

Transit priority system: Planning and pilot project deployment

Organization

York Region – Transportation and Works Department

Status

Started 2002, ongoing

Overview

York Region initiated a pilot project as the first building block in a region-wide transit priority system. York sees transit priority as an essential component of both its long-term transit strategy and its traffic management system.

York approached the pilot project strategically, and actively involved a range of stakeholders. It methodically identified and evaluated alternative routes and technologies for a pilot deployment. The pilot is intended to enable modular expansion of transit priority across York Region, and to serve as an example for other mid-sized Canadian communities.

The selected route for pilot deployment is a six-kilometre stretch of an arterial road in the suburban Richmond Hill community. Eleven signalized intersections will be retrofitted with infrared detectors and upgraded traffic controllers, and 30 buses will be retrofitted with infrared emitters. Buses along the route operate with 15 to 30 minute frequencies.

A comprehensive quantitative performance evaluation of the pilot project will be documented within a month of the initial deployment. Lessons learned will be applied in York Region's Quick Start program, a four-corridor advanced transit priority system to be in operation by 2005.

York's pilot transit priority deployment had a budget of \$500,000 for all planning, design, deployment and evaluation. York Region, which operates the area's transit system, was joined by the Toronto Transit Commission and GO Transit as project stakeholders. Transport Canada funded a major portion of the project through its ITS Plan.

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Resources

- York Region (www.region.york.on.ca)
- York Region Transit (www.yorkregiontransit.com)

Community context

York Region lies immediately north of the City of Toronto and extends northward to Lake Simcoe. Its total area of about 1,750 square kilometres is largely rural, although southern York boasts large urban concentrations. York (population 850,000) is the fastest growing region within the Greater Toronto Area. By 2026 it is expected to be home to almost 1.3 million people — a continued rate of fast growth that will strain the region's transportation system and could cause traffic congestion on its major roads to reach unacceptable levels unless mitigating strategies are put in place.

The Region's policies, direction and budgets are set by Regional Council, which includes mayors and other representatives from the nine local municipalities. Its Transportation and Works Department is responsible for operating and maintaining over 900 kilometres of arterial roads and 565 traffic signals, as well as for operating York Region Transit. In 2001, York Region Transit was created through the amalgamation of six transit agencies operated by lower-tier governments in communities including Markham, Richmond Hill, Newmarket, Aurora and Vaughan.

York Region Transit is now the third-largest public transit service in Ontario, after the Toronto Transit Commission and Ottawa's OC Transpo. Transit routes and schedules are developed to serve two core types of demand, namely (a) travel to and from employment areas, schools, hospitals and shopping centres in York Region, and (b) travel to and from high-demand destinations in Toronto (including York University and Seneca College) and major passenger transfer points in York Region served by other transit services (namely the Toronto Transit Commission and GO Transit, a provincially operated interregional service). Currently, only 8% of rush hour trips in York Region are made by transit.



Policy context

In recent years, York Region has completed a number of major policy documents that emphasize the need to strengthen transit service as a vital part of a long-term community vision.

The York Region Transportation Master Plan sets out an integrated road and transit network plan that will support regional growth to 2031. The plan sets an ambitious objective of serving 30% of peak period trips by transit within 20 years (versus the current rate of 8%). To achieve this goal, the plan sets out a wide-ranging transit strategy that recognizes that most of York Region's transit services will continue to operate on surface roadways, and highlights the need for transit priority measures. These measures include traffic signal priority and physical infrastructure like reserved bus lanes and high-occupancy vehicle lanes.

York's five-year action plan for strengthening its transit system includes a number of rapid transit elements. It sets a number of goals including:

- An increase in annual service from 400,000 to 700,000 vehicle-hours
- An increase in annual transit ridership from 10 to 17 million passengers
- An increase in annual per capita transit ridership from 15 to 22
- An increase in transit's share of travel in the morning peak hour from 8% to 12%

Rationale and objectives

The pilot project's rationale and objectives can be classified into several key areas.

Provide conventional transit priority benefits. As congestion grows, both within and outside peak periods, intersection queue lengths will increasingly compromise public transit services. Transit travel times will grow as buses take longer to enter signalized intersections. As a result, some transit users may choose to travel by car instead, making congestion worse.

Transit signal priority measures can help reduce delay to buses by extending or advancing green signal phases, thereby minimizing the time buses spend in queues at red lights. Recent studies in the Toronto area have shown that transit priority measures can reduce transit delays at intersections by 15% to 48%, making services faster and even reducing the number of buses needed to serve a given route. The potential benefits of transit therefore include faster and more reliable transit service, greater attractiveness to new riders, reduced operating costs, and reduced emissions from idling transit vehicles.

Build on existing traffic management systems. York's transit priority pilot project was also intended to increase the value of the region's existing intelligent transportation systems (ITS) infrastructure and operations, including a centralized traffic signal management system and corridor traffic management operations using video cameras and traffic-responsive controls.

The centralized traffic signal management system, active since 1996, allows traffic signals to relay operational data to a central computer so that unexpected incidents or changes in traffic patterns can be identified and responded to. However, the system had not been integrated with transit services, and the pilot project was envisioned as the first building block in a system-wide upgrade that would allow the central computer to monitor and manage transit priority operations.

Serve as a model for replication and expansion. The pilot project was intended to serve as a model that could be expanded within York Region, resources permitting, in an incremental and modular fashion that does not require significant redesign work. It was also intended to be a model that could be transferred to other mid-sized municipalities in Canada. For this reason, the project was developed within the scope of established Canadian and American standards for ITS architecture and applied off-the-shelf products, with an eye to minimizing operating and maintenance costs.

Actions

The scope of this project was to plan, design and deploy a transit priority system along selected transit routes in York Region. This scope was made more complex by several factors:

- The need to build on York Region's proprietary centralized traffic management system by complementing it with transit priority technologies
- The need to work with York Region Transit, as well as GO Transit and the Toronto Transit Commission (both of which operate transit services in York Region)
- The need to work with several lower-tier municipalities that manage traffic signals within York Region

The major project tasks are summarized below.

Project initiation. York Region retained a consultant team led by LEA Consulting Ltd., and invited GO Transit and the Toronto Transit Commission into the project as key stakeholders.

Strategic vision and control strategy. The project team investigated the needs, strengths, and constraints of each pilot project stakeholder; reviewed the status of York Region's transit system, traffic signal management system and other services; identified possible directions and goals;

and defined a long-term vision and control strategy for the transit priority system.

During the vision development, two major alternatives for structuring the transit priority system were considered: a system with centralized control (i.e. intersections operate under the real-time control of a central computer) and a system with distributed control (i.e. intersections operate independently but within parameters set by a central computer). The centralized control option, while ultimately more flexible and responsive, would require the creation of a new central traffic control system because York's existing system does not operate in real-time. A distributed control approach, which can provide many of the benefits of centralized control but in a more incremental fashion, was therefore adopted for the pilot project.

Evaluation of alternative routes. Pilot project stakeholders identified 16 transit route options for pilot project deployment. The project team subjected these 16 to a screening process that reduced the candidate list to six routes that were evaluated in greater detail. The criteria applied in the evaluation included traffic congestion levels, transit volumes and connections to GO Transit commuter rail services, the type of traffic signal controllers at affected intersections, the opportunity to test various types of transit priority applications, and the ability to base all affected buses in the same garage.

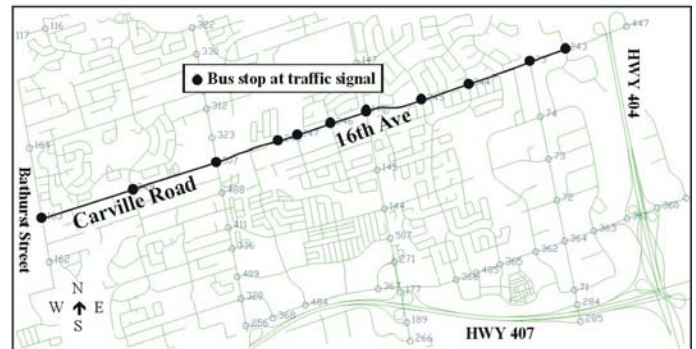
The preferred route was identified as York Region Transit Route 85/85A, operating primarily in the 16th Avenue and Carville Road corridor. This route offered satisfactory transit volumes, upgradeable traffic signal controllers (avoiding the need for replacement), a connection to a GO Transit station, and the potential to introduce transit signal priority at a number of intersections with available funds.

Evaluation of alternative technologies. The project team identified and evaluated available bus detection technologies for use in the pilot project. These included front-fire optical detection, side-fire infrared detection, vehicle-based transponder with in-road loop detection, radio frequency tags with roadside receivers, video image processing, ultrasonic detection, and automatic vehicle location (AVL) using global positioning systems.

The preferred technology was identified as front-fire infrared optical detection due its cost, reliability, and proven performance in providing signal pre-emption for emergency vehicles. A preliminary cost estimate determined that 11 intersections and 50 buses could be equipped with the required technologies within the available pilot project budget. The evaluation did note that AVL using global positioning systems offers great potential flexibility and economies of scale in a centralized control environment, and recommended that it be re-evaluated when future work is undertaken on system-wide transit priority implementation.

Design and specification. The route selected for the pilot deployment is the Carville Road/16th Avenue arterial corridor that runs east-west for about six kilometres between Bathurst Street and Highway 404 in the Town of Richmond Hill. The corridor is served by York Region Transit routes 85/85A, with frequencies of about 15 minutes in peak periods and about 30 minutes at other times. Transit priority will be implemented at all 11 signalized intersections along this corridor.

An optical infrared emitter will be mounted on buses, and an infrared detector will be installed near the primary traffic signal head at each signalized intersection (one per approach direction). Some of the 11 traffic signal controllers will be upgraded, and some will be replaced. The deployment is intended to benefit buses with the least possible impact on established traffic patterns, and therefore will not require modifications to the centralized traffic signal management system or the existing signal timing plans at affected intersections. Thirty buses, all based out of the Richmond Hill garage and representing three different models and vintages (1989 New Flyer vehicles, 1999 Orion vehicles, and 2002 Thomas vehicles) may be assigned to these routes and will be fitted with optical infrared emitters.



Pilot project corridor and affected intersections (courtesy York Region)

Deployment. York Region conducted a competitive process to select a contractor to supply, install and test the infrared emitters, detectors and traffic signal controller equipment. This work will be completed by June 2004. The procurement process involved an initial opportunity for potential equipment suppliers to demonstrate their products, and a final project specification that allowed potential contractors to propose alternative ways of meeting functional requirements in the most cost-effective manner.

Evaluation. Within one month of deployment, a before-and-after evaluation of the project will be completed. It will quantify the pilot project's impacts with respect to travel time reductions, schedule adherence improvements, operating cost savings, and transit vehicle emissions. It will also include a benefit/cost analysis reflecting annualized capital, operating and maintenance costs, with a view to

evaluating the cost-effectiveness of extending the system to additional routes in York Region.

Expansion plan and guidelines. Guidelines for extended application of the pilot project technologies will be documented to ensure effective knowledge transfer within York Region and to other interested communities.

Results

No results are available at the time of writing. York Region's transit priority pilot project is being installed and a performance evaluation is some time away.

Participants

The main participants in this project included:

- The consultant team of LEA Consulting Ltd. in association with Lockheed Martin Canada
- York Region's Transportation and Works Department and its subsidiary York Region Transit, which are responsible for major roads and transit services in the region
- The Toronto Transit Commission (which runs one of the largest transit priority networks in North America) and GO Transit, both of which operate transit services in York Region
- Transport Canada, as a funding partner

Resources

The total value of the pilot project was \$500,000, of which \$250,000 was provided by Transport Canada through the Deployment and Integration strategy of its ITS Plan. York Region provided \$235,000, and LEA Consulting contributed \$15,000 of "in kind" consulting services. York's financial contribution was drawn from its 2002 and 2003 capital and operating budgets. A breakdown of proposed expenditures into key project components is given below:

- Preliminary design — \$40,000
- Detailed design, specifications and procurement— \$90,000
- Deployment and contract administration — \$340,000
- Evaluation, system performance reporting and expansion plan — \$30,000

Timeline

March 2002. Project funding approved by Transport Canada

August to November 2002. Reports on strategic vision and control strategy, options for transit signal priority

function and control, and the evaluation of alternative routes and detector/controller technologies

May 2003. Start of design and specification process

July 2003. Start of procurement process

January 2004. Start of installation

June 2004. Start of operation

July 2004. Completion of evaluation

Lessons learned

At the time of writing, York Region's transit priority pilot project is being installed and a performance evaluation is some time away. However, some lessons learned may be drawn from work to date. They include:

- The consideration of possible transit priority systems must address a very wide range of factors, from emerging national standards for ITS architecture to technical details like signal controller upgradeability.
- Having all stakeholders on board from the beginning of the process is essential to maximize information and manage expectations. A broad stakeholder group provides a forum where limitations and opportunities can be fully enumerated, and competing and complementary perspectives can be identified.
- The active involvement of experienced peers (in this case, the Toronto Transit Commission) is a good way to ensure that lessons learned elsewhere are incorporated into the project.
- In an existing traffic control environment with equipment of mixed manufacturers and vintages, a consultative and function-based procurement process can provide the broadest opportunity for potential contractors to participate.

Next steps

The most immediate application of lessons learned during the pilot project will be in Quick Start, the first phase of York Region's rapid transit plan. Quick Start will involve the installation of transit priority measures as part of a sophisticated real-time transit management system in four key transit corridors, by 2005.

The types of transit priority strategies applied during the pilot project may be enhanced in the future, as York Region adds more signalized intersections that are equipped to provide transit signal priority, as devices are upgraded, and as central traffic control functionality is developed further.