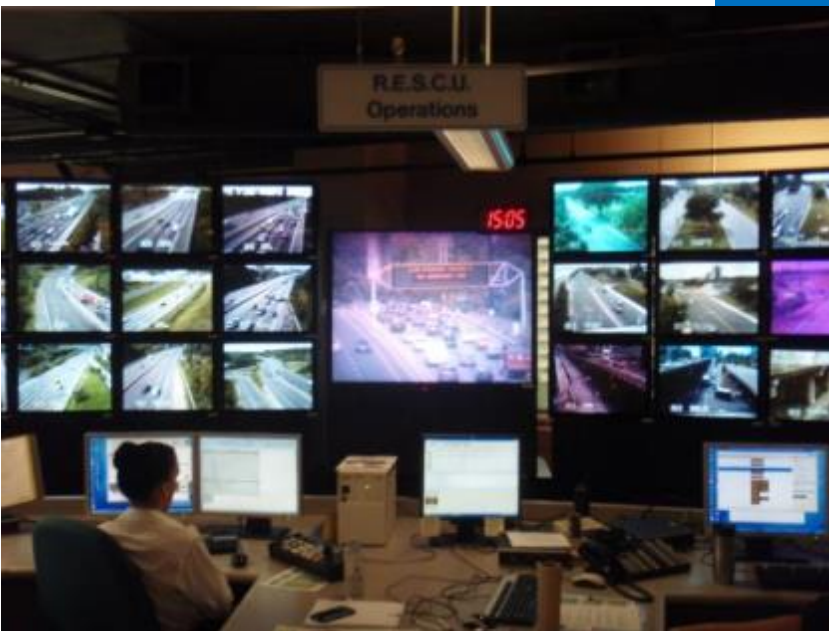




City of Toronto

Congestion Management Plan

2014-2018



OCTOBER 2013

*This report was prepared in 2013 by Delcan and Lura Consulting for the City of Toronto
Transportation Division.*

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List of Abbreviations

CCTV	Closed Circuit Television
DVP	Don Valley Parkway
HOV	High Occupancy Vehicle
ITS	Intelligent Transportation Systems
MTO	Ministry of Transportation Ontario
TOC	Traffic Operations Centre
TTC	Toronto Transit Commission
VMS	Variable Message Sign
VMT	Vehicle Miles Travelled

Road Types in the City of Toronto

Expressway – routes designed for high speed traffic, with regulated entry and exit points. E.g. Allen Expressway and Don Valley Parkway.

Arterial Roads – high capacity thoroughfares that deliver traffic from connecting local roads to expressways. E.g. Yonge Street, Bayview Avenue.

Local Roads – smaller roads with less vehicle traffic, common to local neighbourhoods.



THE NEED FOR CONGESTION MANAGEMENT

Travel demand continues to rise in the City of Toronto as the population increases and our economy grows. New road infrastructure is not able to keep up with this increase in travel demand – in fact it is impractical to build enough roads and infrastructure to comfortably accommodate this demand. The resulting situation – where travel demand exceeds the capacity of the transportation network – is *traffic congestion*.

Each area of the city has different factors that contribute to traffic congestion. Roads in one area may be affected by issues related to parking and stopping or construction work zones; others by infrastructure bottlenecks that decrease road capacity; and still others by traffic signals that could be better coordinated with existing traffic flow. Traffic in all parts of the city can be affected by poor weather conditions, special events, unexpected collisions and other traffic incidents.

The impact of this congestion is significant. Estimates from 2006 for the Greater Toronto and Hamilton Area (GTHA) suggest that congestion cost commuters as much as \$3.3 billion annually in terms of delay and increased vehicle operating costs, while the cost to the local economy was an additional \$2.7 billion due to lost economic output and accompanying job loss.¹ To the typical commuter in the GTHA this translates to an average of 81 hours of delay each year, which reflects a delay of 33 minutes for every hour driven in the peak period.²

¹ Costs of Road Congestion in the GTHA (Greater Toronto and Hamilton Area), Metrolinx, December 2008.

² TomTom North American Congestion Index, TomTom International, 2013.

The City of Toronto Congestion Management Plan 2014-2018

The City of Toronto has been engaged in many activities to manage traffic congestion to benefit travellers, businesses, and the environment. The Toronto Congestion Management Plan builds on these successes and activities, by providing an objectives-driven, performance-based approach to managing congestion. The activities recommended for the next 5 years emphasize:

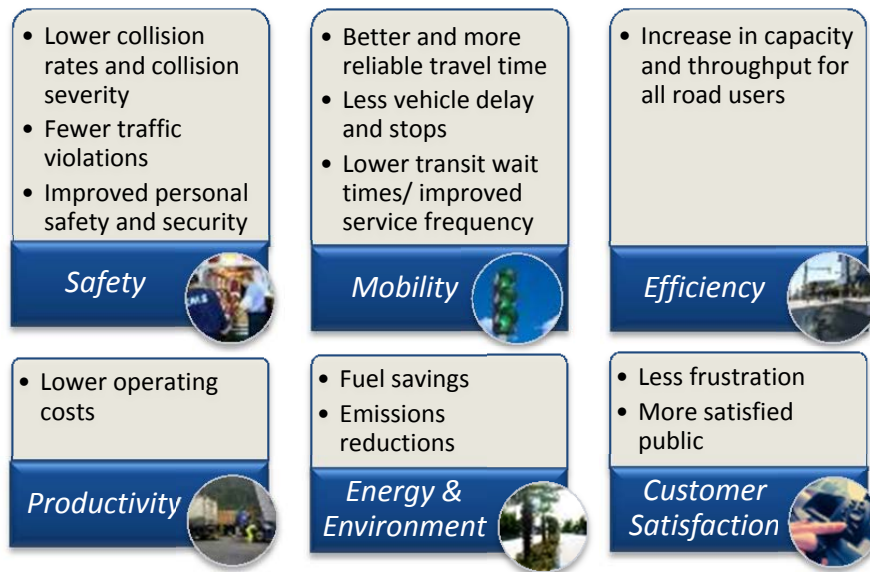
- Taking a more proactive approach to traffic management on arterial roads, complementing current traffic management activities on City expressways;
- Applying evolving technology to traffic and congestion management, from wireless communication to advanced sensors to social media;
- Providing a “tool kit” from which activities can be chosen and applied to the unique road contexts around Toronto; and
- Strengthening partnerships and information sharing, to improve efficiency and coordination of the City’s transportation network.

Recurring Congestion = traffic congestion seen regularly during peak traffic periods, when travel demand is high (e.g. morning and afternoon commutes).

Non-Recurring Congestion = congestion that occurs when something unusual and unexpected happens to reduce available road capacity (e.g. weather, construction).



Benefits of Managing Traffic Congestion



Developing the Plan

The City of Toronto Congestion Management Plan was developed over a 6-month period in 2013. It involved several steps, including: a thorough review of existing activities and projects related to traffic management congestion; research on trends and best practices in other jurisdictions in North America through literature reviews and telephone interviews; development of a vision, goals, and objectives for the Plan; and the selection and refinement of recommended projects and activities. Staff from the City of Toronto's Traffic Management Centre and Regional traffic control centres were involved throughout the development of the Plan through regular meetings, workshops, and one-on-one consultation.

This Plan should be seen as one component of the City of Toronto's overall Transportation Planning Process; one that focuses primarily

on operational activities. Other strategies for managing traffic congestion are included in other City of Toronto plans and strategic documents, including demand management, such as encouraging all modes of transportation and active transportation, and transportation network infrastructure improvements.

Organization of this Report

This Report provides a general overview of the City of Toronto Congestion Management Plan. It describes the recommended projects and activities under each of eight Technical Elements, including how these activities will contribute to managing traffic congestion. Further detailed technical information about these projects (including a breakdown of tasks and budget for each project/activity over the 5-year period) can be found in the *Congestion Management Plan Technical Report*.



VISION FOR MANAGING CONGESTION

The City of Toronto Congestion Management Plan pays special attention to the needs of all travellers – pedestrians, cyclists, public transit users – as well as goods movement and emergency services. The overall vision of the Plan is:

Through innovation and technology maximize the efficiency, safety, reliability and sustainability of the transportation network for all users while reducing the impact on the environment.

CONGESTION MANAGEMENT GOALS

The Vision of the Plan is supported by the following goals and measurable objectives:

GOALS	OBJECTIVES
1. Maximize the transportation system efficiency and reliability	<ul style="list-style-type: none"> • Increase throughput • Reduce delays • Reduce travel time variability • Reduce vehicle operational costs
2. Improve the safety of the transportation network	<ul style="list-style-type: none"> • Reduce traffic collisions • Reduce collision severity
3. Improve the City of Toronto’s ability to detect and respond to incidents, events and changing traffic conditions	<ul style="list-style-type: none"> • Reduce duration of traffic incidents and events through increasing reductions in detection, response and clearance times
4. Improve the availability and reliability of information for the public	<ul style="list-style-type: none"> • Reduce traveller frustration • Increase use of all modes of transportation
5. Reduce the impact of transportation on the environment	<ul style="list-style-type: none"> • Reduce greenhouse gas emissions (GHG) • Increased fuel savings

Appendix A illustrates how each of the activities included in the Congestion Management Plan addresses one or more of the Plan’s 5 goals.



RECOMMENDED PROJECTS AND ACTIVITIES

Recommendations for managing the City of Toronto’s traffic have been grouped under eight strategies or Technical Elements. The eight strategy areas complement and intersect with one another, and together produce a comprehensive approach to managing congestion. The following pages provide more information on each of the eight strategies, including associated projects and activities.

Overview of Recommended Projects in the Toronto Congestion Management Plan

A. Intelligent Transportation Systems	B. Congestion and Engineering Studies	C. Incident and Event Response	D. Construction Coordination
A.1 Replacement of ATMS Software A.2 Enhanced Signal Control Modes A.3 Arterial CCTV Cameras A.4 Arterial Network Monitoring A.5 Update and Expand City Communications Networks A.6 Replacement of hardware	B.1 Auxiliary Signal Timing Plans B.2 Update Corridor Coordination Studies B.3 Active Traffic Management Feasibility Study B.4 Integrated Corridor Management Feasibility Study	C.1 Traffic Incident Management Team Procedures C.2 Service Patrols C.3 Steer It - Clear It Signage Program C.4 Universal Fire Station Pre-emption (Non-vehicle)	D.1 Smart Work Zones D.2 Lane Occupancy Permit Management D.3 Lane Occupancy Permit Review D.4 Work Zone Performance Management and Monitoring
E. Curbside Management	F. Support of All Modes of Transportation	G. Traveller Information	H. Traffic Operations Centre (TOC)
E.1 Parking Charge Review E.2 Develop Parking Strategies E.3 Smart Park	F.1 Transit Signal Priority F.2 HOV - Bus Lane Review F.3 Bicycle Facilities Expansion F.4 Corridor Renewal for Sustainable Transportation	G.1 Traveller Information Strategy G.2 VMSs including Display of Travel Times G.3 Event Database G.4 City Website Improvements G.5 Social Media G.6 Mobile Apps	H.1 Traffic Operations Centre Improvements H.2 Coordination with Emergency Services H.3 Coordination with Transit H.4 Coordination with External Agencies H.5 TOC Operations Coordination



A. Intelligent Transportation Systems

5-Year Cost	Potential Benefits
\$ 31,850,000	High

Communication technology is becoming increasingly sophisticated and rapid. Intelligent Transportation Systems (ITS) apply these advances to the monitoring and management of transportation networks. The City of Toronto has already made extensive progress building an ITS system, including the City's RESCU and SCOOT systems. The majority of this system is 20 years old and requires regular maintenance to maintain operation. The recommended projects under this category will continue to strengthen the ITS system, helping to manage traffic congestion by:

- Improving monitoring capabilities to improve response times to unexpected traffic incidents (e.g. illegal lane occupancy, congestion, collisions);
- Improving coordination of traffic signals with traffic flows;
- Increasing the amount and quality of traffic information for improved planning, prioritizing and performance evaluation;
- Increasing the efficiency of communication across the City's network of computers and traffic signals; and,
- Ensuring equipment is in a state of good repair.

Examples of Potential Benefits

Dallas-Fort Worth's ITS strategy includes CCTV cameras and vehicle detectors to monitor traffic conditions, and traffic management centres to detect incidents and respond. The estimated benefits of the full set of strategies include over 68,000 person hours per day less spent on recurring traffic congestion, over 123,000 person hours less per day from fewer and shorter traffic incidents, and a 30% increase in capacity.

Recommended Initiatives

A.1 Replacement of ATMS Software

Update the City's existing 'RESCU' system through a new Advanced Traffic Management System, so as to enhance monitoring and management of the City's expressways. Target: Deployment by end of 2014.

A.2 Enhanced Signal Control Modes

Update the City's existing 'SCOOT' adaptive traffic signal management system – where traffic signal timing changes based on actual traffic demand. This will follow recommendations outlined in the Traffic Signal Adaptive Control Review. In addition, pilot a feature of the 'TransSuite' coordination system that uses real time data, collected from sensors in the road, to create traffic signal timing plans. Target: Enhanced signal control increased from 18% to 25% of intersections by 2018.

A.3 Arterial CCTV Cameras

Add more closed circuit TV cameras (CCTVs) to the City's arterial road network. Explore cost saving opportunities with new construction and new developments, such as installing cameras as part of work zone monitoring or development permits. Target: 30 cameras installed by 2014; another 40 by 2015, and another 30 by 2016.

A.4 Arterial Network Monitoring

Collect traffic flow data to monitor the network – from vehicle detectors, fleet vehicles, or purchase of third party data. Use algorithms to identify unusual cases of traffic congestion in real time with alarms to notify TOC operators to take further action.

A.5 Update and Expand the City's Communications Networks

Develop a long-term strategy for the traffic management communications network. This includes a performance evaluation of recently adopted cellular wireless technology, to ensure reliability in emergency conditions, and plans for a staged expansion of the City's fibre optic network.

A.6 Replacement of Hardware

Implement a replacement program of aging equipment to ensure system is up-to-date and efficient (e.g. CCTV cameras, message signs, etc.).



B. Congestion and Engineering Studies

The focus of this strategy is to keep the City of Toronto’s signal timing plans current and its traffic management strategies up-to-date with the latest in the industry. Recommended projects and activities under this strategy will help manage traffic congestion by:

- Improving the ability of Traffic Operations Centre operators to respond effectively to changing traffic conditions with pre-prepared plans;
- Maintaining coordination as new traffic signals and new operational features are added to the network;
- Identifying practical solutions to key expressway congestion and safety concerns, through advanced technologies/systems or applying current solutions in innovative ways; and
- Exploring integrated approaches that look at multiple traffic corridors as one system, thus optimizing flow across all corridors.

Examples of Potential Benefits

In 2012-2013, the City of Toronto’s Traffic Operations Centre launched a Corridor Retiming Program. In 2012 traffic signals were re-timed at 112 intersections along three corridors. The predicted benefits of these changes include: reducing traveller delays by 12% or over 380,000 hours each year; reducing the number of vehicle stops by 12% or over 33 million each year, and saving 8% or 2.1 million litres of fuel each year. This last benefit will reduce annual greenhouse gas emissions by 8% or 55 tonnes of CO₂ gases. The overall benefit/cost ratio of these activities is estimated at 66:1.

5-Year Cost	Potential Benefits
\$ 500,000	Low to High

Recommended Initiatives

B.1 Auxiliary Signal Timing Plans

Expand the library of auxiliary signal timing plans for scenarios that occur with some regularity – e.g., adverse weather conditions, lane blockages from collisions on expressways, etc. Use simulation tools to model various road closure scenarios. Target: auxiliary plans completed for 3 high priority corridors by 2014.

B.2 Update Corridor Coordination Studies

Establish a process for the regular review (i.e. every 3 to 5 years) of corridor operations and associated signal timing plans to identify where updates are necessary and the relative priority of each update.

B.3 Active Traffic Management Feasibility Study

Explore the need and potential benefits of active management strategies – e.g. hard shoulder running, such as is allowed in the North DVP where GO Buses use the left shoulder to bypass traffic queues during peak times. This may lead to pilot tests and projects beyond this 5-year Plan.

B.4 Integrated Corridor Management Feasibility Study

Review need and potential benefit of implementing integrated management of transit and vehicle movements in parallel arterial and expressway corridors.

C. Incident and Event Response

The City of Toronto's Traffic Operations Centre has been actively involved in incident management through its RESCU system – detecting collisions and other incidents in expressway corridors, coordinating emergency response, and notifying motorists. The activities under this strategy focus on reducing the duration of incidents and minimizing congestion that can result, and are designed to complement increased monitoring capabilities. Recommended projects and activities under this strategy will help manage traffic congestion by:

- Strengthening relationships among key agencies – e.g., TOC, emergency services, towing industry, road maintenance, etc.– to improve coordination, reduce response and clearance times and improve safety of field personnel; and
- Educating motorists to move their vehicles out of the flow of traffic after minor collisions.

Examples of Potential Benefits

The City of Houston's SAFEclear response team includes tow trucks that patrol highways and CCTV cameras that are used by the police to identify incidents. Over the first four months of the program there was a 10% reduction in the number of collisions on the freeways compared to the same four months in 2003 and 2004. Travel time data from TranStar indicate that travel delay was 1.8 million hours lower in 2005 than expected given the traffic growth rate. Travel time reliability, as measured by the amount of extra travel time to accomplish a trip during the worst day of the month, also stabilized in 2005 after being 16% worse in 2004 than in 2003. Not all of these improvements can be traced to SAFEclear but the improvements in congestion and collisions represent more than \$70 million in savings to motorists.

5-Year Cost	Potential Benefits
\$7,650,000	High

Recommended Initiatives

C.1 Traffic Incident Management Team Procedures

Establish Traffic Incident Management Teams with relevant agencies (e.g. TOC, emergency responders, towing, etc.). These teams will meet regularly to better understand each other's roles, responsibilities, limitations and concerns, and identify ways to work together more effectively.

C.2 Service Patrols

Explore the feasibility of implementing roving service patrol vehicles along the DVP and Gardiner Expressway corridors to help motorists with minor mechanical breakdowns and to clear vehicles from travel lanes.

C.3 Steer It - Clear It Signage Program

Deliver a public education and marketing campaign to encourage motorists involved in a property damage only collision on expressways to move their vehicles to a safe place, if possible. Undertake jointly with MTO to provide better coverage.

C.4 Universal Fire Station Pre-emption (Non-vehicle)

Consider a city-wide standardized approach to fire vehicle pre-emption at traffic signals, in order to improve Fire Services ability to quickly and safely respond to events.

RESCU is Toronto's Road Emergency Services Communication Unit. It includes 76 closed circuit television cameras at key locations along 52 km of the City's expressways. Operators at the TOC monitor these cameras 24 hours a day for any traffic incidents that disrupt regular traffic flow.



D. Construction Coordination

Construction and need for contractors to occupy lanes with equipment and/or supplies can have significant traffic impacts. This includes construction for road maintenance and new building developments. The number of new developments across the City of Toronto is a sign of positive economic development, but also provides a key challenge for traffic flow. Recommended projects and activities under this strategy will help manage traffic congestion by:

- Improving the coordination and management of construction work zones across the City;
- Improving information available to travellers about traffic conditions and detours associated with work zones;
- Improving information available to TOC operators for use in monitoring contractor activities and adjusting signal timing plans accordingly; and
- Encouraging contractors to participate as much as possible in minimizing the impact of work zones on traffic.

Examples of Potential Benefits

In Los Angeles, an automated work zone information system was found to reduce vehicle hours of travel by 37% due to traffic diversion to alternate routes. In Arizona, use of a smart work zone on SR-68 to measure travel times through the work zone and report the information to motorists resulted in reduced congestion within the work zone and a contractor that actively worked to minimize the impact of their work on traffic operations. The system was also used to monitor contractor performance, with penalties and rewards imposed depending on traffic conditions and the contractor's ability to meet specified traffic performance requirements.

5-Year Cost	Potential Benefits
\$ 1,100,000	Low to High

Recommended Initiatives

D.1 Smart Work Zones

Develop a standardized approach to work zone management including use of CCTV cameras and vehicle detectors to monitor traffic conditions, and portable electronic messaging signs to inform motorists. A first step would include installing portable CCTV cameras on trailers at work zones. Target: 5 to 10 CCTV cameras in select work zones by 2014.

D.2 Lane Occupancy Permit Management

Implement an electronic system that streamlines the application, approval, receipt and management/tracking of lane occupancy permits. Approved permits would be electronically available to contractors, City enforcement and TOC staff as well as traveller information services.

D.3 Lane Occupancy Permit Review

Review cost of lane occupancy permits, fines and related contract conditions to ensure they reflect potential impacts on traffic, with the goal to speed up the work and shorten the disruptions to traffic flows.

D.4 Work Zone Performance Management and Monitoring

Implement changes to contract requirements that require contractors to comply with the conditions of lane occupancy permits. Consider monitoring the traffic performance within the work zone and requiring the contractor to maintain specific levels of service throughout the day as a future enhancement.



E. Curbside Management

On-street parking in the downtown core is in high demand with taxis, couriers, delivery trucks and private vehicles all competing for available curb space. The streets in these areas are often narrow with limited road width available and high traffic demand adding to the challenge. Activities under this strategy will be conducted in close collaboration with the Toronto Parking Authority, and will help manage traffic congestion by:

- Using innovative solutions to improve the balance of parking demand with traffic operational requirements;
- Reducing illegal parking which may affect traffic flow; and
- Increasing legal parking availability and reducing parking “search time”.

Examples of Potential Benefits

Baltimore/Washington International Thurgood Marshall (BWI) airport implemented a parking guidance system which directs travellers to individual available parking spaces. An October 2003 survey of BWI travelers found that 81% of surveyed travellers indicated that parking was easier at BWI than at the other airports they frequented and 68% agreed that parking was faster.

5-Year Cost	Potential Benefits
\$ 800,000	Low to Medium

Recommended Initiatives

E.1 Parking Charge Review

Review parking charges in order to encourage shorter duration and higher turnover of on-street parking spaces. This could include increasing rates and/or the use of an escalating parking charge scale where rates increase the longer a vehicle is parked in a location.

E.2 Develop Parking Strategies

Develop innovative parking strategies by area and corridor, in close collaboration with local businesses and the courier industry. These parking strategies could include: studying parking demand in the area and how it varies by hour and day of the week; restricting business deliveries to certain times of the day with allowance for private vehicle parking in the remaining time periods; or strict parking restrictions in some corridors during peak hours, while removing parking restrictions on parallel streets during the same hours. Each parking strategy will depend on the area in question, and will be closely evaluated for effectiveness.

E.3 Smart Park

Investigate the Smart Park concept to determine need, feasibility and potential impact for implementation in the longer term. Smart Park involves using technology such as smart phone apps, electronic message signs, and other tools to monitor parking use and inform motorists where parking is available.



F. Support of All Modes of Transportation

Encouraging people to use modes other than their private vehicles – such as walking, cycling or public transit – is an important traffic management strategy as it reduces the number of vehicle trips. The City of Toronto is already actively promoting all modes of transportation through its Official Plan and other initiatives such as the Bikeway Trails Implementation Plan. Projects and activities under this strategy support those efforts and help manage traffic congestion by:

- Improving the effectiveness and coordination of traffic management activities involving public transit vehicles and alternative transportation modes; and
- Exploring the most creative and effective use of typical street design standards and traffic engineering techniques to provide a more balanced use of the road right-of-way.

Examples of Potential Benefits

TriMet (Portland, Oregon) avoided adding one more bus by using Transit Signal Priority and experienced a 10% improvement in travel time and as much as a 19% reduction in travel time variability. With increased reliability, TriMet has been able to reduce scheduled recovery time. An evaluation of the Portland, Oregon region found that residents had an average of 9.8 Vehicle Miles Travelled per capita in neighborhoods with good transit and a mixed-use environment, compared to 13.3 in good transit neighborhoods without a mixed-use environment. A study in the Puget Sound region found that a fully mixed-use environment was associated with a 20% reduction in Vehicle Miles Travelled compared to a fully segregated environment.

5-Year Cost	Potential Benefits
\$ 7,750,000	Low to High

Recommended Initiatives

F.1 Transit Signal Priority

Review and consider replacing the current approach (streetcars and buses receive unconditional priority at 350 intersections) with a conditional approach. The conditional approach provides priority only when it would benefit the transit vehicle (e.g., it is behind schedule).

F.2 HOV - Bus Lane Review

Review the 8 locations where lanes are dedicated for the use of buses and High Occupancy Vehicles (HOV). The goal will be to identify any needed adjustments to hours of operation or occupancy requirements (e.g. change from 3+ people to 2+ people) that would improve efficiency and use.

F.3 Bicycle Facilities Expansion

Continue to implement and expand bicycle facilities, including a downtown separated bike lane network within the downtown core, to encourage people to use bicycles for short trips.

F.4 Corridor Renewal for Sustainable Transportation

Conduct a feasibility study to identify candidate corridors and potential techniques that could be applied to provide a more multi-modal approach to traffic management. Techniques explored could include the use of left turn lanes, methods to reduce vehicle/pedestrian/bicycle conflicts, multi-phase intersections, bicycle facilities, and curb bulbs to protect parked vehicles and reduce pedestrian crossing times. This project will involve evaluating alternative conceptual designs for top priority corridors and selecting one corridor as a demonstration project for potential improvements.

Search Results

Legend

-  Current Restrictions
-  Future Restrictions
-  Traffic Messages
-  Traffic Cameras



G. Traveller Information

Providing convenient access to current and reliable traveller information allows travellers the opportunity to make informed decisions on the best timing, mode, and route of their trip. This strategy builds on advances made under the Intelligent Transportation Systems activities (see Page 5), and will help manage congestion by:

- Improving the amount of information available to travellers allowing them to make informed decisions on their route;
- Increasing the ease and speed in which information about traffic conditions can be shared with travellers and other agencies; and
- Strengthening data sources and networks to ensure information on current traffic conditions, incidents and events is accurate and reliable.

Examples of Potential Benefits

In Houston, Texas, real-time travel time information posted on VMS influenced drivers' route choice – 85% of respondents stated they changed their route based on the information provided. Of these respondents, 66% said that they saved travel time as a result of the route change.

5-Year Cost	Potential Benefits
\$ 5,900,000	Low to High

Recommended Initiatives

G.1 Traveller Information Strategy

Review the current state-of-the-art approaches and make recommendations on potential techniques and technologies that can be effectively used now and in the future for the collection and dissemination of traveller information.

G.2 VMSs including Display of Travel Times

Use existing and new changeable electronic message signs (Variable Message Signs) to display travel times on expressways and select city streets where there is sufficient demand and space. Priority corridors would include those serving the downtown area.

G.3 Event Database

Develop a web-based event database that allows multiple users (e.g., external TOC operators, emergency services, TTC operators) to input, track, and access current and planned event information to allow for enhanced management. This database could be linked to the Lane Occupancy Permit Management System (D.2) for improved efficiency.

G.4 City Website Improvements

Update the City website to provide traveller information in a more convenient and modern fashion. This could include branding the website with a captivating name, improving visual appeal and interface, and increasing the variety of information.

G.5 Social Media

Review the use of social media as a tool for both distributing information to and receiving information from travellers on incidents and events. This review will explore options, seek input from users, evaluate the effectiveness of various tools, and develop a strategy for the best way to apply social media.

G.6 Mobile Apps

Explore the potential for developing and using mobile applications/devices as a way to distribute information to travellers and possibly as a source of data. Apps could be developed by private entities, public sector or as a partnership.



H. Traffic Operations Centre

The Traffic Operations Centre (TOC) is the City’s nerve centre for traffic and congestion management, monitoring traffic conditions and coordinating traffic control field devices 24 hours a day, seven days a week. Other agencies also play a central role in managing the road network – including emergency services, TTC, GO Transit, Ministry of Transportation Ontario, 407ETR, and Regional governments.

Activities under this Technical Element focus on coordination and cooperation amongst the various agencies to maximize the efficiency of transportation network operations. This would improve traffic congestion by:

- Improving incident detection and monitoring of the transportation network, allowing TOC operators to respond to changes in traffic conditions accordingly and more rapidly; and
- Strengthening a regional approach to traffic and congestion management, addressing Toronto traffic congestion resulting from incidents in other jurisdictions and vice versa.

Examples of Potential Benefits

In New York State, Highway Patrol, Department of Transportation (DOT) and the Thruway Authority used real-time traffic data from vehicle probes to identify problem areas in a shopping area during the Thanksgiving weekend. They jointly worked together to manage traffic and provide information to motorists through electronic message signs. This proactive approach resulted in a 50% reduction in traffic queues over previous years.

5-Year Cost	Potential Benefits
\$ 1,700,000	Medium to High

Recommended Initiatives

H.1 Traffic Operations Centre Improvements

The overall objective of this initiative is to maximize the efficiency of operations within the TOC.

H.2 Coordination with Emergency Services

Expand current information exchange between the TOC and Toronto Emergency Services agencies. This could include the two-way exchange of: images from select police cameras, information on traffic incidents, information from the event database (G.3), information on current lane closures due to construction (D.2), and other traffic information (A.4).

H.3 Coordination with Transit

Establish close working relationships with TTC and GO dispatch centres to exchange information on congestion, incidents, events, and other relevant data.

H.4 Coordination with External Agencies

Strengthen collaboration, coordination, and electronic information sharing between the TOC and adjacent jurisdictions.

H.5 TOC Operations Coordination

Strengthen TOC operations by establishing regular staff meetings and debriefing sessions after events with TOC staff as well as staff from other control centres. Meetings should review processes used, key issues that arose during an event, what did and did not work well, and changes that need to be made to improve operating efficiency.

IMPLEMENTING THE PLAN

Capital and Operating Costs

The City of Toronto Congestion Management Plan 2014-2018 as proposed represents a capital cost of \$57.25 million dollars spread over 5 years. Appendix B documents how this cost breaks down across the eight Technical Elements and their component projects.

The estimated cost associated with the additional staff resource requirements, described below, is \$1.1 million. The marginal additional cost to maintain the proposed additional ITS infrastructure, including both hardware and software, over the 5 year program is \$8 million.

Implementation Schedule

A Gantt chart that illustrates how the recommended projects and activities will be implemented over the next 5 years is included in Appendix C.

Resource Requirements

Recommended projects and activities fall under the responsibility of a number of different sections within the City of Toronto's Transportation Services Division, with the majority falling within the Traffic Management Centre. With the more proactive approach to traffic management on arterial roads described in the Plan, there is a need for additional staff resources to monitor and respond to changing traffic conditions. It is therefore recommended that additional staff positions be created to provide these functions, including: within the Traffic Signal Operations Group (2 positions), the RESCU Group (2 positions), the Traffic Safety Unit (2 positions), and the Traffic Plant Installation and Maintenance Unit (1 position).

To implement the broad range of capital projects outlined in this Plan, it is recommended that a separate Capital Projects Delivery Group be formed that is dedicated to the planning, design and implementation of the capital projects identified. This group would consist of 5 staff positions all operating under the oversight of a manager, and would allow the City to continue to update and expand their traffic management systems beyond 2018.

Monitoring and Evaluation

A process will be established at the outset to monitor and evaluate the performance of the various projects, to ensure goals are being met. Identifying performance criteria will be a key first step to this process. Common transportation network performance indicators include: travel time, average speed, total delay (vehicle-hours or person-hours), travel time index (the ratio of peak period travel time to travel time under free flow conditions) and the buffer time index (the ratio of total trip time a person would plan to allow in order to ensure on-time arrival to average trip time). As these criteria do not reflect how performance can vary over time and space, other methods should be explored for monitoring performance.

The Plan should also be continuously reviewed and updated together with the City of Toronto's overall transportation planning and environmental review processes to ensure it remains relevant in helping to address the City of Toronto's transportation needs and priorities.

APPENDIX A: RECOMMENDED PROJECTS AND ACTIVITIES BY GOAL

P = Primary Goal s = Secondary Goal

Technical Elements & Projects	CONGESTION MANAGEMENT PLAN GOALS				
	Maximize Efficiency & Reliability	Improve Safety	Improve Responsiveness	Improve Information	Reduce Environmental Impact
Intelligent Transportation Systems					
A.1 Replacement of ATMS Software	S	S	P	S	S
A.2 Enhanced Signal Control Modes	S		P		S
A.3 Arterial CCTV Cameras	S	S	P	S	S
A.4 Arterial Network Monitoring	S	S	P	S	S
A.5 Update and Expand City Communications Networks	S		P	S	
A.6 Replacement of Hardware	S	S	P	S	S
Congestion & Engineering Studies					
B.1 Auxiliary Signal Timing Plans	P		S		S
B.2 Update Corridor Coordination Studies	P	S			S
B.3 Active Traffic Management Feasibility Study	P	S			S
B.4 Integrated Corridor Management Feasibility Study	P		S		S
Incident & Event Response					
C.1 Traffic Incident Management Teams	S	P	S		S
C.2 Service Patrols	S	P	S		
C.3 Steer It - Clear It Signage Program	S	P			S
C.4 Universal Fire Station Pre-emption (Non-vehicle)	S	S	P		
Construction Coordination					
D.1 Smart Work Zones	S			P	S
D.2 Lane Occupancy Permit Management				P	S
D.3 Lane Occupancy Permit Review	P				S
D.4 Work Zone Performance Management and Monitoring	P				S
Curbside Management					
E.1 Parking Charge Review	P				S
E.2 Develop Parking Strategies	P				S
E.3 Smart Park	P				S
Support of Alternate Modes					
F.1 Transit Signal Priority	P				S
F.2 HOV - Bus Lane Review	P				S
F.3 Bicycle Facilities Expansion	S	P			S
F.4 Corridor Renewal for Sustainable Transp.	P				S

P = Primary Goal

s = Secondary Goal

Technical Elements & Projects	CONGESTION MANAGEMENT PLAN GOALS				
	Maximize Efficiency & Reliability	Improve Safety	Improve Responsiveness	Improve Information	Reduce Environmental Impact
Traveller Information					
G.1 Traveller Information Strategy	S	S		P	
G.2 VMSs including Display of Travel Times	S	S		P	
G.3 Event Database	S	S		P	S
G.4 City Website Improvements	S	S		P	S
G.5 Social Media	S	S		P	S
G.6 Mobile Apps	S	S		P	S
Traffic Operations Centre					
H.1 Traffic Operations Centre Renovations	P		S		
H.2 Coordination with Emergency Services	S		S	P	S
H.3 Coordination with Transit	S		S	P	S
H.4 Coordination with External Agencies	P		S	S	S
H.5 TOC Operations Coordination	P		S	S	S

APPENDIX B: PROGRAM COST ESTIMATES SUMMARY

Congestion Management Plan
CAPITAL COST AND CASH FLOW SUMMARY

Technical Element	Procurement & Installation Projects					Total Estimated Cost	
	2014	2015	2016	2017	2018		
A	Intelligent Transportation Systems						
A.1	Replacement of ATMS Software	\$ 1,200,000	\$ -	\$ -	\$ -	\$ -	\$ 1,200,000
A.2	Enhanced Signal Control Modes	\$ 150,000	\$ 1,450,000	\$ 2,950,000	\$ 2,950,000	\$ 2,800,000	\$ 10,300,000
A.3	Arterial CCTV Cameras	\$ 900,000	\$ 2,100,000	\$ 50,000	\$ 800,000	\$ 800,000	\$ 4,650,000
A.4	Network Monitoring	\$ -	\$ 100,000	\$ 50,000	\$ 1,050,000	\$ 250,000	\$ 1,450,000
A.5	Update and Expand Communications Network	\$ 150,000	\$ 900,000	\$ 1,000,000	\$ 1,300,000	\$ 1,050,000	\$ 4,400,000
A.6	Hardware Replacement and/or Expansion	\$ -	\$ 1,750,000	\$ 2,210,000	\$ 2,960,000	\$ 2,930,000	\$ 9,850,000
B	Congestion and Engineering Studies						
B.1	Auxiliary Signal Timing Plans	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
B.2	Update Corridor Coordination Studies	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
B.3	Active Traffic Management Feasibility Study	\$ -	\$ -	\$ -	\$ -	\$ 250,000	\$ 250,000
B.4	Integrated Corridor Management Feasibility Study	\$ -	\$ -	\$ 250,000	\$ -	\$ -	\$ 250,000
C	Incident and Event Response						
C.1	Traffic Incident Management Team Procedures	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
C.2	Steer It - Clear It Program	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
C.3	Universal Fire Station Pre-emption (Non-vehicle)	\$ -	\$ -	\$ 50,000	\$ 3,800,000	\$ 3,800,000	\$ 7,650,000
D	Construction Coordination						
D.1	Smart Work Zones	\$ -	\$ 200,000	\$ -	\$ -	\$ -	\$ 200,000
D.2	Lane Occupancy Permit Management	\$ -	\$ 100,000	\$ 550,000	\$ -	\$ -	\$ 650,000
D.3	Lane Occupancy Permit Review	\$ -	\$ -	\$ 150,000	\$ -	\$ -	\$ 150,000
D.4	Work Zone Performance Management & Monitoring	\$ -	\$ 50,000	\$ -	\$ 50,000	\$ -	\$ 100,000
E	Curbside Management						
E.1	Parking Charge Review	\$ -	\$ -	\$ -	\$ 50,000	\$ 50,000	\$ 100,000
E.2	Develop Parking Strategies	\$ -	\$ -	\$ 100,000	\$ 100,000	\$ 400,000	\$ 600,000
E.3	Smart Park	\$ -	\$ -	\$ -	\$ -	\$ 100,000	\$ 100,000
F	Support of Alternate Modes						
F.1	Transit Signal Priority	\$ -	\$ 150,000	\$ 700,000	\$ 650,000	\$ -	\$ 1,500,000
F.2	HOV - Bus Lane Review	\$ -	\$ 100,000	\$ 300,000	\$ 300,000	\$ 100,000	\$ 800,000
F.3	Bicycle Facilities Expansion	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
F.4	Corridor Renewal for Sustainable Transportation	\$ -	\$ 100,000	\$ 200,000	\$ 2,600,000	\$ 2,550,000	\$ 5,450,000
G	Traveller Information						
G.1	Traveller Information Strategy	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
G.2	VMs including Display of Travel Times	\$ -	\$ 100,000	\$ 2,450,000	\$ 2,300,000	\$ -	\$ 4,850,000
G.3	Event Database	\$ -	\$ 100,000	\$ 400,000	\$ -	\$ -	\$ 500,000
G.4	City Website Improvements	\$ -	\$ 150,000	\$ -	\$ 50,000	\$ -	\$ 200,000
G.5	Social Media	\$ -	\$ -	\$ 100,000	\$ -	\$ -	\$ 100,000
G.6	Mobile Apps	\$ -	\$ 50,000	\$ 100,000	\$ 50,000	\$ 50,000	\$ 250,000
H	Traffic Operations Centre						
H.1	Traffic Operations Centre Improvements	\$ 600,000	\$ -	\$ -	\$ -	\$ -	\$ 600,000
H.2	Coordination with Police	\$ -	\$ 100,000	\$ 50,000	\$ 50,000	\$ 150,000	\$ 350,000
H.3	Coordination with Transit	\$ -	\$ -	\$ 150,000	\$ 50,000	\$ 50,000	\$ 250,000
H.4	Coordination with External Agencies	\$ -	\$ -	\$ 300,000	\$ 100,000	\$ 100,000	\$ 500,000
H.5	Traffic Operations Centre Coordination	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
	TOTAL	\$ 3,000,000	\$ 7,500,000	\$ 12,110,000	\$ 19,210,000	\$ 15,430,000	\$ 57,250,000

APPENDIX C: PROPOSED IMPLEMENTATION SCHEDULE

