City of Hamilton

Development of Policy Papers for Phase Two of the Transportation Master Plan for the City of Hamilton
INTELLIGENT TRANSPORTATION SYSTEMS (ITS) POLICY PAPER

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Originator:	Russell Brownlee, Ron Stewart
Reviewers:	Andy Mclaughlin, Bill Janssen, Mary Lou Tanner, Harold Groen, Hélène Ellermeyer

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1. INTRODUCTION

1.1 Study Background and Objectives

The City of Hamilton *City-wide Transportation Master Plan* will provide inputs to the *Growth Related Integrated Development Strategy* (GRIDS) and make recommendations to Council on the adoption of a City-wide Transportation Policy that is cognisant of Vision 2020 and other City of Hamilton long-term planning objectives. The project has been divided into three distinct phases. The first phase consisted of the technical calibration of the existing transportation model to reflect current transportation conditions in Hamilton. The second phase, which is the object of this and other policy papers, will focus on the development of 23 policy papers in the following areas: Travel Demand, Urban Development, System Performance, Infrastructure Planning and Infrastructure Financing. Following the completion of the Policy Papers, the City will proceed to develop transportation scenarios (Phase 3 of the project) based upon the results of the policy work performed in Phase 2 and the land use scenarios developed through the broader GRIDS study, and will test the efficiency and viability of these scenarios by integrating them into the calibrated model.

1.2 Intelligent Transportation Systems Defined

Despite a history of providing and maintaining a comprehensive network of multi-modal transportation facilities, Hamilton's transportation system faces many challenges. Over time the growth in population and industry has led to increasing demands on the transportation system, challenging both efficiency and safety. All agree that transportation is crucial to the social, environmental, public and economic health of the City.

The GRIDS Study Design placed emphasis on sustainable infrastructure planning, including transportation infrastructure. Sustainable infrastructure is infrastructure that is affordable to a community not only in the short-term, but also over the long term. One of the key elements of sustainable infrastructure planning is the ability to maximize the use of existing water, wastewater, stormwater and transportation infrastructure, and use new infrastructure in an efficient manner.

One means of achieving sustainable transportation infrastructure it to employ existing and new technologies to make the best use of existing transportation facilities. These technologies, known as Intelligent Transportation Systems (ITS), have the potential to bring smarter, more economical and environmentally friendly solutions to improve Hamilton's transportation systems.

As defined by Transport Canada, ITS is a broad range of diverse technologies applied to transportation to make systems safer, more efficient, more reliable and more environmentally friendly, without necessarily having to physically alter existing infrastructure. ITS include the application of advanced information processing, communication and electronics technologies, and management strategies, in an integrated manner, to increase the efficiency and safety of ground transportation systems. ITS applications encompass passenger and freight transportation in both urban and rural areas.

The potential general benefits generated from ITS application implementation are:

- Time savings;
- Reduced vehicle and/or fleet operating costs;

- More reliable transportation services for all modes;
- Reduce collision potential;
- Avoided transportation infrastructure capital and maintenance costs; and/or
- Reduced emissions.

1.2.1 ITS ARCHITECTURE FOR CANADA

Canada developed an ITS Plan to provide guidance in the development and implementation of ITS nationally. Canada's ITS Plan includes the development of a national ITS Architecture to provide a unified framework to guide the co-ordinated deployment of ITS programs within the public and private sectors. Canada's ITS Architecture can be found at: http://www.its-sti.gc.ca/en/architecture.htm

1.2.2 ITS FUNCTIONAL AREAS

Included in the Canadian and US ITS architectures are **User Services,** which represent what the system will do from the perspective of the "user". The ITS domain was divided into eight functional areas (User Service Bundles) as described in Exhibit 1.1.

This paper uses this framework as a general focus for the discussion and identification of policy options. There are other "new" technology options for transportation that exist, such as alternative fuels and engines, but these are generally not under the influence of a transportation master plan. However, new technologies that reduce air emissions from vehicles are discussed in the **Air Quality Paper**.

Exhibit 1.1: ITS User Service Bundles

User Service Bundle	Description
Traveller Information Services	Advanced systems and technologies to manage information to help drivers decide routes and departure times and provide opportunities to reserve rides and other traveller services.
Traffic Management Services	Use of advanced systems and technologies to improve the efficiency, operation and safety of existing surface transportation infrastructure. This user service bundle includes user services relating to traffic control, incident management, travel demand management, operations and maintenance, weather information systems and automated warning and enforcement.
Public Transport Services	Innovative applications to improve transit services, rider information, and customer/employee safety for urban and rural public transportation systems.
Electronic Payment Services	Payment and management systems that allow travellers to pay for transportation services such as transit fares, tolls and parking through an electronic payment medium.
Commercial Vehicle Operations	Technologies that improve freight mobility, private sector fleet management, and streamline government/regulatory functions. User services include commercial vehicle electronic clearance, automated roadside safety inspection, and on-board safety monitoring.

User Service Bundle	Description
Emergency Management Services	User services that directly relate to the detection, notification and response to incidents that take place on or adjacent to roadway facilities.
Vehicle Safety and Control Services	Vehicle-based and infrastructure-based collision avoidance technologies and applications designed to reduce the number and severity of collisions.
Information Warehouse Services	Applications to gather, archive, and disseminate/share weather, environmental and transportation data.

2. REVIEW OF EXISTING CITY OF HAMILTON POLICIES

2.1 Current Roles and Responsibilities

Given the breadth of application of ITS, the responsibility of implementation would come under a number of departments. Provided in **Exhibit 2.1** is a summary of the typical areas of responsibility for City of Hamilton Departments.

Exhibit 2.1: Areas of Responsibility – Intelligent Transportation Systems

Department	Typical ITS Responsibility [(1)]
Traffic Engineering and Operations	Traveller Information Advance Traffic Management Traffic Operations/Systems Non-Road User Safety Emergency Vehicle Pre-Emption Incident Management
Hamilton Street Railway	Transit Priority Transit Vehicle Tracking and Management Electronic Payment
Parking	Electronic Payment
Enforcement	Incident Management Automated Enforcement
Emergency Services	Emergency Vehicle Pre-Emption Incident Management

Note: [(1)] Not all of these measures are currently used by the City. The intent of this exhibit is to illustrate responsibilities for ITS technologies in use or that could potentially be introduced in the future. A list of current applications is discussed in the next section.

2.2 Review of Existing ITS Elements

The City of Hamilton currently does not have explicit policies relating to the use or support of ITS applications. Many of the policy statements related to roadway efficiency, economic and safety can be addressed through the application of ITS. Provided in

Exhibit 2.2 is a summary of the technology applications that currently exist in the City of Hamilton.

Exhibit 2.2: Existing City of Hamilton Technology Applications

Technology	Existing City Applications	Application Purpose
Close-loop signal system	25% to 30% of the approximately 30 signal groups	Remote monitoring of signal group operations.
Red-light camera	MTO/Municipal pilot project	Enforcement
Pedestrian Countdown Timers	Various locations	Pedestrian safety
Emergency Vehicle Pre-emption	Flamborough area signals	Fire Services vehicle pre-emption
Signal Eyes	King & Wellington and at Main & Wellington	Reduce potential conflicts between pedestrians and motorists

3. SUPPORTING INFORMATION AND ANALYSES

3.1 Trends

Certain areas of transportation technologies, such as traffic signal systems, have been around for many years and represent a relatively mature market. In contrast, other technologies such as in-vehicle crash avoidance systems are just beginning to emerge. Provided below are some of the general trends that are surfacing as the ITS field continues to develop:

- **Stand Alone Devices and Pilot Projects to Integrated Systems and Wide-Spread Deployment** – As new technologies and applications become further developed and are seeing wide spread deployment and success, more jurisdictions are taking the opportunity to develop and fund system-wide applications. For example, some jurisdictions are including emergency and/or transit vehicle pre-emption equipment on all new traffic signal control installations. In other cases, equipment such as snow plows and or transit vehicles are being purchased with on-board communications systems to integrate into existing monitoring and tracking systems.

- **Public Sector Jurisdiction to Private Sector Participation** – In the past, the majority of the transportation systems were owned, operated and maintained solely by public sector jurisdictions/companies. Recent trends have been to permit private sector companies to occupy one or more of these roles. Some examples of each are:

  - **Own** - Highway 407 ownership and operations by private consortium. York Rapid Transit Plan public-private partnership to provide and operate rapid transit in the Region of York;

  - **Vehicle** – Through electronic on-board toll, tariff and monitoring devices;

  - **Operations and Capital Funding** - Red light camera capital funding and operations in many jurisdictions; and

  - **Maintain** - MTO and City of Toronto roadway maintenance by private firms.

As technologies are incorporated into these day-to-day activities, there becomes greater opportunities for the private sector to fund/own, lease, operate or maintain the system. In addition, many of the developing ITS applications are associated with areas that have been historically private sector responsibilities, i.e., commercial vehicle management and in-vehicle safety systems

- **Proprietary Technology to Open Systems and Standards** – Considerable investment is involved in the development and marketing of a new transportation technology. As such, many manufacturers and suppliers have developed their products to capture and maintain their area of market, for example, a proprietary traffic signal control system with continued dependence on the system developer and limited networking opportunities. One of the downsides is the inability of a system to share information with that of another department or jurisdiction. In addition, a jurisdiction may be restricted to one product and cannot competitively tender future equipment purchases or expansion to the functions. The Canadian ITS Architecture has assisted in establishing standards for emerging technologies. In some cases such as traffic signal control systems and advance road weather information system (ARWIS), the public sector (the "buyers") have developed standards and data protocols to insist on open systems from the bidding suppliers. An example of this is the NTCIP standard for traffic signal control.

- **Traffic Applications to Road User Technologies** – As the objective of many jurisdictions has historically been to move traffic more efficiently and safely, many of the ITS systems in place are focused on traffic flow, congestion management and collision reduction. As many jurisdictions continue to develop and urbanize, other modes of transportation and their efficient and safe operation are receiving greater attention. In many cases these efficiencies and safety improvements are being met by technological solutions. Examples include:

  – Transit vehicle tracking for better management and improved rider information;

  – Transit security systems for operators and passengers;

  – Bicycle warning systems within tunnels or narrow bridges; and

  – Active and passive pedestrian detection at intersections and signal controlled crossings.

- **Reactive Approach to Proactive Surveillance** – In many of the areas of traveller information, incident detection/response, and weather or roadway condition monitoring the trend has been to use technological advances to provide proactive monitoring, advance detection and advanced or real-time information for both the operators and users of the system. Road weather information system deployment has been undertaken in all Provinces of Canada and provides the opportunity to monitor real-time roadway conditions, provide pre-trip information to motorists through various information systems and arrange for time sensitive maintenance activities.

- **Urban Only to Rural Applications** – The development and deployment of ITS applications has, by and large been feasible and necessary in urban areas for one or more of the following reasons:

  – Greater number or magnitude of transportation concerns;

  – Consequences of inefficiencies or incidents had greater impacts, i.e., delay to greater number of motorists, diversion or evacuation of a large number of motorists/residents, etc.

  – Supply of power and communications to rural or remote areas was not cost effective and coverage was limited;

The advances in cellular technology and coverage and solar powered systems, rural applications have become more economical. Examples include: emergency phone systems, ARWIS stations, and solar powered parking systems with remote download of electronic payments. In addition, commercial vehicle tracking, weather information and road condition monitoring, emergency response and other public and private sector needs do not stop at the urban boundaries, and in some cases, become more important in isolated areas.

3.2 Applicability

A qualitative review of each of the primary functional components was reviewed to determine if explicit consideration was applicable to a Transportation Master Plan undertaking. Included in Exhibit 3.1 is a high-level screening of potential ITS technologies as they relate to the Transportation Master Plan.

Exhibit 3.1: Typical ITS Responsibility and TMP Considerations

Use Service Bundle	Typical Applications	Typical Jurisdiction Responsibility				Appropriate for Consideration in Transportation Master Plan?
		Municipal	Provincial	Federal	Private	
Traveller Information Services	• Broadcast Traveller Information	X	X			Yes
	• In-Vehicle Route Guidance				X	No
	• Ridesharing/Ride-Matching	X	X		X	Yes
Traffic Management Services	• Freeway Traffic Management Systems	X	X			Yes
	• Signal Control Systems	X				Yes
	• Environmental Conditions Management	X	X	X		No
	• Operations and Maintenance	X	X			No
	• Non-Vehicular Road User Safety	X				Yes
Public Transport Services	• Transit Tracking/Management	X	X			Yes
	• Passenger and Fare Tracking	X				Yes
	• En-Route Transit Information (Municipal)	X				Yes
Electronic Payment Services	• Electronic Toll Collection				X	No
	• Electronic Parking Payment	X			X	No
	• Transit Services Payment	X	X			Yes
Commercial Vehicle Operations	• Commercial Vehicle Clearance, Inspection and Monitoring		X	X		No
	• Commercial Vehicle Management				X	No
Emergency Management Services	• Emergency Notification and Disaster Response	X	X	X		No
	• Emergency Vehicle Management	X				No

Use Service Bundle	Typical Applications	Typical Jurisdiction Responsibility				Appropriate for Consideration in Transportation Master Plan?
		Municipal	Provincial	Federal	Private	
Vehicle Safety and Control Services	• Vehicle-Based Collision Avoidance				X	No
	• Infrastructure-Based Collision Avoidance	X	X			No
	• Automated Vehicle Operation				X	No
Information Warehouse Services	• Weather and Environmental Data Management	X	X	X		No
	• Archive Data Management	X	X	X		No

Based on the above review, there are a number of policy and program options that should be recognized in the transportation planning effort in the City:

- Traveller Information Services in support of transportation demand management (ride sharing), incident management and transit service;
- Public Transport Services to improve efficiency and traveller information services to promote increased transit use;
- Electronic Payment Services to support transit system use;
- Traffic Management Services, including non-vehicular road user safety systems, to improve the efficiency and safety of the existing and future road network.

4. REVIEW OF PRACTICES IN OTHER JURISDICTIONS

With the breadth of the ITS scope of applications, the policies, programs and applications vary considerably across jurisdictions. In the Greater Toronto Area, Ontario and Canada, the more mature areas of ITS and those having being deployed, include:

- Freeway traffic management systems;
- Signal control systems;
- Traveller information systems;
- Transit vehicle tracking and management systems; and
- Automated enforcement.

A summary of the larger and more prominent initiatives in the GTA and Canada are summarized in Exhibit 4.1.

Most ITS activities for Canadian cities tend to focus on freeway and arterial traffic management. With the exception of Red light cameras, little information was found on initiatives involving automated enforcement, such as enforcement of HOV lanes. This is partly due to the fact that our society is cautious of electronic enforcement and its potential impacts on privacy. The Highway 407 toll electronic toll collection system is one example of where this barrier has been overcome.

Exhibit 4.1: ITS Deployment and Potential Projects in Canada

Jurisdiction(s)	Application	Description
Ontario, Atlantic Provinces, British Columbia, Alberta, Manitoba, Quebec	ITS Strategic Plan	Plans to guide the priority implementation of ITS technologies and applications in their respective provinces.
City of Mississauga	ITS Strategic Plan	Plans to guide the priority implementation of ITS technologies and applications in Mississauga.
Toronto, Ottawa, Peel, Hamilton, Calgary, Manitoba, Halton	Red-Light Cameras	Photo enforcement of red-light running.
City of Toronto	ROADMAP	The Road Access and Disruption Management Program (ROADMAP) system is currently being developed to provide advanced interagency coordination of planned disruptions such as maintenance, construction, utilities, road closures, etc. The system will allow better management of surface travel disruptions.
City of Toronto	Traffic Management Centre (RESCU)	A freeway traffic management system (FTMS) covering approximately 30 kms of the Gardiner Expressway, Lakeshore and Don Valley. The system includes 42 CCTV cameras, 121 detector stations, four permanent changeable message signs (CMS) and four portable CMS. The FTMS

Jurisdiction(s)	Application	Description
		permits the timely detection of incidents/congestion and provides travellers with information regarding the same.
Ministry of Transportation of Ontario	Freeway Traffic Management System Traveller Information	The COMPASS system is designed to reduce traffic congestion and increase safety on the 400 series highways in the GTA. The system consists of 94 CCTV cameras, 33 LED CMSs and 630 vehicle detection stations. The system allows the prompt detection and removal of freeway incidents, provides real-time freeway incident and delay information to motorists, and permits better management of peak rush hour traffic flow.
Region of Durham, Region of York, Region of Niagara, City of Toronto City of Mississauga	Central Signal Control System	Real-time centralized traffic control systems to monitor, maintain and optimize the jurisdiction's traffic signals.
Region of Durham	Incident Management	The Brock Road Incident Management System will implement the physical architecture and processes necessary to establish the basis of the system. The full system build-out will be staged over a number of years.
Numerous provincial and municipal jurisdictions	Variable Message Signs	The use of variable message signs for planning traffic disruptions and construction activities.
City of Calgary	Transit Signal Priority	Route 3 Calgary Transit buses and signalized intersections will be equipped with a traffic signal priority system to enable buses to request additional green traffic signal time. Automatic Vehicle Tracking Systems (AVTS) will also be installed on buses to assist in the development of schedules and track actual travel times.
Region of York City of Mississauga Halifax	Transit Priority System	Existing or future deployments of TPS along key transit routes.
York Rapid Transit Plan	Transit Priority System Traveller Information	Implementation of transit vehicle tracking, transit signal priority, queue jump lanes, and bus information systems.
Alberta	Environmental Condition Management/Traveller Information	ITS network applications on Highway 2 including Road Weather Information Systems (RWIS) stations, changeable message signs (CMS), traffic cameras and highway advisory radios (HAR).
Ottawa	Transit System Priority	Signal priority and queue jump lanes

Jurisdiction(s)	Application	Description
Mississauga	Smart Vehicle Project	The Smartbus component of the system is to be comprised of automatic vehicle location (AVL)/GPS, automatic passenger counting (APC) and a vehicle maintenance monitoring systems for a subset of Mississauga's transit fleet. In addition, the City of Mississauga contracts out their snow clearing operations and will be implementing tracking systems on a subset of the fleet
Mississauga	Smart Vehicle Project	The City is in the process of installing ARWIS stations, and GPS to track maintenance vehicles. The processing and integration of the information generated by these systems can serve determine roadway coverage, plowing operations and materials distribution. This system will provide a valuable tool for efficient and effective winter maintenance and aid in the response to public inquiries.
City of Vaughan	Winter Maintenance Vehicle Information System	A real-time vehicle tracking system to permit the public to view (GPS based maps) the activities of winter maintenance patrols and various roadway and sidewalk snow clearing and salt/sanding vehicles.

5. IDENTIFICATION OF POLICY OPTIONS

The Transportation Master Plan should give direction for the application of a wide range of ITS strategies to meet objectives relating to quality of service, efficiency, cost effectiveness and safety for all travel modes. Based on the review of the available User Service applications in ITS and those being deployed in other Canadian jurisdictions, the following policy options should be considered.

5.1 Need and Justification for ITS

The need and justification of deploying ITS infrastructure should be firmly based on customer service (road user or transit rider quality of service), operating efficiencies, and improvements to road user safety.

Given the breadth of the ITS territory and the potential number of applications, stakeholders and, funding challenges, the need for technology-based improvements need to be prioritized. The need and justification process for ITS systems are similar to those of other transportation improvements, i.e., does the remedial measure implementation provide a net benefit compared to other improvement options, including "do nothing". Provided below is a summary of the primary technology areas and key considerations for the City of Hamilton.

5.1.1 TRAFFIC OPERATIONS AND FREEWAY TRAFFIC MANAGEMENT SYSTEMS

One of the primary objectives of the GRIDS project is to determine ways to better manage, maintain and utilize existing transportation systems to before considering the addition of new infrastructure, i.e., widening of roadways, additional transit vehicles, etc. Real-time traffic management and control have been successfully implemented by numerous jurisdictions to achieve these objectives.

Within the ITS field, there are a number of opportunities to improve traffic and freeway operations without providing physical improvements. Some of the more applicable and proven technologies in traffic control and management include:

- Traffic responsive or adaptive control at intersections;
- Traffic equipment status and monitoring;
- Emergency or transit vehicle control requests, i.e., pre-emption or priority;
- Traffic information dissemination and broadcasts to adjacent jurisdictions, media and other affected authorities; and
- Freeway incident and congestion management.

Exhibit 5.1: Examples of Surface and Freeway Traffic Management Systems from Other Jurisdictions*

	
Traffic Signal Control System	**Freeway Traffic Management System**

* It is noted that these systems are from larger cities and are not proposed for Hamilton

The advantages and disadvantages of these systems are noted below:

Advantages

- Reduces congestion and delay on the freeway network
- Permits timely response to collisions and incidents;
- Allows real-time traffic and incident information dissemination to other agencies and the media; and
- Supports traveller information systems.

Disadvantages:

- Capital intensive;
- Requires similar monitoring, information dissemination and traffic management systems on the adjacent arterial road systems to achieve real benefits.

Caution must be observed when considering and evaluating advanced technologies for the freeway and/or arterial traffic system in Hamilton. Specifically, Hamilton's traffic signal system currently operates quite well and does not experience significant problems. In addition, the City must carefully balance the cost of these technologies with other investments for non-vehicle traffic (e.g. bike lanes, pedestrian facilities, etc.) which can help ease congestion by shifting traffic to non-auto modes.

At present the City's freeway, the Lincoln Alexander Parkway, and its ramp terminals generally operate at an acceptable level of service under normal operating conditions. Therefore, the primary

focus of ITS technologies to support improved traffic flow should be directed towards the critical corridors in the arterial road network. As population and employment intensifies in the southern part of the City, traffic pressures on the freeway operations may necessitate an advance traffic management system.

5.1.2 TRANSIT

ITS infrastructure is an important tool for improving transit management and surface operations. From the perspective of the transit operator ITS facilitates integration and monitoring of traffic signal systems, communication among agencies/departments, transit management and data collection (both passenger and vehicle), and emergency response capabilities. From the perspective of transit passengers, ITS infrastructure facilitates the efficient movement of transit vehicles, provides useful information for people waiting at stations, on transit vehicles and remotely through internet access. In addition, ITS systems can improve passenger safety by incorporating remote monitoring of stations.

On-time performance, advanced traveler Information, and competitive transit travel times (often facilitated by transit priority signalization and rights-of-way) are key contributing factors in encouraging the use of public transit in general and for “choice” riders specifically.

Applicable technologies in the Public Transport Services user service group are:

- **Transit vehicle tracking and fixed-route operations** – automatic vehicle location (AVL) to determine real-time schedule adherence and management. These systems assist the transit authority in routing and scheduling fixed-route operations, as well as, providing real-time schedule information to transit users;

- **Passenger and fare management** – a group of technologies to monitor passenger loading and electronic payment;

- **Public travel security** – monitoring of on-board and public area (transit stop, park and ride and terminal) security.

- **Passenger Information** – including access to transit information, schedules and potentially real-time bus arrival time information (in the longer term) using website and cell-phone technologies.

Provided below is a summary of the primary advantages of the technologies in the Public Transit Service user service group:

- Improved monitoring and management of transit operations;

- Increase in schedule reliability;

- High level of user acceptance and user satisfaction; and

- Improve security for operators and customers.

Disadvantages to these technologies are similar to traffic management in that they are sometimes capital intensive and would require monitoring and on-going maintenance by the transit department.

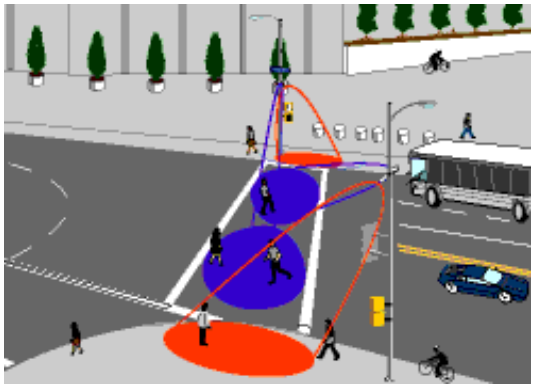
5.1.3 NON-VEHICULAR ROAD USER SAFETY

There are a number of technologies that warn pedestrians, pedestrians with disabilities, bicyclists, and other vehicles of conflict potential at interface areas such as intersections, bridges, tunnels and mid-block crossings. Some examples include:

- Passive or active pedestrian or wheelchair detection to modify signal or other pedestrian control based on pedestrian presence (Refer to Exhibit 5.2); and
- Active bicycle detection to provide additional warning at conflict areas, on narrow bridges or within tunnels.

Exhibit 5.2: Example of Non-Vehicular Road User Safety Applications

Active Detection of Wheelchairs



Passive Detection of Pedestrian Presence

Active Bicycle Detection and Warning

The implementation of these devices could be undertaken in conjunction with the City's current collision network screening process and where pedestrian and other road user safety issues have been identified.

5.1.4 ITS STRATEGIC PLAN

In many cases ITS technologies have been implemented in a jurisdiction or department only to later discover its limitations relating to expansion, functionality or integration with other jurisdiction practices or systems.

The objective of an ITS strategic plan is to prepare an integrated and coordinated roadmap to set the direction and pace of future ITS investments for a jurisdiction over the next 10 years and beyond. The plan should be structured to recognize and leverage national mandates, such as the ITS architecture and federal funding, and include the involvement and input from all key stakeholders in the province and neighbouring jurisdictions (including MTO). The plan should also include only realistic and implementable technologies so that it is possible to demonstrate progress and maintain commitment to the plan.

The development of an ITS strategic plan assists in determining:

- Existing and future transportation needs, assessing what ITS tools are available to address the “needs” and if a technology-based solution is the correct tool, i.e., assessing the potential benefits of the ITS application;
- Regulatory, funding, organizational, legal, user acceptance, technical and other barriers and opportunities that may exist;
- Roles and responsibilities for the implementation of the various areas of ITS including, but not limited to, City departments, Provincial and Federal governments, non-profit or advisory groups, and the private sector.
- Priorities for implementation including the logistics associated with other City initiatives and ITS projects; and
- Evaluation mechanisms to support projects and spur interest and investment in future initiatives.

The following are the advantages and disadvantages of the development of an ITS Strategic Plan.

Advantages:

- Coordinated deployment and application of ITS technologies to meet primary transportation needs;
- Identification of lead and support participants;
- Ability to build on other applications being considered/developed in other departments, agencies, jurisdictions and levels of government;
- Prepare for funding opportunities and private sector investment.

Disadvantages:

- Coordination, resources and funding required to develop an ITS Strategic Plan;
- The Strategic Plan needs to be revisited often (typically every five years) to determine applicability and required modifications, particularly in light of the rapidly changing technologies.

5.2 Roles and Responsibility

Although the majority of the City's transportation systems are owned, operated and maintained by the City, there are many examples of private sector partnerships, funding or operations of public sector systems or functions. Through the industry scan, there are a number of opportunities for the private sector to provide and fund ITS applications. In addition, there are some cases, where private sector entities have the ability to provide a transportation-related service to the public. A good example is electronic payment, where financial institutions and other private entities have the "back office" to process and collect monetary transactions, and offer these services in exchange for a small transaction fee and/or advertising revenue.

In other cases, jurisdictions have outsourced the provision of transportation-related products and services to private sector entities to reduce costs and/or risks or provide a better service to the public. In these cases, the both the public and private sector entities will govern and determine the use of ITS infrastructure and applications into these operations/systems. The private sector may choose to use new technologies to reduce costs and or provide a better "product" to allow them to increase revenue or have a competitive advantage in a tender or bidding process. The City should promote and/or reward private sector initiatives that support the GRIDS objectives, such as reduced costs, improved efficiencies and safety, etc.

Subsequent to determining the priority ITS initiatives to be implemented in the City, a thorough review of each application should be undertaken to determine lead and support participants/departments and the potential for private sector involvement to reduce/share risks, obtain funding or improve the product/service. This review can be undertaken under the umbrella of an ITS strategic plan or a broad assessment of the affected departments, agencies and other stakeholders.

5.3 Funding

As the various areas of ITS have matured and seen wide-spread deployment, the cost associated with the design and manufacture of the products have reduced and thus have become more achievable for implementation at the municipal level. Conversely, there are ITS initiatives such as a traffic signal control systems and transit priority systems that require considerable upfront and ongoing investments due to the capital purchase of field equipment and staffing and maintenance requirements.

With this in mind, the City of Hamilton should consider a number of opportunities for the funding of ITS initiatives in the City:

- **Municipal Funding** – Through the City's annual budget process, submit priority ITS projects.

- **Provincial or Federal Funding** – The City should identify key transportation needs that can be best addressed by the ITS opportunities and therefore be prepared to actively monitor and apply for Provincial and Federal funding for ITS research, development and deployment programs to realize these systems.

- **Other Agency Participation** – With the goal of public safety and overall system efficiencies, i.e., cost savings, there may be opportunities for the City to cost-share ITS initiatives with other agencies. An example of this would be the interconnection of traffic signal control to an road-rail at-grade crossing to address issues of vehicles queuing through the crossing or being unable to clear the crossing during the rail

warning system activation. In this case, both agencies have a stake in ensuring a collision does not occur.

- **Private Sector/Private-Public Partnerships** – As previously discussed in Section 5.2, there are instances where the private sector can provide or support service delivery through ITS.

Given the breadth of the ITS field, it will be the responsibility of the City to determine the best funding, ownership and operating structure will be the most viable and economical in each case. This assessment can be completed on a case-by-case basis as a transportation need and associated ITS improvement are identified. Alternatively, it can be identified in an overall policy document such as an ITS strategic plan.

6. RECOMMENDED POLICIES

Based on the above review, the following policies are recommended for consideration in the Transportation Master Plan:

Recommended Policy

Initiate a process to review appropriate ITS technologies to meet transportation needs and create a short-list of priorities, to identify funding opportunities, to identify lead and support participants and to ascertain potential barriers to implementation.

Implementation

- Undertake an ITS Strategic Plan to guide the implementation and funding priorities.
- Convene an ITS working group comprised of affected departments, to ensure that the implementation of ITS applications provides wide-spread benefits.

Recommended Policy

Pursue technologies that are designed to more efficiently use existing transportation systems and have the flexibility for future applications and expansion.

Implementation

- Assess the need to provide real-time traffic monitoring and control with the primary focus being on the arterial road network and consider the need for a central traffic control system (CTCS) to support real-time monitoring and control of the City's primary traffic signals with explicit consideration of emergency vehicle pre-emption and transit vehicle priority.
- Determine key corridors where transit priority and minor physical improvements, such as queue jump lanes/HOV lanes, can be implemented to improve transit operations and quality of service
- Review the feasibility of providing Traveller Information Systems at transit stops, terminals or pre-travel access through the internet.
- Identify critical pedestrian and bicycle locations where passive or active detection or advanced warning applications can be implemented to improve operations or safety of these modes.
- The City should pursue ITS technologies and products that comply with the Canadian ITS Architecture and where feasible, non-proprietary components to ensure that expansion or future purchases are not inherently "sole source" jobs/purchases.

Recommended Policy

Actively pursue external funding for priority ITS projects.

Implementation

- Establish a business case or "need and justification" for ITS technologies to assist in obtaining capital and on-going funding through the City's yearly budget process.
- Actively monitor and apply for Provincial and Federal funding for ITS research, development and deployment programs such as Transport Canada's ITS Research and Development Plan, ITS Deployment and Implementation Plan, Moving on Sustainable Transportation (MOST) program, Strategic Highways Infrastructure Program (SHIP), etc
- Identify opportunities for joint procurements within the City departments and with other jurisdictions to take advantage of economies of scale.

Recommended Policy

Promote private investment or participation in ITS applications where they are effective and desirable and they are more marketable by the private sector.

Implementation

- Upon determining that a new technology should be incorporated into the City's transportation infrastructure, undertake and evaluation of publicly owned and operated, public-private partnership or private sector owned and operated systems, to determine who best can fund, supply and operate the ITS application.
- Incorporate a "new technology initiative" component into the tendering process for transportation related projects, to promote the use of ITS applications in the supply of goods and services to the City.

7. EVALUATION OF POLICY OPTIONS

7.1 Evaluation Criteria

Evaluation of policy options is based on criteria for achieving sustainable growth and development across all of the policy papers developed in this project. They fall under the three major categories of **social, economic and environmental** impacts, and they are described briefly below.

Exhibit 7.1: Evaluation Criteria

Impact	Acts on	Description (or examples)
Social	Residential communities	Improves quality of life in neighbourhoods
	Safety and security	Reduces collisions; improves personal safety and security
	Ease of implementation & governance	Provides clarity, measurability, accountability
Economic	Development	Attracts employment, capital, optimal use of transportation infrastructure capacity, and future land use
	Land value	Increases land value, or does not decrease land values
	Operating and capital costs	Reduces or defers public and private costs of transportation capital (construction or acquisition of fixed infrastructure and rolling stock) and operations (maintenance, enforcement, delay, fuel, etc.)
	Congestion	Maintains traffic flow at acceptable level
Environmental	Air quality	Reduction of Criteria Air Contaminants
	Noise and vibration	Minimizes noise impacts
	Natural environment	Improves water quality, green spaces, flora and fauna etc.

The rating system that will be used to apply these criteria is a visual five-point scale, to reflect a range from strong positive impact to strong negative impact. (**+, +, o, --, --)**

+ Represents the strong positive impact, **o** represents absence of significant impact either way, and **--** represents strong negative impact.

7.2 Summary of Evaluation

The criteria described in Section 7.1 are applied to the policy options described in Section 6. The results of a preliminary qualitative assessment using the rating scheme described previously are provided in Exhibit 7.2.

Exhibit 7.2: Evaluation of Policy Options

Policy Option Evaluation	Social			Economic				Environmental		
	Residential Communities	Safety and Security	Ease of Implementation and Governance	Development	Land Value	Operating and Capital Costs	Congestion	Air Quality	Noise and Vibration	Natural Environment
Initiate a process to review appropriate ITS technologies to meet transportation needs and create a short-list of priorities, to identify funding opportunities, to identify lead and support participants and to ascertain potential barriers to implementation.	+	+	0	0	0	+	+	0	0	+
Pursue technologies that are designed to more efficiently use existing transportation systems and have the flexibility for future applications and expansion.	0	0	0	0	0	+	0	0	0	0
Actively pursue external funding for priority ITS projects.	0	0	+	+	0	+	0	0	0	0
Promote private investment or participation in ITS applications where they are effective and desirable and they are more marketable by the private sector.	+	+	+	0	0	+	+	0	0	0