ONTARIO MINISTRY OF TRANSPORTATION

LESSONS LEARNED

ATMS Coordination with Major Highway Rehabilitation Work in the Greater Toronto Area

Highway 401 is the major east-west freeway crossing Southern Ontario. Through the Greater Toronto Area, Highway 401 becomes an urban 16 lane core-collector freeway system carrying 300,000 to 400,000 AADT. The heavy traffic volumes have taken its toll on the highway and the highway is in need of major rehabilitation, including resurfacing, reconstruction and operational improvements.

The rehabilitation of Highway 401 requires significant effort to coordinate and schedule ATMS work around the major roadwork rehabilitation contracts. Coordination and negotiation effort is required to ensure that roadway contracts do not overlap with ATMS contracts, that ATMS contracts are incorporated into or follow roadway contracts (rather than precede); and that damage to ATMS field equipment be kept to a minimum during roadway construction. Because of the high traffic volumes and the significant constraints (lane reductions) during roadway construction, it is essential that the ATMS system remain in operation during road construction activities to provide for traffic management services. In many of the roadway contracts, ATMS elements are often temporarily or permanently relocated so as to minimize interruptions and/or damages to the system. Several important lessons have been learned:

- Installing communication fibre cable far away from the roadbed and as close to the property line as possible, significantly reduces the potential impact to communication system during the road rehabilitation work.
- At many locations, ducts are normally strapped to the walls of structures to facilitate crossings. In order to maintain use of the communication fibre in these ducts during structure rehabilitation, a unique method of temporarily hanging ducts below the structures was devised. This allows the system to remain operational, without requiring expensive relocation of ducts and downtime.
- Additional (slack) fibre should be coiled in maintenance manholes to simplify potential temporary relocations.

GENERAL UPDATE ON MTO ADVANCED TRAFFIC MANAGEMENT SYSTEMS

The existing COMPASS system continues to be expanded with much of the effort focused on reducing the gap on the Queen Elizabeth Way (QEW) between Mississauga and Burlington system. Detailed system achievements are as follows:

BURLINGTON: QEW BURLINGTON ADVANCED TRAFFIC MANAGEMENT SYSTEM

Start of operations:	1985
Cameras:	24
Length:	26 km
Changeable signs:	7 fibre optic/flip disk
Detector stations:	227

The second of the three projects to connect the Burlington and Mississauga systems is now complete. This project extends the Burlington ATMS towards the Mississauga system by an additional 12 kilometres and includes loop detectors and 10 additional cameras.

The total cost of connecting the Mississauga and Burlington systems is estimated at $18M (Canadian), and will employ a fibre optic communications strategy. Upon completion of these projects, the Burlington Traffic Operations Centre (TOC) will need to accommodate an additional 23 kilometres of ATMS including the existing 19 kilometres of the Mississauga COMPASS system. Work currently is proceeding on the preliminary design of a new Burlington Traffic Operations Centre to help accommodate this growth.

MISSISSAUGA: QEW MISSISSAUGA ADVANCED TRAFFIC MANAGEMENT SYSTEM

Start of operations: 1975
Cameras: 18
Length: 19 km
Changeable signs: 2 LED
Ramp meters: 11
Detector stations: 159

The design for the third project to complete the connection between the Burlington to Mississauga systems is well underway but recently revised priorities for road expansion and construction in the same corridor require a reassessment of ATMS strategy and timing. This portion of the work will extend the fibre optic trunk cable for another 25 kilometres, and add traffic detection with loops and 7 cameras.

Eventually the entire aging Mississauga communications system will be replaced, and the Mississauga TOC will be connected to the Burlington TOC through a fibre optic link, enabling the Mississauga facility to be decommissioned.

OTTAWA: OTTAWA QUEENSWAY ADVANCED TRAFFIC MANAGEMENT SYSTEM

Phase 3 of the Ottawa-Queensway has been designed with contract tendering pending confirmation of funding priorities. The completion of interim deployment will add 3 new cameras to fill in current gaps in the CCTV subsystem coverage and to improve the video quality provided by the communications subsystem through the installation of fibre optic cable and limited microwave transport.

The current system consists of seven cameras, mounted on buildings, which are used for manual incident detection and management. The communication system uses low power microwave, employing switches at the camera sites and repeaters to bring the images back to the control centre. Because the current video images are of low quality it has not been possible to include them on the COMPASS web site. A planning study is currently underway to look at the long-term requirements for ATMS in the Ottawa area.

ST. CATHARINES: QEW GARDEN CITY SKYWAY ADVANCED TRAFFIC MANAGEMENT SYSTEM

Start of operations: 2000
Cameras: 8
Length: 25 km
Changeable signs: 2 Overhead LED, 5 PVMS
Arterial Advisory Signs: 11
Queue Warning Signs: 6
Detector stations: 12

This system was built for traffic management purposes during the structural rehabilitation of the QEW Garden City Skyway. The project includes an interim control centre, CCTV coverage of about 10 kilometres, vehicle detection and queue end warning signing. Arterial advisory signs on local roads warn of conditions on the QEW freeway; they are made up of composite static message boards coupled with changeable LEDs. Cameras have also been installed in a tunnel on the primary alternate route some 15 kilometres away from the centre in order to validate traffic conditions for signing. Communication from the tunnel is over fibre through a joint sharing agreement with the Seaway Authority. They are allowing us to access their fibre system that runs along the Welland Seaway canal in return for access to some of the Ministry's conduits crossing the canal.

Plans are underway to expand CCTV coverage westerly by approximately 3 km, and to replace the Remote Traffic Microwave Sensors with classical inductive loop technology throughout the entire St. Catharine's system.

TORONTO: HIGHWAY 401 TORONTO AREA ADVANCED TRAFFIC MANAGEMENT SYSTEM

Start of operations:	1990
Cameras:	94 full video
Length:	62 km (plus additional 51 km of camera coverage)
Detector stations:	629
Communications:	fibre optic dedicated
Changeable signs:	33 LED

The Highway 401 COMPASS system is the largest ATMS system on Canada's busiest highway, incorporating CCTV coverage, automatic incident detection and motorist advisory information. The original fibre optic communications system is now outdated and requires replacement and upgrading in order to improve reliability and to provide for the additional bandwidth requirements of a larger system. Design has been completed and contract tendering is planned for 2002. This design will employ SONET technology for the entire length of the Highway 401 COMPASS allowing for field level Ethernet connections, increase data carrying capabilities and remote status monitoring systems.

EMERGENCY ROAD CLOSURE SIGNAGE

The primary purpose of these signs is to advise motorists of road closures due to inclement weather conditions and delays due to construction activities, etc. The signs are located in advance of key decision points in the road system. Communications to the signs are by phone line, and they can be controlled from several key Ministry offices.

- Hwy 17 (Sault Ste. Marie – Nipigon)
  Start of operations: January 2000
  Changeable signs: 4 Pole mounted LED

- Hwy 11 (North Bay and Matheson – Cochrane) and Hwy 17 (Sudbury)
  Start of operations: Under design
  Changeable signs: 5 Pole mounted LED

- Hwy 400 (Barrie)
  Start of operations: Under design
  Changeable signs: 1 LED

ACTIVITIES

Planning

- A **5 Year ATMS Implementation Plan** has been developed based on a benefit-to-cost approach for ATMS deployment. Additional work is currently underway to upgrade the prioritisation tool.
- **Burlington Traffic Operations Centre** Preliminary Design activities are underway to rationalize expanded / future operations of an existing facility which will initially oversee 50 CCTV sites and VDS coverage of over 51 km of freeway.

Technology/Systems

- Continuous efforts are being made to evaluate sensors that are not intrusive to the roadway. **Multizone Microwave Vehicle Sensors** are being investigated in temporary and permanent installations. MTO is initiating two projects to evaluate **Video-based VDS.** The first application will be in a tunnel, using existing static cameras in conjunction with VDS equipment for incident detection. The second trial installation will involve placement of a static camera and VDS equipment in a construction site, with the purpose of monitoring traffic volumes and speed, and incident detection. Both VDS trial projects will use equipment from Citilog, a French company.

- **Low-Power Microwave** devices are of continued interest to MTO for improved deployment time. Specific applications include transmission of CCTV video signals. Low-power microwave devices have an advantage over **High-Power Microwave** devices since they do not require federal license approval. As in any large metropolitan area, unassigned spectrum is a scarce commodity that is tightly regulated and may result in a lengthy approval time to secure an operating license. MTO has been able to overcome the licensing difficulties associated with high-power microwave, and has an

ongoing project that includes three cameras that will transmit CCTV video using high-power microwave technology. High-power was chosen over low-power in this case due to the long distances over which the signal is required to travel. Results with low power microwave have been acceptable but not ideal. The video image is not up to the standards that we would like, however it is usable by TOC operators. High power microwave results to date have been less encouraging, with poor quality video images.

- **Queue-End Warning** system for truck queues at US border crossing approaches, to reduce potential of rear-end type collisions. Contract award is anticipated in January 2002. This system is to provide automated (no operator verification required) warning of end of queue at two major US border crossings in the Niagara peninsula.

- The Ministry recently received an internal government innovation award for the creation and implementation of the **COMPASS Web site.** The Ministry provides a Web site which provides site visitors with up-to-date Traffic and Road Information (TRIS) reports as well as current video images of traffic conditions from many of its CCTV camera locations. The web site provides hyper-links to various other web sites that provide traffic related information of interest to motorists.

- In light of the on-going expansion of Toronto's COMPASS and the need for a more user-friendly COMPASS operator interface, a **Graphical User Interface (GUI)** system was developed. The user interface migrated from menu-driven to GUI to facilitate "point-and-click" functionality that is intuitively easy to use. Through the GUI, operators control CMS/CCTV/VDS and display equipment status. The GUI also has the benefit of providing a shorter learning curve for new COMPASS operators while increasing effectiveness for existing staff. The GUI system has been running successfully for the last eight months. We are continually fine-tuning the application software and Windows NT configurations to improve performance and systems reliability.

ATC Ethernet Camera Control Software Project

- In the early part of 2001, a 15 km easterly expansion of the QEW Burlington system was completed utilizing a SONET/OC-3 ring with both Ethernet and RS-232 field node drops.
- A total of 30 (Unix based) ATCs were installed to serve as both vehicle detectors and PTZ controllers for field cameras.
- Central software for field data communication was modified to include Ethernet protocol.

Centre to Centre (C2C) Data Exchange Network Demonstration Project

- The primary objective of this joint initiative between the Province of Ontario and the City of Toronto, is to develop and implement a data exchange network in order to demonstrate greater coordination and effectiveness between the Province's COMPASS and the City's RESCU traffic management centres. The pilot is expected to be operating by late 2002.

Operational Challenges

- Deployment of Portable Variable Message Signs (PVMSs) for construction signing has been accomplished effectively for the past several construction seasons. These signs provide key information to motorists of downstream construction activity. Operational improvements are being made to ensure consistent messaging and application of the subsystems across the province. A PVMS message library was developed so that all of the regions can use messages to best suit their construction needs.

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