Port of Rochester Intelligent Transportation System (ITS)
Project Architecture Case Study
Final Report and Concept Plan

(Excluding Appendices)

Prepared by the Genesee Transportation Council

In conjunction with the City of Rochester

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Introduction & Background

A safe and efficient transportation system is a key component of the Genesee-Finger Lakes region's quality of life. It has a direct bearing on the mobility and accessibility of people and goods to employment, shopping, and other opportunities. It can promote increased economic development and shape the patterns of growth in the region.

In many respects, the region's transportation system provides it with a comparative advantage over many other regions in the state and nation. This inherent advantage must be protected and enhanced. One way to do so is to integrate and enhance the operations of the transportation system through the use of Intelligent Transportation Systems (ITS).

ITS represents the next step in the evolution of the overall transportation system. As information technologies and advances in electronics continue to revolutionize all aspects of the modern-day world (from homes and offices to schools and even recreation), they are also being applied to the transportation system. These technologies include the latest in computers, electronics, communications, and safety systems.

The purpose of the Port of Rochester ITS Project Architecture Case Study ("Port ITS Case Study") is to define a vision for using ITS technology at a new international border crossing and multi-modal terminal at the Port of Rochester. Beginning May 2004, the Port of Rochester will be the United States terminus of a new "fast ferry" passenger and cargo service between Toronto, Ontario, Canada and Rochester, New York. The Port of Rochester ITS Project Architecture is an important tool in making this new international facility an efficient, safe, and world-class border crossing.

In ITS terms, a project-level ITS architecture defines ITS elements (stakeholders, equipment, facilities, etc.) and computerized data flows between these elements. There has been little experience in the region to-date in developing project-level ITS architectures. Accordingly, it is hoped that the lessons learned from the Port ITS Case Study can be used to guide development of future project-level ITS architectures to be developed in the region.

What is ITS?

Intelligent Transportation Systems are information and communications technologies that are used to better manage and improve the performance of transportation facilities, services, and the overall system. Urban and rural ITS applications can be employed on this region's transportation infrastructure of highways, streets, railways, ports and bridges, as well as to a growing number of modes, including cars, buses, trucks, trains, ships, bicycles and pedestrians. The results are improved mobility, safety, security, air quality and productivity.

Key elements of ITS include:

- Traffic signal control (e.g., coordinated signal timing, traffic/emergency signal preemption, etc.)
- Freeway management (e.g., ramp metering, lane use control, variable message signs (VMS), etc.)

- Transit management (e.g., advanced vehicle locator (AVL), computer-aided dispatching, etc.)
- Incident management / emergency response (e.g., automated incident detection systems, computer-aided dispatching, E-911, etc.)
- Electronic toll collection (e.g., E-ZPass)
- Electronic fare payment (e.g., smart cards)
- Railroad crossings (e.g., side-mounted radar, vehicle warning systems, gate controls, etc.)
- Regional multi-modal traveler information (e.g., internet, cell phone, kiosks, etc.)

The United States Department of Transportation (USDOT) advocates the use of advanced technologies such as ITS to improve the efficiency and safety of our nation's surface transportation system. The Federal Highway Administration (FHWA) has identified four key principals that form the basis of the national ITS program:

1. To promote the implementation of a technically integrated and jurisdictionally coordinated transportation system across the country;
2. To support ongoing applied research and technology transfer;
3. To ensure that newly developed ITS technologies and services are safe and cost-effective; and
4. To create a new industry by involving and emphasizing the private sector in all aspects of the program.

Existing Regional ITS Efforts

The Improved Mobility Areawide Guidance Evaluation (IMAGE) plan of March 1996 is the master plan for Intelligent Transportation Systems in the Genesee-Finger Lakes region. Development of this plan involved Federal, State, and local officials, including GTC. IMAGE inventoried all existing and proposed ITS activities in the region and crafted a long-term vision for the future of ITS in the Genesee-Finger Lakes region.

Much of the existing ITS infrastructure in the region was developed from the IMAGE plan. This infrastructure includes the Regional Traffic Operations Center (RTOC), the upgraded arterial coordinated traffic signal system, the New York State Department of Transportation (NYSDOT) ITS fiber backbone system, and the fire emergency vehicle signal pre-emption system.

As Federal ITS standards became more specific under the rubric of the National ITS Architecture, a Regional ITS Architecture for the region was developed. The framework for the Regional ITS architecture (i.e., the stakeholders, equipment, facilities, activities, and their associated data flows) first developed under IMAGE was reorganized with the completion of the Rochester Regional Architecture Workshop in May 2000. At this workshop, approximately twenty local transportation and public safety agencies constructed an updated Regional ITS Architecture, based on the standards of the National ITS Architecture.

The ITS capabilities in the Genesee-Finger Lakes region were greatly enhanced by the opening of the Regional Traffic Operations Center (RTOC) at the Greater Rochester International

Airport in Summer 2001. The RTOC serves as the Traffic Control Center for Monroe County's Computerized Traffic Signal System (CTSS), the central point for NYSDOT-Region 4's signal maintenance and traffic management activities including dispatching, monitoring of the State's Regional Weather Information System (RWIS), and managing activities in NYSDOT-Region 4's ITS program.

The relocation of the State Police Henrietta Headquarters to this site brought together the operators of the highway network and one of the key responders to traffic incidents on the region's expressways. This multi-agency facility will be the hub of ITS operations in the region for years to come. Many of the Port ITS components identified in this study will connect to the RTOC.

GTC ITS Planning Initiative

The GTC ITS Planning Initiative builds on the IMAGE report, the Regional ITS Architecture, and the recent area-wide ITS advances identified above by developing an in-depth project architecture for an important activity center in the region as a case study.

In accordance with new Federal guidance, this initiative recognized the expanded role of Metropolitan Planning Organizations such as GTC in ITS implementation. To this end, GTC gathered officials from local agencies with a stake in ITS, forming the ITS Planning Working Group to guide the project-level case study component of this Initiative. The ITS Planning Working Group is made up of representatives from the City of Rochester, Monroe County, NYSDOT, and GTC.

Port of Rochester ITS Project Architecture Case Study

A primary result of the GTC ITS Planning Initiative was the development of a project-level ITS architecture case study of an important activity center in the region. The results of the case study and lessons learned are transferable to, and will help guide development of, other project-level architectures in the region.

The Port of Rochester was chosen as an ideal setting for the case study. Expected investment at the Port will lead to major traffic growth in and around the Port area in coming years. ITS components can be utilized to improve the flow of people, goods, and information between the Port of Rochester and the balance of the Genesee-Finger Lakes region. In addition, a fast ferry service to Toronto scheduled to begin in May 2004 will introduce even greater opportunities for ITS applications at the Port, including the provision of a safe and efficient international border crossing.

The case study determined the full range of stakeholders, equipment, facilities, and associated data flows connected with the Port. This exercise engaged transportation, public safety, emergency service providers, and others with a stake in the operation of the Port of Rochester. Determining the project-level architecture also helped define the physical infrastructure needed to support the ITS components required to establish the Port of Rochester as a world-class facility.

Architecture Development Process

Step 1: Understanding ITS

To give the project sponsors an understanding of ITS as well as the overall process involved in creating a project architecture, an FHWA-sponsored training session was held in May 2002. In attendance at this session were representatives from NYSDOT, Monroe County, the City of Rochester, GTC, Canadian-American Transportation System (CATS -- the ferry operators), and LaBella Associates (the Port designers).

Step 2: Determining Stakeholders

The next step in the development of the Port ITS project architecture was a meeting of the City of Rochester, CATS, and GTC to determine what agencies and individuals would be affected by the development of ITS at the Port of Rochester. This session, held July 2002, served as the framework for future discussions concerning which ITS "packages" should be provided for at the Port (market packages are subsystems which serve a specific transportation function or service, such as regional traffic control, advanced traveler information, or international border electronic clearance).

Step 3: Identifying Relevant ITS Elements

In the ensuing step, the relevant ITS market and equipment packages were analyzed in order to clarify which elements and data flows needed to be included in the project architecture. In August 2002, the National and Regional ITS architectures were thoroughly reviewed to ensure that the appropriate elements were in place. During this step, it was determined that, for the purposes of this case study, focus would be placed on the Advanced Traveler Information (ATIS) and International Border Electronic Clearance elements. Emergency management and response was not addressed in detail because this service is adequately covered in the existing Regional Architecture.

Step 4: Developing the Draft Project Architecture

To visualize how the project architecture would look, a draft Port of Rochester ITS Project Architecture was developed. This informal draft version of the architecture, though incomplete, presented a good opportunity to reconvene the ITS Working Group to review the project-to-date and provide recommendations for the final Port of Rochester ITS Project Architecture. In a September 2002 meeting, the Working Group reviewed the draft and expressed support for its assumptions, most notably, the decision to focus efforts on the border crossing and traveler information areas.

Step 5: Developing the Final Project Architecture

In order to formalize the process and build an official document, the final Port of Rochester ITS Project Architecture was developed. Constructing the final project architecture would prove to be a time-consuming and highly technical process. Striving to meet their own deadlines, the Port designers and operators declined involvement in the architecture development process. The decision was thus made to run the specialized ITS software at GTC with input from the City, but without involvement from Port design staff.

While the Regional Architecture provided an excellent reminder of ITS elements to be included at the Port, numerous elements needed in the Port project-level architecture did not exist in the Regional Architecture. These new 'user-defined' elements such as 'Port of Rochester Web Site' or 'Terminal Videoboard' were created and added to the existing elements found in the Regional Architecture. Each new element was then associated with a particular subsystem or terminator to enable the software to recognize the element as being related to the National ITS Architecture. After numerous iterations and reviews by City and GTC staff, the final Port of Rochester ITS Project Architecture was created.

Step 6: Unveiling the Final Project Architecture

To gain support from the project sponsors, the final Port of Rochester ITS Project Architecture was presented to CATS and the Port designers in December 2002. At that time, New York State had just provided the last remaining funding needed for implementation of the ferry project, and all parties involved in the Port of Rochester became focused on designing a Port facility that could be operational by May 2004. This meant that the focus of the Port ITS architecture changed from a theoretical exercise to one of implementation.

Accordingly, discussion at the meeting centered on implementation of ITS elements that should be included in the Port terminal and site design contracts. Participants agreed that since existing funding of the Port facilities could not fund major ITS projects, the ITS concepts contained in the Port ITS Case Study were to be accommodated as much as possible, or at least not precluded by the design of the Port facilities.

Elements of the Port of Rochester ITS Project Architecture

The Port of Rochester ITS Project Architecture focuses on two areas: Traveler Information and Border Clearance. These two areas deserve focus because they are unique to the Port within the region. (For a basic understanding of the relationships between ITS elements in the Port of Rochester ITS Project Architecture, see the "Sausage Diagram" in Figure 1.)

Traveler Information

Advanced Traveler Information Systems (ATIS) include a variety of techniques used to convey messages to travelers either at home, en route, or at a destination. ATIS can take the form of a combination of elements such as a web site, phone line, radio, etc., dispensing a wide variety of information (e.g., traffic, transit, weather, directions, tourist information, advertising). As envisioned for the Port of Rochester, this would involve the following:

- A traveler information web site;
- Kiosks at major tourist and travel centers (e.g., CATS ferry terminal, Rochester Central Station, Amtrak Station, Greater Rochester International Airport, Scottsville and Victor thruway rest stops);
- A toll-free number, especially for cellular phones;
- Communication ties to the New York State Thruway Authority's soon-to-be installed Variable Message Signs near Exits 45, 46 and 47; and,

- Other means of communicating traveler information to the general public.

The deployment of ATIS should take a phased approach:

- Phase 1 - A basic travel/tourism web site containing traffic and weather information, Port-area maps and information (e.g., shops, restaurants, services), and links to regional tourist sites. The initial phase should also include kiosks at the ferry terminal. The kiosks, akin to Internet terminals found at area shopping malls, would allow users to navigate the Port of Rochester web site.
- Phase 2 - Upgrade the web site to include on-line purchasing of ferry tickets and Port-related goods as well as reservations for boat slips, taxi services, and park lodges. Other information such as real-time locations and arrival/departure information for the ferry, RTS buses, and perhaps even Toronto Transit Commission buses, should be incorporated as well.
- Phase 3 - Highway Advisory Radio (HAR) beacons in the vicinity of the Port to aid car travelers in reaching their destinations. A toll-free phone service, possibly 511, could provide another outlet for personalized traveler information.

Border Clearance

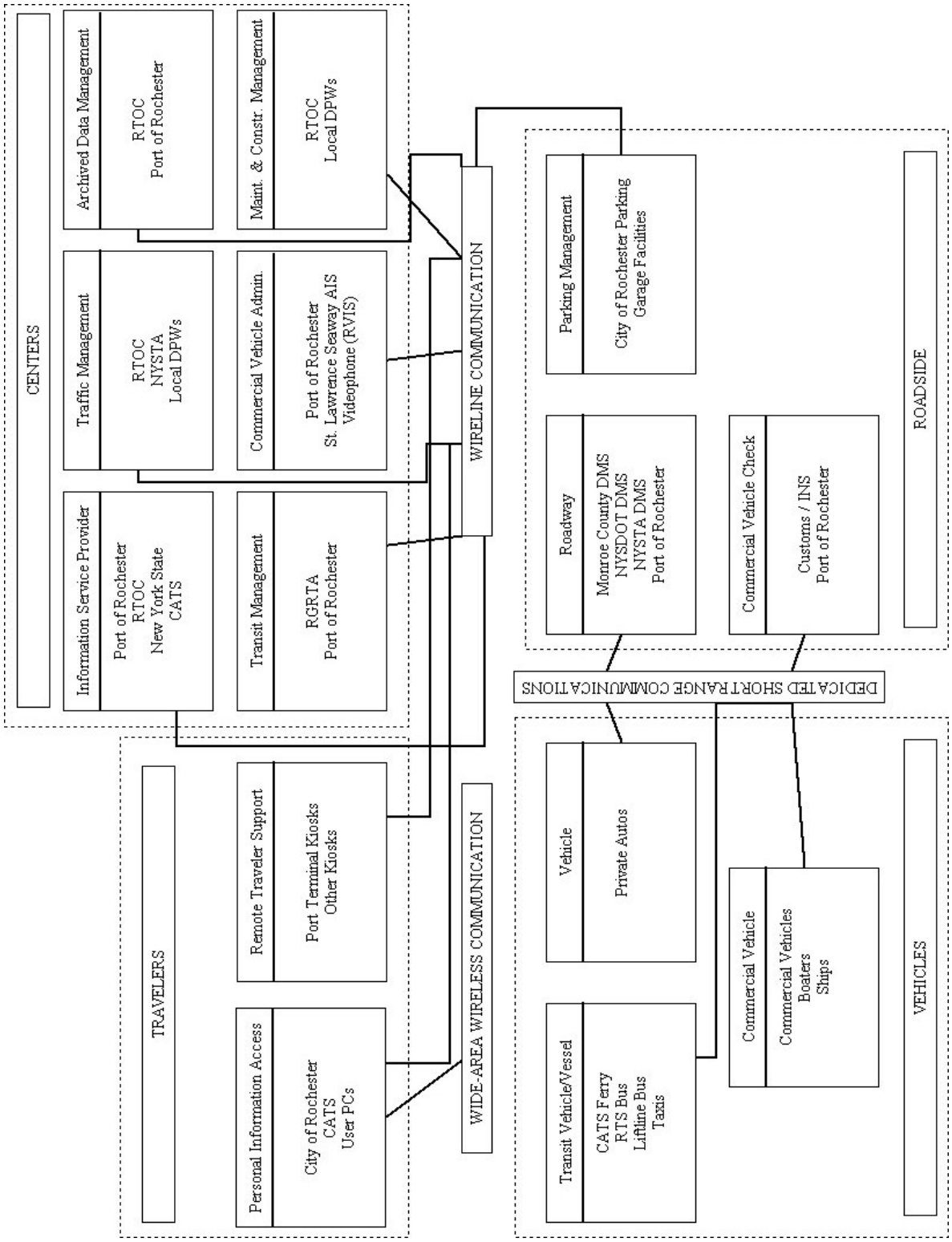
The ferry service will make the Port of Rochester a new international gateway to the United States. Given the events of September 11 and recent trends in border crossing technologies, it is important that the Port of Rochester be prepared to handle new ITS technologies that are viewed as key to securing our nation's borders. At the same time, it is important to the overall success of the ferry service that the border crossing be a safe and efficient state-of-the-art facility.

Border clearance technology provides for more efficient, semi-automated clearance at international border crossings. Much of the ITS technology involved in border clearance is mandated by the Federal government. However, early identification of and planning for such technologies will help ensure their cost effective deployment at the Port.

The International Border Electronic Clearance ITS package augments the basic electronic clearance package (already in widespread use for various transportation applications such as EZPass, truck weigh stations, etc.) by allowing interface with customs and border protection functions. The border clearance package addresses both passenger and commercial vehicle traffic. Although commercial vehicles are not expected to be a large part of ferry traffic, they nevertheless will be present, thus the screening of commercial vehicles and Commercial Vehicle Operations (CVO) is a necessary component of ITS at the Port. However, the main focus of border clearance at the Port is on passenger traffic.

An example of the technology associated with International Border Electronic Clearance for passengers includes NEXUS, which was recently deployed for low-risk, frequent-border crossing passenger vehicles at the Peace Bridge in Buffalo. Another example is the communication link between the ferry ticketing system and the Customs and Border Protection's web-based e-APIS (Advanced Passenger Information System), which is currently under development.

Figure 1: Overview of Relationships Between Elements in the Port of Rochester ITS Project Architecture ("Sausage Diagram")



Current Status of ITS at the Port of Rochester

Pursuant to the Port of Rochester ITS Project Architecture Case Study, several ITS elements are included in the final design contracts of the Port facilities presently under construction, including the installation of:

1. Wiring conduit from the Port terminal to the Lake Avenue signal system;
2. Conduit under Ferry Street to allow a future variable message sign or to allow smart card access to the parking lots;
3. Conduit between the terminal building and the inspection areas to enable future outdoor videoboards, video cameras, NEXUS card readers, license plate readers, weigh-in-motion devices, etc.;
4. Conduit running north from the terminal to serve the future marina; and,
5. Wiring trays throughout the terminal building to allow the future installation of closed circuit TV screens, advanced traveler information kiosks, public transportation information, etc.

As a result, many Port ITS "prerequisites" such as wiring conduits, are now under construction at the Port of Rochester.

Next Steps

A $1.5 million electronic Port of Rochester Transportation and Security project (e-PORTS) is included in the House version of the 2004 Transportation Appropriations bill. Should this become law, as expected, it will enable major ITS components to be constructed at the Port within the next two years, consistent with the specifications of the Port ITS Case Study.

Prioritized List of Interfaces

The following is an abbreviated list of ITS projects recommended as a starting point for the $1.5 million e-PORTS grant (and other future grants at the Port). Detailed negotiations are needed with the City of Rochester, CATS, and Federal inspection agencies to determine the final list of projects.

1. "Smart Room" for Port Operations and ITS computer systems and wiring
2. Port ATIS web site
3. Fiber optic connections to RTOC
4. Terminal kiosks and associated wiring
5. Poles and cameras in (dis)embarking area for security and webcam purposes
6. Multilingual variable message signs at numerous locations in and around the Terminal
7. "CATVision" CCTV screens and associated wiring in Terminal
8. Next-bus/next-ferry communication and display system with possible tie to St. Lawrence Seaway vessel location system (AIS) (likely to require roof antenna)

9. Exterior embarking area videoboard and associated wiring
10. Communication tie to NYS Thruway VMS signs
11. Fiber optic connection to riverfront area for boater information kiosk, St. Lawrence Seaway AIS system or next-bus video sign
12. Wiring for RVIS (Videophone) at marina and/or riverfront area
13. License plate readers in (dis)embarking areas
14. Connection to US Customs & Border Protection / Transportation Security Administration (INSPASS biometric readers in terminal and NEXUS readers in disembarking area)
15. Smart ticket counters for remote ticketing, passenger counts, and ties to e-APIS
16. Communication tie to O'Rorke bridge house
17. Programmable cash registers and smart card readers in terminal ticketing and parking areas for foreign exchange rates and smart card transactions
18. PORTS (US Weather Service) water sensors in the Genesee River and weather sensors on the Terminal roof
19. Security cameras throughout Terminal and Port area, some possibly infra-red with motion detector software

Lessons Learned and Recommendations

The experience of and lessons learned by participants in the Port of Rochester ITS Project Architecture Case Study provide the basis for the following recommendations concerning future project-specific ITS development endeavors in the region:

1. Develop a broader base of ITS-knowledgeable professionals

   ITS is a relatively new concept which is not widely understood. It is important to cultivate knowledgeable and experienced staff at the local and regional level to guide the development of this region's ITS capabilities. ITS architecture and the related software programs require training and time for participants to become familiarized with the concepts and language involved.

2. Technical work should be conducted "behind the scenes"

   Since the language and vocabulary associated with ITS is highly technical, some participants may reject it and resist participation in ITS development efforts. Therefore, it may be more effective to conduct the bulk of the technical work "behind the scenes", engaging key participants at critical decision points and milestones. It is also important to involve the region's recognized ITS experts to lend additional credibility to the effort.

3. ITS considerations must be built in early in the design process

   It is recommended that any project that can benefit from ITS applications should consider such applications from the outset. In the case of the Port of Rochester, due to conflicting schedules and priorities, ITS nearly became an afterthought in the design for the Port

facilities. There must be a recognized level of support for ITS in advance of initiating the project's detailed design phase.

4. <u>All stakeholders must be engaged</u>

   Due to the inter-jurisdictional nature of ITS, support and cooperation must be achieved with multiple layers of government as well as the private sector. Partnerships are key to developing an effective ITS network across the region. A formal Regional Operating Organization (ROO) should be considered to advance the region's priorities in a coordinated and cost-effective manner, as well as to add Federal "legitimacy" to the ITS efforts of the region.