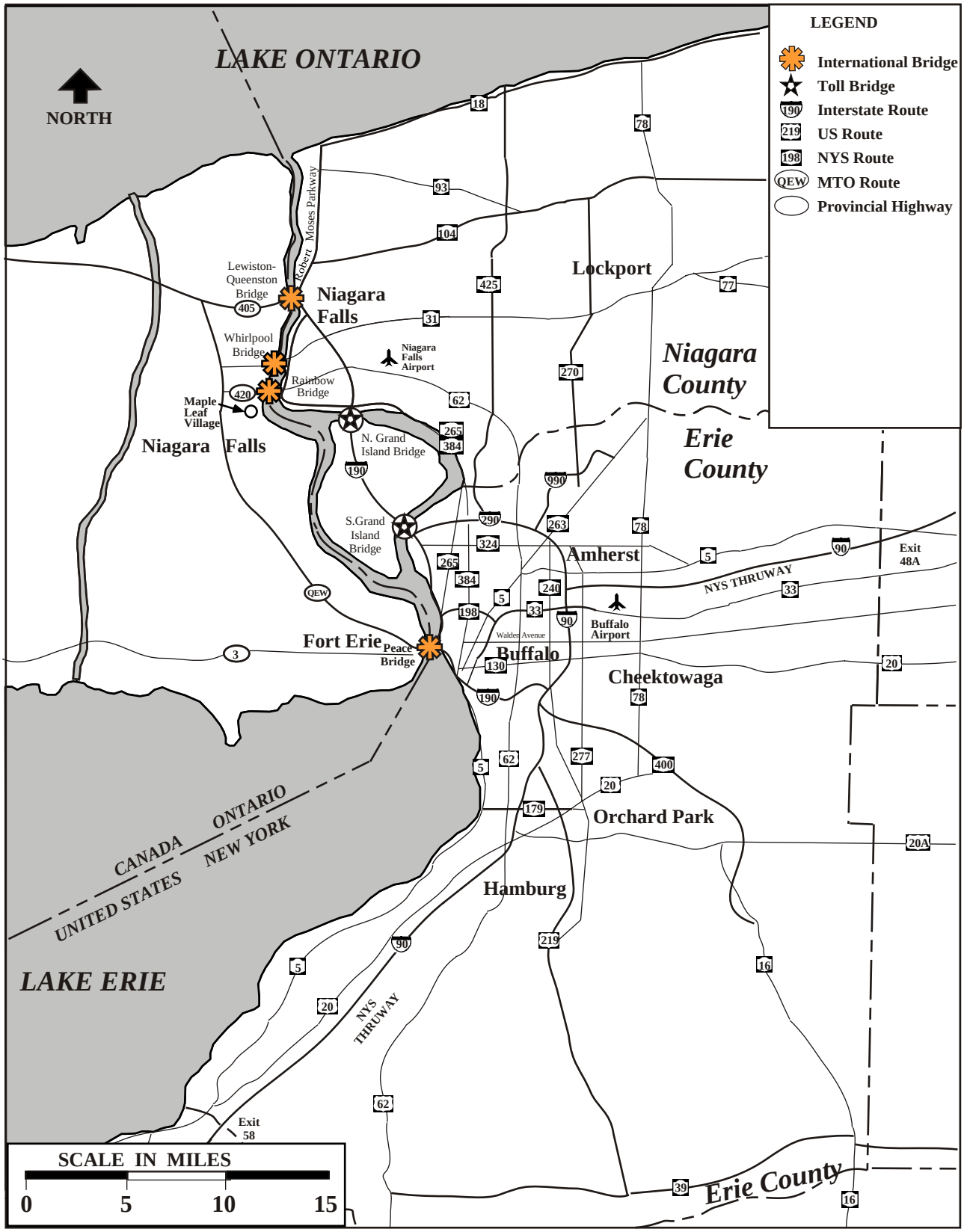

Figure 1 Regional Project Area

Table 1
Membership of:
Niagara International Transportation Technology Coalition (NITTEC)
Western New York Incident Management Team (WNYIMT)
ITS Critical Stakeholders

Agency / Organization	NITTEC	WNYIMT	ITS Critical Stake-holders
Federal Highway Administration	x	x	x
New York State		Police, Conservation Dept.	Police
New York State Department of Transportation	x	x	x
New York State Thruway Authority	x	x	x
Niagara Frontier Transportation Authority	x	x	x
Ministry of Transportation, Ontario	x		x
Niagara County	x	Public Works, Emergency Services, Sheriff	x
Erie County	x	Commissioner, Public Works, Sheriff, Fire & Safety	x
Niagara Falls, New York	x		x
Niagara Falls, Ontario	x		x
City of Buffalo	x	Police & Fire	x
Niagara Frontier Transportation Committee		x	x
Niagara Falls Bridge Commission	x		x
Buffalo & Fort Erie Public Bridge Authority	x		x
New York State Police Department		x	x
Greater Buffalo Partnership			x
Automobile Association of America, Western and Central New York		x	x
Tower Group International (CJ Tower, Inc.)			x
Region of Niagara	x		x
Metro Networks		x	x

Table 1
Membership of:
Niagara International Transportation Technology Coalition (NITTEC)
Western New York Incident Management Team (WNYIMT)
ITS Critical Stakeholders

Agency / Organization	NITTEC	WNYIMT	ITS Critical Stake-holders
US Customs/Immigration & Naturalization Service			x
Fort Erie, Ontario	x		x
Niagara Parks Commission	x		x
CAA Niagara			x
Adelphia Cable Communications		x	
Buffalo/Niagara Frontier Safety Council		x	
Empire State Towing and Recovery Association		x	
Yearke Graphics		x	

The region has a significant number of ITS elements today. Traffic surveillance equipment, in the form of in-pavement detectors scattered throughout the region, are used to count traffic, though not on a continuous, real-time basis. Closed Circuit TV (CCTV) is used on the international bridges to help manage traffic flow and dispatch help as needed, and a few other CCTV cameras are being installed in strategic locations. The "EZ-Pass" system on the NYSTA helps to speed up traffic flow through toll booths. The Skyway closing system along the elevated portion of NY 5 near Lake Erie through downtown Buffalo can also be considered an ITS component, protecting drivers from severe weather conditions.

Existing traffic operations centers individually run by public agencies monitor and manage traffic flow. Agencies with some form of center include the NYSDOT, NYSTA, the Buffalo and Fort Erie Public Bridge Authority (PBA), the Niagara Falls Bridge Commission (for the Niagara Falls area bridges), and the Niagara Frontier Transportation Authority (for public transit facilities). NITTEC has recently begun to develop a Regional Operations Center, or ROC, to coordinate activities of the various traffic operations centers. The interim ROC is currently housed in the NYSDOT General Donovan Building in downtown Buffalo.

The region presently has twenty variable message signs in place. The signs are intended to convey up-to-date traffic conditions to the traveling public. Currently there is no "formal" surveillance, however surveillance in the form of police, motorists, transportation system employees exist and will

be utilized until the "formal" system is in place next year. Supporting improvements to the various traffic operations centers and to the ROC are aimed at improving this situation. Highway advisory radio coverage is provided by NYSTA. In addition, the Niagara Parks Commission jointly with the Niagara Falls Bridge Commission operate a tourist information radio station.

The Niagara Frontier Transportation Authority runs an automated phone-in system to notify users of schedule status. The authority is also adding automatic vehicle identification equipment to its entire fleet of vehicles to better track and manage day-to-day operations. The eight park-and-ride facilities in the region offer the potential to become sites for installation of information "kiosks," with computer screen displays of current schedules and performance.

At the Peace Bridge, a comprehensive study of automated ways to expedite vehicle movement through customs and immigration is underway. The ultimate goal is to expand this application to all four international crossings.

Overall, the various ITS pieces in place are a first step towards a comprehensive regional ITS. These pieces need to be joined together in an overall vision and strategy for improving traffic flow and safety.

3.0 INSTITUTIONAL ISSUES

With the complexity of the region's existing and future transportation facilities and services, institutional issues must be identified and addressed early on. Recognizing this need, NITTEC and the WNYIMT (see Table 1) have been dealing with these concerns. The represented interests, both public and private in the U.S. and Canada, are working to coordinate activities and develop smooth working relationships. Their efforts need to lead ITS planning and implementation. Only by working together can the promise of advanced technologies be put to best use for the traveling public.

Key institutional issues are agency autonomy, legalities and interagency agreements, privacy concerns, and the need to enlist private sector involvement. Each are discussed in turn below.

Regarding autonomy, the basic issue is the need to share information without necessarily relinquishing control. The further development of the ROC depends on clear delegation of authority and resolution of the autonomy issue.

In the legal arena, there is a need for interagency agreements. Not only must interagency agreements between public agencies be developed, but public/private partnerships are high priorities as well. Since no national guidelines exist to guide these steps, proper attention, geared to local conditions, must be focused on this area.

The third key institutional issue is privacy, which has both internal and external aspects. Internally, the issue is the security of the system to protect unauthorized personnel from stealing or corrupting information. Externally, the concern is that even with good internal security, there must be limits on the degree and type of information that is collected and disseminated. A good example is the

need to maintain driver anonymity when tracking individual vehicles traveling on the road, to avoid the specter of "big brother." Current technology typically builds in protections that do not allow access to, for instance, license plate numbers associated with EZ-Pass use. Similar issues arise with video cameras that can "zoom in" on individual vehicles, their passengers and license plates.

Another key issue is motivating the private sector to participate in ITS efforts. Obviously, private interests need to see a profit potential to make investment worthwhile, and are concerned with the protection of intellectual property rights. Public agencies can promote the effort by providing as much information as possible for assessing risks and markets and for developing products.

Overall, institutional issues overlap and are interrelated, and must be considered as a package.

4.0 DEFICIENCIES, NEEDS AND TECHNOLOGIES

Transportation system deficiencies and needs were identified by surveying and interviewing critical stakeholders and a sample of the public at large. In addition, a June 1996 workshop with the critical stakeholders clarified these items further.

Based on the input received, deficiencies and needs have been identified in the following areas:

- Funding and staffing for capital improvements, operations and maintenance;
- Interagency cooperation and communication;
- Congestion relief, both on a day-in/day-out basis, and associated with incidents on the roadway;
- General travel safety;
- Information dissemination related to weather-related travel conditions;
- Border crossing delays associated with customs and immigration processing, particularly for commercial vehicles;
- Information dissemination for recreational travel and tourism;
- Transit system operations and service.

Specific "bottlenecks" and problem areas were reviewed. The most critical capacity and safety deficiencies were identified as: the Kensington Expressway (NY33) from downtown to past the New York State Thruway (I-90), the Thruway in the vicinity of its interchange with the Kensington, and the Thruway south to the vicinity of US 219 and all of the international border crossings, but particularly the Peace Bridge. On top of these specific locations, critical stakeholders felt that incident management, while improving in the past few years, needed better incident detection and coordinated response. The greatest overall limitation, in fact, was that equipment for quickly recognizing accidents and breakdowns was sparse and behind that of other metropolitan areas in the U.S. As a result, while variable message signs have been installed in several locations, they fall far short of their potential, because essential surveillance of operational performance, minute-by-minute, is lacking. In turn, many people view the signs as a waste of public monies.

The needs led to a list of "user services," as defined in national standards for ITS program planning. The user services have subsequently been translated into technical requirements and "market

packages," which are bundles of specific technologies to meet the requirements. Examples of market packages are complete vehicle surveillance systems with communications back to a central control point, and traffic signal systems to handle traffic flow.

Next, a system architecture and Intelligent Transportation Infrastructure (ITI) components were defined. The architecture is a framework for addressing needs and implementing market packages. For the Buffalo/Niagara Falls region, a"partially decentralized" architecture was selected. In this architecture, most day-to-day operations are distributed across operations centers, though this does not preclude control from a central point.

ITI components are the building blocks for ITS implementation, integrated into an overall system. National ITI guidelines define nine components, most of which need to be enhanced in the region. The most important ITI components for implementation locally are Incident Management, Freeway Management and Regional Multi-Modal Traveler Information. The ITI components will serve the needs of both travelers and transportation system operators.

Finally, technologies have been investigated to select the best products currently available to implement regional ITS. A list of specific products was developed, along with general descriptions of features for products in highly competitive market areas. This product list needs to be reviewed and updated in preliminary and final design, since most products involve rapidly changing technologies.

There is an overall need to build ITS using an "open architecture," which means that technical improvements can be smoothly substituted, or added to the system, as technology advances. For dissemination of information to the public, the plan for the next few years calls for use of variable message signs and highway advisory radio. The challenge in the region is to provide the information gathering and processing equipment to make the information worthwhile to travelers.

5.0 STRATEGIC PLAN

The strategic plan is a "road map" of ITS projects and project participants. The participants are identified to help solidify institutional relationships. The plan has been developed to take advantage of existing ITS elements in the near term while laying the foundation for future deployment initiatives. An implementation schedule is included to logically fit the pieces together. Key components of the plan are presented in Table 2, by implementation horizon. Figure 2 locates several of the projects.

Funding for the Upgrading of the ROC, Stage I of a Freeway Traffic Management System (FTMS), and the ROC's Information Exchange Network is currently being obtained from New York State and U.S. Department of Transportation sources. The ROC will be expanded to include an incident management center for major incidents (collisions, spills, weather, event management, etc.). The Stage I FTMS will provide the necessary detector surveillance capability, CCTV verification capability, and a communications system to transport information to the upgraded ROC for processing and distribution to travelers. Highway Advisory Radio and Variable Message Signs will aid in the distribution of information to travelers. The ROC Information Exchange Network will

establish the necessary communications between primary operations and information centers at an intraregional level. These three near term projects will take a large step in making ITS effective in the region.

Within the next five years, the region should experience firsthand what advanced technology, coupled with institutional cooperation and commitment can accomplish. Done correctly, the associated project cost of $5.6 million will be money well spent.

Mid term projects that build on the near term work are estimated to cost about $21.5 to $25.7 million, continuing the vision developed in this study. The plan is to use lessons learned from the near term projects to improve mid term project design and implementation. Ten years from now the region's residents should realize the benefits of a comprehensive state-of-the-art ITS, flexible enough to incorporate new technologies in the future. Definition of long term projects will evolve over time, depending on the success of earlier projects and further development of technology.

The expected benefits of a regional ITS are significant. A comprehensive incident detection and management program can lead to response time reductions of up to 8 minutes, which in turn decreases motorist travel time and inconvenience to a much greater degree. Programs of this type nationally have yielded travel time savings of up to 40% to motorists, because each minute of reduced response time translates into many hours of reduced driver delay, particularly when traffic volumes are heavy.

Motorists provided with travel condition and road weather information before starting a trip are likely to select a faster route. Reduced travel time, air pollution and fuel consumption will result when motorists can "sidestep" congested areas.

Automated fare payment systems such as the "Common Smart Card" are convenient to travelers and provide better receipt accounting for service operators. Unified media for tolls, transit fares and parking fees also supply valuable planning information on travel volumes and trip patterns. The net result is that facilities can be "fine-tuned" for maximum efficiency.

As noted previously, the success of the Strategic Plan relies heavily on building the necessary institutional relationships first. In the region, the two key organizations in this effort are NITTEC and the WNYIMT. NITTEC, in existence since early 1995, aims to improve regional and international mobility by using advanced technology to maximum advantage. From late 1994 to the present, the WNYIMT's mission has been to coordinate emergency response across a multi-jurisdictional area and to enact a "clear roads" policy to allow removal of obstructions and disabled vehicles from the roadway as quickly as possible, without liability consequences. Since NITTEC and the WNYIMT already represent a broad base of public and private agencies, it is essential that they take the lead in further regional ITS development. A broad perspective to pull the various parts together is needed to ensure success.

NITTEC and the WNYIMT need the encouragement and support of elected officials, other agency personnel and the general public. Developing this support will require an active program to inform a wide audience of the benefits and costs of ITS. This program should involve both

general presentations and one-on-one discussions with key individuals over an extended time period. The major focus, however, should be concentrated in a one-year time period starting in early 1997, since that period coincides with major initiatives to design and construct several new ITS facilities.

Table 2 Capital and Annual Operating & Maintenance Costs of Proposed Strategic Plan Projects

PROJECT	PROJECT DESCRIPTION	CAPITAL COSTS	ANNUAL OPERATING COSTS	ANNUAL MAINTENANCE COSTS
NEAR TERM				
5804.08 Regional Operations Center Upgrade	Upgrade of the interim ROC to provide joint operational integration of the Niagara region's existing variable message signs, CCTV, highway advisory radio, weather stations, and emergency response systems.	$896,000	$112,000 to $146,000	$50,000
5804.08 FTMS Stage I	Installation of ITS elements and creation of a Freeway Traffic Management System along the Kensington Expwy. (NY 33; Elm/Oak to I-90), I-90 (NY 33 to I-290) & NY 198 (NY 33 to Parkside). ITS elements include vehicle detection stations, closed circuit television cameras, variable message signs, highway advisory radio and a communications network.	$4,650,600	$17,400	$465,060
5804.08 ROC Information Exchange Network	Establishes an electronic information system to interconnect the primary operations and information centers within the region. The ROC will act as the communications hub.	$105,000	(1)	$60,000
NEAR TERM SUB-TOTAL		**$5,651,600**	**$129,400 to $163,400**	**$575,060**

Table 2 Capital and Annual Operating & Maintenance Costs of Proposed Strategic Plan Projects

PROJECT	PROJECT DESCRIPTION	CAPITAL COSTS	ANNUAL OPERATING COSTS	ANNUAL MAINTENANCE COSTS
MID TERM				
Interconnect to Mayday System	Communications interface between the Mayday Information Service Provider and the 911 emergency system.	$24,000	$12,000	-
FTMS Staged Expansion	Expand upon the existing, committed and near term FTMS elements. Includes installation of an FTMS on: I-290 (I-990 to I-90), NY 33 (I-90 to Buffalo International Airport), NY 198 (I-190 to Parkside), I-90 (NY 33 south to vicinity of US 219). FTMS elements include vehicle detection stations, automatic vehicle identification stations, closed circuit television cameras, highway advisory radio, variable message signs and a communications network.	$5,686,100	(1)	$568,610
Signal Coordination and Closed Loop Signal Applications	Provide ability to coordinate signals and to coordinate FTMS and local roadways traffic management strategies in the vicinity of on/off ramps and along diversion routes as well as event management.	$200,000	$20,000	$20,000
Arterial Bus Priority Demonstration Project	Bus priority system for signalized intersections along a 5-mile arterial corridor in the Buffalo/Niagara Falls region; arterial to be determined.	$199,500	(2)	$19,950

Table 2 Capital and Annual Operating & Maintenance Costs of Proposed Strategic Plan Projects

PROJECT	PROJECT DESCRIPTION	CAPITAL COSTS	ANNUAL OPERATING COSTS	ANNUAL MAINTENANCE COSTS
Common Smart Card Project	Plan and implement a single "smart card" medium for the region, usable for all transportation related tolls transit fares and parking fees.	$9,466,000	(2)	$946,600
Roadway Weather Information System Interconnect	Interconnect all weather/data stations in the project area and integrate with the ROC.	$112,000	(1)	$11,200
Pre-Trip Traveler Information	Develop the interfaces that would allow users access to pre-trip travel information. Includes development of a Web page and traveler kiosks	$1,000,300	(2)	$100,000
Intelligent Transportation Border Crossing System (ITBCS) Expansion Project	Based on the Peace Bridge ITBCS project, expand the system to all four border crossings in the region. Includes communication links and necessary processing functions.	$4,200,000 to $8,400,000	(2)	$420,000 to $840,000

Table 2 Capital and Annual Operating & Maintenance Costs of Proposed Strategic Plan Projects

PROJECT	PROJECT DESCRIPTION	CAPITAL COSTS	ANNUAL OPERATING COSTS	ANNUAL MAINTENANCE COSTS
Roving Service Patrol	Emergency/incident response program with 4 roving vehicles to travel the two freeway rings and NY 33 in the AM and PM peak periods. Roving vehicles will be equipped to service most stalled vehicles.	$650,000	$125,000 to $333,000	$65,000
MID TERM SUB-TOTAL		$21,537,900 to $25,737,900	$157,000 to $365,000	$2,151,360 to $2,571,360
NEAR TERM + MID TERM TOTAL		$27,189,400 to $31,389,400	$286,400 to $528,400	$2,726,420 to $3,146,420
LONG TERM PROJECTS[3]				
Staged Expansion of the FTMS	Staged expansion to complete the FTMS. Coverage possibly provided on the following roadways: I-190, I-990, I-290, I-90, NY 400, NY 5, US 219 and the Robert Moses Parkway.	-	-	-
Advanced Vehicle Control System	Utilize national developments in the automotive industry and other private design firms to provide "self-guided" vehicles. Technologies and scope under research and development at present.	-	-	-
Support for In-Vehicle Route Guidance Systems	In-vehicle equipment and wireless messaging to provide drivers with travel advisories on a real-time basis.	-	-	-

Table 2 Capital and Annual Operating & Maintenance Costs of Proposed Strategic Plan Projects

PROJECT	PROJECT DESCRIPTION	CAPITAL COSTS	ANNUAL OPERATING COSTS	ANNUAL MAINTENANCE COSTS
En-Route Transit Information	Communication interfaces to transmit bus arrival times and travel times to transit riders while en-route, as well as in bus terminals, via kiosks.	-	-	-
Signal Coordination and Closed Loop Applications Project	Provide ability to coordinate signals and to coordinate FTMS and local roadways traffic management strategies in the vicinity of on/off ramps and along diversion routes as well as event management.	-	-	-

(1) Operating Cost included in ROC operating cost.
(2) Minimal annual operating cost included in maintenance cost.
(3) Costs not yet estimated for long term projects.

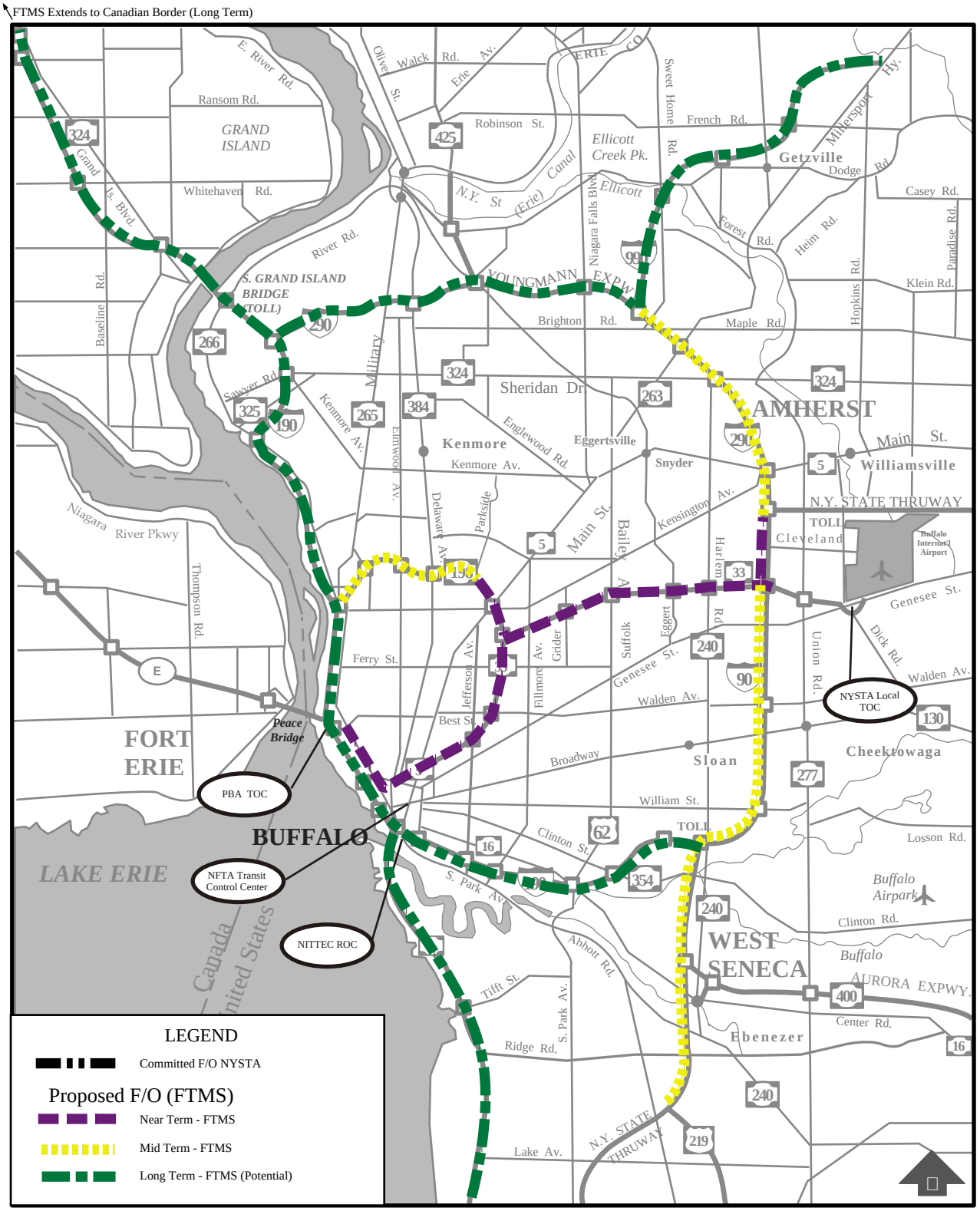

Figure 2 Selected Strategic Plan Projects