Province of Manitoba

MANITOBA INTELLIGENT TRANSPORTATION SYSTEMS STRATEGIC PLAN

FINAL REPORT

NOVEMBER 2003

Canada

IBI GROUP

Manitoba

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II. INTRODUCTION

In partnership with Transport Canada, the Province of Manitoba initiated a strategic planning project to develop a comprehensive "roadmap" to set the direction, priorities, and pace of ITS investments within the Province over the next ten years. In September 2002, IBI Group in association with Wardrop Engineering and Montufar & Associates was retained to undertake the study. The strategic plan development was greatly aided by a comprehensive stakeholder consultation process, which was fundamental to creating a plan that is tailored to the needs of the Province of Manitoba.

The framework for the study was based upon a proven and effective ITS planning process developed by Transport Canada and includes the following components:

- **Step 1** – Coalition Building;

- **Step 2** – Environmental Scan;

- **Step 3** – Opportunities Analysis;

- **Step 4** – Define ITS Program; and

- **Step 5** – Define Deployment Program.

Exhibit II-1 includes a summary of the overall ITS Strategic Plan workflow process supplemented by with the planned points of contact with the Manitoba stakeholder community. The following report is a summary of the Manitoba ITS Strategic Plan developed through this process.

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Exhibit II-1: Work Plan Process

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1 STEP 1 – COALITION BUILDING PLAN

1.1 Introduction

The ITS strategic planning process employed in this project was founded on a "user needs based approach" that yields a practical and viable plan based on a solid understanding of the stakeholder needs and the ability to effectively map them to ITS solutions. A cornerstone of the project was an effective stakeholder consultation initiated at the outset of the Needs Assessment and maintained through the identification of strategic projects in the Deployment Planning exercise.

As the constructive involvement of all stakeholders is vital to the development of an effective ITS strategic plan, the development of the Coalition Building Plan was the first major activity of this project. The remainder of this section summarizes the major components of the outreach efforts and their general results, including a(n):

- Stakeholder survey (**Step 2**);

- User Service Workshop (**Step 2**);

- Information collection effort associated with the Opportunities Analysis task (**Step 3**); and

- Deployment Planning Workshop (**Step 5**).

Detailed descriptions on these points of contact are included in their respective "step" in the project, as noted above.

1.2 Objectives of the Outreach Program

The primary objectives of the Consultation Plan were to:

1. Identify potential stakeholder roles in ITS Deployment

Stakeholder consultation facilitated input on the perceived and actual roles of the public, private, and non-profit sectors in ITS deployment. Opportunities for co-operative deployment of ITS applications with other jurisdictions or institutions, through partnerships, delegation, or contracted services were also explored.

2. Provide a strategy to obtain input from the stakeholders

Stakeholder input relating to existing initiatives and issues, current ITS deployments, and future requirements was solicited. This information was used as a basis to select and prioritize user needs and projects and to define the ITS program.

3. Identify measures of success and associated criteria

Public sector, private sector and non-profit sector organizations or groups have different criteria for evaluating the success of ITS deployment. The stakeholders provided valuable input on methods which should be used to evaluate the success, in terms of efficiency and effectiveness, of the ITS strategy. Since individual stakeholders had varying objectives and therefore different measures of success, a key task to this plan was to recognize these differences and determine how to incorporate them into an integrated ITS program.

4. Identify institutional and other barriers to ITS deployment

Stakeholders provided input on real and perceived institutional, technological, operational, financial, or other barriers to ITS deployment based on their business operations and constraints. They also suggested means of overcoming or reducing these barriers.

5. Build consensus for ITS deployment in Manitoba

In addition to the objectives cited above, stakeholder consultation served as a valuable opportunity to achieve buy-in to the ITS strategy. Typically, individuals and organizations are more receptive to ideas, and committed to a product, if they have had an opportunity to understand the goals, and to help shape the strategy. The consultation process assisted in establishing the predisposition of the private, public and non-profit sectors to widespread ITS deployment in the Province.

1.3 Overall Approach

The overall approach to soliciting input as part of this consultation plan was based on three primary stages:
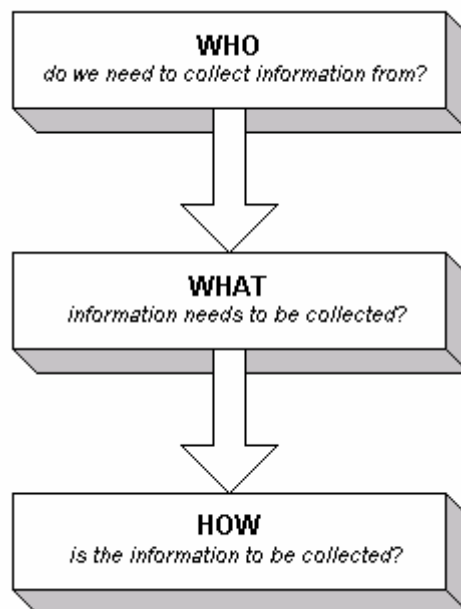
The *first stage* required the identification of the stakeholder community through a review of existing public, commercial, institutional and special interest transportation sectors identified in the project's RFP, as well as, the potential stakeholders identified through the Project Team's local knowledge of the transportation industry in the Province. The stakeholders were placed in the following broad categories, which reflect their primary roles in the transportation industry within the Province:

- Public Agencies;

- Commercial Operators;

- Industrial;

- Suppliers/Service Providers; and

- Institutional/Special Interest.

Included in **Section 1.4** of Coalition Building Plan are further details regarding this identification stage.

Since the type and detail of information varied considerably by stakeholder group and function, the *second stage* of the approach established the types of information required from each of these groups. The *third* and final stage was to define the means and instruments to be used to collect the required information. Details regarding the second and third stages can be found in **Section 1.5**.

1.4 Stakeholder Identification

Prior to initiation of the stakeholder consultation, the Project Team provided the Steering Committee a draft list of stakeholders by category. The database included:

- Stakeholder name and contact;

- Area(s) of ITS interest or participation;

- Group classification; and

- Method of ongoing communications to be used (e.g. e-mail, telephone, meetings, etc.).

The "general public" was recognized as a stakeholder and represented the ultimate end user of many of the ITS services. It was anticipated that the cross-section of stakeholders consulted would adequately represent the interests of the general public.

The initial list was supplemented and amended by the Steering Committee and was revised and maintained throughout the project, as required. The stakeholder contacts are included in **Appendix A**. The following sections include a synopsis of the various groups.

1.4.1   PUBLIC AGENCIES

In Manitoba, public agencies represent the main "owners and operators" of transportation infrastructure and related systems and services, such as emergency services. These include:

- **Provincial Government** – The Department of Transportation and Government Services operates all provincial roadways and manages maintenance of the Manitoba fleet vehicles, the Emergency Measures Organization, Buildings Management, Legislative Security and Parking Police; and

- **Municipalities** – the municipalities operate municipal roads, traffic control systems, transit systems, and emergency services.

In addition, Public Agencies include other functions that have a direct bearing or interest in transportation and ITS:

- Regulations and Enforcement;

- Safety and Security including Border Security;

- Economic Development; and

- Public Insurance.

1.4.2   COMMERCIAL OPERATORS

Commercial operators sector is comprised of private sector companies/entities providing commercial carrier and the related logistical and freight forwarding services within the Province. With considerable advancements and use of in-vehicle safety and information systems, automatic vehicle location (AVL) and regulatory and warning systems, commercial operators have a considerable stake in ITS within the Province.

1.4.3   INDUSTRIAL

The Industrial Sector is comprised of Manitoba industries that operate their own transportation facilities and fleets. Industrial entities to be included in the stakeholder list will reflect operations that are directly related to and/or could benefit from ITS.

1.4.4   SUPPLIERS/SERVICE PROVIDERS

Service providers are predominantly private sector firms and/or associations representing private sector firms and individuals. In some cases, they are in the business of "information service provider" or value-added service provider, by repackaging ITS information and distributing it to the ultimate end user.

1.4.5   INSTITUTIONAL/SPECIAL INTEREST

The institutional category primarily consisted of Manitoba universities and other post-secondary institutions, which have current or planned involvement in the development of ITS applications, and the development of ITS professionals. The research institutions provided input on:

- Opportunities to promote and apply Canadian ITS research;

- Input regarding current and planned ITS applications in the Province; and

- Opportunities for partnerships and the role of research centres of excellence in developing and applying the architecture.

The special interest group category is also often referred to as the non-profit sector, and it covered a broad range of stakeholders. The organizations or groups in this category played a key role in advising the public sector as researchers, or as representatives of private entities. As representatives of private entities or individuals, they can make suggestions on how to integrate public sector and private sector needs. The category included advisory organizations, professional bodies, advocacy groups, and consumer groups.

1.5 Information Needs and Gathering

The type and detail of information required varied by stakeholder group, and in some cases by specific stakeholder depending upon their interest and involvement in ITS. Key areas of information collected from the stakeholders included:

- **Mandate:** Understanding the mandate of a stakeholder was important in defining their "circle of influence" both internally and externally, and identified what areas of ITS were relevant to their operations;

- **Transportation Modes and Services:** The modes and services that a stakeholder has an interest in were key input for the subsequent identification of the initiatives in the ITS Strategic Plan;

- **Needs:** The needs of the stakeholders were established, and compared against their mandate and the transportation modes they planned, used or operated. The needs assessment focused on the stakeholder's fundamental business and operating needs; and

- **Identification of Relevant Inventory:** The inventory of existing and planned ITS deployments in the Province was compiled for incorporation in **Step 2** of this project.

Exhibit 1-1 includes a summary of the types of information that were solicited from the stakeholders. The methodology used for the collection of this information is outlined in the following section.

Exhibit 1-1: Typical Information Requirements	
Category	**Types of Information Required**
Public Agency	*Public Sector Owners/Operators:* • Current transportation needs • The current performance of their systems and future system requirements • Funding/financial issues • Institutional, legislative and technical barriers they have experienced • Opportunities for expansion and integration *Other Public Agencies:* • Their experiences, positive and negative, in dealing with other public agencies and private companies/operators in the Province • Existing partnerships and partnership opportunities • Additional ITS services which would assist in delivery of their services and mandates • The role of ITS in improving safety and addressing the insurance industry needs • Their potential role in promoting ITS in the Province
Commercial Operators/Industrial	• Current transportation needs • The current performance of their systems and future system requirements • Funding/financial issues • Institutional, legislative and technical barriers they have experienced • Opportunities for expansion and integration
Suppliers and Service Providers	• Current advances in the development of ITS products and services • Their experiences, positive and negative, in dealing with public agencies in the Province • Additional ITS services which would enable them to expand their business interests • Institutional, legislative and technical barriers in dealing with ITS service providers • Partnership opportunities • Methods in which the Province and the federal government can play a role in ITS business development within and outside of Manitoba

Exhibit 1-1: Typical Information Requirements	
Category	**Types of Information Required**
Institutional/Special Interest Groups	• Opportunities to promote ITS research • The current and potential supply of ITS professionals through universities • Opportunities for partnerships • Funding/financial issues affecting research • The ITS services desired by users • The role of ITS in promoting commerce and benefits to provincial economy

The following sections outline the means in which stakeholder consultation was initiated and maintained throughout the project.

1.5.1 INITIAL POINT OF CONTACT

The individuals listed as initial stakeholders were contacted by e-mail and/or phone to:

• Introduce the study including its objectives;

• Outline the stakeholder's potential role in the study;

• Confirm the individual's roles and responsibilities and ensure they are the most appropriate participant from their organization; and

• Invite the individual to visit the project web-site, complete the stakeholder questionnaire, and confirm his/her attendance at the User Service Workshop.

1.5.2 PROJECT WEBSITE

1.5.2.1 Purpose and Content

A project website was created and maintained throughout the duration of the project to provide access to:

• Study background material relating to purpose and specific objectives;

• An ITS "primer" for stakeholders and other study participants that are not familiar with ITS and the project. Including a link to the ITS Architecture for Canada (www.its-sti.gc.ca/en/static/content.htm);

• The stakeholder questionnaire in a downloadable Adobe Acrobat format;

- Study team contact information; and

- A link to the Manitoba Transportation and Government Services (www.gov.mb.ca/tgs) and ITS Canada websites (www.itscanada.ca).

1.5.2.2   ITS Primer and Study Background

The ITS primer described ITS and the Strategic Planning project in terms of:

- What is ITS?

- How can you benefit from ITS?

- What is the Province of Manitoba ITS Strategic Plan?

- How can you help?

The project website was hosted by IBI Group at **www.itsmanitoba.com**.

1.5.3   STAKEHOLDER QUESTIONNAIRE

Each stakeholder was requested to complete a questionnaire subsequent to reviewing the study background material and ITS information provided on the website. Included in **Appendix B** is a sample of the questionnaire. The survey format was structured to solicit each stakeholder's:

- Mandate, roles, and responsibilities;

- Potential linkages/connectivity that could form the basis for partnerships;

- ITS applications/initiatives that are currently being utilized or considered;

- Operating needs including those that could potentially be addressed by ITS;

- Underlying funding and revenue generation opportunities; and

- Preferred method of contact.

Stakeholders were invited to complete the questionnaire prior to or at the User Service Workshop. Results of the survey are outlined in **Steps 2 and 3** of this project report.

1.5.4   USER SERVICES WORKSHOP

The User Services Workshop represented the first face-to-face opportunity to bring together the Study Team and the stakeholders. The one-day workshop was structured and facilitated by a "workbook" that guided the stakeholders in providing the information relating to their, and the Province's needs, as a step towards developing an ITS Strategic Plan. The workshop was structured around exercises aimed at opening a constructive dialogue with stakeholders and identifying initiatives for the ITS vision. These exercises included a(n):

- Introductory session;

- Validation of user needs;

- Strengths, Weaknesses, Opportunities and Threats ("SWOT") session;

- Breakout session to develop strategies and candidate projects for each of the key User Service bundles; and

- Closing Presentation.

Each of these components are described in **Step 2** of this report.

1.5.5   OPPORTUNITIES ANALYSIS

During **Step 3** of the project, the Study Team contacted stakeholders, via e-mail and/or telephone, to:

- Update the stakeholder regarding the status of the study; and

- Solicit input regarding: (a) attributes and barriers associated with the higher priority User Services, (b) identification and refinement of "early winner" projects, and (c) draft User Service Plan.

1.5.6   DEPLOYMENT WORKSHOP

During **Step 5** of the study, a one-day workshop was conducted to provide stakeholder input in defining and prioritizing deployment activities as input into the Deployment Program. Once again, the workshop was structured and facilitated by a "workbook". The workshop included a(n):

- Introductory Session;

- Project Profile and Deployment Presentation;

- Project Development Exercise; and

- Deployment Planning and Scheduling Session.

Each of these components is summarized, in detail, in **Step 5** of this document.

2 STEP 2 – ENVIRONMENTAL SCAN

2.1 Introduction

2.1.1 USER SERVICES PLAN

The second step of the Manitoba ITS Strategic Study was to develop a User Services Plan. This section of the report details the development of this plan, and is subdivided into four distinct but interrelated activities. Provided below is a brief description of each sub-section:

- **Needs Assessment -** It was important to develop an understanding of the current state of the transportation systems in the Province of Manitoba, and organize the needs. The needs were identified through three exercises: a stakeholder survey, a user needs assessment, and a SWOT analysis for Manitoba.

- **The Vision** – The development of a "vision" for ITS deployment in the Province of Manitoba was an integral part of the planning process and assisted in shaping the ITS Strategic Plan.

- **User Service Assessment** – The stakeholders were asked to identify the higher priority User Services as defined in the *Canadian Architecture for Intelligent Transportation Systems.* Each User Service was assessed against a number of criteria including its ability to address the identified needs. These User Services were then mapped to the needs.

- **Performance Criteria** – A set of performance criteria was established, and mapped against the primary User Services identified in the preceding section.

Each of these components are summarized in the following sub-sections.

2.1.2 NEEDS ASSESSMENT

The objective of the Needs Assessment was to develop an understanding of the current state of the Province of Manitoba transportation system, and describe and organize the needs into a consistent framework. This process ensured that current issues, concerns, problems and gaps were identified and addressed on a consistent basis.

On November 15, 2002, a User Needs Workshop was conducted. The one-day session included a(n):

- Introductory session to provide an overview of the Canadian ITS Architecture, and description of the 35 User Services;

- Workshop session to assess the user needs for the surface transportation system, which might be at least partially addressed through ITS;

- Workshop session to validate the draft strengths, weaknesses, opportunities, and threats (SWOT) analysis for each of the eight User Service bundles, which had been prepared by the consultant team;

- User Service prioritization exercise;

- Breakout session to assess the higher priority User Services; and

- Breakout session to develop candidate projects for each of the key User Service bundles.

The stakeholders were also asked to complete the stakeholder survey.

The User Needs Workshop attracted a diverse range of stakeholders who actively participated in the exercises. The participants included representatives from roads, transit services, and airport operators, emergency services personnel, commercial vehicle operators, regulators and advocacy groups. The following agencies, companies and organizations were represented at Workshop #1:

- Canada Customs & Revenue Agency
- City of Winnipeg Transit
- City of Brandon – Design and Inspection
- Walinga Inc.
- University of Manitoba
- Manitoba Culture, Heritage & Tourism
- Vasco Electronics
- Western Diversification
- Transport Canada
- Manitoba Health
- City of Winnipeg – Public Works

- City of Winnipeg Emergency Response
- Manitoba Public Insurance
- Manitoba Trucking Association
- Winnipeg Airport Authority
- Canadian Automobile Association
- Manitoba Transportation and Government Services:
  - o Transportation Policy
  - o Transportation Regulation
  - o Engineering and Operations
  - o Driver and Vehicle Licencing
  - o Administrative Services

2.1.2.1   Stakeholder Survey

In November 2002, the stakeholders were sent a stakeholder survey by email, and asked to complete the survey prior to or during the User Needs Workshop.

The contents of the survey were tailored to the type of stakeholder. The categories included: public owner/operator, private operator/industrial, suppliers/service providers, and institutional/special interest. Twenty-two surveys were completed and submitted.

The questions related to:

- Transportation related needs;

- ITS services that are the most marketable;

- Performance criteria of ITS applications;

- Organization's primary mandate;

- Barriers to achieving mandate;

- ITS services that they are involved in, or have an interest in;

- ITS-related research;

- Benefits of ITS;

- Key public transportation agencies dealt with;

- Experience with regulatory and enforcement agencies; and

- Partnership opportunities.

The responses to these questions were used in the development of the strategic plan. The responses to the first three questions provided input to the needs assessment. The responses to the remaining questions provided input to **Step 3** – Opportunities Analysis.

A summary of the responses for each of these questions is provided in **Appendix C**. The transportation needs identified included, but were not limited to:

- Better delivery of traveller information;

- Enhanced service to the public on roadways and transit;

- Improved traffic signal operation; and

- Better service to commercial vehicle operators.

The responses were considered in the development of the User Needs listing summarized in **Section 2.1.2.3**.

2.1.2.2   SWOT Analysis

A Strengths, Weaknesses, Opportunities and Threats (SWOT) exercise was undertaken at the November 15th, 2002 User Needs Workshop. The SWOT analysis exercise was very helpful in prompting stakeholders to think about the existing transportation related characteristics within the Province (i.e. strengths and weaknesses), as well as identifying future considerations (i.e. opportunities and threats). Workshop participants were provided with the Consultant Team's initial thoughts regarding the SWOT attributes. Participants were invited to edit and add to the forms distributed. Some particular areas included identification of existing ITS applications and plans for deployment, which are reflected in strengths and opportunities. Many of the comments on threats were centred on the lack of ITS awareness and the associated inability to secure funding. Many of the comments on future opportunities focussed upon integration and interoperability among agencies. The results of the analysis are provided in **Appendix D**. The additions made by the stakeholders are shown in *italics.*

2.1.2.3   User Needs

Based upon the research performed by the Project Team, the stakeholder survey, and the SWOT analysis, a number of current and future transportation needs were established. **Exhibit 2-1** includes a summary of the identified needs (in no particular order of importance). For each of these needs, a summary page was prepared to provide a synopsis of the following:

- Existing Need;

- Potential Stakeholders;

- Facts;

- Priority of Need; and

- Associated User Services.

Accordingly, **Appendix E** includes the summary sheets for each identified need. A review of these profiles underscores some key themes for the Province of Manitoba. These themes include reduction in incidents due to adverse weather and/or road surface conditions, improved response to incidents, improved traffic and transit operations in urban areas, and the efficient movement of goods on-road, and across borders. In order to achieve these priorities, there is a series of needs focussing on improved real-time data collection, such as road weather conditions, improved inter-agency coordination and information exchange and improved interactive interfaces with travellers and carriers.

Exhibit 2-1: Identified Transportation Needs	
Need	**Description**
1	Reduce collisions during adverse weather and/or road surface conditions
2	Improve incident notification and response in Manitoba
3	Improve traffic control and monitoring in urban areas
4	Improve security and expedite border crossing inspection and clearance for commercial vehicles
5	Provide an improved system for the application of seasonal weight limits
6	Improve traveller information in rural areas
7	Provide more convenient transit service
8	Improve efficiency of the permitting process
9	Reduce wildlife-vehicle collisions
10	Improve efficiency of truck inspection stations and roadside checks
11	More efficient data capture for the roadway system management

2.1.3   VISION

It is important to capture the user needs of the Province in a common "ITS Vision" which stakeholders can identify with, and work towards. The vision was an integral part of the planning process and helped to shape the ITS Strategic Plan. The Needs Assessment developed profiles of eleven "needs" of the Province of Manitoba. The next challenge was to translate these various "needs" into a vision.

This section begins with "a vision for the future". It leads to a summary of typical ITS goals, followed by a series of "views":

- The **"User Views"** present "a day in the life" in the Province of Manitoba, demonstrating how the users will benefit from the functions of the different surface transportation services;

- The **"Business View"** approaches the ITS strategy from the perspective of the different roles of the stakeholders;

- The **"Procurement View"** suggests the potential contracting, partnering and funding options for deploying ITS; and

- Finally, the **"Process View"** describes how the plan can evolve and change as new technologies and systems are developed.

2.1.3.1   A Vision for the Future

Over the coming ten years, technology performs a key role in improving the performance of transportation systems in the Province of Manitoba. Information technology is a driving force behind how people get to work, do business, and sell and transport goods. State-of-the-art wireless technology, and the use of Global Positioning Systems (GPS) will form a foundation for the application of the technology.

All across the Province of Manitoba, road and weather information systems will collect real-time data on current conditions. The information will be made available to travellers through advance warning systems and traveller information systems. These road and weather information systems will also monitor the condition of the road structures, thereby helping to preserve and maintain the road infrastructure. Owners and operators will use the improved data collection and archiving to efficiently and safely maintain their transportation systems.

Travel in rural Manitoba will be less troublesome. Systems will be in place to help drivers plan trips, avoid adverse weather and road conditions, and avoid collisions with vehicles, wildlife, and trains.

The traffic management system in Winnipeg will continue to develop, providing more sophisticated traffic control and incident management.

Despite the widespread deployment of safety systems, incidents will still occur, but in far fewer numbers. When an incident does occur, emergency services will automatically be contacted regarding the location of the incident. In urban areas, emergency vehicle

operators will be able to select the fastest route to the incident site, based upon real-time travel information and emergency vehicle priority. If the incident involves a spillage of hazardous material, a message will be sent electronically to emergency management centres providing details on the type of material. In urban areas, the traffic management systems will implement special plans to clear the response route of traffic.

Commerce will thrive in the Province of Manitoba. Commercial vehicles will be able to apply for and pay fees and tariffs electronically before or during their trip. This will especially apply at all Manitoba-North Dakota, and Manitoba-Minnesota border crossings. Security at the borders will also be improved, through the use of radio frequency identification tags for vehicles and smart cards, combined with biometric systems for driver identification.

Drivers of passenger vehicles can travel their route confident that the large commercial vehicles in their midst are driving safely. Electronic roadside inspection points check the condition of all commercial vehicles on major road facilities. They perform weigh-in-motion, and receive an electronic report from the commercial vehicle's operating system on the status of key systems.

The City of Winnipeg will maintain sophisticated public transit systems. Transit riders will be able to determine precisely when the next transit vehicle will arrive. The improved service helps promote public transit as a viable alternative for commuters and recreational travellers. The Cities of Winnipeg and Brandon will join forces to jointly implement "smart card" payment and further promote public transit travel.

Providing "intelligent" solutions to transportation problems allows for an investment in the economies of the Province of Manitoba. Manitoba-based transportation equipment suppliers will provide the infrastructure and widespread telecommunications for developing Province of Manitoba systems. The implementation of these sophisticated systems is possible because transportation professionals in the Province of Manitoba participated in extensive ITS training programs to learn about the technology, implementation strategies, and experience gained in other jurisdictions.

2.1.3.2   ITS Goals

In order to translate the vision into a strategy, it was important to establish goals, and ultimately, clearly defined objectives. Traditional ITS goals applicable to the Province of Manitoba include:

1.   Improve safety for the traveling public and commercial vehicles;

2.   Minimize delays and congestion in the transportation network to reduce delay costs and boost economic activity and development;

3.   Manage travel demand in order to use the transportation network more effectively;

4.   Provide fast and coordinated responses to incidents and other emergencies;

5.   Improve data collection, management and sharing to provide users with relevant timely information, and help agencies better manage their operations and infrastructure;

6. Improve interagency coordination and cooperation in order to develop solutions that cross-geographic and institutional boundaries; and

7. Improve the economic prosperity of Manitoba, the Prairie Region, and Canada.

These goals are, in some cases, inter-related and will be achieved through a combination of resources. First, there are the four cornerstones that create a composite of transportation in ITS: travellers, vehicles, wayside and centres. These ITS cornerstones are further described below in **Section 2.1.3.3**. Then there are the different roles of participants. The strategies will be implemented through different methods and different processes. The remaining sections provide a series of "views" from each of these perspectives.

2.1.3.3   Users Views

ITS is an industry that works with both the motor vehicle and the road network. The evolution of the motor vehicle has traditionally been a function of the private sector while the public sector has primarily been charged with the development of the transportation network, to support the motor vehicle and other modes of transportation. Today, public agencies are predominantly in an "operate, maintain and enhance" role as the rate of transportation network expansion has declined, which is mirrored by declining funding.

We are entering a new phase in the evolution of the vehicle, as we enter the era of the "intelligent" vehicle. The demands resulting from development of the intelligent vehicle create the need for the road right-of-way and the road network to respond through the implementation of ITS.

The broad vision for ITS development in Manitoba incorporates both the public and private sector roles in ITS as applied to the four cornerstones. The communications backbone is used to link these components. The ITS cornerstones and the communications backbone form the "physical architecture" as demonstrated in the Canadian ITS Architecture (see Exhibit 3.4) to which the ITS vision is applied.

Travellers: "Travellers" include commuters, commercial vehicle operators and tourists. They have an interest in personal mobility, safety, comfort, and efficiency.

Vehicles: Unless they are on foot, travellers move from location to location using some form of vehicle. "Vehicles" include bicycles, motorcycles, automobiles, trucks, buses, trains and ferries. These types of vehicles serve as private vehicles, public transit vehicles, commercial vehicles, maintenance vehicles, and emergency vehicles.

Wayside: The travellers move on foot or in vehicles from location to location along public rights-of-way. These public rights-of-way are comprised of roads, rail lines, sidewalks, structures, and traffic control and monitoring devices. Traffic control and monitoring devices are installed and operated in the "wayside".

Centres: Centres play a key role in collecting and disseminating information between travellers, vehicles and the wayside to deliver intelligent transportation systems. This information is collected and disseminated through a variety of communication devices.

2.1.3.4   Business View

In developing the ITS strategy, it was important to establish the roles of the stakeholders in the Province of Manitoba. These roles are distinctly different, and the role of the stakeholder is dependent on the specific strategy or project. There are four "profiles" to describe the alternative roles. The four "profiles" are:

• Observer;

• Facilitator;

• Participant; and

• Manager.

These alternative roles are described in the following sections. It should be noted that the four roles are not mutually exclusive, and that the progression from Observer through to Manager reflects an expanding role.

Observer

In this role, the stakeholder serves solely in a "monitoring" function. ITS progress is dictated by the objectives of the other private sector and/or other public sector agencies.

Facilitator

In this case, other private and other public sector objectives lead ITS progress. However, the stakeholder has control over some type of "barrier" to the implementation, and has the power to assist in removing the barrier. The private sector or public sector agencies identify barriers to be addressed and the stakeholder responds. The barriers could include such aspects as access to data, access to property, access to financial resources, and policies and regulations.

Participant

In this case, the other private sector or other public sector agencies identify their objectives. Where it impacts on the stakeholder's mandate, the stakeholder serves as a facilitator. However, in this scenario, the stakeholder also actively participates in the project, since it provides a significant benefit to the stakeholder.

Manager

Under this scenario, the stakeholder's mandate is directly affected by ITS progress. In this case, the stakeholder identifies all the objectives, and chooses the projects, partners, and funding mechanisms.

2.1.3.5 Procurement View

The first step in the procurement view was to establish who will be the primary and secondary beneficiaries of an ITS application.

Exhibit 2-2 provides a perspective. It is logical to assume that the organization absorbing the "costs" would be responsible for procuring the application.

ITS Application	Beneficiary		Costs
	Primary	**Secondary**	
Advanced Traffic Management Systems	Public Individuals Private Sector Agencies	Public Sector Agencies	Public Sector Agencies
Advanced Traveller Information System	Public Individuals Private Sector Agencies		Public Individuals Private Sector Agencies
Electronic Toll Collection	Private Sector Agencies Public Individuals	Public Sector Agencies	Private Sector Agencies Public Individuals
Commercial Vehicle Operations	Private Sector Agencies	Public Individuals Public Sector Agencies	Private Sector Agencies
Advanced Public Transport Services	Public Individuals Public Sector Agencies		Public Sector Agencies

Exhibit 2-2: ITS Applications – Typical Beneficiaries

There are a variety of procurement strategies to be assessed. They include public agency procurement, public-private partnership, and public-public partnership. **Exhibit 2-3** includes examples of the different procurement processes for applications at the national, regional, and local levels.

Exhibit 2-3: Examples of Procurement Processes

Type of Partnership	National	Regional	Local
Public-Private Partnership	E-Commerce in the Canadian Trucking Industry	RWIS for Snow Plows in Southern Ontario	
Public-Public Partnership	Canadian Multi-Application Smart Card Initiative Canadian National ITS Architecture	Centre-to-Centre ITS for Toronto	Manitoba ITS Strategic Plan

2.1.3.6   Process View

The vision sets the stage for the strategy development. Goals will be set, and a series of specific objectives will be identified through the matching of provincial needs to specific ITS benefits. The Strategic Plan will then progress to develop strategies and specific projects. Roles will be defined for the stakeholders, and an implementation plan will be developed and executed.

Notwithstanding, a strategic plan cannot be a static document. Many of the strategies and projects will take years to execute. In the meantime, new User Services will be identified, and new technologies will be developed. The plan will need to evolve and change to reflect these developments.

The cornerstone of the Strategic Plan is a straightforward process that flows logically from goals and objectives, through the identification of strategies and roles, and then to implementation plans. If the Strategic Plan process is easy to follow, then it will be easy to incorporate a new User Service, or a new technology, into the plan. Conversely, a user will be able to determine that a new development does not fall within the ITS Strategic Plan.

When a new technology or potential User Service is identified, it will first be assessed to determine if it contributes to the ITS goals. The next step will be to determine if it can directly contribute to meeting a specific objective. If the new development "passes" these tests, then it can be integrated into the Strategic Plan.

2.1.4   USER SERVICE ASSESSMENT

With the identification of the transportation needs in Manitoba completed and an "ITS Vision" developed to assist in shaping the Strategic Plan, the next step was to determine the ITS "tools" that can best address the needs identified within the Province. The following section provides an overview of the User Service "toolbox".

2.1.4.1   User Service 'Tools'

It is useful to compare the selection of ITS applications to the process of selecting 'tools' from a 'toolbox'. The 'toolbox' can be taken to be the *Canadian Architecture for Intelligent Transportation Systems*. The 'tools' are the User Services and User Sub-Services that are identified to define the Architecture. These tools can be used independently or in combination to address the transportation needs of Manitoba.

The User Services of the Canadian ITS Architecture are organized into 8 User Service bundles. Within these bundles, there are 35 User Services and 90 User Sub-Services included in the toolbox. A complete definition of each User Service and associated sub-services is available on the Architecture CD, or at www.its-sti.gc.ca.

2.1.4.2   Identification of Higher Priority User Services

The starting point for this process was the complete list of thirty-five ITS User Services defined in the Architecture. These services were reviewed and discussed with the stakeholder community at the November 15, 2002 workshop. Stakeholders and the Project Team considered what functions are characteristic of a given need, and in turn how a given User Service may improve upon that functionality. The workshop resulted in the identification of a shortlist of the most applicable User Services.

In consideration of the input from the Needs Assessment, the User Services outlined in **Exhibit 2-4** were identified as having the higher priority within the Province of Manitoba.

Exhibit 2-4:   Higher Priority User Services

User Service Reference [1]	User Service Name
1.1	Traveller Information
2.1	Traffic Control
2.2	Incident Management
2.4	Environmental Conditions Management
2.5	Operations and Maintenance
2.6	Automated Dynamic Warning and Enforcement
3.1	Public Transport Management
4.1	Electronic Payment Services
5.1	Commercial Vehicle Electronic Clearance
5.2	Automated Roadside Safety Inspection
5.4	Commercial Vehicle Administrative Processes
6.2	Hazardous Material Planning and Incident Response
6.4	Emergency Vehicle Management
7.2	Infrastructure-Based Collision Avoidance
8.1	Weather and Environmental Data Management
8.2	Archived Data Management
(1) Canadian ITS Architecture references	

Definitions for these sixteen User Services are presented in **Appendix F** and focus on key themes most relevant to the Province, namely road weather information, rural incident response, goods movement, urban traffic management, and public transport in urban areas. It is important to note that within these User Services there may be some components that are not as relevant as others, and the subcomponents (referred to as "sub-services" in the Canadian ITS Architecture) will be specifically addressed in **Step 4** of this document, which deals with the identification of functional requirements. Similarly, this listing is not intended to be exclusive, and sub-services from other User Service areas could emerge as being relevant as the Plan evolves over time.

While any of these User Services can exist independently, there are several logical synergies among the shortlist. For example, Environmental Conditions Management directly relates to Weather and Environmental Data Management and Archived Data Management, which in turn supports other services identified, such as Traveller Information and Operations and Maintenance.

2.1.4.3 Mapping the User Services to Needs

Exhibit 2-5 maps the identified needs against the User Services and sub-services. Essentially, the exhibit is a visual summary indicating the User Services that have the potential to address the identified needs and would be most useful as elements of an ITS strategy.

Exhibit 2-5: Relevant User Services and Sub-Services											
USER NEEDS	1	2	3	4	5	6	7	8	9	10	11
RELEVANT USER SERVICES AND SUB-SERVICES	Reduce collisions during adverse weather and/or road surface conditions	Improve incident notification and response in Manitoba	Improve traffic control and monitoring in urban areas	Expedite border crossing inspection and clearance for commercial vehicles	Provide an improved system for the application of seasonal weight limits	Improve traveller information in rural areas	Provide more convenient transit service	Improve efficiency of the truck permitting process	Reduce wildlife-vehicle collisions	Improve efficiency of truck inspection stations and roadside checks	More efficient data capture for roadway system management
1.1 TRAVELLER INFORMATION											
1.1.1 Broadcast Traveller Information		✓				✓					
1.1.2 Interactive Traveller Information	✓	✓				✓					
2.1 TRAFFIC CONTROL											
2.1.1 Traffic Network Flow Monitoring			✓								✓
2.1.2 Surface Street Control			✓								✓
2.1.5 Traffic Information Dissemination		✓	✓			✓					
2.2 INCIDENT MANAGEMENT											
2.2.1 Incident Management Coordination	✓	✓									

Exhibit 2-5: Relevant User Services and Sub-Services											
USER NEEDS	1	2	3	4	5	6	7	8	9	10	11
RELEVANT USER SERVICES AND SUB-SERVICES	Reduce collisions during adverse weather and/or road surface conditions	Improve incident notification and response in Manitoba	Improve traffic control and monitoring in urban areas	Expedite border crossing inspection and clearance for commercial vehicles	Provide an improved system for the application of seasonal weight limits	Improve traveller information in rural areas	Provide more convenient transit service	Improve efficiency of the truck permitting process	Reduce wildlife-vehicle collisions	Improve efficiency of truck inspection stations and roadside checks	More efficient data capture for roadway system management
2.4 ENVIRONMENTAL CONDITIONS MANAGEMENT											
2.4.1 Roadway Environmental Sensing	✓				✓	✓					✓
2.4.3 Road Weather Information System	✓					✓					✓
2.5 OPERATIONS AND MAINTENANCE											
2.5.1 Infrastructure Maintenance Management	✓					✓					✓
2.5.2 Smart Work Zones		✓	✓			✓					
2.6 AUTOMATED DYNAMIC WARNING AND ENFORCEMENT											
2.6.1 Dynamic Roadway Warning	✓								✓		
3.1 PUBLIC TRANSPORT MANAGEMENT											
3.1.1 Transit Vehicle Tracking							✓				
3.1.2 Transit Fixed-Route Operations							✓				
3.1.3 Passenger and Fare Management							✓				
4.1 ELECTRONIC PAYMENT SERVICES											
4.1.3 Transit Services Payment							✓				

Exhibit 2-5:	Relevant User Services and Sub-Services										
USER NEEDS	1	2	3	4	5	6	7	8	9	10	11
RELEVANT USER SERVICES AND SUB-SERVICES	Reduce collisions during adverse weather and/or road surface conditions	Improve incident notification and response in Manitoba	Improve traffic control and monitoring in urban areas	Expedite border crossing inspection and clearance for commercial vehicles	Provide an improved system for the application of seasonal weight limits	Improve traveller information in rural areas	Provide more convenient transit service	Improve efficiency of the truck permitting process	Reduce wildlife-vehicle collisions	Improve efficiency of truck inspection stations and roadside checks	More efficient data capture for roadway system management
5.1 COMMERCIAL VEHICLE ELECTRONIC CLEARANCE											
5.1.1 Electronic Clearance				✓				✓			✓
5.1.2 International Border Crossing Clearance				✓				✓			
5.1.3 Weigh-in-Motion (WIM)				✓				✓			
5.2 AUTOMATED ROADSIDE INSPECTION											
5.2.1 Inspection Support Systems				✓				✓		✓	
5.4 COMMERCIAL VEHICLE ADMINISTRATIVE PROCESSES											
5.4.1 Commercial Vehicle Administrative Processes				✓				✓			
6.2 HAZARDOUS MATERIAL PLANNING AND INCIDENT RESPONSE											
6.2.1 Hazardous Material Planning and Incident Response		✓									
6.4 EMERGENCY VEHICLE MANAGEMENT											
6.4.1 Emergency Response Management	✓	✓									
6.4.2 Emergency Vehicle Routing		✓									

Exhibit 2-5: Relevant User Services and Sub-Services											
USER NEEDS	1	2	3	4	5	6	7	8	9	10	11
RELEVANT USER SERVICES AND SUB-SERVICES	Reduce collisions during adverse weather and/or road surface conditions	Improve incident notification and response in Manitoba	Improve traffic control and monitoring in urban areas	Expedite border crossing inspection and clearance for commercial vehicles	Provide an improved system for the application of seasonal weight limits	Improve traveller information in rural areas	Provide more convenient transit service	Improve efficiency of the truck permitting process	Reduce wildlife-vehicle collisions	Improve efficiency of truck inspection stations and roadside checks	More efficient data capture for roadway system management
8.1 WEATHER AND ENVIRONMENT DATA MANAGEMENT											
8.1.1 Roadway and Weather Data Fusion	✓										✓
8.1.2 Environmental Information Dissemination	✓										✓
8.2 ARCHIVED DATA MANAGEMENT											
8.2.1 Archived Data Mart	✓										✓
8.2.2 Archived Data Warehouse	✓										✓
8.2.3 Archived Data Virtual Warehouse	✓										✓

2.1.4.4 User Service Analysis

Each candidate User Service was analyzed against a set of criteria that were established and refined through previous ITS Strategic Planning studies in Canada and abroad. A brief description of these criteria is provided as follows:

- **Ability to Address Need** – Does a widely recognized need currently exist and can the technologies/services included in the User Service be used to address these priorities?

- **Compatibility with Vision** – Does the User Service correspond with the fundamentals of the Provincial ITS Vision?

- **Availability of Champion(s)** – Are there individuals, groups or agencies willing to spearhead the planning/implementation to move the initiative along?

- **Potential Benefits** – Which of the User Services will be of the most benefit in terms of magnitude, payback period, and potential beneficiaries?

- **Practicality** – Can the User Service be ready in the allotted timeframe and are potential users and beneficiaries positioned to make use of the initiative?

- **Risk Management** – Are there risks involved and can they be overcome and managed in the implementation time frame?

- **Capability for Integration** – Can the ITS service be easily integrated into mainstream transportation and management activities already in place within the public and private sector activities in the Province? Can the User Service be integrated across modes, jurisdictions and geographic areas?

At the November 15, 2002 workshop, the Project Team and stakeholders conducted the preliminary User Services assessments. During this process one User Service was set aside, as it was not deemed to sufficiently fulfill the above criteria. Building upon these initial efforts, the Project Team completed the User Services Assessment. The resulting set of "User Service Assessment" summaries is included in **Appendix G** for the higher priority/ more relevant User Services. A review of the User Service assessments yields the following observations:

- Virtually all of the User Services are characterized by a high degree of compatibility with the identified needs and the Vision;

- Most of the User Services under consideration employ proven applications and hence can be considered practical for implementation in Manitoba. However, some User Services, such as Archived Data Warehouse, are characterized by significant implementation hurdles to overcome, such as agreement on a common data platform by multiple agencies with a number of data sources, and may be less practical for near term implementation.

- Many of the User Services, such as Incident Management Coordination, involve a broad range of stakeholders on a Province-wide scale. This requirement presents challenges in terms of identifying appropriate champions to secure funding and lead a deployment and operations effort.

Many of the User Services under consideration offer some level of capability to integrate and exchange information with other companion User Services. In many cases, enabling standards to support this integration exist or are under development.

2.1.5   PERFORMANCE CRITERIA

Performance evaluation is a key component of ITS deployment. The foundation of any performance evaluation is the development of a useful and practical set of performance criteria. These criteria were used to assess the ability of the candidate User Services to meet the identified needs and subsequently in the evaluation of the overall effectiveness of the implemented initiatives.

The performance criteria established for the Manitoba ITS Strategic Plan included both qualitative and quantitative measures, which were generally obtainable and provide an overall measure of success:

- **Safety** – A measure of the frequency/severity of collisions and the associated response times should a collision or incident occur;

- **Transportation Efficiency** – performance measures reflecting a reduction in travel/delivery times, improved reliability of travel time scheduling, a reduction in vehicle delays and the consequential reduction in vehicle emissions;

- **User Satisfaction** – A determination of "customer satisfaction", where the road users are the customers in the system;

- **Reduction in Public Fund Expenditures** – A criteria to determine if the overall benefit of the initiative outweighs the costs of implementation, for the public sector(s); and/or

- **Economic Development** – A measure of the financial effect on the tourism, trucking and manufacturing industries.

- **Security** – A measure of the contribution of the strategy to the security commitments at international border crossings.

Exhibit 2-6 includes a summary of the performance criteria for each of the User Services and associated needs. It was intended that the identified performance criteria relevant to a given User Service be carried forward and used to rationalize and assess any given project activities associated with that User Service. Included in **Step 5** of this report is a more detailed analysis of performance criteria for the recommended deployment projects.

Exhibit 2-6: Performance Criteria For Planning Assessment												
		PERFORMANCE CRITERIA										
USER SERVICES	RELATED NEEDS	Reduction in Delay	Reduction in Fuel Used	Reduction in Pollutant Emissions	Increase in Schedule Reliability	Reduction in Collisions	Reduction in Response Time	Reduction in Duration of Incident	Level of User Acceptance/Satisfaction	Increase in Tourism-Related Revenue	Reduction in Public Cost	Improvement in Quality of Life
1.1 Traveller Information	1, 2, 6, 11	●	●	●	●	●			●		●	●
2.1 Traffic Control	2, 3, 6, 11	●	●	●		●	●		●		●	●
2.2 Incident Management	1, 2	●	●	●		●	●	●			●	●
2.4 Environmental Conditions Management	1, 5, 6, 11	●	●	●	●	●	●				●	●
2.5 Operations and Maintenance	1, 2, 3, 6, 11				●	●					●	●
2.6 Automated Dynamic Warning and Enforcement	1, 9					●					●	●
3.1 Public Transport Management	7				●				●		●	●
4.1 Electronic Payment Services	7	●	●	●	●				●	●	●	●
5.1 Commercial Vehicle Electronic Clearance	4, 8	●	●	●	●	●					●	●
5.2 Automated Roadside Inspection	4, 8, 10	●	●	●	●	●					●	●
5.4 Commercial Fleet Administrative Processes	4, 8	●	●	●	●						●	●
6.2 Hazardous Material Planning and Incident Response	2						●	●			●	●
6.4 Emergency Vehicle Management	1, 2						●	●			●	●
7.2 Infrastructure-Based Collision Avoidance	6					●					●	
8.1 Weather and Environmental Data Management	1, 2, 11	●	●	●	●	●	●				●	●
8.2 Archived Data Management	1, 11	●	●	●	●	●	●				●	●

3   STEP 3 – OPPORTUNITIES REPORT

The Opportunities Analysis is intended to provide the basis for ITS planning and design initiatives in the Province and to guide investment decisions relating to ITS activities. The analysis undertaken within this component of the study identified ITS deployment, operations, and maintenance, and an identification of stakeholder roles to successfully apply the Strategic Plan.

Through discussion with the stakeholders, the types of opportunities that were deemed most applicable in the Province of Manitoba, and that warrant development and sponsorship include:

- Improving the efficiency of the commercial vehicle operations and clearances, while reducing the financial and operational burden on regulatory agencies, with the application of automated credential acquisition, clearances and safety checks.

- Making more efficient use of existing transportation infrastructure through the provision of urban arterial traffic management, timely incident management, and real-time traveller information;

- Improving the efficiency of the urban public transit systems and the level of customer service provided to the user; and

- Reducing the number and severity of vehicle collisions through in-vehicle and wayside means. Improving response to personal injury and hazardous material spills through prompt notification and emergency vehicle priority will reduce delays in getting the appropriate help. Wayside systems will advise motorists of hazardous roadway conditions, including intersection situational hazards.

3.1 Stakeholder Input

Input regarding this step of the strategic planning project, was obtained through a variety of means, each of which is described in the following subsections.

3.1.1   STAKEHOLDER QUESTIONNAIRE

As previously noted, stakeholders completed a questionnaire as part of the **Step 2** activities. A number of the questions included in the questionnaire were directly applicable to the opportunities analysis and included the:

- Agency's primary mandate and barriers to achieving this mandate;

- ITS services that they are involved in, or have an interest in;

- ITS-related research;

- Benefits of ITS;

- Key public transportation agencies dealt with and any partnership opportunities; and

- Experience with regulatory and enforcement agencies.

A summary of the responses for each of these questions is provided in **Appendix C**. Primary observations taken from the surveys are as follows:

- Inter-organization coordination and project financing were indicated the most frequently as barriers that prevent the agency or company from optimizing their transportation related systems. Other barriers have a higher frequency of response included: staff skill sets, provincial acts, liability, and lack of standards;

- The Traveller Information Services, Traffic Management Services, Commercial Vehicle Services, Vehicle Safety and Control Services were considered by the respondents to be the most marketable, or to have the greatest potential to help an organization's mandate. Included in **Exhibit 3-1** is a summary of the responses in this regard; and

- The majority of the respondents indicated that they are in need of or seeking partnership opportunities to improve their business (70%).

Exhibit 3-1: Marketable/Important User Service Bundles		
ITS Architecture Designation	**User Service Bundle**	**Number of respondents indicating that the User Service bundle is the most marketable or would help their mandate**
1.0	Traveller Information Services	13
2.0	Traffic Management Services	11
3.0	Public Transportation Services	4
4.0	Electronic Payment Services	8
5.0	Commercial Vehicle Services	15
6.0	Emergency Management Services	9
7.0	Vehicle Safety and Control Services	12
8.0	Information Warehousing Services	9
Note: Respondents were permitted to indicate more than one User Service bundle		

3.1.2   USER NEEDS WORKSHOP

During the User Needs Workshop, the Consultant Team used the opportunity to obtain preliminary input regarding aspects of the opportunities analysis. In particular, participants completed workshop activities associated with the assessment of higher priority User

Services and the development of potential ITS projects. These two components are outlined below.

<u>User Service Assessments</u>

Each of the candidate User Services was subjected to a detailed evaluation in terms of:

- Key beneficiaries;

- Delivery participants;

- Availability of technologies;

- Operations and maintenance considerations; and

- Potential barriers.

The intent of the exercise was to involve the stakeholders in identifying the logical roles for relevant stakeholders in taking ownership in resolving implementation barriers for any given User Service area.

<u>Project Development</u>

The stakeholders were invited to propose potential project ideas through the completion of ITS project development forms in a discussion forum of smaller groups. The following is a summary of the criteria for which the participants were asked to address for each potential project:

- **Meets perceived need** – The project meets a perceived need and addresses a higher priority issue in the Province;

- **Consensus support** – The initiative has received a level of consensus among stakeholders that it is a worthwhile project to pursue;

- **Technological barriers** – Has a low risk of being held-up or defeated by a technological barrier;

- **Institutional barriers** – Has a low risk of being held-up or defeated by a institutional barrier;

- **Business case** – Can be implemented at a reasonable cost and provide obvious and real benefits to a large stakeholder group;

- **Attracts champions** – Will catch the attention of potential champions among legislators, business leaders, the public and the media; and

- **Vital to mainline strategy** – Showcases ITS as a viable component of the mainline transportation strategy.

Exhibit 3-2 is a summary of the potential projects identified by the participants. The identified projects provided a solid starting point for implementation planning, and these projects were carried forward for further consideration during the deployment planning activity. Each project was characterized in terms of the lifecycle development from concept through to implementation and management. **Appendix H** includes summary sheets, which assess each candidate project against the stated criteria.

Exhibit 3-2: Initial Candidate Projects	
Project Name	**Description**
Emergency Vehicle Pre-Emption	Pre-emption of traffic signals by emergency response vehicles on McPhillips Street, Regent Avenue and Portage Avenue in Winnipeg.
Transit AVL, Traveller Information and Signal Priority	Install a GPS-based AVL system on Winnipeg Transit fleet to monitor schedule adherence and provide the basis for transit priority and real-time traveller information.
Electronic Fare Collection	Replace antiquated fare boxes to permit the use of fare mediums including smart cards and proximity cards in Winnipeg and Brandon.
Corridor Signal Co-ordination	Co-ordinate traffic signals along specific corridors in Winnipeg to improve progression.
Traveller Information System for Highway #1 and Highway 75	Provide real-time information on road/weather conditions and incident delays on Highway #75 between Winnipeg and Fargo, North Dakota and Highway #1 between Winnipeg and Regina, Saskatchewan.
Active Advance Warning	Provide active warning components to specific isolated hazards in rural areas, including stop ahead, hidden intersection, speed advisory and blind hills.
Weather Camera Linkage to Weigh Station	Monitor high traffic areas through the "weather station" cameras to identify commercial vehicles with unsafe loads
Use of WIM and AVC Devices for Enforcement	Use weigh-in-motion (WIM) and automated vehicle classifiers (AVCs) approaching the inspection stations to permit the deployment of enforcement efforts based on the screening of the information.
On-Line Credentials, Permitting and Reporting	Implement a system that provides the ability to obtain and pay for all transportation related documents, including permitting, through the internet or telephone.
Work Zone Traffic Management	Develop a system to advise drivers of work zones and associated speed and guidance requirements.
Expansion of Automated Enforcement	Expand the red light camera project to additional signalized intersections on high speed routes
Pavement Condition Monitoring to Implement Active Seasonal Weight Limits	Implement a network of advanced technologies to measure the pavement and sub-grade conditions for the management of seasonal weight limit restrictions
TraCS	The Traffic and Criminal Software (TraCS) project is currently being developed in IOWA. It involves integrated systems for collision reports, commercial checking, citations and drunk driving reports. Manitoba is currently considering this type of system to improve data acquisition, querying and dissemination.

3.1.3   STAKEHOLDER INTERVIEWS

Throughout the Opportunities Analysis activity, the Consultant Team contacted a number of the stakeholders to discuss specific aspects of their:

- Existing operations and partnerships;

- On-going challenges; and

- Future endeavours including planned partnerships.

The information acquired through these interviews has been incorporated into the relevant areas of this section.

3.2 Operations Plan

3.2.1   CONTEXT

The ITS Operations Plan and an Institutional Analysis for the Province of Manitoba are interrelated in that they both have a bearing on the opportunities to identify projects and associated delivery approaches. The following section discusses the various aspects of the Operations Plan; whereas, the Institutional Analysis, covering key barriers to implementation and potential resolution to these barriers, are included in **Section 3.3**.

The ultimate goal of developing the Operations Plan was to identify ITS deployment initiatives associated with the higher priority User Services. The Plan addresses aspects relating to the:

- Actual means of initiating projects including an identification of financial means and proponent roles in the delivery;

- Staging of delivery; and

- Ongoing operations and maintenance of system components.

It is through the review and analysis of these attributes that decisions are made with regard to the priority of implementing the User Services.

To provide an analytic approach in assessing the higher priority User Services and the potential projects that may emerge from them, a compilation of factors or criteria defined as "strategic plan attributes" were considered. These attributes highlight the most pertinent aspects of the User Services, as they might be applied in the Province, and are defined in the subsequent subsections.

3.2.2   STRATEGIC PLAN ATTRIBUTES

There are four pertinent attributes of the Strategic Plan that must be analyzed in order to make decisions regarding the initiation of projects and the stakeholders that should be involved in the implementation. The critical Strategic Plan attributes are:

- Key beneficiaries;

- Delivery participants;

- Availability of technologies; and

- Operations and maintenance considerations of services provided.

These attributes were first raised in **Section 3.1.2**.

The following sub-sections describe the attributes, in detail, as they have been considered in the Opportunities Analysis. Included in **Section 3.5** is a summary assessment of the higher priority User Services in the form of a matrix of these strategic plan attributes mapped against the higher priority User Services. The fifth attribute "potential barriers", is discussed in detail in **Section 3.3**.

3.2.2.1   Key Beneficiaries

There are several ways to categorize key beneficiaries. The approach selected for use in this application includes all potential beneficiaries of ITS implementation. The initial list covers the stakeholder categories identified in **Step 1 and 2** of the project:

- Public Agencies;

- Commercial Operators;

- Industrial Sector;

- Suppliers and Service Providers;

- Researchers and Special Interest Groups.

The commercial operators and industrial sector categories were aggregated based upon their similar characteristics and roles in this component of the plan. The public agency group was subdivided into the following groups to provide better definition of the key beneficiaries:

- **Owners/Operators** – The owner and operators of transportation infrastructure, services and related systems can benefit from ITS either in augmenting the existing systems or provide another means of carrying out specific aspects of their mandate. Improvements to customer service, efficiencies and the safety of their operations/services are a few of the major benefits that may be attained through ITS applications.

- **Enforcement Authorities –** The ability of enforcement authorities to provide security and safety in the context of transportation facilities is enhanced with ITS. Whether their jurisdiction involves traffic act infractions, import/export regulations, or immigration/emigration policy adherence, ITS can provide them with an improved means of providing inspections, monitoring and surveillance in an efficient manner.

- **Emergency Service Providers –** In the event of emergencies, whether they are road-related or not, emergency providers rely on roads to access the site of the emergency. In the event of a non-road related emergency, emergency service providers can use electronic real time information to identify the most appropriate route to the emergency, based on congestion reporting or other road conditions reports. For road related emergencies, ITS can offer surveillance opportunities to assist emergency staff to assess the situation prior to responding.

In addition to the above, perhaps the most important beneficiaries are **travellers** or users of the systems. These individuals rely on road agencies and service providers for up-to-date information regarding the availability and schedule of those transportation facilities and services that they are intending to use.

This list of key beneficiaries has been regrouped into the following seven categories, for the purposes of developing the operations plan:

- Owners/Operators
- Enforcement Authorities
- Emergency Service Providers
- Commercial Operators/Industrial
- Suppliers and Service Providers
- Researchers/Special Interest Groups
- Travellers

3.2.2.2   Delivery Participants

ITS services are traditionally implemented by major public and private organizations. For the purposes of this application, the following participant groups were identified for consideration:

- **Federal Government –** The Federal Government sets some policies, regulations and standards to protect the safety, security and efficiency of Canada's rail, marine, road and air transportation systems, including the transportation of dangerous goods and sustainable development. In addition, they monitor and assess the performance of the transportation systems.

- **Provincial Government –** The Department of Transportation and Government Services is responsible for: the management of transportation on all provincial roads; the design and construction of infrastructure; the development and enforcement of policies, regulations and legislation; maintenance of the Province's fleet vehicles; and driver and vehicle licensing. The Provincial Government is responsible for Emergencies Measures Organization, which develops the overall provincial emergency program.

- **Municipal Government –** The municipalities operate road networks, traffic control devices, transit systems, parking and emergency services.

- **Non-Profit/Advisory –** The non-profit/advisory sector provides input on how the other participant groups can serve their stakeholders. Professional bodies play a key role in information transfer, standards setting, education and training.

- **Private Sector –** The private sector organizations are identified as "customers" since they in most cases directly receive an ITS service for commercial purposes. In some cases, they are in the business of "information service provider" or value-added service provider, by repackaging ITS information and distributing it to the ultimate end user. They also produce the hardware and software used to deliver ITS.

Potential delivery participants were identified through the User Service Assessment process undertaken in the November 15th, 2002 workshop and augmented with the Consultant Team's input.

3.2.2.3   Availability of Technologies

Technologies that are potentially applicable in the Province of Manitoba range from electronics and communications instrumentation in vehicles, to computer hardware in control centres and consumer households, and to field instruments. For the purposes of this application, five groups of technologies were considered and a basic description of each is provided in **Exhibit 3-3** below. The five groups are defined in terms of the two-way communications that are established between entities. This includes the communications itself but also the terminal equipment involved with the entire communications process.

There are a number of approaches that can be adopted to provide the communication links listed below. They include the use of "wireline" technology such as copper twisted pair, and fiber optic cable, and "wireless" technology, such as global positioning systems (GPS) and wayside vehicle detection devices. The links are described in detail in the ITS Architecture for Canada and will be further defined in **Step 4** of the Strategic Plan. Included in **Exhibit 3-4** is an illustration of these communication links.

Exhibit 3-3: Communication Links		
Communication Link	**Description**	**Operations/Systems Requiring This Type of Communication**
Between Centre and Wayside	These components provide communications between operations centres and electronic equipment that are in the transportation networks of the Province, primarily along the provincial highway network, but also at international border crossings and at terminals.	Data collection and monitoring devices Dynamic message signs Environmental monitoring devices Traffic signals Vehicle sensors Video monitoring.
Centre-to-Centre	As data is transmitted from an operator to another information user, it is considered to be centre-to-centre communications.	Data archival Incident management Rail coordination Traffic management Transit management Traveller information.
Between Centre and Vehicle/Traveller	In the situations where information is conveyed directly between an ITS operations centre and a traveller, whether enroute or prior to travel, it is considered to be centre to vehicle/traveller.	Mayday Transit vehicle communications Traveller information.
Between Wayside and Vehicle	Information that is transmitted from the field equipment to a vehicle is considered to be wayside to vehicle communications	Electronic toll/fee collection Signal priority.
Between Wayside and Wayside	Information is in some cases communicated between two wayside environments/ components.	Highway Rail Intersection "Smart signs".

Exhibit 3-4:   Communication Links Diagram
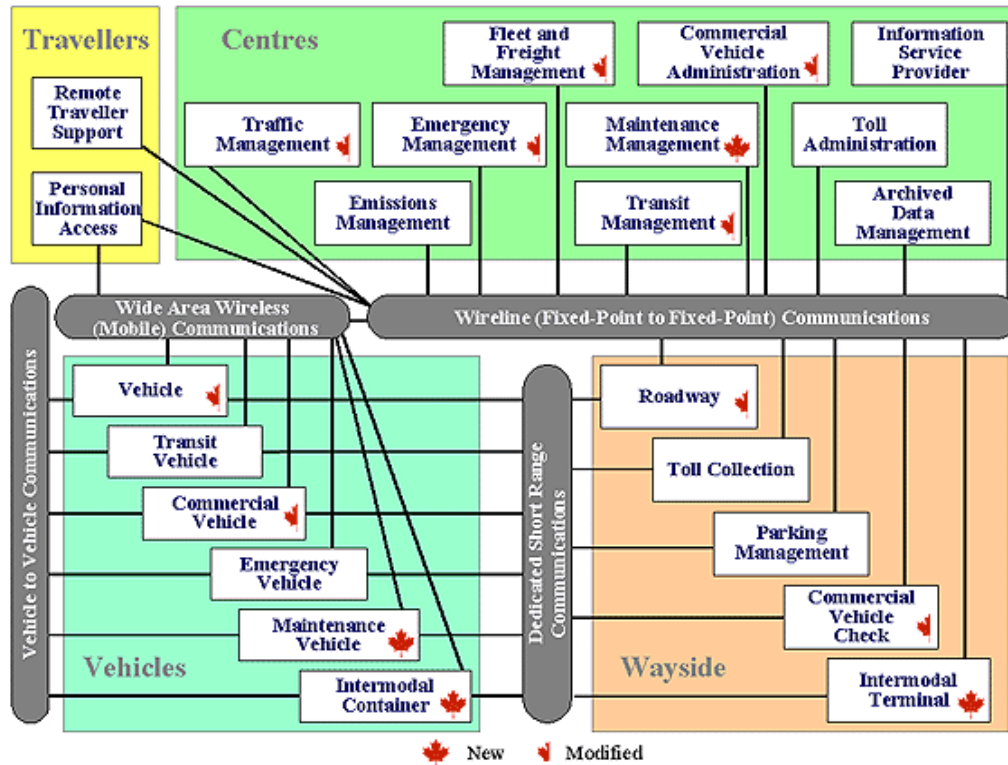
3.2.2.4   Operations and Maintenance Considerations of Services Provided

As with any service that is implemented for transportation purposes, once it has been installed and operational, it must be operated and maintained on an ongoing basis. This role may involve individual focus on a full time basis, or intermittent observation of its operational status over the course of a long time period. In all cases with ITS equipment, operations and maintenance is required and must be considered in the opportunities assessment of ITS projects. Consideration of skills that are inherent with the operations and maintenance must be brought into the assessment of whether an ITS technology can be readily introduced into any particular application in the Province. This important consideration was first identified in the SWOT exercise at the User Needs Worksop.

3.3 Institutional Analysis

Some of the key considerations in implementing ITS User Services are the potential barriers to that implementation. The barriers of a User Service, also described as issues that may slow or eliminate the potential for application, must be identified early on so as to also identify any potential actions that could be incorporated to overcome those barriers. In reviewing the key barriers to implementation, there are a number of common challenges to be addressed.

Many of these challenges are not necessarily unique to the agencies and companies in the Province of Manitoba, and in fact are shared by many regions in North America. These include:

- Lack of inter-agency co-ordination;

- Lack of start-up funding;

- Concerns about privacy of employees and road users;

- Protection of intellectual property;

- Requirement for an expensive "back-office" to process data and/or transactions;

- Financing to obtain equipment is an issue for smaller commercial operators; and

- Competitors must co-operate and co-ordinate to deliver a joint service.

Some of the challenges that are more specific to Manitoba include:

- Gaps in wireless service especially in rural and remote areas in the northern regions of the Province; and

- Large low-density geographic areas which may make it difficult to build a business case for widespread application of a specific ITS initiative.

The barriers presented in the following section are pertinent in the Province and were established in part through the User Service Assessment exercise undertaken with the stakeholders to identify the specific barriers. Included in **Section 3.3.2** is a discussion regarding the potential solutions to overcome these barriers. Included in the summary matrix of the Strategic Plan Attributes (Refer to **Section 3.5**) is a general indication of the known barriers to implementation for each of the higher priority User Services.

3.3.1   KNOWN BARRIERS TO IMPLEMENTATION

Decades of experience have led to a stable operating structure for government agencies responsible for building, maintaining, and operating transportation facilities. Each agency is responsible for specific roads and/or transit services. The responsible agencies are traditionally well versed in their respective tasks. Funding mechanisms are in place, experienced staff carries out projects, and long-term plans guide decision-making. To some extent each agency is capable of operating independently of other government departments responsible for transportation. This "stability" can sometimes represent a barrier in terms of a lack of flexibility to introduce innovative programs.

Conversely, a number of government agencies have experienced radical change over the past few years. Jurisdictions have been amalgamated, the roles of the agencies have been redefined, organizations have been restructured and down-sized, and the financial processes have changed. In these cases, the barrier can be "instability".

Deployment of ITS is a significant departure from "business as usual" for transportation agencies. Projects cut across all types of transportation facilities and raise a whole host of new implementation questions. Balancing ITS and "traditional" transportation investments becomes a challenge, as does finding the right personnel for the job. In fact, the multitude of "institutional issues" related to ITS planning and deployment are so significant that they often overshadow the technological challenges of a given project.

At their core, many ITS issues simply boil down to a lack of experience. In time, agencies will adapt to the needs associated with ITS, just as they adapted to major highway building programs, new transit systems, and other major developments. Now that transportation agencies within Manitoba and throughout Canada and the US have close to 10 years of experience with widespread ITS deployment, many of the challenges and most promising solutions are becoming more apparent.

There are five groups of barriers that are anticipated to have a bearing on the success of implementing the Operations Plan. The groups are:

- Organizational Issues;

- Project Finance;

- Legal;

- User Acceptance; and

- Technical.

Each of these groups of barriers is described in the subsections below.

3.3.1.1 Organizational Issues

Inter-Agency Coordination

One of the most widely documented institutional issues is interagency coordination and communication. Many ITS projects, such as traffic management, rely on data from a number of transportation agencies. Projects must be designed with the needs of a wide array of users (travellers) and operating agencies in mind. In many cases, however, these agencies are not accustomed to working together closely and on a consistent basis. A primary example is coordination between provincial and municipal traffic engineering staff. Establishing interagency coordination and mechanisms for communications is both a serious challenge and crucial to project success.

Intra-Agency Coordination

Intra-agency coordination can also be a significant issue, especially in larger organizations. For example, it is not clear who would take responsibility for new and emerging roles/services such as commercial vehicle operations programs. Another example is at the municipal level, the department of a municipality responsible for traffic signal operations might not interact very often, or very successfully, with the department responsible for transit operations.

Partnerships

Over the past several years there has been an increasing emphasis on the establishment of partnerships to enable various transportation industry stakeholders to jointly pursue common interests and objectives. Public-public partnerships can be used as a means of facilitating inter-agency co-operation. However, public sector agencies have traditionally been constrained in their ability to enter into partnerships, specifically with private sector entities.

Changing Skill Sets

Most transportation agencies have hired technical expertise to deal with traditional transportation tasks like road building and maintenance, transit operations, etc. Few agencies, however, have expertise in software design and procuring ITS equipment. Also, the availability of information technology resources in the current market is an issue. ITS deployment necessitates that transportation agencies quickly acquire a broad set of high-technology skills, and that transportation planners focus more on the needs of day-to-day operations rather than just capital improvement projects.

Customer Focus

Transportation agencies are under increasing pressure to accommodate the transportation needs of their communities with a new customer focus. Recent policy statements of the Provincial Government have included a "customer service" based approach to core business. There is increasing pressure to shift attitudes among transport authorities away from simply maintaining infrastructure, to managing the provision of transport services. Contributing to the customer focus is the realization that transportation agencies will not be able to build their way out of transportation problems such as congestion, and mitigating those problems often involves promoting a less "popular" means of travel. For these reasons, transportation agencies need to understand their customers and the acceptable solutions to transportation problems in their community.

3.3.1.2   Project Finance

All government agencies are facing constrained budgets, and each year the challenge of providing the same level of service becomes more and more difficult. In the conventional transportation funding model ITS could represent an additional burden for government agencies. The very nature of ITS makes it necessary for agencies to change the way they see their "customers". It also opens the door to new means of financing projects. In some cases government agencies know little about the financing opportunities that exist and are unaware of how to proceed with an innovative project finance plan. This project is an example opportunity, through the Transport Canada ITS Partnerships Initiative to provide funding as part of the ITS Plan for Canada.

3.3.1.3   Legal

Liability

A significant risk to both government agencies and commercial vendors is legal liability. Through the stakeholder questionnaire and the first workshop, it was evident that liability is a primary concern shared by a number of municipalities. Any new technology or process raises questions pertaining to how the user can expect to be protected and who is at fault if the system does not perform as expected.

Privacy

Another barrier to widespread adoption of certain technologies is privacy. Travellers may be concerned that traffic monitoring efforts may eventually lead to "Big Brother" tracking an individual's daily movements. The legal identification of vehicles through electronic license plates has long since been contemplated for a number of ITS applications but privacy concerns have posed a significant barrier. Commercial vehicle operators may be concerned that electronic access to data pertaining to permits, inspection records, etc., may lead to certain carriers being targeted for increased scrutiny by regulatory officials.

Intellectual Property

Many ITS projects involve a commercial vendor developing a customized computer and/or telecommunications package for a government agency. In some cases this project may be a public-private partnership, while in others it may be a conventional customer-vendor arrangement. The development of technologies and processes under these arrangements raises intellectual property issues.

Procurement Practices

Public sector departments active in the ITS arena are typically limited in their flexibility with respect to procurement policies and mechanisms. In the interest of equitability, agencies are typically restricted to public tender and RFQ/RFP processes for procurement. For transport authorities, these processes are typically oriented towards hard engineering for infrastructure development and may not provide the flexibility for innovative multi-agency ITS applications.

Policy and Legislation

Current government policy at all levels is unlikely to be broad enough to accommodate the intents and methods that ITS will require as it becomes sought for wider application in Manitoba. For example, the Province currently legislates the use of the Canadian Manual of Uniform Traffic Control Devices (MUTCD) for traffic control on their highways. In some cases, ITS applications may represent deviations from the provisions of this document. In addition, aspects that include public-private partnerships, guidelines and best practices to encourage use of ITS, intellectual property, privacy and the traffic acts of the Province must be addressed in order that the application of new technologies can be implemented and within acceptable boundaries of use, e.g., the Manitoba Photo Enforcement Program required changes in provincial legislation.

3.3.1.4 User Acceptance

Technology Adaptation

The ability of the public to accept new technology applications and integrate these applications into their daily routines is a critical consideration for ITS deployment.

Public Perceptions

The public's perception of how a technology is being applied will influence the rate of acceptance. As information flows within the transportation sector become more automated, there is increasing public concern over the transfer of information.

3.3.1.5 Technical

Standards and Architecture

ITS architecture and standards are crucial to ensuring that whatever technologies are deployed deliver the maximum benefits to the traveling public and government agencies. Many jurisdictions may already have components of incompatible systems in place and will be reluctant to agree to a standard that requires them to replace their existing equipment. Similarly, private sector vendors will lobby aggressively for those specifications that are closest to their existing products and capabilities.

Availability or Infiltration of Field Equipment

In addition to the compatibility aspects of ITS implementation, it is very important to stage ITS implementation to utilize technologies as they become available to the Province. It may be suggested that a particular technology is expected to improve efficiencies significantly, once available or further developed into a conventional product.

3.3.2 POTENTIAL ACTIONS TO RESOLVE BARRIERS

Although the list of potential barriers included in the preceding section is long, these are not barriers experienced only in the Province of Manitoba. Other jurisdictions can provide valuable input to how barriers were identified and then addressed in order to successfully implement an ITS project. Several types of actions are available to overcome barriers that are identified. Examples of these actions, as they have been applied elsewhere, are provided in **Exhibit 3-5** for consideration in addressing those that may arise.

Exhibit 3-5: Potential Actions to Resolve Barriers
Financial Grants
• Establish grant programs to provide seed money for ITS. Government agencies may be reluctant to commit their own funds for a new application or means of doing business. Seed money can be very effective in expediting participation and consensus among a coalition of agencies.
Improved Electronic Communications
• Improve the communications backbone facilitating the rapid transfer of voice and data; and
• Use web-based tools as interim means or surrogates to higher order communications.
Changes to Policies/Legislation
• Examine legislative requirements to facilitate public-private partnerships;
• Provide policy framework and department autonomy to facilitate rapid response to public-private partnership opportunities;
• Establish Task Force to identify/prioritize legal issues that require attention to facilitate ITS. Where necessary, recommend changes to legislation to support use and implementation;
• Establish guidelines and best practices to encourage responsible activity by government agencies and/or private vendors. Such documentation reduces the liability risk to both agencies and vendors;
• Establish guidelines for dealing with intellectual property concerns in agreements with the private sector;
• Establish guidelines for dealing with privacy issues pertaining to the collection of data and images which can be potentially used to identify individuals; and
• Provide the flexibility and autonomy to pursue innovative initiatives while maintaining principals of equity and open procurement.
Introduction of Standards
• Develop Regional ITS Architecture through an ITS implementation body or working group; and
• Participate in Canadian and international standards development initiatives such as the International Standards Organization and the US program with a view to representing specific Manitoba needs and goals.
Improved Skill Sets
• Work with the University and community colleges to promote programs that emphasize skills appropriate for ITS. Systems engineering is often a key need;
• Promote professional capacity building programs to introduce existing staff to skills necessary to support ITS;
• Implement project teams made up of individuals with diverse skill sets. Facilitate exchanges of staff between different offices and/or agencies;
• Promote participation and representation in organizations such as ITS Canada that provide access to industry leaders, access to international standard-setting activities and a host of other benefits.
Partnerships
• Develop organizational framework and hierarchy as a crucial first step toward building consensus and efficient division of tasks;
• Improve communications amongst groups to establish a variety of means of disseminating information to coordinate activities such as a Task Force and on-going ITS website;
• Implement a program of staff exchanges to promote communication between agencies and to make more efficient use of individuals with complementary skills.
• As ITS partnerships have the potential to address a wide array of traditional barriers, **Section 3.4** includes a discussion dedicated to partnership opportunities.
Private Sector Involvement
• Consider privatizing or permitting private sector involvement in some traditional public sector functions. Use the private sector know-how in customer service to promote public sector goals such as increased cost-recovery; and
• Bring private sector on-board early to encourage interest in ITS and learn what the private sector will expect/need from government agencies.
Public Education
• Undertake outreach efforts to identify privacy concerns among the traveling public;
• Undertake public relations campaign to waylay concerns regarding privacy and information use; and
• Provide public education/awareness regarding system benefits and control of information.

3.3.2.1   Resolving Specific Barriers

There were a number of actions identified to resolve barriers. Some of the specific actions that applied within the Province of Manitoba include:

- Work with the University of Manitoba, University of Winnipeg, Brandon University and other post-secondary institutions to promote programs that emphasize skills appropriate for ITS. Foster co-op placements in IT and ITS programs to develop practical skill sets;

- Expand existing ITS partnership opportunities with the post-secondary institutions to draw on highly qualified people in academia and build upon the many advantages of "in-kind" resources from these entities;

- Regional coordination meetings within the Province to facilitate the use of ITS;

- Education of the purchasing agencies within the public sector owner/operators on the nature of the systems procurement process, and the distinguishing features relative to the conventional construction process;

- Promote greater involvement of Manitoba Transportation and Government Services staff with the National ARWIS working group;

- Pursuit of joint procurement by public agencies within the Province in order to employ common equipment specifications, and take advantage of economies of scale, e.g., Winnipeg and Manitoba transportation services, Winnipeg and Brandon Transit, etc.;

- Continue to actively represent Manitoba's interest within partnership initiatives such as the ITS/CVO Plan for the North America International Trade Corridor;

- Identification of lead agencies, or joint ventures among peer agencies in order to take the initiative on multi-party, back office applications, such as that required for data warehousing/archiving and potentially electronic payment;

- Extend networking opportunities with neighbouring State and Provincial staff to evaluate potential partnering opportunities and build upon ITS initiatives undertaken in other jurisdictions;

- Identification and engagement of a champion(s) from the tourism and automobile industry associations (e.g., CAA membership services) and Provincial Ministry of Tourism in order to help realize opportunities with traveller information services;

- Initiate early discussions regarding potential "early winner" projects to quickly and effectively access the cost-share projects under Transport Canada's Intelligent Transportation Systems (ITS) Deployment and Integration Plan, should the Federal Government let further calls for proposals;

- Promote ITS investment and initiatives at policy-level meetings/venues such as the Annual Meeting of the Association of Manitoba Municipalities.

Undertake public education campaigns for systems such as red-light and speed enforcement cameras (photo and/or licence plate based systems), to provide the public with information regarding the collection and processing of licence plate and photo identifier information. The legislation for the Manitoba Photo Enforcement Program and privacy information produced for the Winnipeg Safe Streets initiative are examples.

For transponder or subscriber-based systems, provide informational material to account holders at the time they are applying to participate. Information would describe generally how the system only uses the tag ID to establish a trip, then discards the data, and does not link to personal account information. This is for the purposes of transportation analysis (O-D studies, travel time monitoring, border crossing studies, etc.) This has been the experience of agencies in Ontario and in the northeast United States, where toll tags are used to monitor travel times.

3.4 Identification of Opportunities

Partnerships are becoming commonplace in ITS projects and initiatives throughout the world. Specifically, many ITS projects involve one or more of the following characteristics and/or aspects that lend themselves to partnering opportunities:

- Significant upfront and ongoing investment. Likewise, potential for significant benefits and revenue streams;

- Multiple mode impact and geographic coverage;

- Challenging operational transitions;

- Requirement of specialized skill sets;

- Coordination of several agencies and jurisdictions; and

- Multiple beneficiaries in terms of operations and "end users".

In the Province of Manitoba, ITS partnerships can provide various benefits and opportunities, some of which include the following:

- **Dissolving Agency Barriers** – Provide framework to address inter-jurisdictional barriers and introduce co-operation between organizations that generally are viewed as competing entities;

- **Improve Product and ITS Deployment** - Improve the product/project provided to the end user. Improve efficiency of the project and promote greater adherence to delivery schedule;

- **Standard Approach and Awareness of Rationale** - Induce regular meetings and communications between members, which assist in the development of a standard approach, and facilitates increased awareness of the project and decisions made. Also, on-going discussions facilitate the comprehension of other participants' perspectives;

- **Funding and Risk** – Provide opportunities to finance projects and share funding. Along the same vein, partnerships can reduce/share other risks and/or increase the return on investment;

- **Knowledge Sharing/Assemblage** – Take advantage of the strengths of different organizations and their respective skill sets. In many cases, partnerships result in the assembly of special skills and management personal; and

- **Project Savings** - Provide the ability to take advantage of the "economies of scale" through various means ranging from volume purchases of equipment to sharing on-site construction offices.

The experience of many public sector agencies in pursuing partnerships suggests that significant efforts may be required to adapt procurement practices to accommodate partnership proposals. It is important that this effort be invested at the outset in order to avoid long lead times for individual proposals/projects.

3.4.1   TYPES OF PARTNERSHIPS

It became apparent through the stakeholder questionnaire and the Strengths Weaknesses Opportunities and Threats (SWOT) analysis, that there exist a number of opportunities, benefits and motives to form partnerships between various agencies, jurisdictions and private sector entities. **Exhibit 3-6** includes a summary of partnership examples that have been formed to achieve goals of various types of ITS related projects ranging from strategic planning and research projects, to maintenance and operations of facilities.

Exhibit 3-6: Partnership Examples			
Project Type	**Type of Partnership**	**Related User Services**	**Examples**
Partnerships for ITS Planning and Coordination	Public-Public	All	• ITS Architecture for Canada • Manitoba, BC, Atlantic and Ontario ITS Strategic Plans • I-95 Corridor Coalition • COATS – California Oregon Advanced Transportation System • State wide Plan for ATIS – Minnesota
ITS Research	Public-Private	All	• University of Toronto Advanced Transportation Systems Testbed
Joint Use Call Centres	Public-Public	Traffic Control	• City of Toronto and Ministry of Transportation of Ontario – Road information line
Traveller Information Systems	Public-Public Public-Private	Traveller Information	• Manitoba Highway Traffic Information System • IOWA ATIS Initiative • Confederation Bridge Highway Advisory Radio • Texas DOT and TransGuide • TravInfo (et al) – San Francisco Bay Area • SmartTraveler – Boston
Fibre for Right-of-Way	Public-Private		• Ministry of Transportation of Ontario • New York State Thruway Authority
Centre-to-Centre	Public-Public	Traffic Control	• Greater Toronto Area • Silicon Valley
Toll Roadways	Public-Private	Electronic Payment Services	• Dulles Greenway Trip II • Highway 407
Traffic Operations Centres	Public-Public	Traffic Control Incident Management Travel Demand Management	• Minnesota (Arrowhead Region) - ARTIC • City of Toronto Joint Operations Centre • Houston TranStar
Multi-Modal Operations	Public-Private		• BC CVO
Adaptive Signal Control System	Public-Public Public-Private	Traffic Control	• Winnipeg Pilot Project • Minneapolis, Minnesota – SCOOT

Exhibit 3-6:	Partnership Examples		
Project Type	**Type of Partnership**	**Related User Services**	**Examples**
Advanced Road Weather Information System	Public-Public Public-Private	Environmental Conditions Management	• MRDC – Fredericton-Moncton Highway • New Brunswick and Nova Scotia Departments of Transportation and Public Works
Emergency Vehicle Management	Public-Public	Incident Detection Emergency Vehicle Management	• RESCU – Toronto
Commercial Vehicle Clearance	Public-Private Public-Public	Commercial Vehicle Electronic Clearance	• I-35 and I-95 ITS/CVO Plan • NORPASS
Border Crossing ITS Plan and Design	Public-Private	Electronic Payment Services Commercial Vehicle Electronic Clearance	• ITBCS - New York-Ontario International Border Crossing • AVION – ITS • Mid-Continent Corridor Initiatives
Red-Light and Speed Enforcement/Warning	Public-Public Public-Private	Automatic Dynamic Warning and Enforcement	• Manitoba Photo Enforcement Program • Variable Message Signs – Winnipeg/MPI • Ontario Municipality Pilot Project • Numerous US examples
AVL/Operations and Maintenance	Public-Public Public-Private	Public Transport Management	• Winnipeg Airport Ground Side Transportation • Pearson Airport Limousine Management
Smart Card Initiatives	Public-Private	Electronic Payment Services Public Transport Management	• City of Burlington-GO Transit • Barrie Transit VISA Cashcard • Guelph Transit Smart Card
Public Transport Management	Public-Private	Public Transport Management Traveller Information	• Summit Stage Transfer Centre – Colorado • TravLink – Minnesota
Transit Priority	Public-Public	Traffic Control	• Toronto Transit Priority Projects for Streetcars

Exhibit 3-6:	Partnership Examples		
Project Type	**Type of Partnership**	**Related User Services**	**Examples**
Advanced Parking Information Systems	Public-Public	Traveller Services and Reservations Traveller Information	• City of St. Paul • Boston

3.4.2   POTENTIAL PARTNERSHIP OPPORTUNITIES

A number of potential partnerships have emerged in key User Services through the analysis and discussions completed to date. Included in **Exhibit 3-7** are some examples of such prospects.

Exhibit 3-7:	Example Partnership Opportunities	
User Service/ Application	**Potential Partners**	**Advantages**
Electronic Payment Services Smart Card technologies to pay for transit and other services.	Winnipeg Transit, Brandon Transit and eventually other participants	• Combined resources for technology reviews and "lessons learned" • Greater buying power • Demonstrate partnering success to encourage potential expansion to parking facilities, payphones and retail purchases
Emergency Vehicle Management Traffic Signal Pre-emption	City of Winnipeg Fire Paramedic Service, Winnipeg Police Service, City of Winnipeg Public Works, MTGS, and Winnipeg Transit.	• Assist in eliminating agency barriers • Increase awareness of each agency's operating needs and rationale behind decision making • Promote the use of common technologies between emergency services and any future transit needs for pre-emption.
Weather and Environmental Data Management	City of Winnipeg, MTGS, and federal government	• Improve information provision and use by the end users • Knowledge sharing between counterpart agencies • Development of a common standard

3.5 Refine User Service Plan

3.5.1 OPPORTUNITIES ANALYSIS

As part of the **Step 2** process, preliminary assessments of the candidate User Services were undertaken to make an initial determination of their applicability and feasibility in Manitoba. The attendees at the November 15, 2002 workshop completed the initial assessments based on their knowledge of current transportation systems and agency structure. The material was then reviewed, edited and enhanced by the Consultant Team through telephone discussions with the relevant stakeholders. The input of this "local" knowledge is a key contribution to identifying the regional projects, the specific barriers to overcome, and realistic timeframes for implementation.

Appendix G contains the refined User Service Assessments that provide the detail to support the Opportunities Analysis. In addition, the assessment responses and subsequent discussions with the stakeholder group provided significant insight into the potential barriers in the domain of each User Service. With the aggregation of these key components, the Consultant Team completed the Opportunities Analysis.

The Opportunities Analysis included an applicability or relevance "rating" for each of the Strategic Plan Attributes and (potential) Barriers, followed by a recommended "Timeframe for Implementation". The rating consisted of two basic categories:

- "Applicable" indicates that the attribute/barrier is a component/consideration in developing an implementation plan; and

- "Not applicable" indicates that the attribute/barrier is not pertinent/not a consideration to developing the implementation plan.

The Opportunities Analysis summary matrix in **Exhibit 3-8** and provides a general assessment of the applicability of each attribute and (potential) barrier for the sixteen higher priority User Services.

The "Timeframe for Implementation" is divided into three timeframes: "Early winner", "Medium term", and "Longer term". The attributes that most affect the estimated timeframe are the known barriers to implementation. User Services with substantial barriers are more likely to require more time to overcome the barriers, and subsequently implement the service.

The sixteen User Services, as assessed, reflect several trends that are noteworthy:

- In all cases, the owners/operators are key beneficiaries, as are suppliers in many cases, and travellers in most cases;

- Delivery of most User Services includes the Provincial Government and almost equally, Municipal Governments. The private sector is seen to be involved in most delivery activities;

- Technologies are generally available and in some case being used in Manitoba, particularly Centre to Wayside and Wayside to Vehicle;

- The availability of the necessary skill sets to support ITS technologies in Manitoba is a concern. Acceptable levels of skill sets are identified as being present for seven of the sixteen User Services;

- With regard to barriers, the element most critical to implementing many ITS initiatives is funding availability. This barrier was identified in the SWOT analysis and in a number of the User Service assessments. Also, lack of interagency coordination can be a significant barrier since ITS requires cooperative effort in many applications; and

- Legal hurdles are also present, particularly where safety, electronic payment and data sharing are involved.

The results of the Opportunities Analysis were used to refine the User Service Plan and provided the foundation for the deployment plan.

Exhibit 3-8:   Opportunities Analysis

(Legend: ● – indicates that the attribute/barrier is a component/consideration in developing an implementation plan)

Strategic Plan Attributes and Barriers	Traveller Information 1.1	Traffic Control 2.1	Incident Management 2.2	Environmental Conditions Management 2.4	Operations and Maintenance 2.5	Automated Dynamic Warning and Enforcement 2.6	Public Transport Management 3.1	Electronic Payment Services 4.1	Commercial Vehicle Electronic Clearance 5.1	Automated Roadside Safety Inspection 5.2	Commercial Vehicle Administrative Processes 5.4	Hazardous Material Planning and Incident Response 6.2	Emergency Vehicle Management 6.4	Infrastructure-Based Collision Avoidance 7.2	Weather and Environmental Management 8.1	Archived Data Management 8.2
Key Beneficiaries																
Owners/Operators	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●
Enforcement Authorities			●			●			●	●		●				
Emergency Service Providers		●	●	●								●	●			
Commercial Operators/Industrial	●	●	●	●	●	●			●	●	●	●		●		
Suppliers and Service Providers	●	●						●							●	●
Researchers/Special Interest Groups															●	●
Travellers	●	●	●	●	●	●	●	●	●				●	●	●	●

Exhibit 3-8:   Opportunities Analysis

(Legend: ● − indicates that the attribute/barrier is a component/consideration in developing an implementation plan)

Strategic Plan Attributes and Barriers	Traveller Information 1.1	Traffic Control 2.1	Incident Management 2.2	Environmental Conditions Management 2.4	Operations and Maintenance 2.5	Automated Dynamic Warning and Enforcement 2.6	Public Transport Management 3.1	Electronic Payment Services 4.1	Commercial Vehicle Electronic Clearance 5.1	Automated Roadside Safety Inspection 5.2	Commercial Vehicle Administrative Processes 5.4	Hazardous Material Planning and Incident Response 6.2	Emergency Vehicle Management 6.4	Infrastructure-Based Collision Avoidance 7.2	Weather and Environmental Management 8.1	Archived Data Management 8.2
Delivery Participants																
Federal Government				●			●		●	●		●				
Provincial Government	●	●	●	●	●	●			●	●	●	●	●	●	●	●
Municipal Government	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●
Non-Profit/Advisory	●								●							
Private Sector	●				●	●		●	●		●				●	●

Exhibit 3-8: Opportunities Analysis																
(Legend: ● – indicates that the attribute/barrier is a component/consideration in developing an implementation plan)																
Strategic Plan Attributes and Barriers	Traveller Information	Traffic Control	Incident Management	Environmental Conditions Management	Operations and Maintenance	Automated Dynamic Warning and Enforcement	Public Transport Management	Electronic Payment Services	Commercial Vehicle Electronic Clearance	Automated Roadside Safety Inspection	Commercial Vehicle Administrative Processes	Hazardous Material Planning and Incident Response	Emergency Vehicle Management	Infrastructure-Based Collision Avoidance	Weather and Environmental Management	Archived Data Management
	1.1	2.1	2.2	2.4	2.5	2.6	3.1	4.1	5.1	5.2	5.4	6.2	6.4	7.2	8.1	8.2
Availability of Technologies																
Centre to Wayside	●	●	●	●			●	●	●			●	●		●	●
Centre to Centre	●	●	●	●			●		●			●	●		●	●
Centre to Vehicle/Traveller	●		●	●		●	●			●	●					
Wayside to Vehicle	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
Wayside to Wayside		●												●		

Exhibit 3-8: Opportunities Analysis
(Legend: ● – indicates that the attribute/barrier is a component/consideration in developing an implementation plan)

Strategic Plan Attributes and Barriers	Traveller Information 1.1	Traffic Control 2.1	Incident Management 2.2	Environmental Conditions Management 2.4	Operations and Maintenance 2.5	Automated Dynamic Warning and Enforcement 2.6	Public Transport Management 3.1	Electronic Payment Services 4.1	Commercial Vehicle Electronic Clearance 5.1	Automated Roadside Safety Inspection 5.2	Commercial Vehicle Administrative Processes 5.4	Hazardous Material Planning and Incident Response 6.2	Emergency Vehicle Management 6.4	Infrastructure-Based Collision Avoidance 7.2	Weather and Environmental Management 8.1	Archived Data Management 8.2
Operations and Maintenance Consideration of Services Provided																
Available Skill Sets	●	●	●	●	●		●	●	●		●			●	●	●
Known Barriers to Implementation																
Organizational Issues	●		●	●		●		●	●	●	●	●	●		●	●
Project Finance	●	●	●	●	●	●	●	●	●	●	●			●	●	●
Legal			●	●	●	●			●	●				●	●	●
User Acceptance	●					●	●	●	●	●	●					

Exhibit 3-8: Opportunities Analysis																
(Legend: ● – indicates that the attribute/barrier is a component/consideration in developing an implementation plan)																
Strategic Plan Attributes and Barriers	Traveller Information	Traffic Control	Incident Management	Environmental Conditions Management	Operations and Maintenance	Automated Dynamic Warning and Enforcement	Public Transport Management	Electronic Payment Services	Commercial Vehicle Electronic Clearance	Automated Roadside Safety Inspection	Commercial Vehicle Administrative Processes	Hazardous Material Planning and Incident Response	Emergency Vehicle Management	Infrastructure-Based Collision Avoidance	Weather and Environmental Management	Archived Data Management
	1.1	2.1	2.2	2.4	2.5	2.6	3.1	4.1	5.1	5.2	5.4	6.2	6.4	7.2	8.1	8.2
Known Barriers to Implementation (cont'd)																
Technical		●		●		●		●				●	●			
Timeframe for Implementation																
Early Winner (0 - 3 Years)	●	●		●	●	●	●	●	●		●			●	●	
Medium Term (4 – 7 Years)			●							●		●	●			●
Longer Term (8 - 10 Years)																

3.5.2   USER SERVICE REFINEMENT

The development of the Strategic Plan began with **Step 1**, the development of a Coalition Building Plan. **Step 2** of the plan was designed to deal with the needs, the vision, and the assessment and selection of higher priority User Services. **Step 3**, the Opportunities Analysis, dealt with the beneficiaries, delivery participants, technology availability, barriers, and actions to resolve barriers. The **Step 2** and **Step 3** processes are presented in **Exhibit 3-9**, reflecting the co-ordination and flow between these various steps and analyses. It is clear that ITS projects should be initiated on the basis of need and through application of the most appropriate User Services.

A refinement process was undertaken subsequent to the Opportunities Analysis to review all of the earlier analytical results. This review was undertaken to ensure consistency within each step and to validate the selection of User Services. Similarly, the timing of implementation should be based on the priorities that have been established for each need and the timeframe assessments that have been completed.

The refinement process confirmed that all sixteen User Services that had been identified through the study process were appropriate for implementation in Manitoba and confirmed that the timeframes are consistent with the priorities that are attached to the transportation needs. The potential timeframes also take into consideration the potential barriers and the opportunities to resolve those barriers.

Exhibit 3-9:   Refining the User Services
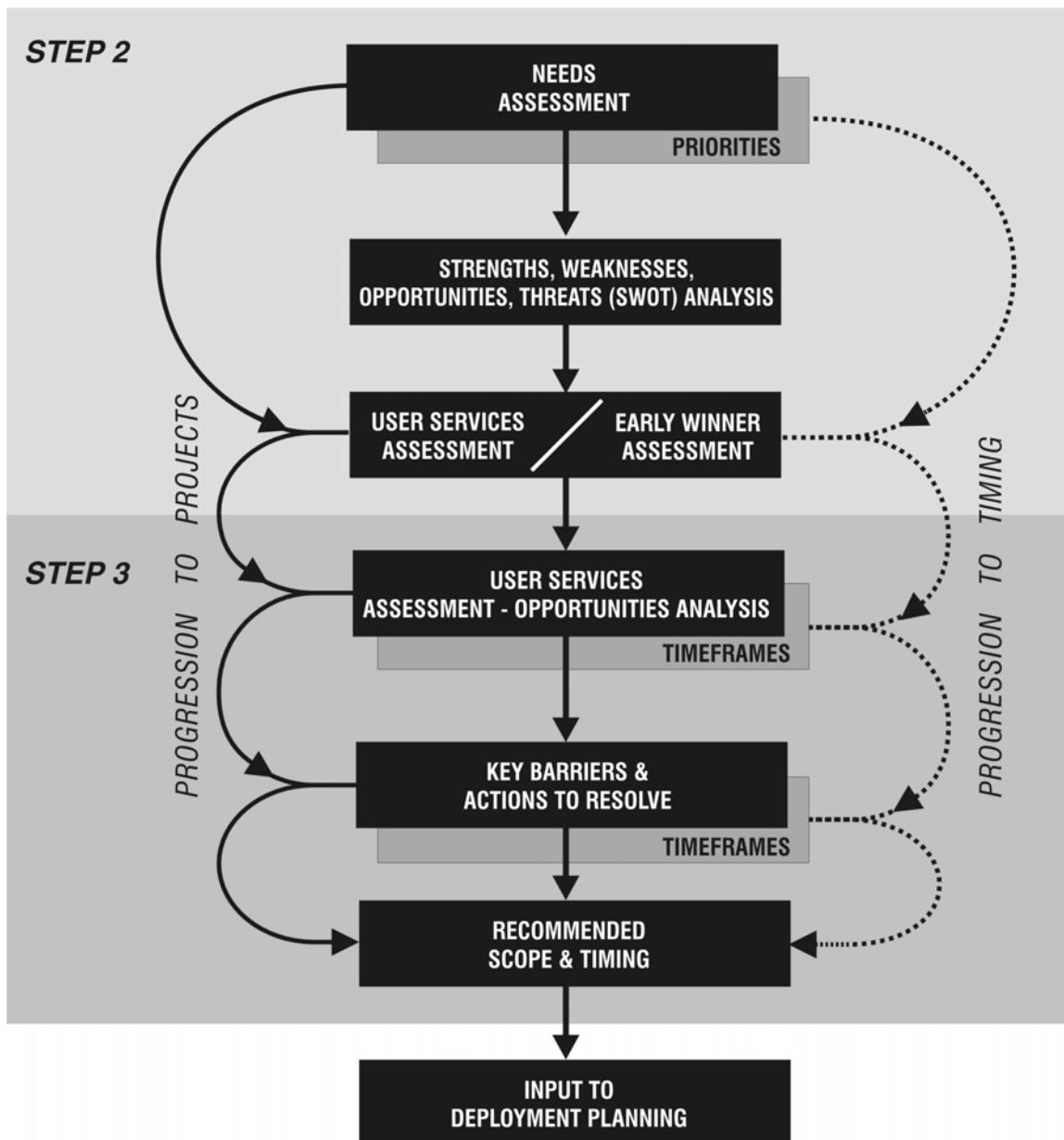
As initial effort towards the Deployment Plan, key actions and potential timeframes were assessed for each of the higher priority User Services. Included in **Exhibit 3-10**, is a cursory review of these considerations.

Exhibit 3-10: Key Actions and Potential Timeframes			
USER SERVICE	**KEY BARRIERS**	**ACTIONS TO RESOLVE BARRIERS**	**POTENTIAL TIMEFRAME**
1.1 Traveller Information	• Lack of inter-agency co-ordination • Lack of start-up funding • Lack of central warehouse for storing information • Gaps in wireless service in rural and remote areas	• Identify a champion to resolve issues, possibly Transportation and Government Services or Manitoba Tourism • Build on "lessons learned" from IOWA pilot project • Start with high profile pilot project on the Winnipeg-Fargo corridor with potential links to the 511 initiatives in North Dakota	0 - 3 4 - 7 8–10 YRS Early Medium Long Winner Term Term
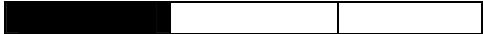
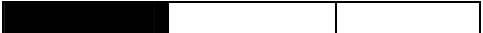| Exhibit 3-10: Key Actions and Potential Timeframes			
USER SERVICE	**KEY BARRIERS**	**ACTIONS TO RESOLVE BARRIERS**	**POTENTIAL TIMEFRAME**
2.1 Traffic Control	• Existing field systems may require upgrade/replacement of controllers, and therefore requires substantial funding • Commodity-based procurement practices can lead to problems when procuring sophisticated hardware/software (eg. traffic control systems) • Lack of industry standard	• Educate purchasing agencies on the issues of installing these systems – importance of the best long-term investment, versus the short-term price • Build upon pilot project being undertaken in the Polo Park area of Winnipeg • Ensure appropriate performance measures are in place to justify expansion and educate the public with regards to the benefits of system	0 - 3 4 - 7 8–10 YRS Early Medium Long Winner Term Term
2.2 Incident Management	• Lack of mechanisms available for inter-agency co-ordination • Lack of funding • Large geographic areas, with relatively low population density make it difficult to build a business case	• Identify a champion to resolve agency coordination issues, possibly Manitoba EMS • Raise awareness of the benefits of incident management • Undertake pilot project in Winnipeg along key response and/or high collision corridor	0 - 3 4 - 7 8–10 YRS Early Medium Long Winner Term Term

	Exhibit 3-10: Key Actions and Potential Timeframes		
USER SERVICE	**KEY BARRIERS**	**ACTIONS TO RESOLVE BARRIERS**	**POTENTIAL TIMEFRAME**
2.4 Environmental Conditions Management	• Lack of funding	• Build on federal effort to develop a nation-wide Road and Weather Information System network. Pursue federal funding/partnering through existing programs • Actively participate in national ARWIS standards working group • Build on City of Winnipeg initiatives already in place	0 - 3 4 - 7 8–10 YRS Early Medium Long Winner Term Term
2.5 Operations and Maintenance	• Introduction of sophisticated technology to operations and maintenance activities • Exposure to liability if systems fail • Require substantial initial funding	• Implement as part of a greater strategy to form public/private partnerships to deliver operations and maintenance services • Build funding rationale upon recent initiatives to reduce road salt usage in Canada and provide better customer service in the Province of Manitoba	0 - 3 4 - 7 8–10 YRS Early Medium Long Winner Term Term
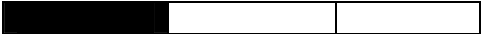
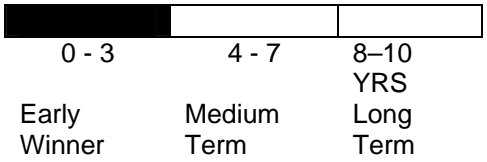| Exhibit 3-10: Key Actions and Potential Timeframes			
USER SERVICE	**KEY BARRIERS**	**ACTIONS TO RESOLVE BARRIERS**	**POTENTIAL TIMEFRAME**
2.6 Automated Dynamic Warning and Enforcement	• Existing infrastructure may not accommodate system requirements • Systems are costly to implement, and require a back-office to process fines • Deviations from Canadian MUTCD may contravene provincial policy • Public may perceive electronic enforcement as primarily a revenue generation strategy	• Municipalities and Province can consider joint procurements to take advantage of economies of scale • Create ability to offset cost with revenue generation • Build on photo enforcement and dynamic warning initiatives in the City of Winnipeg and Province. Ensure appropriate performance measures are in place to justify expansion and/or similar projects • Educate the public with regards to the benefits of systems	0 - 3 4 - 7 8–10 YRS Early Medium Long Winner Term Term
3.1 Public Transport Management	• Systems are costly to implement and operate – require a sound business case • May be privacy issues with transit employees	• Market importance of advances to maintain a modern alternative to the car • Build upon recent initiatives to improve customer service and reduce vehicle emissions in the Province	0 - 3 4 - 7 8–10 YRS Early Medium Long Winner Term Term

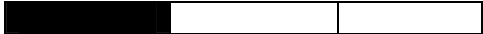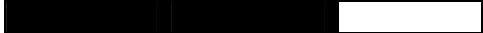| Exhibit 3-10: Key Actions and Potential Timeframes			
USER SERVICE	**KEY BARRIERS**	**ACTIONS TO RESOLVE BARRIERS**	**POTENTIAL TIMEFRAME**
4.1 Electronic Payment Services	• Requires one back office to process transactions • Requires substantial initial investment, including back office functions • Privacy and intellectual property • Public required to change payment habits • National standards still evolving	• Obtain government funding for start-up • Involve financial community • Form partnerships with public and private entities and designate one to operate the common back office • Partner with Manitoba Smart network initiatives and demonstration projects	0 - 3 4 - 7 8–10 YRS Early Medium Long Winner Term Term

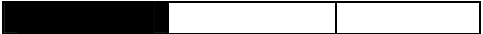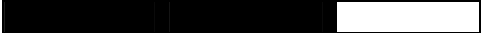|	Exhibit 3-10: Key Actions and Potential Timeframes		
USER SERVICE	**KEY BARRIERS**	**ACTIONS TO RESOLVE BARRIERS**	**POTENTIAL TIMEFRAME**
5.1 Commercial Vehicle Electronic Clearance	• For international border, requires co-operation and information sharing between U.S. and Canadian agencies. May be legislative restrictions on data exchange • Operators may have privacy concerns • Financing to obtain equipment is an issue for smaller commercial operators	• Pilot projects provide opportunity to assess operation/policy issues • Build upon recent "shared facility" agreements between Manitoba and the US • Build on increased interest in border security measures might lead to greater support for initiatives	0 - 3 4 - 7 8–10 YRS Early Medium Long Winner Term Term
5.2 Automated Roadside Safety Inspections	• Lack of understanding of the applications and their abilities • Potential for perception of preferential treatment of particular carriers • View that industry is already "over-regulated"	• Undertake awareness campaign to scope out and address potential technology acceptance issues	0 - 3 4 - 7 8–10 YRS Early Medium Long Winner Term Term

Exhibit 3-10:	Key Actions and Potential Timeframes		
USER SERVICE	**KEY BARRIERS**	**ACTIONS TO RESOLVE BARRIERS**	**POTENTIAL TIMEFRAME**
5.4 Commercial Vehicle Administrative Processes	• Inter-jurisdictional applications will require coordination and common reporting structures • Central permitting section will require coordination of numerous agencies and departments	• Designate a champion to resolve agency/departmental issues • Set-up agreements relating to the ownership of information	0 - 3 4 - 7 8–10 YRS Early Winner Medium Term Long Term
6.2 Hazardous Material Planning and Incident Response	• Information sharing, and control at the scene • Lack of dedicated response personnel	• Educate agencies responsible for disaster response planning regarding role that ITS can play	0 - 3 4 - 7 8–10 YRS Early Winner Medium Term Long Term
6.4 Emergency Vehicle Management	• Require extensive field equipment, both on the wayside, and on emergency vehicles • Interoperability of systems • Lack of dedicated response personnel	• Promote ITS as a potential strategy to deal with stress on emergency services budgets • Consider pilot project in conjunction with Winnipeg traffic signal system initiatives • Set-up regional meetings between organizations	0 - 3 4 - 7 8–10 YRS Early Winner Medium Term Long Term
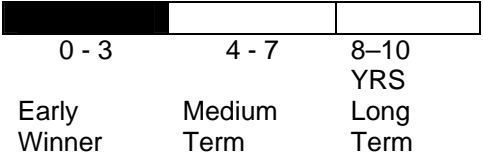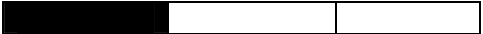
Exhibit 3-10: Key Actions and Potential Timeframes			
USER SERVICE	**KEY BARRIERS**	**ACTIONS TO RESOLVE BARRIERS**	**POTENTIAL TIMEFRAME**
7.2 Infrastructure-Based Collision Avoidance	• Justification of initiatives on rural or remote roadways may be difficult given the low traffic volumes	• Establish sound process for justifying and prioritizing installations • Ensure proper performance measures are established and build upon successful pilot locations	0 - 3 4 - 7 8–10 YRS Early Medium Long Winner Term Term

	Exhibit 3-10: Key Actions and Potential Timeframes		
USER SERVICE	**KEY BARRIERS**	**ACTIONS TO RESOLVE BARRIERS**	**POTENTIAL TIMEFRAME**
8.1 Weather and Environmental Data Management	• Ownership of data • Coverage in rural areas may be financially difficult to justify given low traffic volumes • Lack of incentives for champion or ownership	• Start with pilot project involving public/public partnership or public/private partnership • Approach Universities and Colleges regarding joint venture and technical support • Establish working group to discuss data format and sharing.	0 - 3　　4 - 7　　8–10 YRS Early　　Medium　　Long Winner　　Term　　Term
8.2 Archived Data Management	• Lack of understanding of the value of the information and modelling functions these systems will support • Ownership of data	• Seek private partner with consideration of the resale of information to partially fund project • Create pilot project for a specific data type • Establish working group to discuss data format and sharing	0 - 3　　4 - 7　　8–10 YRS Early　　Medium　　Long Winner　　Term　　Term

3.5.3   RECOMMENDED SCOPE AND TIMING

Through a process of reviewing and refining the User Service Plan and the associated analyses, a comparison was made of the User Services identified for consideration. It is on the basis of this overall summary of ratings that decisions were made to recommend timing for deployment of the User Services.

With regard to timeframes, eleven Early Winners were identified. The decision to focus on a limited number of Early Winners is strategic from a number of perspectives. Initiating too many projects will dilute the ability of regional stakeholders to focus on the deployment issues that need to be addressed including financing, partnerships, skills and legal aspects. If attention is focused on a small number of projects, then the chances for success increase. The successes of the first few projects will be examined critically by Government and the communities involved and thus their success is important to ITS deployment in the Province. This selection of ten User Services overall will provide a diverse sample of projects for urban and rural applications in the Province.

The User Services identified for Early Winners deployment included:

- 1.1   Traveller Information;

- 2.1   Traffic Control;

- 2.4   Environmental Conditions Management;

- 2.5   Operations and Maintenance;

- 2.6   Automated Dynamic Warning and Enforcement;

- 3.1   Public Transport Management;

- 4.1   Electronic Payment;

- 5.1   Commercial Vehicle Electronic Clearance;

- 5.4   Commercial Vehicle Administrative Processes;

- 7.2   Infrastructure-Based Collision Avoidance; and

- 8.1   Weather and Environmental Data Management.

These User Services represent projects that are sufficiently challenging to initiate and support within the Province but less challenging than others. The Opportunities Analysis resulted in eleven User Services that were considered "early winners" (implementation in zero to three years), and seven User Services that should be considered for the "medium term" (implementation in four to seven years). The following is a summary rationale for delaying implementation of seven of the remaining higher priority User Services.

Incident Management (2.2)

Although there is interest in the benefits of implementing this User Service, a specific "early winner" has not been identified by the stakeholders.

Automated Roadside Safety Inspection (5.2)

This User Service is heavily reliant on expensive equipment procurement and commercial operator acceptance. The slow acceptance rate and high start-up costs will delay widespread implementation.

Hazardous Material Planning and Incident Response (6.2)

A greater emphasis has been placed on emergency preparedness and response in the past few years; however, a specific "early winner" was not identified. Based on discussions with emergency services personnel, it appears that many of the coordinating initiatives are currently being pursued.

Emergency Vehicle Management (6.4)

Emergency Vehicle Management relies on a number of traffic signal system and dynamic route guidance functions. As such, the provision of these emergency vehicle systems will need to be differed until such time as the associated base systems are in place.

Archived Data Management (8.2)

Archived Data Management is closely linked to Weather and Environmental Data Management (8.1). It is suggested that the focus be on developing the standards and needs associated with the collection methods and protocols, with the archiving and Data Mart features to be established once this framework is in place.

The recommended timeframes above will be incorporated during the development of the deployment plan.

4   STEP 4 – ITS PROGRAM FRAMEWORK

4.1 Introduction

The next step in the Strategic Planning process is to define the ITS Program by identifying and assessing the functional requirements for each of these User Services, as tailored to the needs of the Province. **Step 4** is an application of the ITS Architecture for Canada to assist in the definition of an ITS Program for Manitoba. It does so by:

- Defining the functional requirements related to the User Services that are specifically relevant to the Province;

- Identifying the enabling technologies that address these functional requirements; and

- Defining the User Sub-Services and applications that employ these technologies.

User Services define ITS in terms of broad categories of services. The ITS Architecture for Canada defines User Services in terms of what they are supposed to accomplish for the end-user. A broad range of users is considered, including the travelling public as well as many different types of system operators. The application of the concept of User Services facilitates the identification of high level services that will be provided to address identified problems and needs.

The ITS Architecture for Canada further sub-divides User Services into User Sub-Services. These were developed to more fully define the range of possible services provided. In addition, these User Sub-Services can be mapped directly to Market Packages, i.e. the system delivery to meet the identified needs.

The descriptions provided for the User Services and Sub-Services in this document are substantially taken from those provided in the ITS Architecture for Canada, but have been edited to reflect the priorities, needs and context for Manitoba.

It is anticipated that a given stakeholder within the Province will have an interest in a specific User Service or set of related User Services, such as the CVO bundle. This document serves as a reference tool to enable the stakeholder, or project participants, to source high-level statements of functionality, ITS Architecture references, and key enabling technologies for the User Services that are of particular interest.

4.1.1   CONTENTS

The remainder of the ITS Program Definition has been subdivided into the following interrelated activities. Provided below is a brief description of each component:

- **Functional Requirements (Section 4.2)** – This section outlines the functional requirements for each of the ITS User Services previously identified as important to the Province.

- **Enabling Technologies (Section 4.3)** – This section summarizes a variety of practical technologies that can be combined to deliver the functionality as outlined in **Section 2**. The current state of maturity for each of these technologies is identified.

- **User Sub-Services (Section 4.4)** – This section provides further refinement of the User Services with reference to the applicable market packages.

To assist in the interpretation of the technical terminology contained in this document, a Glossary of Terms is provided as **Appendix I.**

A more detailed discussion regarding the enabling technologies identified in **Section 4.3** is provided as **Appendix J**.

4.2 Functional Requirements of the Refined User Service Plan

The Canadian ITS Architecture identifies 35 User Services. These User Services document what ITS should accomplish to fulfill user needs. A broad range of users must be considered, including the travelling public as well as many different types of system operators. User Services definitions assist in project planning exercises by establishing the high level services that will be provided to address identified problems and needs.

Step 2 and Step 3 of the project have identified a total of 16 User Services of relevance to Manitoba. The following sections outline the intended functionality for each of these candidate User Services. The functionality for each User Service is defined according to the following headings (where applicable):

- Surveillance;

- Data Processing;

- Control;

- Traveller Interface;

- Navigation;

- In-vehicle Sensors; and

- Communications.

4.2.1   TRAVELLER INFORMATION (USER SERVICE 1.1)

The Traveller Information User Service provides travellers with information to assist them in making mode choices and route decisions. Information is integrated from various transportation modes and other information sources and is presented to the traveller, pre-trip or en-route, for decision-making. The following functional areas are required in support of this User Service.

- Surveillance – Traveller Information shall provide for the collection of traffic conditions, road conditions, event/incident advisories, general public transportation, toll and parking information, and air quality and weather information.

- Data Processing – Traveller Information shall collect surveillance data from a variety of sources and integrate into a common database (i.e. data fusion). Algorithms validate data to estimate in near real-time current traffic conditions, road conditions, transit services, ride share/ride match, parking management, and pricing information for dissemination to the public.

- Traveller Interface – Traveller Information shall support both interactive and broadcast capabilities to access information prior to a trip or en-route. Information is conveyed using a variety of media that includes text, voice, advisory, map display and video.

- Communications – Wide area coverage is required for en-route traveller information. Broadcast and two-way (interactive) en-route traveller information is transmitted over low bandwidth wireless communication systems. Broadcast and two-way (interactive) pre-trip traveller information is transmitted over higher bandwidth wireline communication systems to support feature-rich traveller interfaces (e.g. interactive map display).

4.2.2   TRAFFIC CONTROL (USER SERVICE 2.1)

The Traffic Control User Service manages the movement of traffic on streets and highways. It includes surface street controls such as traffic signal systems, adaptive traffic control systems and freeway control techniques such as ramp metering and lane control.

- Surveillance – Traffic Control shall provide for the collection of traffic conditions, and road conditions data using road condition sensors, environmental sensors and other surveillance equipment such as video monitoring.

- Data Processing – Traffic Control shall provide data processing for:

    – Fixed device communication;

    – Data pre-processing and validation;

    – Processing algorithms for monitoring traffic environmental and road conditions, identification and verification of incidents, and local surface street control and/or arterial traffic management.

- Control Strategies - Traffic Control shall provide control strategies to support daily operations and incident management (refer to User Service 2.2 Incident Management) and shall include:

    – Surface street control;

    – Highway control;

    – Regional traffic control.

- Traveller Interface – Traffic Control shall support the dissemination of traffic information to drivers and vehicles using roadway equipment, and dissemination of information to users and Information Service Providers (ISP) for distribution to a wider audience for either en-route, or pre-trip planning purposes (refer to 1.1 Traveller Information).

- Communications – A range of two-way wireline and wireless communications systems may be used to support the various devices employed under this User Service. Low bandwidth two-way communications systems are used for communications between the control centre and field devices. High bandwidth communication systems are required for the transmission of video. High-speed networks are required for digital data and video transmission between control centres.

4.2.3   INCIDENT MANAGEMENT (USER SERVICE 2.2)

The Incident Management User Service enhances traffic monitoring and control capabilities to identify incidents, formulate response actions, and support initiation and ongoing co-ordination of those response actions.

- Surveillance – Incident Management shall use the surveillance equipment deployed under the Traffic Control User Service for the collection of traffic conditions, and road conditions using road condition sensors, environmental sensors and other surveillance equipment. Call centres will provide incident detection capabilities in rural areas, and supplemental information for incident detection on instrumented roadways.

- Data Processing – Incident Management shall use the incident detection capabilities included in the Traffic Control User Service for incident detection. Automated processes shall be employed to initiate and manage response to the incident site.

- Control Strategies - Incident Management shall manage both scheduled and unscheduled incidents so that the impact to the transportation network and traveller safety is minimized. The incident response may include co-ordination with emergency management, traffic control strategy modifications and dissemination of information to affected users.

- Traveller Interface – Incident Management shall:

  – Provide regional co-ordination with other traffic management and emergency management centres, weather service entities, and event promoters.

  – Disseminate traffic information to drivers and vehicles using roadway equipment.

  – Disseminate information to users and the ISP for distribution to a wider audience for either en-route, or pre-trip planning purposes.

- Communications – A range of two-way wireline and wireless communications systems may be used to support the various devices employed for this User Service. Low bandwidth two-way communications systems are used for communications between the control centre and field devices. High bandwidth communication systems are required for the transmission of video. High-speed networks are required for digital data and video transmission between control centres and the emergency management system. Wireless communications systems are required in rural areas for incident detection and response.

4.2.4   ENVIRONMENTAL CONDITIONS MANAGEMENT (USER SERVICE 2.4)

The Environmental Conditions and Monitoring User Service provides for the collection and processing of road weather information to optimize winter maintenance. In addition, road weather information and forecasts provide inputs to other services such as Traffic Management and Traveller Information to increase safety and efficiency.

- Surveillance – Environmental Conditions Management shall utilize fixed sensor stations on and about the roadway, to provide information on road and weather conditions. Road condition information may include pavement moisture content and temperature. Weather condition information may include precipitation, drifting snow, temperature, wind direction and speed and the presence of fog. Additional environmental hazards may be monitored along site-specific routes or locations, prone to these hazards such as mudslides or fire (smoke).

- Data Processing – Environmental Conditions Management shall analyze environmental data to detect and forecast environmental hazards, which can be used to more effectively deploy road maintenance resources, issue general traveller advisories, improve emergency management and response, and support location specific warnings to drivers. Environmental data may be obtained from system surveillance equipment, the national meteorological services and aviation services (refer to 8.1 Weather and Environmental Data Management).

- Control Strategies –Environmental Conditions Management shall increase the efficiency of plowing operations and the application of anti and de-icing materials through the prediction of weather conditions and the monitoring of roadway conditions.

- Traveller Interface – Environmental Conditions Management shall disseminate information regarding environmental hazards through connections with traffic management systems, traveller information systems and information services providers. Environmental Conditions Management shall use in-vehicle signing to inform maintenance vehicle operators of detected road and weather conditions. In-vehicle signing may use audio, visual and tactile interface technologies.

- In-Vehicle Sensors – Environmental Conditions Management shall use sensors located on the maintenance vehicles to monitor and report the application of anti- and de-icing materials.

- Communications – Low bandwidth two-way wireline and wireless communication is required between field devices and the traffic management centre. Two-way wide area wireless communications system may be used to communicate with maintenance vehicles.

4.2.5 OPERATIONS AND MAINTENANCE (USER SERVICE 2.5)

The Operations and Maintenance User Service provides road authorities, as well as contractors with the resources to manage the operations and maintenance of vehicle fleet and equipment assets, and monitor and manage traffic flow around work zone areas.

- Surveillance – Operations and Maintenance shall:

  - Use road weather information as collected under the Environmental Conditions Management User Service.

  - Monitor maintenance vehicle (e.g. snowplows and sand/salt trucks) location, vehicle status, and the output of sensors (such as environmental or road surface sensors), which are mounted on the vehicle.

  - Use roadside sensors to monitor traffic in the vicinity of the work zone.

- Data processing – Operations and Maintenance shall process maintenance resource requests with the other available current and archived information (refer to Environmental Conditions Management) to dynamically provide optimized maintenance assignments.

- Control Strategies – Operations and Maintenance shall use roadside elements to control traffic in the vicinity of the work zone.

- Traveller Interface – Operations and Maintenance shall provide the ability for the maintenance and construction driver to exchange information with the operation centre.

- Communications – Low bandwidth two-way wireline and wireless communication is required between field devices and the traffic management centre. Two-way wide area wireless communications system may be used to communicate with maintenance vehicles.

4.2.6 AUTOMATED DYNAMIC WARNING AND ENFORCEMENT (USER SERVICE 2.6)

The Automated Dynamic Warning and Enforcement User Service provides systems that warn vehicles or motorists of imminent danger, and provide electronic enforcement of traffic control and regulations.

- Surveillance – Automated Dynamic Warning and Enforcement shall monitor vehicles, roadway weather conditions, road surface conditions, traffic conditions, and obstacles or wildlife in the roadway.

- Data Processing – Automated Dynamic Warning and Enforcement shall process:

  - Surveillance data for driver notification of dangerous conditions (i.e. wildlife on roadway);

  - Vehicle and traffic signal display status for enforcement purposes (i.e. red light camera).

- Control Strategies - Automated Dynamic Warning and Enforcement shall dynamically vary speed limits in response to roadway conditions and enforce roadway traffic signals and speed limits.

- Traveller Interface – Automated Dynamic Warning and Enforcement shall disseminate warning information to the roadway user using dynamic message signs.

- Communications – A range of two-way wireline and wireless communications systems may be used to support the various devices employed under this User Service. Often, surveillance data can be processed remotely at the roadside, reducing communications requirements.

4.2.7 PUBLIC TRANSPORT MANAGEMENT (USER SERVICE 3.1)

The Public Transport Management User Service applies tracking and communications functions to various public transportation modes to improve service to the public. It includes operation of vehicles and facilities, planning and scheduling, and personnel management.

- Surveillance – Public Transport Management shall track the transit vehicle position.

- Data Processing – Public Transport Management shall:

  - Process vehicle location information to update the transit schedule for dissemination to patrons, and adjust transit vehicle operations to maintain schedule compliance;

  - Process and store data as necessary for electronic payment (refer to User Service 4.1 Electronic Payment Services);

–   Monitor the status of transit vehicle critical systems for transit maintenance activities;

–   Coordinate with multiple transit and traffic agencies to improve service coordination.

- Control Strategies – Public Transport Management shall provide local co-ordination between the transit vehicle and the individual intersection for signal priority. Real time operations adjustments can be implemented to optimize service.

- Traveller Interface – Public Transport Management shall make real-time schedule information available via the Traveller Information User Service (refer to **Section 2.1** of this document – Traveller Information) for dissemination.

- In-Vehicle Sensors – Public Transport Management shall provide the capability to monitor transit vehicle positioning, critical system status, passenger loading, and allow for electronic fare payment.

- Communications – Two-way low bandwidth wireless communications between the transit vehicle and transit management system is used for relaying vehicle position, and system status. Control measures (signal priority) are typically implemented using low bandwidth wireless roadside communication systems. Some information, such as vehicle maintenance data can be batch downloaded using short range communications.

4.2.8   ELECTRONIC PAYMENT SERVICES (USER SERVICE 4.1)

The Electronic Payment Services User Service allows travellers to pay for transportation services by electronic means. It may also serve broad non-transportation functions and may be integrated with credit and debit cards in banking and other financial transactions.

- Surveillance – Electronic Payment Services shall provide transportation operators with the ability to detect and process violators.

- Data Processing – Electronic Payment Services shall:

–   Provide toll operators with the ability to locally or centrally process transactions electronically;

–   Provides electronic processing of parking fees;

–   Allows for the fare payments onboard transit vehicles using electronic means;

–   Processing includes account reconciliation using pre-paid or credit accounts.

- In-Vehicle Sensors – Electronic Payment Services shall use short-range communications with in-vehicle equipment for electronic toll collection and

parking payment. Electronic Payment Services shall use transit in-vehicle systems to allow transit fare payment.

- Communications – Dedicated short-range communication between the roadway equipment and the vehicle is required. Dedicated high bandwidth two-way network communications between the toll collection equipment, transportation authorities and the financial infrastructure is required to support fee collection and processing.

4.2.9   COMMERCIAL VEHICLE ELECTRONIC CLEARANCE (USER SERVICE 5.1)

The Commercial Vehicle Electronic Clearance User Service consists of both domestic and international border electronic clearances. Domestic electronic clearance allows commercial vehicles to continue past inspection stations without stopping. International border clearance allows vehicles to bypass international border checkpoints without stopping, or at least expedited checks. As a vehicle approaches an inspection station or checkpoint, vehicle to roadside communications take place that identify the vehicle and make available to authorities the necessary data about credentials, vehicle weight, safety status, cargo, and occupants. Enforcement personnel can then select potentially unsafe vehicles for inspection and allow safe and legal vehicles to bypass the inspection station/checkpoint.

- Surveillance – Commercial Vehicle Electronic Clearance shall provide automated clearance at roadside check facilities. The roadside check facility will be equipped with sensors to identify and weigh vehicles. Vehicle and cargo status monitoring capabilities are secondary technologies enabling this ITS application.

- Data Processing – Commercial Vehicle Electronic Clearance shall use surveillance data to retrieve snapshots of critical carriers, vehicle, and driver data. When making the "Pass/Need to Stop" determination, vehicle/carrier safety information, vehicle credentials, driver credentials, driver status, and vehicle weight information shall be checked.

- Control Strategies – Commercial Vehicle Electronic Clearance shall include equipment needed to signal "Pull-in for Safety Inspection".

- Traveller Interface – Commercial Vehicle Electronic Clearance shall provide messaging to drivers approaching the inspection station/checkpoint using roadside display or in-vehicle signalling.

- In-Vehicle Sensors – Commercial Vehicle Electronic Clearance shall use a range of on-board sensor technologies that monitor vehicle condition, performance and safety.

- Communications – Low bandwidth two-way communications systems are used to allow a compliant vehicle/driver/carrier to pass roadside facilities at highway speeds.

4.2.10 AUTOMATED ROADSIDE SAFETY INSPECTION (USER SERVICE 5.2)

The Automated Roadside Safety Inspection user service provides automated inspection capabilities that check safety requirements more quickly and accurately during a safety inspection that is performed when a vehicle has been pulled off the highway at a fixed or mobile inspection site.

- Surveillance – Automated Roadside Safety Inspection shall include the ability to identify approaching commercial vehicles.

- Data Processing – Commercial Vehicle information may be stored on electronic tags and used for quick retrieval of information including basic identification, status, safety and performance monitoring.

- Control Strategies – Automated Roadside Safety Inspection shall include equipment needed to signal "Pull-in for Safety Inspection".

- Traveller Interface – Automated Roadside Safety Inspection shall provide messaging to drivers approaching the inspection station/checkpoint using roadside display or in-vehicle signalling.

- In-vehicle Sensors – Commercial Vehicles involved in an Automated Roadside Safety Inspection program may be required to install electronic tags, including status and performance monitoring sensors.

- Communications – Systems may use low-bandwidth wireless communication to retrieve vehicle information from electronic tags. Two-way communication is used in some implementations to inform the operator of upcoming checkpoints.

4.2.11 COMMERCIAL VEHICLE ADMINISTRATIVE PROCESSES (USER SERVICE 5.4)

The Commercial Vehicle Administrative Process user service includes: 1) electronic purchase of credentials, 2) automated mileage and fuel reporting and auditing, and 3) international border electronic clearance. The user service provides for electronic application, processing, fee collection, issuance, and distribution of CVO credential and tax filing.

- Data Processing – Includes the processing of vehicle, driver and/or carrier profiles/snapshots in the Commercial Vehicle Administration Subsystem that is relied on for information for other Commercial Vehicle Operations.

- Communications – The user service requires two-way communication with roadside checkpoints/inspection stations.

4.2.12 HAZARDOUS MATERIAL PLANNING AND INCIDENT RESPONSE (USER SERVICE 6.2)

The Hazardous Materials (HAZMAT) Incident Response user service focuses on providing information to emergency response agencies at the scene of an incident. This user service integrates incident management capabilities with commercial vehicle tracking to assure effective treatment of HAZMAT material and incidents.

- Surveillance – This user service includes tracking of HAZMAT materials through the Fleet and Freight Management Subsystem.

- Data Processing – Information about commercial vehicles carrying HAZMAT materials is gathered prior to a trip or following an incident. This information helps tailor a response through the Emergency Management Subsystem.

- Control Strategies – Implement a Traffic Management Strategy to divert central traffic.

- Traveller Interface – Commercial Vehicle Operators may be required to input information prior to a HAZMAT-payload trip depending on the selected policy and implementation.

- Navigation – To assist HAZMAT response vehicles to reach the scene of an incident quickly.

- In-vehicle Sensors – In-vehicle sensors is used to detect if an incident has occurred and communicates this information back to the Emergency Management Subsystem. Additional sensors may be used to increase the level of information following an incident which can allow for a faster and more appropriate response.

- Communications – Vehicles communicate with the Emergency Management Subsystem through low-bandwidth one-way wireless communication following an incident.

4.2.13 EMERGENCY VEHICLE MANAGEMENT (USER SERVICE 6.4)

The Emergency Vehicle Management Service User Service is oriented towards reducing the time from the receipt of notification of an incident by an emergency services dispatcher, and the arrival of emergency vehicles on the scene. It includes emergency vehicle fleet management, route guidance to the incident scene or a suitable hospital, and pre-emption of traffic signals on an emergency vehicle's route to receive more green displays.

- Surveillance – Emergency Vehicle Management shall provide for tracking the location of emergency vehicles. Real-time traffic conditions for emergency routes are obtained from the ISP.

- Data Processing – Emergency Vehicle Management shall:

  - Enable safe and rapid deployment of appropriate resources to an emergency;

  - Co-ordinate the emergency response between agencies;

  - Select the preferred route for the emergency vehicle;

  - Track the progress of emergency vehicles to the emergency scene;

  - Re-route the emergency vehicle based on roadway conditions.

- Control Strategies – Emergency Vehicle Management shall interact with the traffic signal control system to provide pre-emption to the emergency vehicle along its selected route. Alternatively, the emergency vehicle would be equipped with dedicated short-range communications for local signal pre-emption.

- Navigation and Guidance – Emergency Vehicle Management shall reroute the emergency vehicle depending on roadway conditions.

- Communications –Area-wide low-bandwidth wireless two-way communications between the emergency vehicle and the emergency management system is required for vehicle tracking and guidance.

4.2.14 INFRASTRUCTURE-BASED COLLISION AVOIDANCE (USER SERVICE 7.2)

The Infrastructure-based Collision Avoidance user service improves the driver's ability to avoid or decrease the severity of collisions that occur at intersections or merge areas. The function of this service is to track the position and state of vehicles within a defined area surrounding an intersection, and may involve roadside-to-vehicle or vehicle-to-vehicle communications.

- Surveillance – This user service involves roadside infrastructure that monitors vehicle locations and speeds as they approach the intersection.

- Data Processing – Data collected from sensors is processed to determine a probability of collision. Weather information could be imported or collected that can impact time to stop for each vehicle. Whereas a warning system would communicate dangers to the driver, an in-vehicle avoidance system (one type of implementation) would go on to determine control actions including altering the vehicle's speed or steering control.

- Control Strategies – The Traffic Control Device must select the appropriate signal display for conflictive vehicles.

- Traveller Interface – The Infrastructure-Based Collision Avoidance system would communicate to the driver through in-vehicle audible or visual warnings. An in-

vehicle avoidance system would actually take control of the car and slightly adjust speed or steering.

- Navigation – Vehicle locations and speeds are tracked while in the vicinity of the intersection.

- Communications – Low-bandwidth high-priority wireless communication will be required between the roadside and vehicle. In some implementations, vehicle-to-vehicle communication will also be required.

4.2.15 WEATHER AND ENVIRONMENTAL DATA MANAGEMENT (USER SERVICE 8.1)

The Weather and Environmental Data Management User Service provides system-wide gathering, fusion, and dissemination of information on roadway weather conditions and forecasts.

- Surveillance – Weather and Environmental Data Management shall use roadside sensor systems and weather sensors mounted on maintenance vehicles to collect roadway environmental data, while the national meteorological services provides the basic weather data and modeling functions.

- Data Processing – Weather and Environmental Data Management shall aggregate data from multiple sources and produce a consolidated data source. This data shall be combined with weather predictions for modeling purposes to predict roadway conditions (refer to Environmental Conditions Management).

- Communications – High-bandwidth wireline communications networks are required between centres.

4.2.16 ARCHIVED DATA MANAGEMENT (USER SERVICE 8.2)

Includes the gathering, fusion, and dissemination of weather and environmental data. It also includes the archiving and sharing of historical transportation data.

- Data Processing – Archived Data Management provides the basic data quality, data privacy, and meta data management common to all ITS archives and provides general query and report access to archive data users. In addition, data may be physically distributed requiring a virtual warehouse that combines all the records.

- Communications – High-bandwidth wireline communications networks are required between each agency's data centre.

4.3 ENABLING TECHNOLOGIES

4.3.1   INTRODUCTION

The candidate ITS User Services outlined in **Section 4.2** of this section employ many technologies, each with unique performance, cost and maturity characteristics. Many of these technologies are commercially available and would expose the implementing authority to little technical risk in the near term. The most problematic technology implications exist where a required ITS function is not presently supported by any cost-effective, commercially available technology. In a few instances, required technologies may not exist or may be too costly and/or unreliable for commercial application. ITS services that are dependent on such technologies require further research and development before a commercially viable product will be available.

This section will identify and describe the technologies associated with each of the higher priority User Services, define the maturity of the particular technology, and briefly discuss its local availability in the Province.

4.3.2   TECHNOLOGY REQUIREMENT RELATIONSHIPS

Exhibit 4-1 identifies functional groups of technologies and relates each of them to the candidate ITS User Services outlined in **Section 2** of this document. Each column in the exhibit represents a general technology area that is required to deploy ITS services. The technology requirements for each ITS Service are presented in the body of the exhibit. The opaque, black squares (■) denote that there is a relationship between the candidate ITS User Service and the technology area.

The candidate ITS User Services are ultimately at a very coarse resolution level for the purposes of this technology assessment. However, this will suffice to identify the areas that are likely to be deployable as near term services (within 3 years - by 2006) and which are likely to be longer term services (after 2006).

Exhibit 4-1: Technology Areas Associated with the Priority User Services for Manitoba

Manitoba ITS Services	Traffic	Vehicle Status	Environment	Vehicle Monitoring	Driver Monitoring	Cargo Monitoring	Obstacle Ranging	Lane Tracking	Security	Location Determination	Data Processing	Signals	Signs	Vehicle	Driver	Traveler	Operator	Navigation	In-Vehicle Sensors	Extended Range 2-Way	DSRC	Vehicle-Vehicle	Broadcast	Fixed Wireline
	Surveillance										**Data Processing**	**Control**			**Traveler I/F**					**Communications**				
1.1 Traveller Information	■		■							■	■				■	■	■	■		■			■	■
2.1 Traffic Control	■		■	■						■	■	■	■				■			■	■			■
2.2 Incident Management	■		■							■	■	■	■				■			■				■
2.4 Environmental Conditions Management		■	■	■							■		■		■		■		■	■				■
2.5 Operations and Maintenance	■		■	■	■					■	■	■	■	■	■		■		■	■				
2.6 Automated Dynamic Warning and Enforcement	■		■							■	■	■	■											
3.1 Public Transport Management				■	■					■	■				■	■	■		■	■	■			
4.1 Electronic Payment Services									■	■	■									■	■			■
5.1 Commercial Veh. Electronic Clearance		■		■		■				■	■	■	■		■		■	■	■	■	■			■
5.2 Automated Roadside Safety Inspection											■		■		■				■		■			
5.4 Commercial Vehicle Administrative Processes						■			■		■				■									■
6.2 Hazardous Mat'l Planning and Incident Response		■		■		■				■	■				■		■		■	■				
6.4 Emergency Vehicle Management				■					■	■	■				■		■	■	■	■	■			■
7.2 Infrastructure-based Collision Avoidance	■		■	■			■	■		■	■		■		■			■				■	■	
8.1 Weather and Environmental Data Mgt.			■								■												■	■
8.2 Archived Data Management											■													■

■ Denotes a relationship between Canadian ITS User Service Applicable to Manitoba and the technology area.

For descriptions of technologies, refer to Appendix J.

4.3.3   TECHNOLOGY AREAS

This Section discusses each of the functional groups introduced in **Section 4.2** (i.e. surveillance, data processing, control, traveller interface, navigation, in-vehicle sensors, and communications) in terms of sub-groups or 'technology areas'. **Exhibit 4-2** summarizes the technology areas that have been analyzed within each of the candidate ITS User Services and the relative maturity of that particular technology. A more detailed description of each technology is included within **Appendix J**. The ITS Architecture for Canada performed an initial assessment, using the year 2010 as a watershed. The assessment of maturity has been updated as part of this study.

The maturity assignments are defined as follows:

●   **Mature:** Current commercially available technology supports the identified ITS requirements in this area. Deployment of the candidate ITS Services is not predicated on further research and development of these technologies. *Candidate ITS Services with dependencies only on these mature technologies should be deployable prior to 2010 with low risk.*

◕   **Mature with rapid innovation:** Current commercially available technology supports the identified ITS requirements. The area is one of rapid technology growth that indicates that the basic support provided by current technologies will likely be superseded within the period to 2010. While further research and development is not required to support ITS, future deployment may benefit from technology enhancements that should not be precluded by excessive rigidity in the architecture or deployment definitions. *Candidate ITS Services with dependencies only on this class of technologies should be deployable prior to 2010 with low performance risk and medium cost risk, based on obsolescence.*

◑   **Mixed:** This technology area is required to satisfy a range of ITS requirements including some that are not supported by current technology. Useful services may be deployed using currently available technologies; however, satisfying all ITS Service requirements will require additional research and development to bolster the identified deficiencies. Where this assignment is made, the associated description in highlights the specific areas where technology advancement is required. *Candidate ITS Services with dependencies only on these "mixed" technologies may not be deployable prior to 2010 without significant technical risk.*

◔   **Immature:** Additional research and development is required before technologies in this area can be cost-effectively and reliably applied to support the candidate ITS Services. In some cases, potentially suitable technologies have been applied in defence and/or aerospace applications, but not in commercial transportation applications. Additional research and development is still required in these areas to address the unique mass production, safety, and cost issues associated with larger commercial markets. *Candidate ITS Services with dependencies only on these immature technologies may not be deployable prior to 2010 under any risk scenario.*

The identification of a technology area as immature is not the same as an absolute prediction that deployments will not occur without significant further research. There are numerous examples where relatively immature technologies have been applied in successful products, depending on the customer's needs and expectations. Where the need is great enough, creative providers will find other approaches that can be used for interim deployments. For example, technologies that automate vehicle occupant sensing for the purposes of determining compliance with HOV requirements are in their infancy. However, special rules and manned surveillance stations with high speed cameras are currently being used in several locations to support vehicle occupant sensing.

Although the relationship is not absolute, the timing of the required technology advancements will influence the deployment timing for the dependent candidate ITS Services. Unfortunately, accurately forecasting technology development timing is extremely difficult. This timing is dependent upon the current status of the required technology and the quantity and productivity of the research that will be performed in the area.

Exhibit 4-2:   Enabling Technologies Summary

Technology Area	Technology	Description	Maturity
1. Surveillance Section			
Traffic Table J.1 (Appendix J)	Loop Mats	generate an electromagnetic field designed for temporary use	◐
	Pressure Plates	detect axles thru electrical contact	◐
	Magnetometer	measure change in Earth magnetic field	◐
	Inductive loop	wireline buried in pavement	●
	Magnetic Probes	measures change in Earth magnetic field	◐
	Sensing Cable	technology limited to detect axles	◕
	Video Imaging	uses the visible light and near infrared bandwidths to sensor traffic parameters	◕
	Radar	2 types: Doppler radar - unable to measure presence; and True presence microwave - detects volume, presence and calculates speeds	◕
	Laser	technology is sensitive to mounting height and position and noise	◐
	Ultrasonic Sensing	transmit and receive an acoustic wave that is analyzed to determine vehicle volume	◐
	Automatic Vehicle Identification	may be used to provide road link travel time data between antennae for freeway and arterial networks	●
Vehicle Status Table J.2	Vehicle Classification	sensors which determine individual characteristics of passing vehicles (e.g. vehicle length, weight, no. of axles, lane position, speed)	◕
	Vehicle Emissions	enforcement application technologies that monitor emissions, passenger counts and operational status for specific vehicles are less mature	◐
Environment Table J.3	Environmental Sensors	technologies which monitors local climate (temperature, humidity, precipitation, wind, pollution) and road surface status (dry, wet, ice, snow)	●
Vehicle Monitoring Table J.4	CCTV Cameras	provides visual surveillance and confirmation of incidents, may be used to detect incidents, and to monitor environmental conditions, supports vehicle classification and enforcement	●
Driver Monitoring Table J.5	Driver Monitoring Sensors	technologies which monitor driver condition by monitoring driving characteristics and/or other psycho-physiological symptoms associated with impaired performance	◔

Exhibit 4-2 – Enabling Technologies Summary (Cont'd)

Technology Area	Technology	Description	Maturity
Cargo Monitoring Table J.6	Cargo Monitoring Sensors	technologies which monitor various indicators of cargo status such as load distribution, temperature, acceleration, pressure	●
Obstacle Ranging Table J.7	Obstacle Ranging Sensors	technologies which detect and characterize potential obstacles (other vehicles, people, road debris) in a vehicle's vicinity	◕
Lane Tracking Table J.7	Lane Tracking Sensors	technologies on board which monitor the position of the vehicle with respect to travel lane	◕
Security Table J.8	Security Sensors	technologies which provide surveillance of and restrict access to secure public areas such as card readers, CCTV	●
Location Determination Table J.9	GPS	technologies which determine absolute position	●
2. Data Processing Section			
Algorithms Table J.10	custom software packages for automatic incident detection, real-time signal optimization, route optimization, traffic simulation	e.g. McMaster algorithm, SCOOT (Split Cycle Offset Optimization Technique), INTEGRATION, TRANSYT-7F	◕
3. Control Section 4.2.6			
Information Management Table J.10	Regional traffic control	encompasses the communications links and integrated control strategies to enable integrated interjurisdictional traffic control	◕
	Incident Management Systems	manages both predicted and unexpected incidents to impact to safety is minimized	◕
Signals Table J.11	UTC Systems	Traffic signal control, limited ATMS abilities	●
Signs Table J.12	Light Emitting Diode	uses pixels comprised of clusters of hi-intensity LEDs	●
	Liquid Crystal Displays	insufficient contrast ratios and operating temperature restrictions limit outdoor use	◑
	Hybrid	includes fibre/flip, LED/flip: each disk has a small opening to expose the end of an illuminated fibre strand	●
	Rotating Drum	No. of messages displayed depends on no. of drums and no. of sides of its drums	●
Vehicle Table J.13	Vehicle Control Sensors	technologies will emerge on the market as a collection of discrete market driven features (e.g. adaptive cruise control)	◕

Exhibit 4-2:   Enabling Technologies Summary (Cont'd)

Technology Area	Technology	Description	Maturity
4. Traveller Interface Section			
Driver Table J.14	Driver Interface	Audio, visual and tactile interface technologies appropriate for interaction with drivers during vehicle operation (e.g. console LED, LCD, heads-up displays and synthesized speech)	◑
Traveller Table J.15	Traveler Interface	Same technologies as for D/I with varied constraints, extreme portability requirements restrict interface options	◑
Operator Table J.16	Operator Interface	Same as for T/I	◑
5. Navigation Section			
Navigation Table J.17	Route Selection and Guidan	can be either autonomous or dynamic	●
6. In-Vehicle Sensors Section			
In-Vehicle Table J.18	In-Vehicle Sensors	The range of on-board sensor technologies which monitor vehicle condition (e.g. engine, brake, tire and suspension status) and performance (e.g. speed, braking)	●
7. Communications Section			
Extended Range 2-Way Table J.19	PCS	analog cellular and digital PCS services offered in Canada	●
	Enhanced Specialized Mobile Radio (ESMR)	form of high mobility telephony and dispatch service	◑
	Microwave	uses a no. of microwave radios, low cost, high bandwidth alternative to a fibre network build	●
DSRC Table J.20	Dedicated Short Range Communications	wireless devices capable of transferring data at a high rate between mobile and/or stationary devices but are limited to a short-range	●
Vehicle-Vehicle Table J.21	Vehicle to vehicle Communications	short-range wireless communications used to exchange information between vehicles in close proximity for applications such as intersection collision avoidance and vehicle platooning	◕
Broadcast Table J.22	Broadcast Communication	highway advisory radio, licensed AM or FM frequency, DAB is a wireless audio and data transmission system developed for point to multipoint data broadcast applications	◑
Fixed Wireline Table J.23	Fixed Wireline Communicat	SONET is a multiplexing industry standard for fibre optic transmission system ATM is a packetization standard which facilitates the transfer of data in cells or packets of a fixed size	●

4.4 User Sub-Services

4.4.1 INTRODUCTION

The ITS Architecture for Canada identifies User Sub-Services to further refine the context for each of the User Services. The ITS Architecture for Canada provides 90 User Sub-services for its 35 User Services. The Manitoba ITS Strategic Planning Study has identified 16 priority ITS User Services of relevance to the Province in response to its identified existing and anticipated user needs. Specifically, the **Step 2** "User Service Plan" document mapped user needs to User Sub-Services and the relevant constituent Sub-Services summarizes the User Sub-Services that have been identified for each of the candidate ITS User Services. A rating for the relative relevancy and maturity of the particular User Sub-Service to the Province is also provided. A total of 36 User Sub-services were identified as relevant to Manitoba.

The relevancy rating assignments were based on the potential of a particular User Sub-Service to:

- meet multiple user needs (as defined in the **Step 2** "User Service Plan"); and/or

- meet the needs of a particularly high-priority user need.

The relevancy rating assignments are defined as follows:

● **Highly Relevant:** Meets multiple user needs and/or high priority user needs.

◐ **Moderately Relevant:** Meets some user needs and/or user needs of a lesser priority.

○ **Less Relevant:** Does not directly address user needs. Has a low priority for implementation in Manitoba.

The maturity rating assignments are as defined in **Section 4.3** of this document and correlate to those outlined in **Exhibit 4-3**.

Exhibit 4-3: User Sub-service Readiness for Deployment		
User Sub-Services	**Relevancy to Manitoba**	**Maturity of Application**
1.1 Traveller Information		
1.1.1 Broadcast Traveller Information	●	●
1.1.2 Interactive Traveller Information	●	◕
1.1.3 Real-Time Ridesharing Information	○	◔
2.1 Traffic Control		
2.1.1 Traffic Network Flow Monitoring	◐	◕

Exhibit 4-3: User Sub-service Readiness for Deployment		
User Sub-Services	**Relevancy to Manitoba**	**Maturity of Application**
2.1.2 Surface Street Control	●	●
2.1.3 Highway Control	◐	●
2.1.4 Regional Traffic Control	◐	●
2.1.5 Traffic Information Dissemination	●	◕
2.1.6 Virtual TMC	○	◐
2.1.7 Probe-based Flow Monitoring	○	◕
2.1.8 Traffic Estimation and Prediction	◐	◔
2.2 Incident Management		
2.2.1 Incident Management Coordination	●	◕
2.2.2 Incident Prediction System	○	◔
2.4 Environmental Conditions Management		
2.4.1 Roadway Environmental Sensing	●	●
2.4.2 Emissions Management	◐	◐
2.4.3 Road Weather Information System	●	●
2.4.4 Vehicle-based Sensing	◐	●
2.5 Operations and Maintenance		
2.5.1 Infrastructure Maintenance Management	●	●
2.5.2 Smart Work Zones	●	●
2.6 Automated Dynamic Warning and Enforcement		
2.6.1 Dynamic Roadway Warning	◐	◕
2.6.2 Variable Speed Limit and Enforcement	○	●
2.6.3 Signal Enforcement	●	●
3.1 Public Transport Management		
3.1.1 Transit Vehicle Tracking	●	●
3.1.2 Transit Fixed-route Operations	◐	●
3.1.3 Passenger and Fare Management	◐	●
3.1.4 Transit Maintenance	◐	●
3.1.5 Multi-Modal Coordination	○	◐
3.1.6 Multi-modal Connection Protection	○	◐

Exhibit 4-3: User Sub-service Readiness for Deployment		
User Sub-Services	**Relevancy to Manitoba**	**Maturity of Application**
4.1 Electronic Payment Services		
4.1.1 Electronic Toll Collection	○	●
4.1.2 Electronic Parking Payment	○	●
4.1.3 Transit Services Payment	●	●
4.1.4 Traveller Services Payment	◐	●
5.1 Commercial Vehicle Electronic Clearance		
5.1.1 Electronic Clearance	●	◕
5.1.2 International Border Crossing Clearance	●	◐
5.1.3 Weigh-in-Motion (WIM)	●	●
5.2 Automated Roadside Safety Inspection		
5.2.1 Inspection Support Systems	●	◕
5.2.2 Automated Vehicle Safety Readout	◖	◐
5.4 Commercial Vehicle Administrative Processes		
5.4.1 Commercial Vehicle Administrative Processes	●	◕
6.2 Hazardous Material Planning and Incident Response		
6.2.1 HAZMAT Planning and Incident Response	◖	◐
6.4 Emergency Vehicle Management		
6.4.1 Emergency Response Management	●	◕
6.4.2 Emergency Vehicle Routing	◖	●
7.2 Infrastructure-based Collision Avoidance		
7.2.1 Intersection Collision Warning	●	◔
7.2.2 Intersection Collision Avoidance	○	○
8.1 Weather and Environmental Data Management		
8.1.1 Roadway and Weather Data Fusion	●	●
8.1.2 Environmental Information Dissemination	●	●
8.1.3 Roadway Meso and Micro Prediction	◐	◐
8.2 Archived Data Management		
8.2.1 Archived Data Mart	●	◑
8.2.2 Archived Data Warehouse	●	◑
8.2.3 Archived Data Virtual Warehouse	●	◐

4.4.2 OUTLINE OF RELEVANT USER SUB-SERVICES

This section provides brief descriptions for the User Sub-Services identified as 'highly relevant' in the previous section. These descriptions are substantially taken from those provided in the ITS Architecture for Canada, but have been tailored (where appropriate) to reflect the priorities, needs and context for Manitoba.

This section may be characterized as an introduction to the following section: **Step 5** 'Deployment Planning'. The aim of this section is to identify practical implementation scenarios for each of the above-noted User Sub-Services. Consequently, the Market Package(s) within the ITS Architecture for Canada that are associated with these User Sub-Services have been identified.

Traveller Information (User Service 1.1)

Broadcast Traveller Information (User Sub-Service 1.1.1)

This User Sub-Service provides the user with a basic set of ATIS services; its objective is early notification. It involves the collection of traffic conditions, road conditions, advisories, general public transportation, toll, ferry, border crossing and parking status information, incident information, air quality and weather information, and the near real time dissemination of this information over a wide area through existing infrastructures and low cost user equipment. The successful deployment of this User Sub-Service relies on the availability of real-time traveller information from roadway instrumentation, probe vehicles, or other sources.

This User Sub-Service is related to the *Broadcast Traveller Information Market Package* within the ITS Architecture for Canada.

Interactive Traveller Information (User Sub-Service 1.1.2)

This User Sub-Service provides tailored information in response to a traveller request. Both real-time interactive request/response systems and information systems are supported, that "push" a tailored stream of information to the traveller based on a submitted profile. The traveller can obtain current information regarding traffic conditions, road, weather and sea conditions, transit services, ride share/ride match, parking management, ferry status and/or scheduling, border crossing delays, and pricing information. A range of two-way wide-area wireless and wireline communications systems may be used to support the required digital communications between traveller and the information service provider. A variety of interactive devices may be used by the traveller to access information prior to a trip or en-route to include phone, kiosk, Personal Digital Assistant, personal computer, and a variety of in-vehicle devices. Successful deployment of this User Sub-Service relies on availability of real-time transportation data from roadway instrumentation, probe vehicles, parking managers, transit providers, traffic management authorities, or other means.

This User Sub-Service is related to the *Interactive Traveller Information Market Package* within the ITS Architecture for Canada.

Traffic Control (User Service 2.1)

Surface Street Control (User Sub-Service 2.1.2)

This User Sub-Service provides the central control and monitoring equipment, communication links, and the signal control equipment that support local surface street control and/or arterial traffic management. A range of traffic signal control systems are represented by this User Sub-Service ranging from static pre-timed control systems to fully traffic responsive systems that dynamically adjust control plans and strategies based on current traffic conditions and priority requests. Additionally, general advisory and traffic control information can be provided to the driver while en-route. This User Sub-Service is generally an intra-jurisdictional sub-service that does not rely on real-time communications between separate control systems to achieve area-wide traffic signal co-ordination. Systems that achieve co-ordination across jurisdictions by using a common time base or other strategies that do not require real time co-ordination would be represented by this sub-service. This User Sub-Service is consistent with typical urban traffic signal control systems.

This User Sub-Service is related to the *Surface Street Control Market Package* within the ITS Architecture for Canada.

Traffic Information Dissemination (User Sub-Service 2.1.5)

This User Sub-Service allows traffic information to be disseminated to drivers and vehicles using roadway equipment such as dynamic message signs or highway advisory radio. This User Sub-Service provides a tool that can be used to notify drivers of incidents. Careful placement of the roadway equipment provides the information at points in the network where the drivers have recourse and can tailor their routes to account for the new information. This User Sub-Service also covers the equipment and interfaces that provide traffic information from a traffic management centre to the media (e.g. via a direct tie-in between a traffic management centre and radio or television station computer systems), transit management centre, emergency management centre, and information service provider.

This User Sub-Service is related to the *Traffic Information Dissemination Market Package* within the ITS Architecture for Canada.

Incident Management (User Service 2.2)

Incident Management Coordination (User Sub-Service 2.2.1)

This User Sub-Service manages both scheduled and unscheduled incidents so that the impact to the transportation network and traveller safety is minimised. Requisite incident detection capabilities are included in the highway control User Sub-Service. The regional co-ordination with other traffic management (e.g. municipal and regional traffic and transit authorities, ferry operators, etc.), and emergency management centres, weather service entities, and event promoters is supported by this User Sub-Service. Information from these diverse sources are collected and correlated by this User Sub-Service to detect and verify incidents and implement an appropriate response. This User Sub-Service provides Traffic Management Subsystem and Maintenance Management Subsystem equipment that supports traffic operations/maintenance personnel in developing an appropriate response in co-

ordination with emergency management and other incident response personnel to confirmed incidents. The response may include traffic control strategy modifications and dissemination of information to affected travellers using the Traffic Information Dissemination market package. The same equipment assists the operator by monitoring incident status as the response unfolds. The co-ordination with emergency management might be through a CAD system or through other communication with emergency field personnel. Co-ordination between traffic and maintenance operations is also included and also includes assets such as tow trucks.

This User Sub-Service is related to the *Incident Risk Prediction System Market Package* within the ITS Architecture for Canada.

Environmental Conditions Management (User Service 2.4)

Roadway Environmental Sensing (User Sub-Service 2.4.1)

This user sub-service monitors road and weather conditions using data collected from environmental sensors deployed on and about the roadway. In addition to fixed sensor stations at the roadside, sensor systems located on the Maintenance Vehicle Subsystem can provide information on road and weather conditions. The collected environmental data is analysed by the Traffic Management Subsystem to detect and forecast environmental hazards such as icy road conditions, dense fog, and approaching severe weather fronts. This information can be used to support ATMS and ATIS functions including more effectively deploy road maintenance resources, issue general traveller advisories, and support location specific warnings to drivers using the user sub-service 2.1.5--Traffic Information Dissemination or the user sub-service 8.1.2--Environmental Information Dissemination.

This User Sub-Service is related to the *Roadway Environmental Sensing Market Package* within the ITS Architecture for Canada.

Road Weather Information System (User Sub-Service 2.4.3)

Monitors current road and weather conditions using a combination of weather service information and data collected from environmental sensors deployed on and about the roadway. The collected road weather information is monitored and analysed to detect and forecast environmental hazards such as icy road conditions, dense fog, and approaching severe weather fronts. This information can be used to more effectively deploy road maintenance resources, issue general traveller advisories, improve emergency management and response, and support location specific warnings to drivers using the user sub-service 2.1.5-Traffic Information Dissemination.

This User Sub-Service is related to the *Road Weather Information System Market Package* within the ITS Architecture for Canada.

Operations and Maintenance (User Service 2.5)

Infrastructure Maintenance Management (User Sub-Service 2.5.1)

This user sub-service supports automated management of fleets of maintenance, construction, or special service vehicles. These types of vehicles include snowplows and sand/salt trucks. This user sub-service includes the infrastructure-based systems that monitor vehicle location, vehicle status, and the output of sensors (such as environmental or road surface sensors) which are mounted on the vehicles. Also included are the systems within the maintenance vehicles that create this information and send it to the control centre or control system. The infrastructure systems perform vehicle dispatch, routing, and asset management.

This User Sub-Service is related to the Maintenance Fleet Management Market Package.

Smart Work Zones (User Sub-Service 2.5.2)

This User Sub-Service includes systems that gather, store, and disseminate information relating to work zones. The roadside elements of the User Sub-Service can monitor and control traffic in the vicinity of the work zone. The central element of this User Sub-Service can participate in incident management by initiating incident notification, or by participating in incident response. It can advise drivers of work zone status (either directly at the roadside or through an interface with the Information Service Provider or Traffic Management Subsystems.). The central systems can manage and track construction and maintenance activities while co-ordinating with other Subsystems (such as traffic management). It can schedule and manage the location and usage of maintenance assets (such as portable dynamic message signs). These information systems are used by roadway maintenance personnel, roadway construction personnel, and other work crew personnel assigned to highway construction and maintenance to rapidly correct deficiencies that are noted through its advanced surveillance capabilities. This improves the quality and accuracy of information available to Travellers regarding closures and other roadway construction and maintenance activities, and improves safety for workers within the work zone.

This User Sub-Service is related to the *Smart Work Zones Market Package* within the ITS Architecture for Canada.

Automated Dynamic Warning and Enforcement (User Service 2.6)

Signal Enforcement (User Sub-Service 2.6.3)

This user sub-service supports the detection and enforcement of roadway control signals. A common implementation of this capability is "red light enforcement" for signalized intersections. Information documenting a vehicle disobeying a traffic signal is captured and conveyed to law enforcement. This user sub-service is a logical predecessor to "Intersection Safety Warning" and "Intersection Collision Avoidance", where the signal violation detection is also used to reduce the likelihood of a traffic accident. This same relationship also exists to "Mixed Use Warning Systems" and "Automated Non-Vehicular Road User Protection", since pedestrians, bicyclists, and other non-vehicle traffic may be threatened by signal violations.

This User Sub-Service is related to the *Signal Enforcement Market Package* within the ITS Architecture for Canada.

Public Transport Management (User Service 3.1)

Transit Vehicle Tracking (User Sub-Service 3.1.1)

This User Sub-service provides for an Automated Vehicle Location System to track the transit vehicle's real time schedule adherence and updates the transit system's schedule in real-time. Vehicle position may be determined either by the vehicle (e.g., through GPS) and relayed to the infrastructure or may be determined directly by the communications infrastructure. A 2-way wireless communication link with the Transit Management Subsystem is used for relaying vehicle position and control measures. Fixed route transit systems may also employ beacons along the route to enable position determination and facilitate communications with each vehicle at fixed intervals. The Transit Management Subsystem processes this information, updates the transit schedule and makes real-time schedule information available to the Information Service Provider Subsystem via a wireline link.

This User Sub-Service is related to the *Transit Vehicle Tracking Market Package* within the ITS Architecture for Canada.

Electronic Payment Services (User Service 4.1)

Transit Services Payment (User Sub-Service 4.1.3)

Allows for the fare payments on-board vehicles using electronic means. The payment instrument may be either a stored value or credit card specific to the application, or as supported by a broader banking network. This user sub-service is implemented with readers located either in the infrastructure or on-board the transit vehicle to allow fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Transit Management Subsystem using existing wireless infrastructure.

This User Sub-Service is related to the *Passenger and Fare Management Market Package* within the ITS Architecture for Canada.

Commercial Vehicle Electronic Clearance (User Service 5.1)

Electronic Clearance (User Sub-Service 5.1.1)

This User Sub-Service will be of particular relevance to the main border crossing facilities with the United States. It provides for automated clearance at roadside check facilities. The roadside check facility communicates with the Commercial Vehicle Administration Subsystem over wireline to retrieve infrastructure snapshots of critical carrier, vehicle, and driver data to be used to sort passing vehicles. This User Sub-Service allows a compliant driver/vehicle/carrier to pass roadside facilities at highway speeds using transponders and dedicated short-range communications to the roadside. The roadside check facility may be equipped with AVI, weighing sensors, transponder read/write devices, and computer workstation processing hardware, software, and databases.

This User Sub-Service is related to the *Electronic Clearance Market Package* within the ITS Architecture for Canada.

International Border Crossing Clearance (User Sub-Service 5.1.2)

Similarly important for Manitoba are border facilities with the U.S., this User Sub-Service provides for automated clearance specific to international border crossings. This sub-service augments the electronic clearance sub-service by allowing interface with customs related functions and permitting NAFTA required entry and exit from Canada and the U.S.

This User Sub-Service is related to the *International Border Crossing Clearance Market Package* within the ITS Architecture for Canada.

Weigh-in-Motion (WIM) (User Sub-Service 5.1.3)

This User Sub-Service provides for high speed weigh-in-motion with or without AVI capabilities. If the equipment is fixed, then it is characterized as an addition to the electronic clearance and would work in conjunction with the AVI and AVC equipment in place.

This User Sub-Service is related to the *Weigh-In-Motion (WIM) Market Package* within the ITS Architecture for Canada.

Automated Roadside Safety Inspection (User Service 5.2)

Inspection Support Systems (User Sub-Service 5.2.1)

Provides for automated roadside safety monitoring and reporting. It automates commercial vehicle safety inspections at the Commercial Vehicle Check roadside element. The capabilities for performing the safety inspection are shared between this user sub-service and the user sub-service 5.3.1--On-Board CVO Safety which enables a variety of implementation options.

This User Sub-Service is related to the *Roadside CVO Safety Market Package* within the ITS Architecture for Canada.

Commercial Vehicle Administrative Processes (User Service 5.4)

Commercial Vehicle Administrative Processes (User Sub-Service 5.4.1)

Provides for electronic application, processing, fee collection, issuance, and distribution of CVO credential and tax filing. Through this process, carriers, drivers, and vehicles may be enrolled in the electronic clearance program provided by a separate user sub-service which allows commercial vehicles to be screened at mainline speeds at commercial vehicle check points. Through this enrolment process, current profile databases are maintained in the Commercial Vehicle Administration Subsystem and snapshots of this database are made available to the commercial vehicle check facilities at the roadside to support the electronic clearance process.

This User Sub-Service is related to the *Commercial Vehicle Administrative Processes Market Package* within the ITS Architecture for Canada.

Hazardous Material Planning and Incident Response (User Service 6.2)

Hazardous Material Planning and Incident Response (User Sub-Service 6.2.1)

Integrates incident management capabilities with commercial vehicle tracking to assure effective treatment of HAZMAT material and incidents. HAZMAT tracking is performed by the Fleet and Freight Management Subsystem. The Emergency Management Subsystem is notified by the Commercial Vehicle if an incident occurs and co-ordinates the response. The response is tailored based on information that is provided as part of the original incident notification or derived from supplemental information provided by the Fleet and Freight Management Subsystem. The latter information can be provided prior to the beginning of the trip or gathered following the incident depending on the selected policy and implementation.

This User Sub-Service is related to the *Hazardous Material Planning and Incident Response Market Package* within the ITS Architecture for Canada.

Emergency Vehicle Management (User Service 6.4)

Emergency Response Management (User Sub-Service 6.4.1)

This User Sub-Service provides the computer-aided dispatch systems, emergency vehicle equipment, and wireless communications that enable safe and rapid deployment of appropriate resources to an emergency. Co-ordination between Emergency Management Subsystems supports emergency notification and co-ordinated response between agencies. Existing wide area wireless communications would be utilized between the Emergency Management Subsystem and an Emergency Vehicle to enable an incident command system to be established and supported at the emergency location. The Emergency Management Subsystem would include hardware and software for tracking the emergency vehicles. Public safety, traffic management, maintenance management and many other allied agencies may each participate in the co-ordinated response managed by this sub-service.

This User Sub-Service is related to the *Emergency Response Management Market Package* within the ITS Architecture for Canada.

Emergency Vehicle Routing (User Sub-Service 6.4.2)

This User Sub-Service supports dynamic routing of emergency vehicles and co-ordination with the Traffic Management Subsystem for special priority on the selected route(s). The Information Service Provider Subsystem supports routing for the emergency fleet based on real-time traffic conditions and the emergency routes assigned to other responding vehicles. In this User Sub-Service, the Information Service Provider Subsystem would typically be integrated with the Emergency Management Subsystem in a public safety communications centre. The Emergency Vehicle would also optionally be equipped with dedicated short-range communications for local signal pre-emption.

This User Sub-Service is related to the *Emergency Vehicle Routing Market Package* within the ITS Architecture for Canada.

Weather and Environmental Data Management (User Service 8.1)

Roadway and Weather Data Fusion (User Sub-Service 8.1.1)

This User Sub-Service supports the fusion of roadway environmental data with general weather forecasts and observations. Roadside sensor systems, or sensor systems mounted on maintenance vehicles collect roadway environmental data while the national meteorological service provides the basic weather data and modelling functions.

This User Sub-Service is related to the *Roadway and Weather Data Fusion Market Package* within the ITS Architecture for Canada.

Environmental Information Dissemination (User Sub-Service 8.1.2)

This User Sub-Service supports the dissemination of roadway and weather data to centres which can utilize it as part of their operations, or to the Information Service Providers who can provide the information to travellers.

This User Sub-Service is related to the *Environmental Information Dissemination Market Package* within the ITS Architecture for Canada.

Archived Data Management (User Service 8.2)

Archived Data Mart (User Sub-Service 8.2.1)

Provides a focused archive that houses data collected and owned by a single agency, district, private sector provider, research institution, or other organization. This focused archive typically includes data covering a single transportation mode and one jurisdiction that is collected from an operational data store and archived for future use. It provides the basic data quality, data privacy, and meta data management common to all ITS archives and provides general query and report access to archive data users.

This User Sub-Service is related to the Archived Data Mart Market Package.

Archived Data Warehouse (User Sub-Service 8.2.2)

Includes all the data collection and management capabilities provided by the ITS Data Mart, and adds the functionality and interface definitions that allow collection of data from multiple agencies and data sources spanning across modal, jurisdictional, and sector boundaries. It performs the additional transformations and provides the additional meta data management features that are necessary so that all this data can be managed in a single repository with consistent formats. The potential for large volumes of varied data suggests additional on-line analysis and data mining features that are also included in this user sub-service in addition to the basic query and reporting user access features offered by the ITS Data Mart.

This User Sub-Service is related to the Archived Data Warehouse Market Package.

Archived Data Virtual Warehouse (User Sub-Service 8.2.3)

Provides the same broad access to multimodal, multidimensional data from varied data sources as in the ITS Data Warehouse user sub-service, but provides this access using enhanced interoperability between physically distributed ITS archives that are each locally managed. Requests for data that are satisfied by access to a single repository in the ITS Data Warehouse user sub-service are parsed by the local archive and dynamically translated to requests to remote archives which relay the data necessary to satisfy the request.

This User Sub-Service is related to the Archived Data Virtual Warehouse Market Package.

5 STEP 5 - ITS DEPLOYMENT PLAN

At the strategic level, an ITS Deployment Plan defines a program for the implementation and evaluation of strategic ITS projects commensurate with the needs of a region. The definition is ascertained through the following components:

- Identification of strategic projects for short, medium and long term deployment;

- An implementation schedule which identifies stakeholder roles, phasing requirements and approximate durations and for each project; and

- Mechanisms for the ongoing monitoring of project implementation including performance evaluation.

The following section is a summary of these key aspects as they relate to Manitoba.

5.1 Strategic Projects

5.1.1 DEVELOPMENT OF STRATEGIC PROJECT SHORT-LIST

The Stakeholder Group developed a preliminary list of potential ITS projects during the User Needs Workshop convened in November 2002. Working from these initial thoughts, the project list was refined with input/discussions with relevant stakeholders and the analysis undertaken in **Steps 1 through 4**. From these efforts, a short-list of strategic projects was developed that:

- Meet the needs and vision;

- May expand the use of technology;

- Are expected to receive positive reaction from various sectors and stimulate other projects in the Province of Manitoba; and/or

- Are essential to support other priority ITS projects identified.

The list of potential strategic projects was refined through the stakeholder consultation process outlined in the following section.

5.1.2   STAKEHOLDER INPUT

The Stakeholder Group was reconvened in Winnipeg on February 11, 2003 to undertake a Deployment Planning Workshop. The workshop included a(n):

- Introductory session which provided an overview of the study status and conclusions arrived at to date;

- Project profile assessment exercise aimed at identifying priority ITS projects and defining the various characteristics of these projects;

- Exercise to seek out innovative means of resolving barriers to ITS deployment; and,

- Opportunity to provide input relating to the timing and phasing of the project deployment plan.

The following agencies, companies and organizations were represented at Workshop #2:

- Canada Customs & Revenue Agency
- Walinga Inc.
- University of Manitoba
- Manitoba Health Emergency Services
- Web Wizards Inc.
- Transport Canada
- City of Winnipeg – Transportation
- Keystone Agricultural Producers
- Manitoba Agriculture and Food
- Winnipeg Police

- City of Winnipeg Fire Paramedic Services
- Manitoba Public Insurance
- Manitoba Transportation and Government Services:
  - Transportation Policy
  - Transportation Regulation
  - Engineering and Operations
  - Driver and Vehicle Licencing
  - Administrative Services

Individuals directly related to the project area of expertise and others in the area of expertise reviewed the requirements of the priority projects. Participants were asked to provide input regarding specific components in the product cycle development process, as applicable:

- Concept development;

- Product development;

- Research;

- Pilot Project;

- Marketing;

- Implementation; and

- Management.

As a result of the input received through the February 2003 workshop, a number of additional priority projects were identified and detailed.

Subsequent to the February 2003 workshop, the Consultant Team created "project profiles" for each of the priority projects. The objective and contents of the project profiles are detailed in the following section. The relevant stakeholders, Project Steering Committee members and other affected parties were contacted by the Consultant Team to review, in detail, the:

- Project profile content and scope;

- Potential resource commitments; and

- Estimated deployment timelines.

This final consultation was undertaken to ensure that all comments were received and the details of the projects had been accurately documented and confirmed.

Exhibit 5-1 includes a summary of the final list of the twelve projects to be included in the Plan. Each project was given a reference number based upon their primary User Service. The projects are listed in order of their User Service bundle specified in the Canadian ITS Architecture and arbitrarily numbered sequentially within those bundles.

Exhibit 5-1: Identified ITS Strategic Projects	
Project Reference	Project Name
TI-1	Highway 75 Traveller Information System
TM-1	Winnipeg Traffic Signal System
TM-2	Manitoba ARWIS Expansion
TM-3	Winnipeg Emergency Vehicle Priority
TM-4	Active Seasonal Roadway Weight Limits
TM-5	Work Zone Traffic Management
PT-1	Winnipeg Transit Vehicle Management and Real-Time Schedule Information
EP-1	Electronic Transit Fare Collection
CV-1	Expansion of Commercial Vehicle Enforcement (WIM and AVC)
CV-2	On-Line Commercial Vehicle Credentials and Reporting
VSC-1	Active Advance Hazard Warning
IW-1	Automated Data Capture for Incident Reporting and Offences
Notes: TI – Traveller Information VSC – Vehicle Safety and Control TM – Traffic Management EP – Electronic Payment PT- Public Transport CV- Commercial Vehicle IW – Information Warehouse	

5.1.3   PROJECT PROFILES

A one-page "project profile" was developed for each of the short-listed strategic projects to provide a brief summary of the details of the project. A summary template was developed to allow for easy consumption and review by the stakeholders and others, by providing a common format and a consistent level of detail for all projects.

The project profile summaries include:

- **Project Title and Reference Number** as noted in **Exhibit 5-1;**

- **ITS Definitions** – Identification of the components of the ITS architecture that are applicable to the project, including User Services, User Sub-services and Market Packages;

- **Project Description** – A brief description of the project highlighting the principle components and a direct reference to one or more needs from Task 1 that are being addressed by the initiative;

- **Benefits** – The nature of the anticipated benefits and the key beneficiaries;

- **Project Logistics** – A description of the related ITS and other on-going projects external to the Plan, the technologies required to implement the initiative and the required resources;

- **Participants** – Categorization of participants into lead and supporting participants as a function of there expected involvement in the project;

- **Barriers** – Identification of any known barriers to implementation including organizational, financial, legal, user acceptance or technical impediments;

- **Implementation Time Frame** – The implementation time frame including an estimation of the start date; and

- **Evaluation** – A description of the measures of effectiveness and the methodologies to evaluate the relative success of the project.

Project profiles for the finalized list of strategic projects are included in the following pages.

5.2 Deployment Plan

5.2.1 DEPLOYMENT SCHEDULE AND PHASING

Having outlined the priority ITS projects for Manitoba, attention was turned to determining realistic schedules for the various phases of their deployment. Consideration was given to funding availability, current operations of the participating jurisdictions/agencies, related ITS and traditional transportation projects and initiatives, identified barriers to implementation, etc., as the deployment planned was developed.

Preliminary input regarding the scheduling of the priority projects was received through a group discussion during the Deployment Planning Workshop in February 2003. The Consultant Team, in consultation with the primary project participants and key supporting participants, further refined the deployment schedule subsequent to the workshop.

In order to better guide the implementation, allow for evaluation of progress, and permit proper allocation of financial resources, the deployment schedules for the various projects have been sub-divided into major phases, as applicable, and include the following categories:

- Planning, legislation and research activities;

- Design of the system or infrastructure;

- Procurement of the required technologies and pilot project installation; and/or

- Full deployment or construction of the project.

Included in **Exhibit 5-2** is a summary of the estimated project implementation time frames. It should be recognized that implementation schedule reflects the workable time for each project, *should project funding be available*.

The proposed timeframes are subject to further fine-tuning and definition though the project development process. It is the responsibility of the lead participants to take the initiative to draw upon the information as provided through the Strategic Planning process, and assemble the appropriate rationalization and coordination of resources required to undertake the projects. The rationale behind the project timelines and phases are outlined below.

The Deployment Schedule was given a start year of 2004. It is recognized that certain components of the priority projects have been already or would be initiated in the current year (2003), particularly some of the planning and research activities; however, key funding opportunities may not be available until the next fiscal year in many of the organizations and jurisdictions.

TI-1   Highway 75 Traveller Information System

The Province of Manitoba is currently participating in an Advance Traveller Information System (ATIS) project in Iowa. It is the intention to initiate the planning of the Manitoba ATIS system subsequent to the Iowa initiative to incorporate experience and "lessons learned" into the process. Accordingly, a project start date of 2008 has been identified for the planning component of this project. A duration of one year has been provided for each of the planning and design activities. Following these stages, a one year pilot project would be deployed on Highway 75 between Winnipeg and Fargo, North Dakota. In conjunction with the above two aspects of the study, the data structure and storage, as well as the functionality of a data warehouse can be determined by the participating jurisdictions and agencies.

Further deployment of the data warehouse and traveller information system would follow on the completion of the pilot project. It is anticipated that the next deployment would include the Highway 1 corridor, with emphasis on the Winnipeg to Regina, Saskatchewan section. It is estimated that full deployment will take one year to complete, including this Highway 1 corridor.

Pilot Project Cost (Highway 75): $600,000 to $1.2 million, as a function of hardware provided

TM-1   Winnipeg Traffic Signal System

The City of Winnipeg is currently undertaking a signal system upgrade in the Polo Park Mall/Stadium area. This project looks to improve Winnipeg's traffic signal system by upgrading/replacing the current fixed-time system with real-time corridor signal coordination.

It is anticipated that the design and pilot project stages of this project will be undertaken over the next twelve months. Following these stages, full deployment would be undertaken over the next four years.

Full Deployment Cost (50 to 100 signals): $1.5 to $3.0 million

TM-2   Manitoba ARWIS Expansion

The Province of Manitoba is currently seeking funding for four ARWIS stations to be located outside of the City of Winnipeg urban boundary on Highway 1, Highway 75 and the west Perimeter. Provincial Staff are currently participating in the National ARWIS Working Group, which are undertaking planning efforts to establish common data collection and storage protocols. Once initiated, twelve months have been allocated for the planning, design and tender of the four site installations. It is anticipate that the pilot deployments would be installed over the next six months. Full deployment beyond the pilot installations would occur over the next three years.

Pilot Project Cost: $250,000 to $300,000 for 4 sites

TM-3   **Winnipeg Emergency Vehicle Priority**

This project will look at introducing traffic signal priority for emergency vehicles along high priority routes. As the majority of the City's current signal controllers cannot readily accommodate emergency vehicle priority equipment, it is proposed that a pilot study be undertaken in conjunction with the traffic signal system pilot study being undertaken as part of Project TM-1: Traffic Signal System. The identification of other prior routes and full deployment would be undertaken coincident with other traffic signal system initiatives in the City.

Pilot Project Cost (30 to 35 signals): $300,000

Exhibit 5-2: Implementation Plan

		2004				2005				2006				2007				2008			
		QTR1	QTR2	QTR3	QTR4	QTR1	QTR2	QTR3	QTR4	QTR1	QTR2	QTR3	QTR4	QTR1	QTR2	QTR3	QTR4	QTR1	QTR2	QTR3	QTR4
TI-1	Highway 75 Traveller Information System																				
TM-1	Winnipeg Traffic Signal System																				
TM-2	Manitoba ARWIS Expansion																				
TM-3	Winnipeg Emergency Vehicle Priority																				
TM-4	Active Seasonal Roadway Weight Limits																				
TM-5	Work Zone Traffic Management																				
PT-1	Winnipeg Transit Vehicle Management and Real-Time Schedule Information																				
EP-1	Electronic Transit Fare Collection																				
CV-1	Expansion of Commercial Vehicle Enforcement (WIM and AVL)																				
CV-2	On-Line Commercial Vehicle Credentials and Reporting																				
VSC-1	Active Advance Hazard Warning																				
IW-1	Automated Data Capture for Incident Reporting and Offences																				

Legend:
- Planning/Legislation/Research
- Design
- Procurement/Pilot Deployment
- Deployment/Construction

TM-4   Active Seasonal Roadway Weight Limits

This project will look at the possibility of a dynamic system to identify weight limits for commercial vehicles based on weather and pavement conditions. The first phase of the project will be a planning component to review and update previous research undertaken by the University of Manitoba Transport Information Group (UMTIG) and determine an area or corridor in the Province that may benefit the most from this new system of applying seasonal weight limits. The design of the data collection and analysis systems would follow the planning phase and would include the selection of a preferred technology. It is anticipated that these two components would span two years. A two-year pilot study may be established on key corridors based on the findings of the planning phase. Based on the success of the pilot study, full deployment may occur over the next three to four years.

Pilot Project Cost: $100,000 to $200,000 for test site at existing/proposed ARWIS station

TM-5   Work Zone Traffic Management

The first phase of this project would involve the design of a standard package of ITS components for work zone traffic management. The duration of this phase is anticipated to be six months. In the following twelve months, the resulting work zone management system would be deployed at one major construction project. Following a refinement of the standard package design, based on the pilot installation, additional systems would be purchased over the next three years for deployment at all major construction projects in the Province.

Deployment Cost: $300,000 to $500,000 (including four PCMS, two local Highway Advisory Radio and software)

PT-1   Winnipeg Transit Vehicle Management and Real-Time Schedule Information

The City of Winnipeg Transit Department is currently undertaking planning efforts to review the implementation of a transit management and user information system. It is anticipated that the planning phase will be undertaken over the next two years.

An initial implementation of the system would be undertaken over the subsequent two years and would include transit vehicle tracking/management and an initial deployment of kiosks and/or passenger information displays. These components are anticipated to be completed in approximately eighteen months. Full deployment of the system would follow.

Pilot Project Cost: $300,000 to $500,000

Full Deployment Cost: $2 to $4 million

EP-1   Electronic Transit Fare Collection

There are current efforts by the Integrated Mobility Systems (IMS) Consortium to conduct a worldwide investigation of best practices for the design, procurement and operation of electronic fare collection systems. It is recommended that this project be initiated in 2005 to build upon the IMS initiatives and any resultant findings. The first six-month stage would be a planning component to establish the participating agencies/service providers and review specific needs of the Winnipeg and Brandon transit systems. A pilot deployment would follow and could be coordinated with other deployments associated with the IMS Consortium initiatives. Pilot deployment would be undertaken over the next two years, followed by full deployment.

Deployment Cost: $6.5 to $7.0 million

CV-1   Expansion of Commercial Vehicle Enforcement

The first component of the project would involve a planning component to review the existing data/information collection efforts and the potential to use this information for enforcement and pavement maintenance activities. A design phase would be initiated to review the data processing and information dissemination components. It is anticipated that these two phases would be undertaken concurrently and would have a duration of approximately two years. Following these phases, a one-year pilot project would be undertaken for a number of roadways in rural Manitoba. Full deployment would occur on key corridors over the following two or three years.

Scoping Study Cost: $80,000 to $100,000

Integration Cost: $300,000

CV-2   On-Line Commercial Vehicle Credentials and Reporting

The first phase of this project would review the functional requirements of the system to accommodate the current jurisdictional requirements. It is anticipated that this phase will span twelve months from the start of 2004. Full deployment would be undertaken over the next two years.

Function Requirements Document Cost: $60,000 to $80,000

Deployment Cost: $250,000

VSC-1   Active Advance Hazard Warning

The first year of the project will involve a planning exercise to establish site selection criteria and determine critical locations within the Province for deployment. Deployment of the systems will be undertaken over the next four years.

Scoping Study Cost: $50,000

Deployment Cost: $30,000 per intersection

IW-1   **Automated Data Capture for Incident Reporting and Offences**

This project would build upon the current TraCS (Traffic and Criminal Software) project being undertaken in Iowa. Accordingly, a joint planning and design phase will be undertaken over the next twelve to eighteen months to review system functions, interoperability between jurisdictions and software customization requirements. This task will be undertaken in association with a number of Canadian jurisdictions under the Traffic Related Data Strategies (TREDS) project. Subsequently, full deployment would commence and would span approximately two years.

Full Deployment Cost: $1.0 million

5.2.2   RELATED DEPLOYMENT – ITS AND BORDER SECURITY

In the wake of the terrorist attacks of September 11, 2001, Canada and the United States signed the Smart Border Declaration, December 2001 which outlined a 30 point action plan to improve the security and efficiency of ports of entry. One of those points of action acknowledged the role of intelligent transportation systems to help facilitate these objectives for ports of entry, and in particular, for land crossings and intermodal terminals. The ITS industry provides the opportunity to utilize readily deployable technologies and integrated systems in order to improve security, safety and efficiency at the border. In many cases, the enabling technologies, such as Radio Frequency (RF) identification, are well established and proven. However, there are a number of relevant new technology areas such as biometrics, and electronic seals that involve technologies which are at the development or prototype phase. Their implementation will be dependent on resolving a wide range of institutional barriers stemming from the broad range of agencies and legacy systems involved at the border. In the near term, it is vital that ITS solutions be included in order to provide some measure of remedial response to border congestion. In the longer term, ITS should be considered to be an integral component for the various border infrastructure expansions being contemplated.

ITS border applications could be characterized in a geographic sense starting from the border crossing itself, and working out to a region-wide perspective:

- Expedited processing at the primary inspection line (PIL).

- Priority access at the crossing for vehicles participating in expedited processing programs.

- Management of approaches to the border crossing site.

- Traveller information on a region-wide basis for vehicles approaching the border.

5.2.2.1 Expedited Processing

There are existing programs primarily led by customs and immigration authorities on both sides of the border to facilitate driver/vehicle pre-registration, automatic identification, and rapid processing at the border. The primary enabling technologies include RF identification tags for vehicles and smart cards, ultimately combined with biometrics for driver identification. The program for heavy vehicles and cargo is known as Free and Secure Trade (FAST) and is currently operating at major Canada/U.S. border crossings, with expansion plans including the Emerson-Pembina crossing by late 2003. The bilateral driver identification program is known as NEXUS, which is also currently in operation at major crossings, with expansion programs to include Emerson-Pembina by December 2003.

5.2.2.2 Priority Access

The pre-clearance programs such as FAST and NEXUS as noted above typically involve dedicated lanes for participating driver/carriers at the PIL. There is an issue at many crossings in that the geometric design and/or capacity at the site may restrict the ability for expedited vehicles to access the designated lanes. There is a role for a number of traffic management technologies, such as lane control signs to help separate the movement of expedited vehicles from other mixed traffic approaching the PIL. In some cases, infrastructure modifications are underway to help support this. As an example, there are plans to add a lane to the bridge deck for the Lewiston-Queenston bridge on the Niagara frontier, and to designate that lane for fast carriers in-bound to the U.S. At land crossings that are not characterized by bridge infrastructure, such as the case at Emerson, there is greater opportunity to provide infrastructure and associated traffic management systems to facilitate priority access at lower costs.

5.2.2.3 Management of Roadway Approaches

The provinces, states and local municipalities play a key role in providing traffic management on the approaches to the border sites. This is particularly important under "Code Orange" scenarios wherein there may be extensive queuing at the crossings, and also at sites such as the Niagara frontier and the B.C.-Washington crossings where there are parallel alternate routes to provide the opportunity for demand balancing. In both these regions, the provinces have invested in advanced traffic management systems technology to monitor queues and provide advisories to motorists in order to improve safety through reduction of queue-end collisions, as well as balance traffic demand on parallel approaches as follows:

- the Peace Bridge and the Lewiston-Queenston bridge on the Niagara frontier;

- Highway 99 and Highway 15 crossings on the B.C.-Washington frontier.

5.2.2.4 Traveller Information

As the Advanced Traffic Management System (ATMS) capabilities continue to expand on approaches to the border, it is important to use a range of technologies such as the internet, Dynamic Message Signs, and Highway Advisory Radio in order to provide advance information to carriers and travellers. As an example, the Ministry of Transportation, Quebec is presently posting border delay information and camera images for the Lacolle-Champlain

crossing. The U.S. Department of Homeland Security currently posts border wait times for all crossings on their web site, however for most sites this is anecdotal information as the automated data collection systems are not yet in place.

In summary, there are important on-going system planning and deployment efforts by key border stakeholders including customs, immigration and transportation authorities on both sides of the border. It is important that these initiatives be orchestrated through joint planning and systems architecture initiatives in order to leverage the maximum benefit from these initiatives, and ensure the appropriate co-ordination with on-going border infrastructure development.

5.2.3   PROJECT PARTICIPANTS AND AVAILABLE RESOURCES

Recognizing that lead and supporting agency staff resources are essential in the initiation, management and/or undertaking of the strategic projects, a high level review of the project commitments for each major jurisdiction, agency or group was carried out. The primary objective of this exercise is review the commitments of the various participants, the nature of their roles and the timelines associated with these commitments. The implementation of the strategic projects can become hindered if considerable resources are required from key stakeholders through their participation as lead or supporting entities in a number of initiatives.

The lead and supporting participants were categorized based on the general groupings outlined in the **Step 3**: Opportunities Analysis, which covered the key beneficiaries and delivery participants of the Strategic Plan.

A matrix was developed, which tracks projects on one axis versus the various stakeholders, by category, on the other axis. The list of stakeholders is not meant to be exhaustive, but to include the major players that have the potential to be involved the planning and deployment activities for a number of projects. To better understand their commitments, in each case the participation was identified as a lead or supporting role in the project. Included in **Exhibit 5-3** is a summary of the projects mapped against the intended lead and supporting agency obligations, with the following groups identified:

- Owner/operators;

- Customer service providers;

- Researchers, enforcement authorities, emergency service providers; and

- Other agencies, jurisdictions or departments.

Exhibit 5-3: Agency / Jurisdiction Project Commitments

Project		Owner/Operators			Enforcement/Emergency Services					Research	Customer Service Providers				Other Participants					
		Manitoba Transportation and Government Services	Winnipeg Transit	Brandon Transit	Fire/Paramedic Services	Police Services	RCMP	Canada Customs and Revenue Agency	US Customs	University of Manitoba	Manitoba Public Insurance Corporation (MPI)	Manitoba Trucking Association (MTA)	Commercial Vehicle Operators	Canadian Automobile Association (CAA)	City of Winnipeg Public Works	Manitoba Agriculture and Food	Environment Canada	Rural Municipalities	Neighbouring Departments of Transportation	Manitoba Department of Justice
TI-1	Highway 75 Traveller Information System	Lead					Supporting	Supporting						Supporting					Supporting	
TM-1	Winnipeg Traffic Signal System				Supporting	Supporting									Lead					
TM-2	Manitoba ARWIS Expansion	Lead									Supporting			Supporting	Supporting	Supporting	Supporting			
TM-3	Winnipeg Emergency Vehicle Priority	Supporting			Lead	Supporting					Supporting				Lead					
TM-4	Active Seasonal Roadway Weight Limits	Lead										Supporting	Supporting					Supporting		
TM-5	Work Zone Traffic Management	Lead				Supporting					Supporting				Supporting					
PT-1	Winnipeg Transit Vehicle Management and Real-Time Schedule Information		Lead																	
EP-1	Electronic Transit Fare Collection		Lead	Lead																
CV-1	Expansion of Commercial Vehicle Enforcement (WIM and AVC)	Lead									Supporting	Supporting								
CV-2	On-Line Commercial Vehicle Credentials and Reporting	Lead						Lead	Supporting		Supporting	Supporting			Supporting					
VSC-1	Expansion of Active Advanced Hazard Warning	Lead									Supporting								Supporting	
IW-1	Automated Data Capture for Incident Reporting and Offences	Lead			Supporting	Supporting														Lead

■ Lead Participant   ▨ Supporting Participant

Based on a review of the planned roles, the following are concluded:

- Manitoba Transportation and Government Services represent the most significant presence among the proposed list of projects. Various divisions within MTGS will take a lead role in Eight projects including: Highway 75 Traveller Information System (TI-1), Manitoba ARWIS Expansion (TM-2), Active Seasonal Roadway Weight Limits (TM-4), Work Zone Traffic Management (TM-5), Expansion of Commercial Vehicle Enforcement (CV-1), Active Advanced Hazard Warning (VSC-1) and Automated Data Capture for Incident Reporting and Offences (IW-1).

- Winnipeg Transit is leading the two proposed projects related to transit technologies, namely Winnipeg Transit Vehicle Management and Real-Time Schedule Information (PT-1) and Electronic Transit Fare Collection (EP-1). The lead role in the development of EP-1 will be shared with Brandon Transit.

- The City of Winnipeg Public Works Department is identified as a participant in five projects. It will act as a lead in the Winnipeg Traffic Signal System (TM-1) and Winnipeg Emergency Vehicle Priority (TM-3) projects, and will support MTGS in the Manitoba ARWIS Expansion (TM-2), Work Zone Traffic Management (TM-5) and On-Line Commercial Vehicle Credentials and Reporting (CV-2).

- The University of Manitoba is being identified for involvement in two projects. The university will act in a supporting role providing research services for the Expansion of Commercial Vehicle Enforcement (CV-1) and Active Advanced Hazard Warning (VSC-1).

- Winnipeg Fire and Paramedic Services is to be involved in two projects. They will share the lead role with the City of Winnipeg Public Works Department in the development of a Winnipeg Emergency Vehicle Priority (TM-3) system. As well, they are to provide support in the Winnipeg Traffic Signal System (TM-1) project also to be headed by the City.

- Winnipeg Police Services is identified as a supporting participant in four projects: TM-1, TM-3, TM-5, and IW-1.

- With the inclusion of two commercial vehicle operations related projects, commercial vehicle operators and the Manitoba Trucking Association are included as participants, each in a supporting role for three projects (TM-4, CV-1, CV-2).

- Manitoba Public Insurance Corporation (MPI) is expected to take on the role of a supporting participant for four projects: TM-3, TM-5, CV-2 and VSC-1.

- The Canada Customs and Revenue Agency is included as a participant in two projects. They are identified as being in a lead role together with MTGS for CV-2 and in a supporting role for TI-1.

5.2.4   PARTNERSHIP AND PROJECT FUNDING OPPORTUNITIES

Project funding was identified as a barrier or issue in existing operations and maintenance of the transportation systems in Manitoba, as well as, a barrier in the implementation of a number of the ITS strategic projects. A review of potential partnership and funding opportunities was undertaken to determine programs that may be pursued by the lead participant(s) for each respective project. Provided in **Exhibit 5-4** is a summary of these current prospects.

Exhibit 5-4: Summary of Current Prospects	
Organization/Fund	**Description**
Transport Canada	
Strategic Highways Infrastructure Program (SHIP) http://www.tc.gc.ca/SHIP/menu.htm	In Budget 2000 the federal government announced that up to $600 million would be spent from 2002 to 2006 on highway construction and national system integration initiatives.
ITS Deployment and Integration Plan http://www.its-sti.gc.ca/en/its_deployment.htm	Program funds (through SHIP) cost-shared ITS initiatives as part of the ITS Plan for Canada (Deployment and integration of ITS across Canada).
Moving On Sustainable Transportation (MOST) Program http://www.tc.gc.ca/EnvAffairs/MOST/	The MOST Program will provide funding to help support projects that will: • Provide Canadians with practical information and tools to better understand sustainable transportation issues; • Encourage the creation of innovative ways to promote sustainable transportation; • Achieve quantifiable environmental and sustainable-development benefits.
Urban Transportation Showcase Program http://www.tc.gc.ca/programs/environment/urbantransportation/	Transport Canada will work in partnership with provinces and municipalities, to establish a number of transportation "showcases" in selected cities, for demonstrating and evaluating a range of urban transportation strategies within a broad planning framework.

Exhibit 5-4:	Summary of Current Prospects
Organization/Fund	**Description**
Freight Efficiency and Technology Initiative http://www.tc.gc.ca/programs/environment/freighttransportation/menu.htm	The five-year initiative is designed to reduce the growth of greenhouse gas (GHG) emissions from the freight transportation. It consists of the following three components: • Demonstrating and encouraging the uptake of innovative technologies and efficient best practices within the freight transportation sector through the Freight Sustainability Demonstration Program; • Soliciting the freight transportation industry's participation in emissions reduction initiatives through voluntary performance agreements; and • Increasing fuel efficiency and environmental training and awareness amongst freight operators and shippers.
Climate Change http://www.tc.gc.ca/programs/environment/climatechange/menu.htm	Transport Canada will continue to work with other federal departments, provincial transport departments, municipal governments and the broader transportation community to seek partnerships, and implement measures to reduce GHG emissions.
Provincial Governments	
Provincial Tax Credit Program	The provincial government offers tax credits for research and development firms within each province.
Ministry of Finance	
CCRA Refundable Tax Credits	The Canada Customs and Revenue Agency offers small and medium sized Canadian controlled businesses a refundable tax credit.
Industry Canada	
Lean Logistics Technology Roadmap http://www.infochain.org/roadmap/LRTM_en.html	Through the Technology Roadmap process, companies in the logistics sector can lever their resources and work with academia and governments to look into the future, in order to try to determine both where their specific market is going and the critical technologies that will be required. The development of the Logistics Technology Roadmap (LTRM) is overseen by a Steering Committee comprising of various working groups tasked with examining different areas of importance in the logistics sector. Industry Canada is providing resources to facilitate the development of the LTRM.

Exhibit 5-4: Summary of Current Prospects	
Organization/Fund	**Description**
Environment Canada	
Green Fund Climate Change Action Fund (CCAF) http://www.climatechange.gc.ca/ english/actions/action_fund/inde x.shtml	The Climate Change Action Fund (CCAF) was established in 1998 by the federal government to help Canada meet its commitments under the Kyoto Protocol to reduce greenhouse gas emissions. Operation of the CCAF is based on a number of principles: • Building where possible on existing initiatives and mechanisms; • Leveraging and cost-sharing with the provinces and the private sector; • Concrete milestones and demonstrable results; and • A transparent process that engages all relevant federal departments and agencies and external stakeholders.
Canada Infrastructure Program	
Physical Infrastructure Program http://www.tbs-sct.gc.ca/ino-bni/Main/main_e.asp	In partnership with provincial, territorial and local governments, First Nations and the private sector, Infrastructure Canada will help to renew and build infrastructure in rural and urban municipalities across Canada.
Strategic Infrastructure Program	Strategic investments are applied to key areas such as: • Water & waste water • Roads & transit • Recreational areas & tourism • Information technology
National Research Council	
Industrial Research Assistance Program (IRAP) http://www.nrc.ca/irap/home.htm l	IRAP's mandate is to stimulate wealth-creation for Canada through technological innovation. Our mission is to stimulate innovation in Canadian small and medium-sized enterprises (SMEs).
Transportation Association of Canada (TAC)	
http://tac-atc.ca/	TAC is a non-profit association of transportation stakeholders in government, private industry, and educational institutions. It is a neutral forum for gathering or exchanging ideas, information and knowledge in support of technical guidelines and best practices. In the past TAC has funded ITS projects that have Canada-wide installation potential (e.g. ARWIS).
PRECARN	
IRIS http://www.precarn.ca/IRIS/IRIS LOI/	The Institute for Robotics and Intelligent Systems (IRIS) is one of the Networks of Centres of Excellence (http://www.nce.gc.ca/) and has been in existence since 1990. IRIS is currently preparing its final application for NCE funding to take it to March 31st, 2005.

Exhibit 5-4: Summary of Current Prospects	
Organization/Fund	**Description**
T-GAP http://www.precarn.ca/iris/t-gap_(new).cfm	The IRIS Research Management Committee has allocated funds—referred to as the Technology-Gap Assistance Program (T-GAP)—to advance technologies that show commercial promise. The T-GAP Program is intended to support six-month projects with funding in the range of $40,000 to $60,000 per project.
Regional Alliance Program http://www.precarn.ca/PRECARNResearchProgram/alliance.cfm	Precarn's Alliance Program is aimed to foster the development of intelligent systems technologies in small and medium sized companies across Canada. Under the Alliance Program, Precarn will partner with a regional organization to help fund R&D projects. The Alliance Program is an important means of extending Precarn's reach into all regions of Canada.
U.S. Department of Transportation Federal Highway Administration	
TEA-21 – Coordinated Border Infrastructure Program http://www.fhwa.dot.gov/tea21/	TEA-21 authorizes the Federal surface transportation programs for highways, highway safety, and transit for the 6-year period 1998-2003. $140 million (USD) has been earmarked for the 2003 Coordinated Border Infrastructure Program. A focus of this program is on international coordination of planning, programming and border operation with Canada and Mexico relating to expediting cross border vehicle and cargo movements.

5.3 Develop Action Plan for Ongoing Evaluation

5.3.1 STRATEGIC PROGRAM MANAGEMENT

The goal of the Action Plan for Ongoing Evaluation is to design a framework for the stewardship of the overall Manitoba ITS Strategic Plan.

The specific tasks include:

- Project tracking process;

- Provide a resource group to make suggestions if a project is encountering difficulties;

- Maintain an ITS component on the MTGS website to provide future updates to ITS planning and deployment;

- Disseminate information on the ITS activities to stakeholders in the Province of Manitoba.

The tools to be used to oversee the Action Plan:

- Establishment of a permanent Manitoba ITS Steering Committee; and

- On-going engagement of stakeholders.

Establishment of Manitoba ITS Steering Committee

In order to maintain momentum and focus on the implementation of the Strategic Plan, it is extremely important to establish a permanent Manitoba ITS Steering Committee. The committee should consist of, as a minimum, representatives of:

- Manitoba Transportation & Government Services;

- Transport Canada;

- City of Winnipeg Transit

- City of Winnipeg Fire Paramedic Service; and

- A representative of the academic/research community in Manitoba.

The government members of the Steering Committee will share information on:

- Changes to Provincial institutional, legislative and technical barriers;

- Projected effects of policy and regulatory changes on the performance of the existing transportation infrastructure;

- Opportunities for ITS to address existing challenges in maximizing the efficiency of the existing infrastructure;

- Environmental, economic and social policies that can contribute to the development of the ITS infrastructure in the Province.

The academic/research member of the Steering Committee will provide input on:

- Opportunities to promote and apply ITS research in Manitoba;

- Opportunities for partnerships and the role of research centres of excellence in developing and implementing "early winner" ITS deployments.

Ongoing Engagement of Stakeholders

It is important to continue the efforts initiated through this project. It is recommended that the Manitoba ITS Steering Committee contact the stakeholders subsequent to the preparation of the final report to establish any further interest in ITS planning and deployment in Manitoba. From this effort, an ITS stakeholder list should be prepared and would be used to disseminate information resulting from Committee meetings, deployment project reports, Plan updates, etc.

The Manitoba ITS Website should be maintained as a means of providing a central contact point and to post announcements concerning staff changes, new projects, relevant events, and project progress reports. As a starting point, this report should be posted on the site for review and consideration by the stakeholders. For example, the MTGS could maintain an ITS section on their website.

5.3.2   ACTION PLAN STRUCTURE

The proposed frequency of the ongoing monitoring and maintenance of the Plan is outlined in **Exhibit 5-5**.

Exhibit 5-5:	Action Plan Activities	
Action Plan Activity	**Frequency**	**Tasks**
Steering Committee	4 times per year	• Meet via conference call • Discuss events which impact, or potentially impact the ITS Strategic Plan • Review overall Strategic Plan schedule • Review project status reports
Website	4 times per year	• Website to be updated 4 times per year, following each Steering Committee meeting • Website to report on key topics of discussion, and project status reports
Project Status Reports	One per year	• Project Managers requested to complete and submit annual status reports, using the standard template

5.3.3   STRATEGIC PROJECT EVALUATION

It is envisioned that the Manitoba ITS Strategic Plan be evaluated through collection of relevant "before" data, annual reviews of project progress, and a formal five-year update. The three components are outlined below:

Collection of "Before" Data

In **Step 2** of the Plan, general performance criteria were identified for each User Service for future evaluation purposes. These criteria were carried forward and mapped against the strategic projects to provide a basis to determine data collection needs, specifically, the "before" data requirements. Included in **Exhibit 5-6**, is a summary of the applicable performance criteria, by project. Also included in **Exhibit 5-6**, is a summary of the data that should be collected prior to the project initiation/implementation, to permit the assessment of the benefits.

		Step 2 – Performance Criteria											
Reference	Project	Reduction in Delay	Reduction in Fuel Used	Reduction in Pollutant Emissions	Increase in Schedule Reliability	Reduction in Collisions	Reduction in Response Time	Reduction in Duration of Incident	Level of User Acceptance/Satisfaction	Increase in Tourism-Related Revenue	Reduction in Public Cost	Improvement in Quality of Life	Before Data to be Collected
TI-1	**Highway 75 Traveller Information System**	◆		◆	◆				◆	◆		◆	• Number of "hits" on existing traveller information web sites • Number of telephone queries to the public and private sector organizations currently providing road condition and weather status • User surveys
TM-1	**Winnipeg Traffic Signal System**	◆	◆	◆							◆	◆	• Average delay incurred by vehicles in current system
TM-2	**Manitoba ARWIS Expansion**	◆				◆					◆	◆	• Number and rate of (total and fatal) collisions • Number and rate of (total and fatal) collisions per registered vehicle, where weather and/or road surface was a contributing factor • Coverage area per winter maintenance vehicle • Current annual budget spent by jurisdictions collecting data on road and weather conditions

Exhibit 5-6: Performance Criteria and Before Data Collection Requirements

		Step 2 – Performance Criteria											
Reference	Project	Reduction in Delay	Reduction in Fuel Used	Reduction in Pollutant Emissions	Increase in Schedule Reliability	Reduction in Collisions	Reduction in Response Time	Reduction in Duration of Incident	Level of User Acceptance/Satisfaction	Increase in Tourism-Related Revenue	Reduction in Public Cost	Improvement in Quality of Life	Before Data to be Collected
TM-3	Winnipeg Emergency Vehicle Priority					◆	◆	◆			◆	◆	• Average and/or maximum response time to incidents • Average length of deployment before incident is cleared • Number of accidents involving emergency vehicles when responding to incidents
TM-4	Active Seasonal Roadway Weight Limits			◆							◆	◆	• Current restriction limits • Roadway maintenance records
TM-5	Work Zone Traffic Management	◆				◆			◆			◆	• Average vehicle speed in work zone • Number and rate of collisions in a work zone • Average delay per vehicle incurred in work zones • User attitudes survey
PT-1	Winnipeg Transit Vehicle Management and Real-Time Schedule Information	◆	◆		◆				◆			◆	• Annual ridership • Percentage of on-time performance • Number of schedule-related complaints • User attitudes survey
EP-1	Electronic Transit Fare Collection	◆							◆		◆	◆	• Average fare transaction time • Annual ridership • User attitudes survey
CV-1	Expansion of Commercial Vehicle Enforcement	◆	◆	◆	◆	◆			◆		◆		• Average vehicle inspection times • Current enforcement resources

Exhibit 5-6: Performance Criteria and Before Data Collection Requirements

Exhibit 5-6:	Performance Criteria and Before Data Collection Requirements												
		Step 2 – Performance Criteria											
Reference	Project	Reduction in Delay	Reduction in Fuel Used	Reduction in Pollutant Emissions	Increase in Schedule Reliability	Reduction in Collisions	Reduction in Response Time	Reduction in Duration of Incident	Level of User Acceptance/Satisfaction	Increase in Tourism-Related Revenue	Reduction in Public Cost	Improvement in Quality of Life	Before Data to be Collected
VSC-1	**Active Advance Warning System**					◆					◆	◆	• Number and rate of (total and fatal) collisions in deployment locations
IW-1	**Automated Data Capture for Incident Reporting and Offences**										◆		• Credential review and clearance times • Existing system operating costs

Annual Review

As the implementation plan is built upon a start date of 2004, it is recommended that a yearly review of project progress be undertaken to identify deviations from the original scope or time frames. To assist in the timely and consistent review of the project progress by each lead jurisdiction, a common template should be developed. Provided in **Exhibit 5-7** below is the major components and the associated content that could be included in the template.

Exhibit 5-7: Annual Project Progress Review	
Item	**Content**
Project Name and Reference Number	Project name and reference number as identified in the ITS Strategic Plan
Activities completed to date	A brief outline of major tasks completed to date with reference to the deployment plan schedule. A revised schedule of project activities should be included, as applicable.
Changes in project scope, if any	As the projects proceed, it may be advantageous to revise the scope of the project to better suit the needs and opportunities presented. Any major changes in scope should be identified including the primary reasons for the change.
Technology advancements	Given the nature of the technologies required for many of the projects, it is anticipated that advancements in technology will occur over time and during the project implementation. Any progression in a technology field should be identified.
Evaluation of system, if applicable	Both qualitative and quantitative evaluation of the project should be provided.
Revised list of participants	If any changes have been made to the lead and supporting participants, the modifications should be identified and reasons provided.
Partnership opportunities	Identification of partnerships that have been developed for the project. Details regarding the nature and extent of and the motivation for the partnership should be provided for others to take into account.
Funding opportunities	All internal and external funding that has been obtained or earmarked for the project should be identified. "In-kind" services should be included in this summary.
Barriers	Any barriers encountered in the project implementation or completion should be identified including their impact on the project progress. Measures undertaken or to be considered to remove the barriers should be acknowledged.
Lessons Learned	Provision of any lessons learned that may prove beneficial to other projects, jurisdictions or companies.

Sample Template

This evaluation form would be distributed to the lead participant(s) for each project in January of each year starting in January 2005. Electronic distribution of the evaluation form is recommended to permit timely response and the ability to forward the form if the responsible agency or individual has changed over the course of the project. The annual report will be compiled and distributed by the Steering Committee and posted to the website.

Plan Update (Five Year Review)

It is recommended that a five year review of the Plan be undertaken to ensure that the Plan is a "living document" reflects the Province's current needs, opportunities and objectives, as they relate to ITS services. As noted in **Section 5.3.1**, it is recommended that a Steering Committee be established for the ongoing monitoring and management of ITS deployment in Manitoba. It is anticipated that the ITS Steering Committee would undertake a five year review of the plan, the scope of which would be determined at the time of its commissioning.