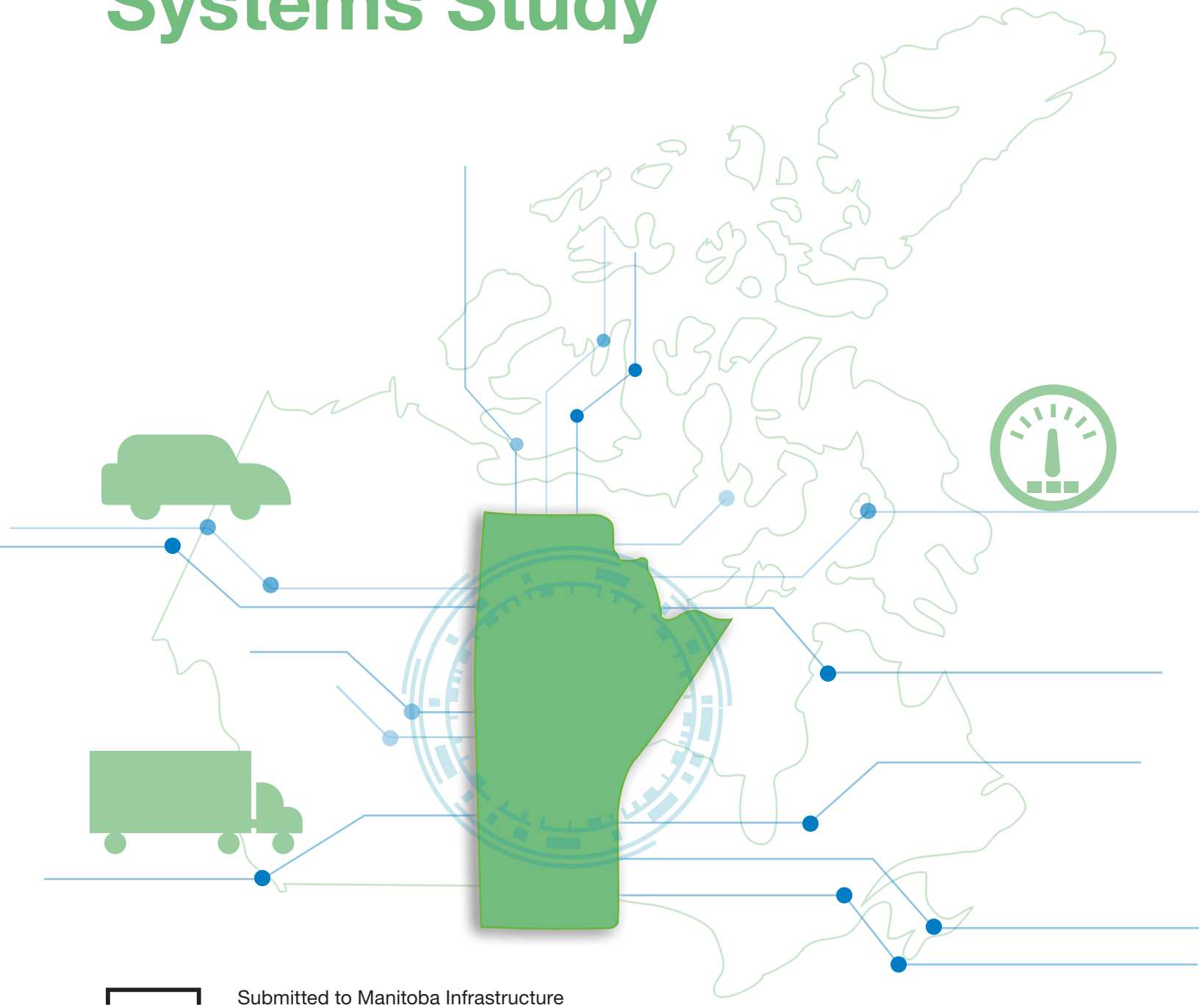
Manitoba

Final Report

Intelligent Transportation Systems Study



IBI

Submitted to Manitoba Infrastructure
by IBI Group

October 26, 2018

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Report Acronyms

ACV	Automated and Connected Vehicles
APTS	Advanced Public Transportation Systems
ALPR	Automatic License Plate Recognition
ARPS	Advanced Routing and Permitting System
ATDM	Active Transportation and Demand Management
ATMS	Advanced Traffic Management System
ATIS	Advanced Traveller Information System
AV	Automated Vehicle
AVC	Automatic Vehicle Classification
BIIS	Bridge Inventory Inspection and Information System
BIFA	Border Infrastructure Flow Architecture
BMS	Bridge Management System
BNSF	Burlington Northern and Santa Fe
BPOC	Bi-National Port Operations Committee
BTT	Information Technology Services
C2C	Centre to Centre
CAA	Canadian Automobile Association
CBP	U.S. Customs and Border Protection
CBSA	Canada Border Services Agency
CCMTA	Canadian Council of Motor Transportation Administrators
CCTV	Closed Circuit Television
CDPD	Cellular Digital Packet Data
CNR	Canadian National Railroad
CPS	Carrier Profile System
CPU	Central Processing Unit
CV	Connected Vehicle
CVISN	Commercial Vehicle Information Systems and Network
CVO	Commercial Vehicle Operations
CVRIA	Connected Vehicle Reference Implementation Architecture
DOT	Department of Transportation
DSRC	Dedicated Short Range Communications
DMS	Dynamic Message Sign

EMO	Emergency Management Operations
EOC	Emergency Operations Centre
FAST	Free and Secure Trade
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FTE	Full Time Equivalent
GIS	Geographical Information System
GPS	Global Positioning System
GSA	U.S. General Services Administration
HAR	Highway Advisory Radio
HAZMAT	Hazardous Material
HCM	Highway Capacity Manual
IP	Internet-based Protocol
ISTEA	Intermodal Surface Transportation Efficiency Act
ITS	Intelligent Transportation System
JWC	Joint Working Committee
LED	Light Emitting Diode
LOS	Level of Service
LPR	License Plate Reader
MAP-21	Moving Ahead for Progress in the 21st Century
MASAS	Multi-Agency Situational Awareness Systems
MDSS	Maintenance Decision Support System
MIGS	Manitoba International Gateway Strategy
MI	Manitoba Infrastructure
MOE	Measure of Effectiveness
MPV	Minutes per vehicle
MTQ	Ministere des Transports Quebec
NEMA	National Electrical Manufacturers Association
NEPA	National Environmental Policy Act
NEXUS	Canada-US Trusted Traveller Program
NB	Northbound
NDDOT	North Dakota Department of Transportation
NDHP	North Dakota Highway Patrol

Report Acronyms

NHS	National Highway System
NITTEC	Niagara International Transportation Technology Coalition
NTCIP	National Transportation Communications for ITS Protocol
NWPTA	North West Partnership Trade
NYDOT	New York State Department of Transportation
O/D	Origin and Destination
PIC	Partners in Compliance
PIL	Primary Inspection Lane
POE	Port of Entry
PR	Provincial Road
PSC	Project Steering Committee
PTH	Provincial Trunk Highway
PTZ	Pan/Tilt/Zoom
RCWS	Remote Control Weigh Station
RFID	Radio Frequency Identification
RFP	Request for Proposal
RCC	Regulatory Cooperation Council
RRFB	Rectangular Rapid Flash Beacon
ROI	Return on Investment
ROM	Rough Order of Magnitude
ROWS	Remote Operated Weigh Station
RWIS	Road and Weather Information System
SB	Southbound
SC	ITS Steering Committee
SCMS	Security Certificate Management System
SDI	Spatial Data Infrastructure
SHS	Strategic Highway System
SW	Southwest
TBWG	Transportation Border Working Group
TC	Transport Canada
TDM	Transportation Demand Management
TMC	Traffic Management Centre
TSM	Transportation Systems Management
U of M	University of Manitoba
US	United States
USDOT	U.S. Department of Transportation

V2I	Vehicle to Infrastructure
V2R	Vehicle to Roadside
V2V	Vehicle to Vehicle
VACIS	Vehicle and Cargo Inspection System
VDS	Vehicle Detection Station
VMS	Variable Message Signing
VPH	Vehicles per Hour
WAN	Wide Area Network
WIM	Weigh in Motion

Executive Summary

1

The purpose of this study is to identify Intelligent Transportation Systems (ITS) applications that can support Manitoba Infrastructure's (MI) objectives related to improving trade facilitation, motor carrier enforcement, traffic management, road safety, traveller information, and data sharing and coordination.

Under the management of the Transportation Systems Planning and Development branch of the Engineering and Operations Division, and supported by a Project Steering Committee (PSC) established to provide oversight and guidance to the study development, this study was undertaken over three phases encompassing:

- Phase 1) ITS inventory, needs assessment, and environmental scan;
- Phase 2) ITS program development; and,
- Phase 3) deployment planning, ultimately leading to this final report which synthesizes the key findings and recommendations.

Manitoba's ITS investments to date have been limited, but targeted towards priority areas related to road and weather systems, commercial vehicle operations, and traveller information. In addition to these deployments, there are also a number of existing and planned ITS technologies at the Pembina-Emerson Port of Entry related to advance notification, lane assignment, traffic monitoring and trusted trader (FAST) / trusted traveller (NEXUS) programs that are the responsibility of either highway agencies (ie. MI / NDDOT) or border service agencies (ie. CBSA / CBP).

In developing an ITS program for Manitoba, this study has followed an industry-standard needs based approach intended to provide traceably between recommended ITS investments and the original needs they are intended to address. The basic approach starts with needs as a foundational basis to identify ITS service packages from the Canadian ITS Architecture, aggregates them into major initiatives, which then form the basis of individual ITS projects.

A jurisdictional scan and ITS inventory **(Appendix A)** were conducted as base line inputs to this study. Based on consultation and interviews with representatives from various departments and stakeholder groups, a detailed inventory of 49 needs were compiled **(Appendix B)**, and used as a starting point for identifying ITS program initiatives. A set of eleven (11) ITS Initiatives **(Appendix C)** were then identified and presented to the PSC, prior to the development of constituent projects **(Appendix D)** and a deployment plan.

Recommended Projects

Each of the 11 initiatives was broken down into constituent projects. A total of 26 projects (Appendix D) were developed and included in a deployment plan spanning short (2018-2022), medium (2023-2027), and long term (2028-2032) investments. Exhibit 1 provides a synthesis of the recommended projects, their focus areas, time horizons, and rough order of magnitude (ROM) budget allocations based on an average ITS expenditure over the past 3-5 years.

Exhibit 1: Summary of Recommended Projects

Project Grouping & Time Horizon	FOCUS AREAS	Budget Placeholder
Program Management (ONGOING)	Business process, policy, evaluation, and research oriented studies.	**INTERNAL STAFF RESOURCES**
Foundational (2018-2020)	Traffic monitoring, core traveller information upgrades, and data warehouse architecture.	**$450K per year**
Short-term (2019-2022)	Traveller information, traffic management, commercial vehicle screening and permitting.	**$ 1M per year**
Medium to Long-term (2023-2032)	Functional and geographic expansion of short-term projects focusing on traffic management, traveller information, commercial vehicle safety and enforcement, and data warehousing	**TBD**

Recommended ITS Management Approach

This study also considered the management approach required to successfully support the proposed ITS deployment plan. The current organizational structure limits the departmental ability to plan, procure and operate ITS in an efficient and coordinated manner. In order to maximize benefits that can accrue from ITS implementation, this study recommends establishing an ITS Coordinator role within MI. This position will act as a champion for ITS and be responsible for guiding ITS plans and projects, coordinating branch inputs and preparing budgets from all business units, developing and maintaining a 5-year program and following up with various business units on deployment. The ITS Coordinator would also represent MI at external ITS stakeholder groups and facilitate the development external funding sources and partnerships.

Recommended Approach Towards Data Management

The current method of storing ITS data varies by department and project. Some are hosted in internal applications, some are hosted at vendor sites (i.e. 511) and some are cloud hosted solutions (i.e. RWIS). There is currently no common data warehouse for ITS data within the Government of Manitoba established for the purposes of storing data in common formats and making the data accessible to other departments or agencies. One of the key foundational projects identified relates to data management, in terms of auditing current data sources and establishing appropriate architecture for a new integrated ITS data warehouse.

Key drivers for a provincial data warehouse include increased efficiency, managing large and diverse volumes of data, automated data aggregation and transformation for the current business units' operational use, centralized data process and analysis, data sharing with partner agencies and dedicated staff resources to support business units operations. MI needs to review and adapt data management and warehousing practices to effectively deal with both current data issues and the additional data inputs that will be generated by future ITS implementation. The planning, design and implementation of a new data management system will take 1 to 2 years. The data warehouse will continue to grow over time as new ITS systems and processes are implemented. The costs for the data warehouse (capital and operating) will be identified as part of a prerequisite project where the formate and storage of existing data is audited and will vary greatly depending on the status of the Spatial Data Infrastructure (SDI) project and what can be leveraged from what is already complete.

Automated and Connected Vehicles

Connected Vehicles (CV) and Automated Vehicles (AV) are evolving rapidly, both technologically and institutionally. For roadway authorities, the key area of interest will be Vehicle to Infrastructure (V2I) requirements and the associated technical and financial considerations they would impose on roadside ITS infrastructure. As AV and CV technologies evolve and deploy, supporting architectures, standards, and communications platforms should be incorporated into ITS designs and specifications as they become available. While this information may not be available for input into short-term projects, their evolution should be closely monitored so that, where possible, ITS infrastructure to support any potential V2I operations has been appropriately considered.

Moving Forward

This ITS deployment study represents a proactive step by MI to plan for integrating ITS solutions into the Province's highway infrastructure and operations for current National Highway System (NHS) routes. This study provides overarching guidance to the department on the prioritization and sequencing of projects and resources required to implement a comprehensive ITS strategy. Given that the ITS environment is a rapidly changing industry, it will be important to revisit and update this document every two to three years to refine and realign strategies and projects based on changes in ITS technology, priorities, budgets and lessons learned.

2 Project Terms of Reference

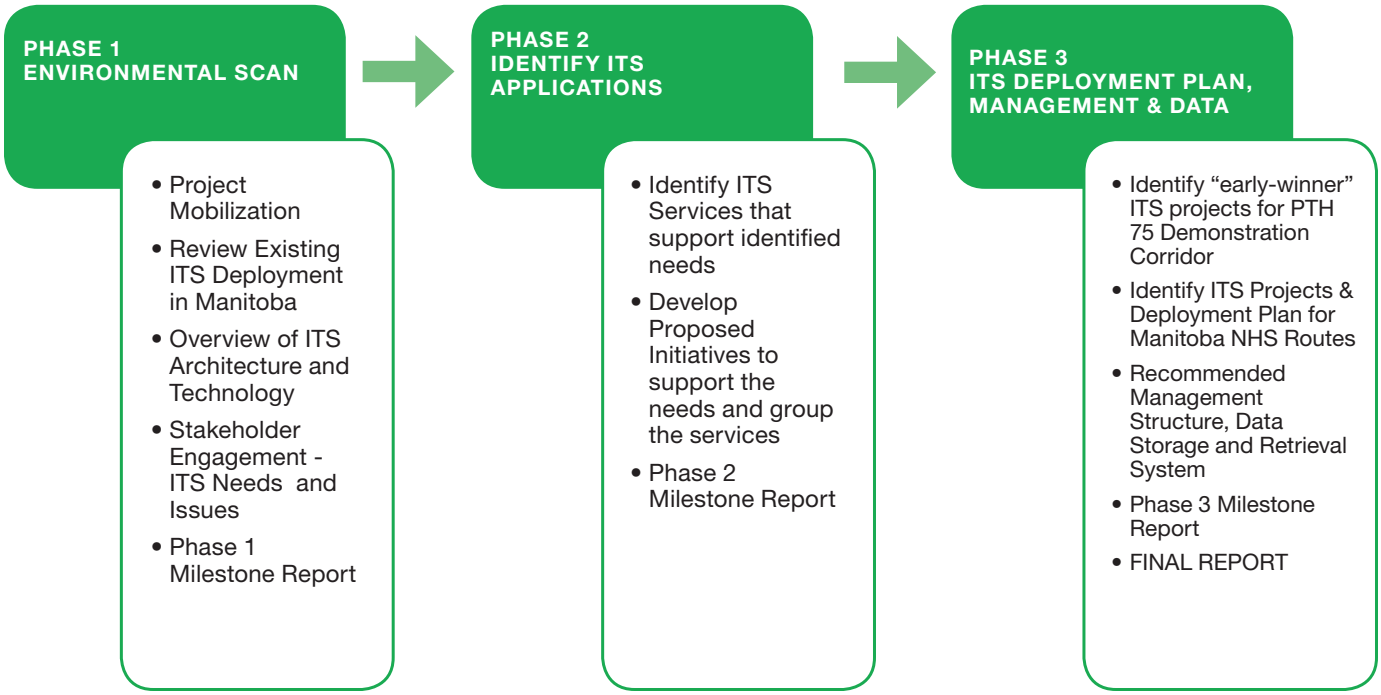
Manitoba Infrastructure (MI) originally developed the “Manitoba Intelligent Transportation Systems (ITS) Strategic Plan” in 2003. There has been significant industry evolution of ITS technologies and approaches since that time. Since 2003, The departmental approach to ITS has been somewhat fragmented and piece-meal with no clear organizational framework or resource commitments for coordinating ITS deployment.

The Terms of Reference (2016) for this study identified two principal objectives, namely to assess ITS required to facilitate trade, and to support motor carrier enforcement activities. The general scope associated with this study is as follows:

1. Review and assess current ITS applications in Manitoba.
2. Assess and recommend a suite of ITS applications targeted to address departmental priority areas over the short, medium and longer terms for:
    - Motor Carrier Enforcement
    - Trade Facilitation
    - Road and Weather Information to the Travelling Public
    - Road Safety
    - Asset Management
3. Detail the recommended suite of ITS applications into specific projects that can be pursued to address needs identified.
4. Prepare an ITS deployment plan with D-level capital costs and operating costs.
5. Evaluate and propose organization models for ITS management within the department as well as addressing ITS data management issues.

Exhibit 2 illustrates the activities and tasks undertaken to address the above objectives.

Exhibit 2: Study Work Plan



This ITS study was managed by the Transportation Systems Planning and Development branch of the Engineering and Operations Division, supported by a Project Steering Committee (PSC). The PSC was comprised of the following individuals:

Project Manager:

- David Lettner, Senior Transportation Planning Consultant

PSC Members:

- Ruth Eden, Assistant Deputy Minister, Engineering and Operations
- Erica Vido, Director Transportation Systems Planning & Development
- Glenn Cuthbertson, Director Traffic Engineering Branch
- Tim Brown, Director Motor Carrier Enforcement
- Brian Imhoff, Director Operational Services
- John Teillet, Director, Information Technology
- Brett Wareham, Director of Operations, Region 1: Steinbach Office
- Lawrence Mercer, Director Motor Carrier Enforcement Programs (retired)
- Maurice Alexander, Policy Consultant

Jurisdictional Scan

3

A review of ITS technology and architecture considerations was undertaken to determine options for insuring interoperability for any ITS elements that may support operations on Manitoba highway system NHS routes. This overview included a scan of neighbouring jurisdictions to determine what considerations related to specific ITS applications may benefit from regional harmonization. The jurisdictional scan included North Dakota, British Columbia, Alberta, Saskatchewan, Ontario and Quebec. Pertinent findings are discussed below with a summary provided in **Appendix A**.

- Both the Canadian and US ITS Architectures have been successfully used in efforts similar to the Manitoba ITS study where ITS solutions are mapped to needs. The Canadian ITS Architecture provides an important framework for describing how ITS can contribute to addressing key transportation challenges in Manitoba, especially along the NHS routes and at the Pembina-Emerson port of entry where a multitude of bi-national agencies and system interfaces may be needed. The jurisdictional scan supports the following best practices:
    - Developing an inventory of needs and mapping them to service packages in the Canadian ITS Architecture.
    - Using the Service Packages as the mechanism to map needs to ITS solutions, and to identify relevant and applicable standards for use in Manitoba – as a means to reduce risks and increase interoperability opportunities.
- Traffic Management and Traveller Information related ITS applications are foundational elements for overlaying other ITS solutions within neighbouring jurisdictions and are characterized by the following features:
    - Leveraging traffic, road, and weather monitoring technologies as the basis for enhanced traveller information services to increase mobility and improve safety.
    - Anchoring of key operations, systems, and decision making in a Transportation Management Centre environment.
    - Adopting open data and sharing policies to maximize benefits of ITS investments creating business intelligence.
- ITS applications to support goods movement in other jurisdictions has been implemented in a manner whereby harmonization in regional approaches and practices are being established. Commercial Vehicle credentials administration, electronic screening, and border operations by North Dakota, Ontario, Quebec (and to a lesser extent Alberta and Saskatchewan) are highly relevant to Manitoba. These applications also support the goals of the New West Partnership Trade Agreement (Manitoba, Saskatchewan, Alberta and British Columbia) which include trade and goods movement. Associated architectures and standards can be used as a starting point to pursue complementary applications in Manitoba.

ITS Inventory

4

An inventory of ITS deployments in Manitoba was compiled at the outset of this study to provide a baseline for overlaying study outcomes and recommendations relative to, and building upon, what exists today. The inventory was compiled using information on ITS deployments provided by Manitoba and included existing, proposed, and potential ITS applications and installations.

Exhibits 3, 4, and 5 are a graphical representation of the inventory of existing ITS deployments currently deployed on Manitoba's highway network from a provincial, municipal (Winnipeg Capital Region area), and at the Pembina-Emerson port of entry. The complete ITS inventory is included in **Appendix B**. As illustrated, ITS investments to date have been limited, but targeted towards priority areas related to road and weather systems, commercial vehicle operations, and traveller information are consistent with the foundational ITS applications implemented in many other jurisdictions. In this context, existing ITS deployments in Manitoba include:

- Road Weather Information System (RWIS), Cameras and Dynamic Message Signs (DMS).
- Weigh Stations and Inspection Stations.
- Weigh in Motion (WIM) and Automatic Vehicle Classifications (AVC) installations.
- Supporting systems such as Manitoba 511, and manual permitting, routing systems etc.

In addition to these deployments, there are also a number of technologies in use at the Pembina-Emerson Port of Entry in support of FAST and NEXUS programs by CBSA and CBP; these technologies include Radio Frequency Identification (RFID) readers, License Plate Readers (LPR), Dynamic Message Signs (DMS), and radiation portal monitors. Manitoba Infrastructure and other bi-national agency partners at the Pembina-Emerson port of entry are working on the deployment of other ITS in conjunction with the recommended long term improvements currently underway at the port.

It was noted that the lack of documented inventories or asset management databases created challenges in sharing asset details, age and location thereby making it difficult to confirm and account for the deployment of all ITS devises.

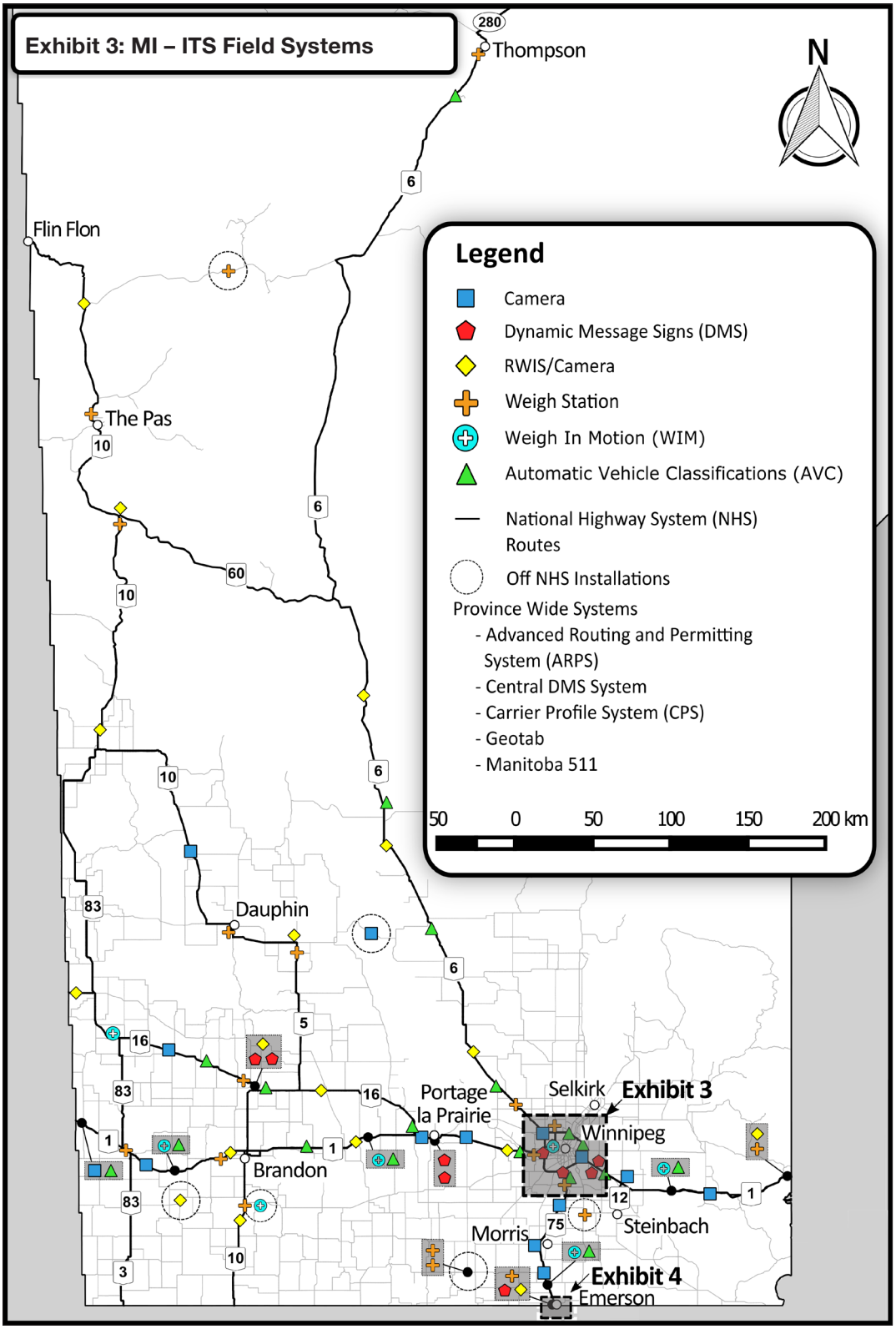


Exhibit 3: MI – ITS Field Systems
N
Legend
Camera
Dynamic Message Signs (DMS)
RWIS/Camera
Weigh Station
Weigh In Motion (WIM)
Automatic Vehicle Classifications (AVC)
National Highway System (NHS) Routes
Off NHS Installations
Province Wide Systems
- Advanced Routing and Permitting System (ARPS)
- Central DMS System
- Carrier Profile System (CPS)
- Geotab
- Manitoba 511
50 0 50 100 150 200 km
Thompson
Flin Flon
The Pas
Dauphin
Brandon
Portage la Prairie
Selkirk
Exhibit 3
Winnipeg
Steinbach
Morris
Exhibit 4
Emerson
280
6
10
60
83
5
16
1
12
75
3

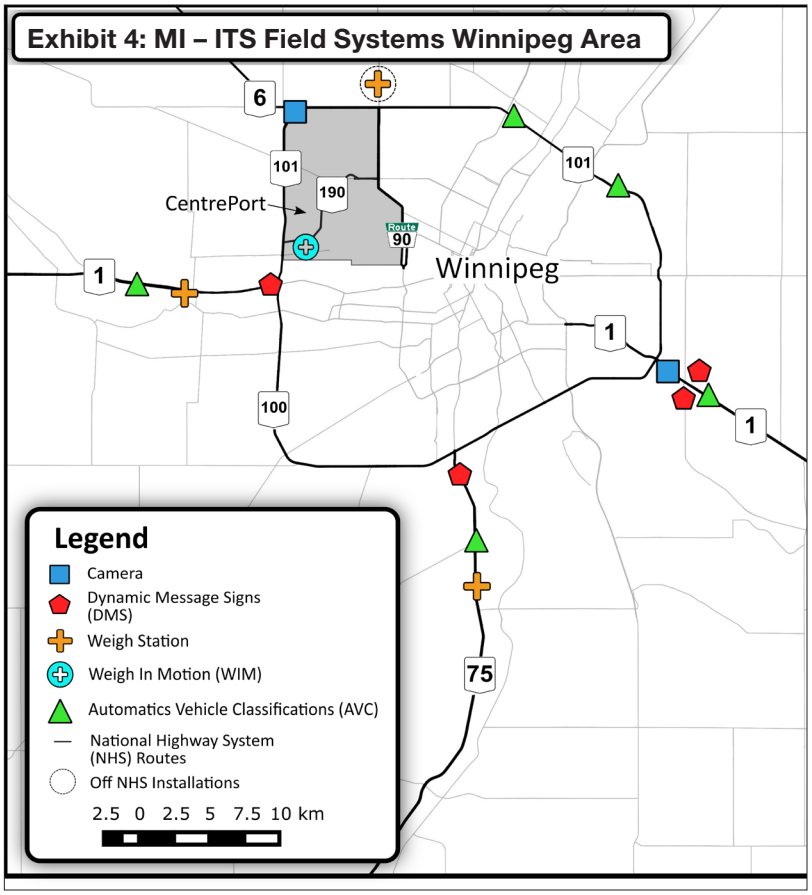
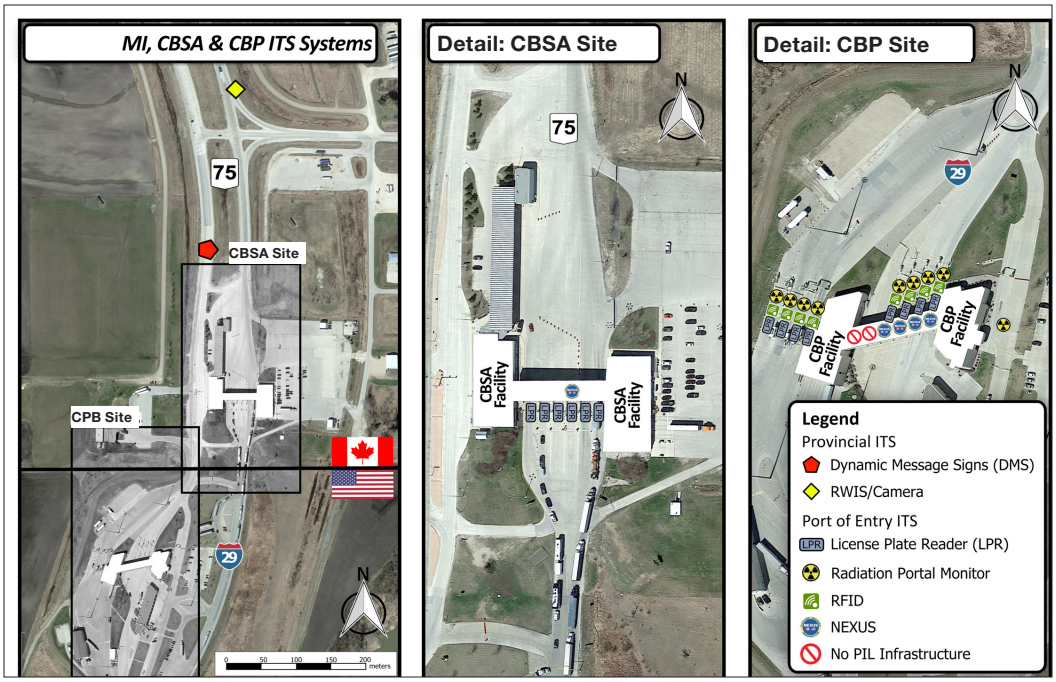


Exhibit 5: MI – ITS Field Systems at Pembina-Emerson Port of Entry



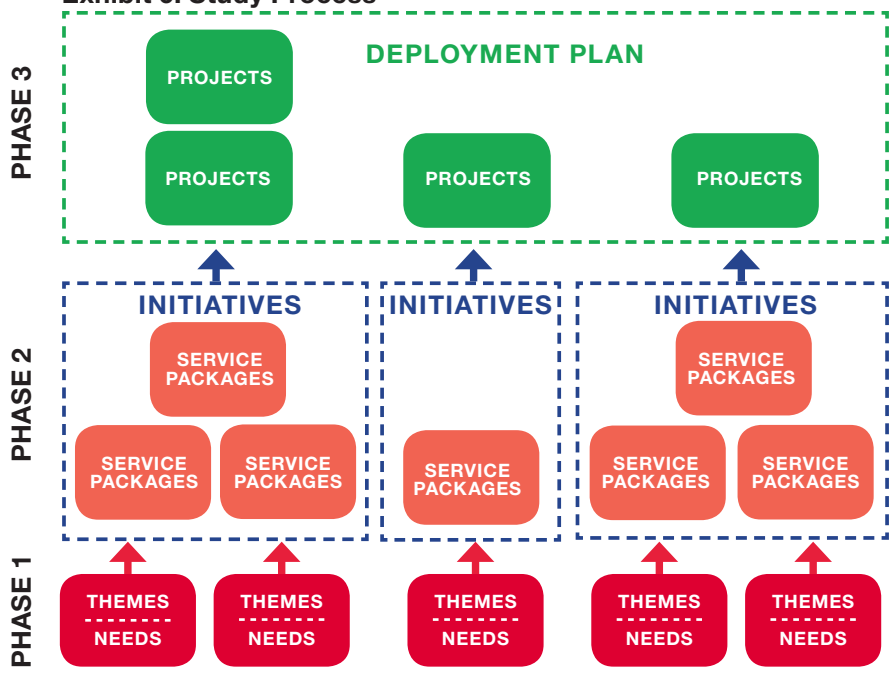
Study Process

5

This study followed a needs based approach consistent with industry best practices in ITS planning. **Exhibit 6** identifies which study phase each of the following four (4) stages in the ITS methodology were undertaken. The basic approach starts with needs as a foundational basis to identify ITS service packages from the Canadian ITS Architecture, then aggregates them into major initiatives, which then forms the basis of individual ITS projects; specifically:

- **Needs / Themes** are defined as the requirements identified by MI and other stakeholders as part of phase one of this study. The summarized list of needs are provided in this report and are used as input to the identification of ITS service packages and initiatives. The list of needs (49) were then distilled into nine (9) themes. (refer to **Appendix B**)
- **Initiatives** represent a logical grouping of potential service packages that can address similar needs and have similar stakeholders. Initiatives could also be viewed as programs that are managed by one group within the department as the lead for coordinating projects that will be developed to support the initiative. Each initiative will be supported by a group of projects that will be defined as part of the ITS deployment plan. (refer to **Appendix C**)
- **Service packages** are standardized groupings of ITS services that MI would want to implement for their operations and help to provide a bridge between initiatives and specific projects. These packages are standardized as part of the Architecture for ITS.
- **Projects** are more specific activities that will be implemented to support the specific initiative that further support the needs identified. Projects typically have a shorter implementation lifecycle (1-2 years) and include design, procurement and implementation activities. Projects can also include internal activities to organize or change department operations to better support the objectives of the department. (refer to **Appendix D**)

Exhibit 6: Study Process



In context of the approach presented in **Exhibit 6**, a number of consultative interviews were held with various stakeholder groups, to capture any issues which might assist in defining ITS needs. The stakeholder groups were organized thematically as follows:

- Pembina-Emerson Port of Entry (ie. NDDOT, CBSA, CBP, GSA)
- Motor Carrier Operations (ie. Motor Carrier Division, MTA)
- Trade and Economic Development (ie. Centreport Canada, Winnipeg Economic Development)
- Planning and Construction (ie. MI Engineering and Operations Division)
- Traveller Information and Open Data (ie. Operational Services, Travel Manitoba, CAA)
- Highway Operations (ie. Directors of MI Regional Operations, Regions 1-5)
- Emergency Management (ie. Operational Services, EMO, DFC)
- Municipal / Provincial Interface (ie. City of Winnipeg Public Works, MI)

The needs identified by the stakeholders aligned with the two over-arching objectives of this study, being: to assess ITS required to facilitate trade; and, to identify ITS to support motor carrier enforcement. A total of **49 key needs** were derived from this process and mapped to the following 9 general themes:

A Trade Facilitation

B Traveller Information

C Data Management

D Traffic Management

E Road Weather Management

F Pembina-Emerson Port of Entry Management

G Commercial Vehicle Management

H Asset Management

I Inter-Agency Coordination and Open Data

Appendix B presents the detailed listing of all 49 needs mapped to the above themes.

Based on the identified needs and the potential suite of ITS service packages that may be aggregated to contribute to addressing them, a set of **eleven (11) ITS Initiatives** were identified and presented to the PSC, prior to identification of constituent projects and a deployment plan. These initiatives are listed below and detailed in **Appendix C**:

1. Critical Network Traffic Monitoring
2. Expanded Network Environmental Monitoring
3. Enhanced Traveller Information
4. Traffic and Event Management
5. Cross Boarder Traffic Management
6. ITS Asset Management
7. Border/CentrePort Applications to Improve Trade
8. Commercial Vehicle Credentialing, Screening, and Inspection
9. Province Wide Data Warehouse
10. Research and Development
11. Institutional Collaboration

Using the ITS Architecture for Canada Version 2.0 as the reference, for each initiative, one or more associated ITS projects were developed to cover short, medium and long term horizons for future implementation. Among those projects, some of them were defined as “Foundational” ITS projects. “Foundational” ITS must be implemented prior to others, as the outcomes and systems implemented other province-wide projects. A total of 26 projects were identified. The projects are presented in Exhibit 8 including their relative alignment to their primary initiative. **Appendix D** contains detailed project sheets for the short-term project and thumbnails for the medium-long term projects.

Exhibit 8: Association Between ITS Initiatives and ITS Projects

Project No.	PROJECT NAME	Initiative No.	Initiative Name
1	Sensor Based Traffic Monitoring	1	Critical Network Traffic Monitoring
2	Probe Based Traffic Monitoring	1	Critical Network Traffic Monitoring
3	Traveller Information System Core Upgrade	3	Enhanced Traveller Information
4	Data Warehouse Audit and Architecture	9	Province Wide Data Warehouse
5	RWIS and Environmental Detection Expansion	2	Expanded Network Environmental Monitoring
6	Road Weather Forecasting and Operational Procedures	2	Expanded Network Environmental Monitoring
7	Traveller Information System Public Interface Upgrade	3	Enhanced Traveller Information
8	Border Traffic Management & Information System Concept of Operations	7 5	Border/Centre Port Applications to Improve Trade & Cross Border Traffic Management
9	Automated Electronic Permit and Routing System	8	Commercial Vehicle Credentialing, Screening, and Inspection
10	Electronic Screening for Commercial Vehicle Inspection Bypass	8	Commercial Vehicle Credentialing, Screening, and Inspection
11	Business Process and Policy Development	4	Traffic and Event Management
12	Develop and monitor ITS Research Program	10	Research and Development
13	Automated Weather Response Deployment	2	Expanded Network Environmental Monitoring
14	Enroute Systems Deployment	3	Enhanced Traveller Information
15	Traveller Information System Data Exchange	3	Enhanced Traveller Information
16	Traffic Management Centre	4	Traffic and Event Management
17	Border Traffic Management System Deployment	5	Cross Border Traffic Management
18	Industry and technology detailed Assessment for Secure Tracking	7	Border/Centre Port Applications to Improve Trade
19	MI Asset Monitoring Sensor Expansion	6	Asset Management
20	Corporate Asset Management System Integration	6	Asset Management
21	Integration of Asset Management GIS Data with Traffic Management Centre	6	Asset Management
22	Data Warehouse Development and Deployment	9	Province Wide Data Warehouse
23	Traffic Management System	4	Traffic and Event Management
24	Border Approach Demand Management	5	Cross Border Traffic Management
25	Pilot Program for Secure Container Tracking	8 7	Commercial Vehicle Credentialing, Screening, and Inspection & Border/Centre Port Applications to Improve Trade
26	Data Sharing and Analytics	9	Province Wide Data Warehouse

6 Findings & Recommendations

Deployment Plan Considerations

This section of the report summarizes key study recommendations related to a proposed management structure which can better support departmental ITS deployment, data management and warehousing issues as well as an ITS deployment plan which identifies project phasing and sequencing considerations. This section concludes with a brief discussion of automated and connected vehicles as well as a synopsis of the relevance of the plan to current government priorities.

ITS Management Considerations

Currently each branch within MI pursues ITS investments independently with no formal mechanism or process for internal consultation and coordination. Exhibit 9 illustrates that MI is currently situated within Stage 1 along an ITS coordination continuum. **Exhibit 10** illustrates the business units within MI that have some involvement in ITS projects. Typically, MI's Information Technology Services Branch provides linkages to MI's corporate services (focusing on operational needs) by providing project management, business analysis, and GIS services. Funding comes from the department or business unit initiating a project or operating the systems, with the central IT group, Business Transformation and Technology (BTT), playing an important role for managing contracts and vendor relationships. Currently 11 of the 24 branch business units (45%) have some ITS responsibilities.

However, as illustrated in **Exhibit 9**, the need for a coordinated approach to managing ITS planning, design, implementation, and operation increases as the scale and complexity of ITS deployment increases. While a fragmented and uncoordinated organizational approach to ITS does also exist in other jurisdictions that have minimal ITS investments, this organizational approach poses the following limitations:

- Absence of coordinated planning minimizes opportunities for systems integration, minimizes potential ITS benefits and often increases costs.
- Insufficient ITS coordination can lead to downstream interoperability issues as systems grow.
- Lack of data sharing can affect informed decision making. Poor data utilization can negatively impact decision-making.
- Uncoordinated maintenance can lead to negative operational results.

Exhibit 9: ITS Coordination Continuum

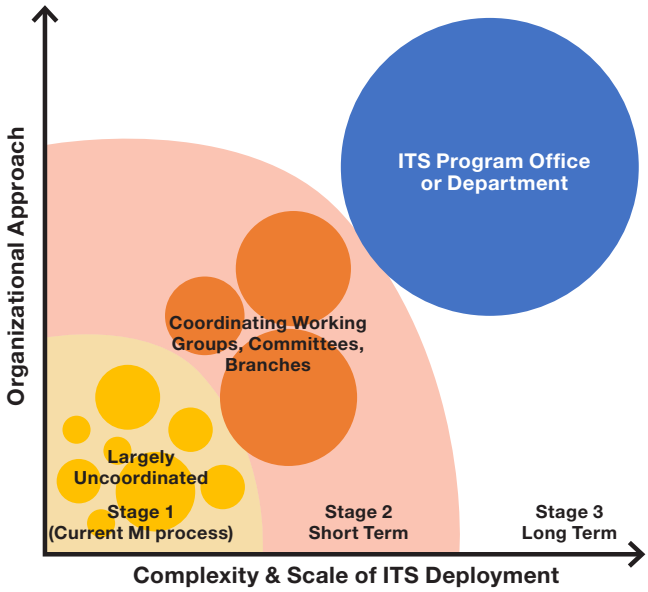
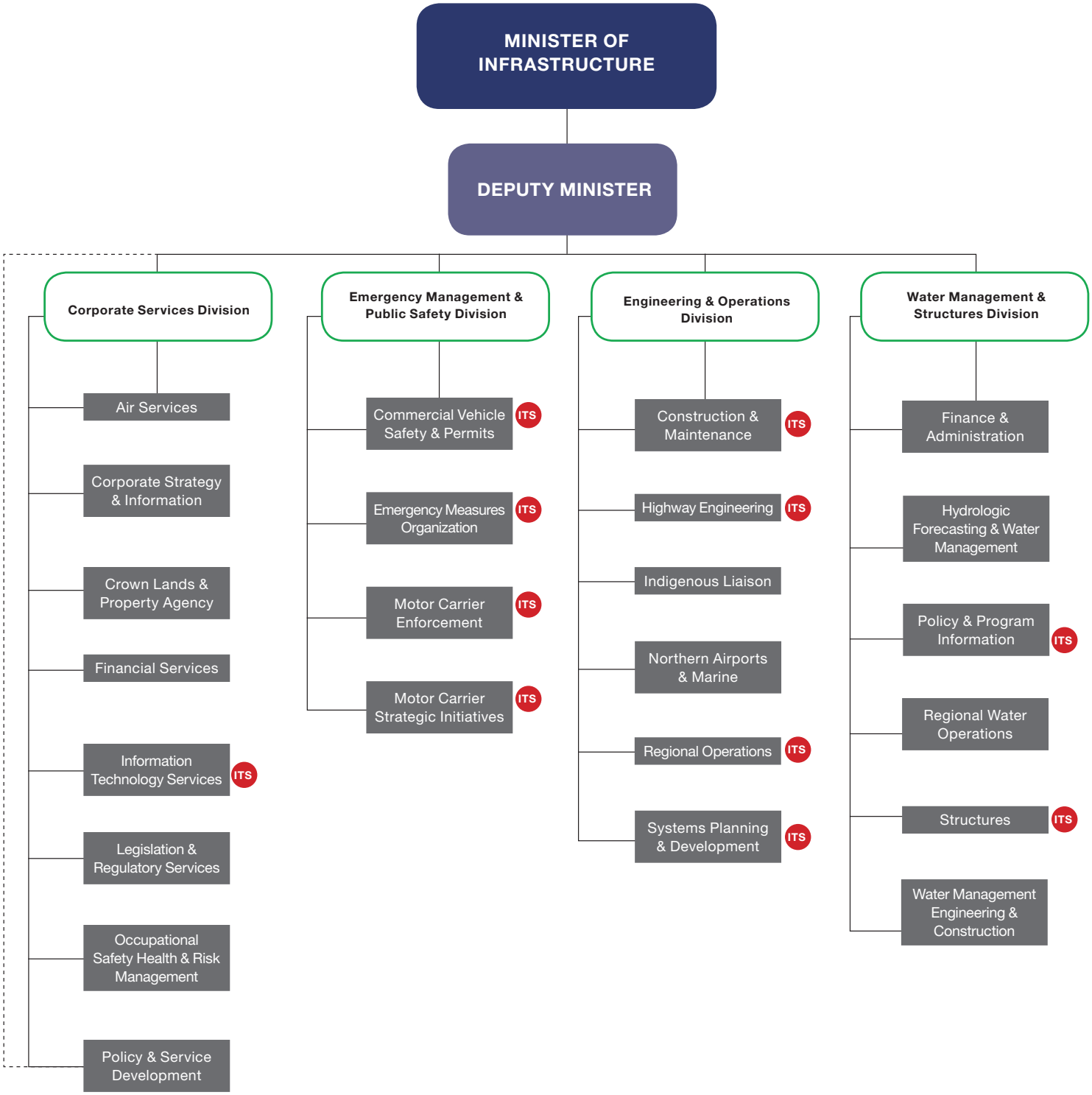


Exhibit 10: Existing MI Organizational Chart (October 2018) and ITS Departmental Business Unit Touchpoints



Under current conditions, the MI-ITS organizational approach is far too fragmented to facilitate optimum results. With any additional ITS deployments, as most certainly will be the case, the need to consider a more effective organizational model becomes more critical. There are essentially three broad organizational options for MI to consider:

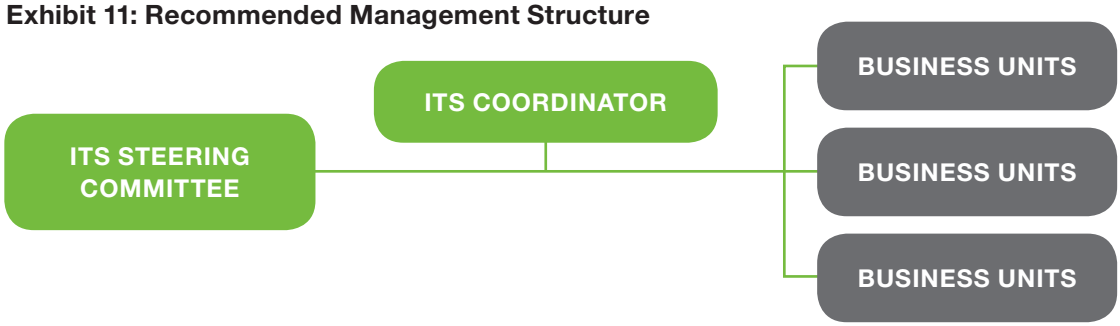
1. **Status Quo Plus+** This represents the existing compartmentalized approach, where divisions / branches pursue and invest in ITS on their own. Under this approach, it would be advisable (hence the "Plus+") to establish a formal protocol to oversee projects with an "ITS Steering Committee" (SC) comprising representatives from any departmental business units with some ITS functions. The role of the ITS SC would be to guide the individual Project Manager(s) to consider some of the dependencies and ramifications identified in this plan, and provide a forum for discussion and some enhanced coordination.
2. **ITS Coordinator** In this option, MI would create a new position of ITS Coordinator. This new role would act as a champion for all departmental ITS and be responsible for guiding ITS plans and projects, coordinating branch inputs, ITS preparing budgets from all business units, developing and maintaining a 5-year program and following up with various business units on deployment. The ITS Coordinator would also represent MI at external ITS stakeholder groups and facilitate the development external funding sources and partnerships.
3. **ITS Branch** This option involves establishing a dedicated ITS branch, responsible for dedicated ITS research, planning, program management, internal and external collaboration, funding, and contracting.

Recommended ITS Management Approach

Based on the current MI context, discussions with the PSC relative to existing roles and responsibilities, and the ITS initiatives and projects identified in this study, the establishment of an **ITS Coordinator** represents a logical next step toward the evolution of a more integrated and coordinated ITS approach within the department. Early actions for the recommended approach include:

1. Establish an ITS Steering Committee (SC) to develop the job description and lines of reporting for an ITS Coordinator. The SC would include representatives from "end user" business units including policy, funding, engineering project development, information technology, and operations of systems across MI. Once the ITS SC has been established and an ITS coordinator appointed, the ITS SC would be chaired by the ITS Coordinator.
2. Departmental budget and FTE support to fund the ITS Coordinator position.
3. Mandate the new ITS Coordinator to develop an annual Work Plan and multi-year budget projections that can be used by the SC to guide and develop detailed project proposals in consultation with affected business units, secure appropriate funding through the annual budget cycle process and evaluate the effectiveness of completed projects.
4. Convene the ITS SC on a quarterly basis to facilitate ongoing dialogue among the branches. Establish standing agenda items to ensure that the committee is sufficiently comprehensive in overseeing the mandate and success of the ITS Program for the whole organization.

Exhibit 11: Recommended Management Structure



Data Management & Warehousing Considerations

The current method of storing ITS data varies by department and project. Some are hosted in internal services directly by the application, some are hosted at vendor sites (i.e. 511) and some are cloud hosted solutions (i.e. RWIS). There is currently no common data warehouse for ITS data within the Government of Manitoba established for the purposes of storing data in common formats and making the data accessible to other departments or agencies. MI will need to adapt its data management and warehousing approaches to support the project deployment plan recommended in this ITS Study. Based on industry practices, some common issues relevant to data management are:

- Organization & Mandate
- Capital and Operational Expenditures
- Data Sharing Agreements
- Applicable Data Standards
- Spatial Data Management
- Data Validation
- Data Source Integration
- System Performance & Scalability
- Security

The primary drivers for a provincial data warehouse include increased efficiency, managing large volumes of data, automated data aggregation and transformation for the current business units' operational use, centralized data process and analysis, data sharing with partner agencies and dedicated staff resources to support business units operations.

Within this context, this ITS study includes a project for developing an ITS data warehouse for Manitoba. A number of specific steps are identified as the building blocks for a provincial ITS data warehouse including auditing available and existing ITS data within disparate systems and developing an architecture that documents integration and interfaces. This is followed by a phased approach starting with an initial data warehouse with a limited number of data sources (to facilitate receiving input from end users), followed by a more comprehensive deployment aimed at integrating data from other remaining systems.

The planning, design and implementation of these data warehouse systems typically require 1 to 2 years to develop and implement. The data warehouse will continue to evolve over time as new ITS systems and processes are implemented. The costs for the data warehouse (capital and operating) will be identified as part of the data warehouse audit and will vary greatly depending on the status and outcomes of the spatial data infrastructure (SDI) project.

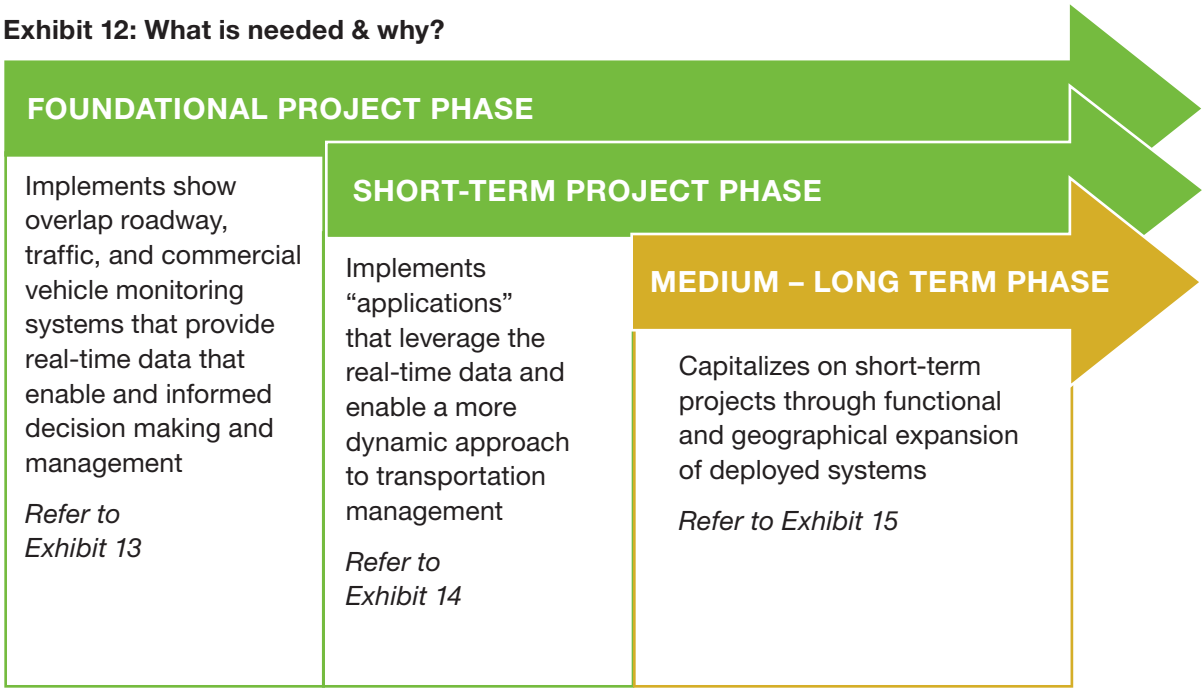
ITS Deployment Plan

Exhibit 11 conceptually illustrates the roll-out of the recommended ITS deployment plan. The deployment plan reflects three distinct phases, namely: foundational, short-term and medium to long-term projects. The three phases of the ITS deployment plan reflect a 15 year time frame with the foundational and short-term projects reflecting an initial 5-year roll-out period.

- Availability of funding;
- Availability of the specific branch to lead, implement and manage the project;
- Pre-requisite projects being completed in advance;
- Ability to deploy the projects using non-traditional approaches;
- State of the maturity of the technology at the time of deployment;
- Ability for the Information technology branch to support and maintain the implementation; and
- Commitment of other private and public sector partners to engage and successfully support the project.

The sections that follow tabulate the projects in terms of Program Management Projects, Foundational Projects, and short, medium, and long term projects.

Exhibit 12: What is needed & why?



Foundational Projects Phase

Exhibit 13 illustrates program management and foundational projects that are recommended in the ITS deployment plan. This phase is undertaken during the first 5-year period of the ITS deployment plan.

The capital funding associated with the foundational projects is estimated to be $300 K per year over a 4-year period. The scope and scale of some project deployment can be adjusted to reflect an initial focus on a "demonstration corridor" such a PTH 75 from CentrePort Canada to the Pembina-Emerson port-of-entry.

Exhibit 13: ITS Program Management and Foundational Project Phase (2018-2022)

FOUNDATIONAL PROJECTS	DEPLOYMENT APPROACH	ROI	CAPITAL RESOURCING
1 Sensor Based Traffic Monitoring	Staged Deployment	H	$250,000
2 Probe Based Traffic Monitoring	Staged Deployment	H	$200,000
3 Traveller Information System Core Upgrade	Solution as a Service	H	$530,000
4 Data Warehouse Audit and Architecture	Traditional Approach	M	$250,000
4 YEARS AT $330K PER YEAR			

PROGRAM MANAGEMENT	ROI	CAPITAL RESOURCING
Development of Management Structure	H	Internal Staff Resources
Review of Existing Projects	H	Internal Staff Resources
11 Business Process and Policy Development	H	Internal Staff Resources
12 Develop and Monitor ITS Research Program	M	Internal Staff Resources

Summary of Results

This phase of work will result in the implementation of core infrastructure and systems to begin to demonstrate the benefits of ITS as well as enable future ITS investments to be more effective. There will be a more coordinated approach to ITS across MI creating stronger collaboration, reduced overlap of efforts and reduced implementation costs.

Travellers will benefit from more informative and accurate traveller information and MI operations will benefit from access to real-time and historical data from all systems through the data warehouse.

Short Term Projects

Exhibit 14 illustrates the projects included in the short-term project phase. The capital funding associated with the projects in this phase are estimated to be approximately $1M per year over a 3-year period. This expenditure projection was developed on the basis of historical expenditures on ITS over the previous 5-year period by the department.

Exhibit 14: Short Term Project Phase (2019-2022)

SHORT TERM PROJECTS	DEPLOYMENT APPROACH	ROI	CAPITAL RESOURCING
5 RWIS and Environmental Detection	Staged Deployment (4 Sites)	H	$700,000
6 Forecasting and Operational Procedures	Traditional Approach (10 Vehicles)	M	$350,000
7 Traveller Information System Public Interface Upgrade	Solution as a Service	H	$250,000
8 Border Traffic Management and Information System Concept of Operations	Traditional Approach	H	$250,000
9 Automated Electronic Permit and Routing System Enhancements	Traditional Approach	M	$200,000
10 Electronic Screening for Commercial Vehicle Inspection Bypass	Staged Deployment (1 Site)	H	$1,500,000 per station

Summary of Results

This phase of work will leverage off of the foundational projects to achieve broader information about the condition of roads and predictive analytics to provide proactive road maintenance plans. The same information will be available to the public in real time before and during their travel. Important milestones will have been achieved in developing collaborative multi-agency designs and implementation plans for border systems as well as implementation of systems to assist commercial vehicle operators.

Highway operations will have more efficient operations for maintain roads in winter conditions and the travellers will benefit from better road conditions and access to real-time information. Commercial vehicle operators will see improved permitting processes and reduced delays and costs at inspection stations.

Medium to Long Term Project Phase (2023-2032)

Exhibit 15 illustrates the remaining suite of ITS projects that has been recommended for implementation over the medium to long term. The **medium term** should include short-term projects that were not feasible to pursue or be completed in the short term. Beyond such projects, the medium term projects are grouped/prioritized below:

Exhibit 15

Projects 13-18 Enabled by Short-term Projects
13 **Automated Weather Response Deployment**
14 **En-route Traveller Information**
15 **Traveller Information System Data Exchange**
16 **Traffic Management Centre**
17 **Border Traffic Management System Deployment**
18 **Industry and Technology Detailed Assessment for Secure Tracking**
Data & Asset Management Projects
19 **MI Asset Monitoring Sensor Expansion**
20 **Corporate Asset Management System Integration**
21 **Integration of Asset Management GIS Data with Traffic Management Centre**
22 **Data Warehouse Development and Deployment**
Long Term Projects
23 **Traffic Management System**
24 **Border Approach Demand Management**
25 **Pilot Program for Secure Container Tracking**
26 **Data Sharing and Analytics**

Summary of Results

This longer term program will see wide ranging improvements on management of traffic, traveller information, asset management and see implementation of new technologies in implementing secure and efficient movement of goods across the US-Canada border and through Manitoba.

Travellers will benefit from safer and more efficient travel. MI will benefit from more efficient/improve operations as well as improved management and preservation of ITS and infrastructure assets. Commercial vehicle operators will realize more efficient good movements supporting economic development through the province.

Return on Investment Considerations

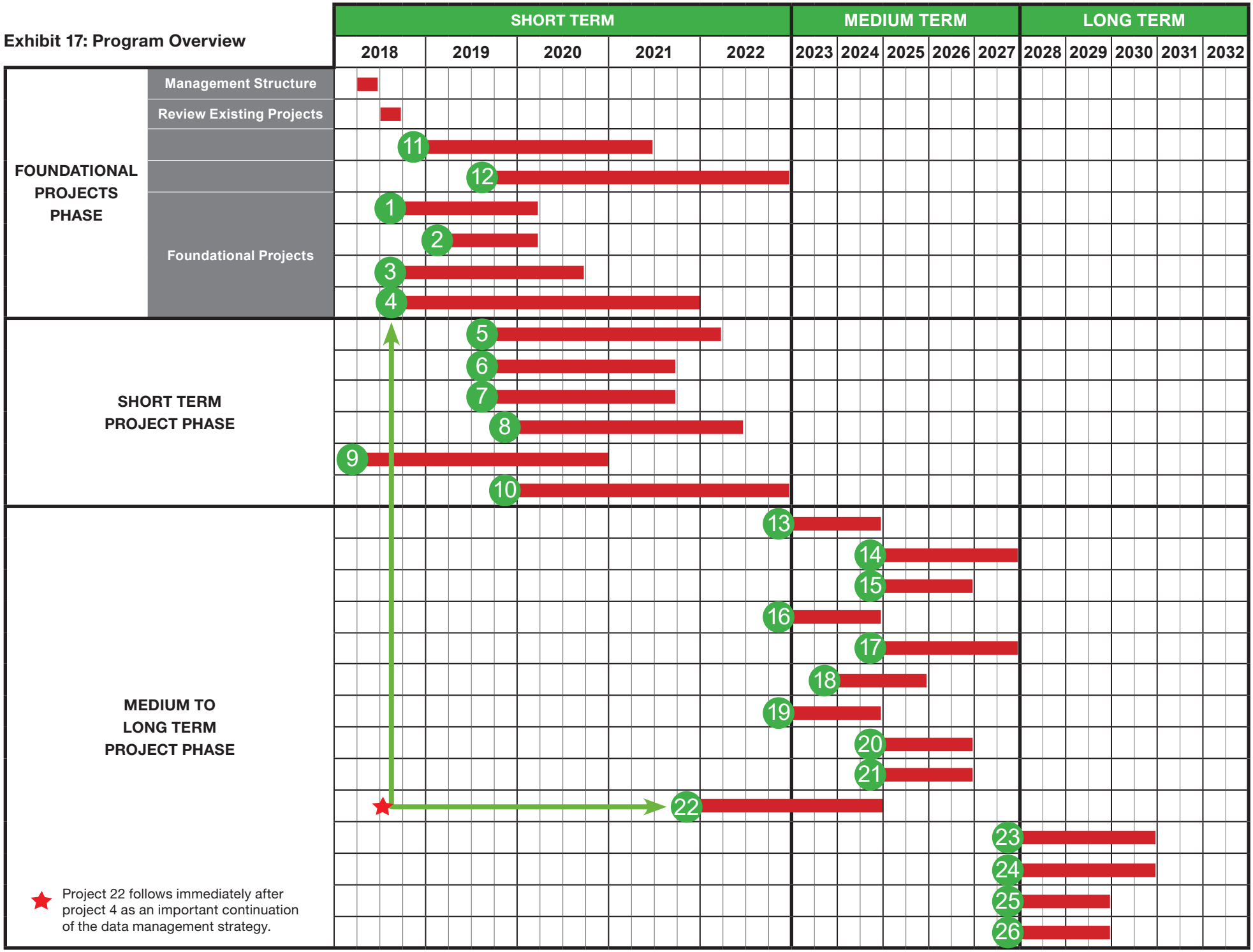
Exhibit 16 illustrates the macro-level analysis that has been developed to conceptually assess the potential return on investment (ROI) for an ITS project. The eight criteria used to assess ROI reflect considerations related to both departmental goals and stakeholder needs. The ROI matrix is intended as a starting point for conducting any detailed assessments required during the project development process to obtaining the necessary funding and approvals. The 8 criteria are loosely grouped into four categories, namely: cost reductions and performance, trade facilitation and collaborations, carrier enforcement and safety, traffic management and traveller information. For each project a high level evaluation has been conducted and a corresponding ROI established for each of the short-term projects.

Exhibit 16: Return On Investment

	Short-Term										Medium to Long -Term															
Projects	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Cost Reduction				☐	☐					☐			☐			☐			☐			☐	☐			
Improved System Performance	☐	☐	☐	☐	■	☐	☐			☐			■	■	☐	■	☐		☐		■	■	■	☐	☐	■
Trade Facilitation	☐	☐	☐				☐	■	■	■	☐	☐		☐		☐	■	■					☐	☐	■	☐
Collaboration & Sharing	■	■	■	■	☐	☐	■	■	☐	☐	☐	☐		☐	■	■	■	☐	■	■	■	■	☐		☐	■
Carrier Enforcement	☐	☐		☐					■	■	☐	☐						■							☐	☐
Safety	☐	☐	☐		■	☐	☐	☐	■	■	☐	☐	☐	☐		■	☐	☐	■	☐	☐		■		☐	☐
Traffic Management	■	■	■	☐	■	■	■	■		☐	☐	☐	☐	■	☐	■	■		☐		☐	☐	■	■		☐
Traveller Information	■	■	■	☐	■	■	■	■			☐	☐	☐	■	■	☐	■		☐		☐	☐	■	☐		☐
ROI	■	■	■	■	■	■	■	■	☐	■																

LEGEND Blank: Low ☐ : Medium ■ : High

Exhibit 17: Program Overview



Technology Deployment

Exhibit 18 illustrates the technology overlaps for all 26 projects. In some instances, the physical installations of a shared technology between projects do not always correspond to the same locations.

Exhibit 18: Technology Deployment Matrix

TECHNOLOGY	EXHIBIT 7: TECHNOLOGY APPLICATION MATRIX		
	Short-Term Projects 2018-2021	Medium-Term Projects 2022-2027	Long-Term Projects 2028-2032
Central Hardware & Software	1 2 3 5 7 8 9 10	13 14 15 16 17 20 22 23	23 26
Dynamic Message Signs	10	13 14 15 17 18	24
Telecom	1 2 5 8	20	
CCTV	1 5 8		
Environmental Sensors	5 6 8		
Mobile RWIS	5 6 8		
Traffic Sensors	1 8		
Mobile Probe	2 8		
Roadside Probe	2 8		

Exhibit 18: Technology Application Matrix Continued

TECHNOLOGY	EXHIBIT 7: TECHNOLOGY APPLICATION MATRIX		
	Short-Term Projects 2018-2021	Medium-Term Projects 2022-2027	Long-Term Projects 2028-2032
Web/Mobile App		18	24
E-Seals		19	25
Container Tracking		19	25
Data Integration	3		
Third-Party Forecasting	6		
Automatic Vehicle Identification	10		
Weigh in Motion	10		
In-Vehicle Signage	10		
Field Sensors		20	

Automated and Connected Vehicles

Connected Vehicles (CV) and Automated Vehicles (AV) are evolving rapidly, both technologically and institutionally.

- AV are vehicles in which at least some aspect of a safety-critical control function (e.g., steering, throttle, or braking) occurs without direct driver input. AVs may be autonomous (i.e., use only vehicle sensors) or may be connected (i.e., use communications systems such as V2I in which cars and roadside infrastructure communicate wirelessly).
- CV leverage the power of wireless connectivity among vehicles (referred to as vehicle-to-vehicle or V2V communications), the infrastructure (vehicle-to-infrastructure or V2I communications), and mobile devices to improve highway safety, mobility, and the environmental impacts of the transportation system.

Most of the research and regulatory efforts on CV/AV to date has been federally led; however, their rapid evolution is making it important for provinces and municipalities to prepare themselves for their eventual and imminent reality. For roadway authorities, a key area of interest will be the Vehicle to Infrastructure (V2I) aspects and the requirements they would impose on roadside ITS infrastructure. In the future, supporting architectures, standards, and communications platforms should be incorporated into ITS designs and specifications as they become available. While this information may not be available for input into short-term projects, their evolution should be closely monitored so that, where possible, provisions can be made in a proactive fashion, since retrofitting roadside ITS infrastructure will cost more.

Currently the global industry is still in the testbed and piloting phase. There are some limited number of vehicles that are being shipped with connected vehicle equipment. The initial beneficiaries of the connected vehicle technology are expected to be commercial vehicle operators that are able to leverage V2V technology to allow for closer platooning of vehicles increasing the efficiency of operation. MI would benefit from the additional capacity that this may create on the road network.

The current test beds are implementing dedicated short range technology at approximately 1 km spacing, typically on existing structures or on dedicated poles. These sites require power and telecommunications. Future advances in mobile telecommunications (5G) and alternative power (solar) may reduce the supporting infrastructure that V2I systems require.

Moving Forward

This study represents an integrated approach to assessing ITS requirements and solutions for Manitoba's National Highway System (NHS) routes. The key outputs of this ITS deployment plan are to identify an array of ITS projects that address both departmental goals and stakeholder needs, to organize these projects in the appropriate implementation sequence and to assign a timeframe for implementation. The framework of the ITS deployment plan is flexible and dynamic, enabling decision-makers to adjust project implementation schedules based on available funding, shifting ITS priorities or evolving ITS technologies.

Appendices

Table of Contents

Jurisdictional Scan

Appendix

A

Summary of key findings from the Canadian ITS Architecture review and jurisdictional scan.

A

The Canadian ITS Architecture provides an important framework for describing how ITS can contribute to addressing key transportation challenges in Manitoba, especially along the NHS routes and at the Pembina-Emerson border crossing where a multitude of agencies and systems/interfaces may be needed.

B

A best practice for ITS planning is to use the "Service Packages" within the ITS Architecture as the mechanism to map needs to ITS solutions. This approach provides a traceability between the needs and a "deployment oriented" view of the architecture without the details of the logical or physical architecture. Once a mapping between needs and service packages is done, subsequent efforts – dealing with the development of regional or specific architectures can use those service packages to add logical and physical details – both of which are beyond the scope of this study.

C

A subset of the ITS Architecture Service Packages will be selected to address needs determined in this study and to form the suite of ITS solutions that will be recommended for the PTH 75 Demonstration corridor and/or the NHS routes in phases 2 and 3 pf this study respectively.

D

The focus on connected and autonomous vehicles, as well as interoperability and enterprise data provide useful guidance to the Manitoba ITS Study with respect to future focus areas that require associated need to research and plan for their eventual realization.

E

The applicability and importance of CVISN within the Canadian context is reflected in the fact that one of the 11 priority initiatives recommended in the Ontario – Quebec Smart Corridor Concept of Operations is establishing a Canadian CVISN for all provinces. This will require regulatory cooperation and system integration between Canadian province commercial vehicle enforcement agencies; and, will also require a national safety compliance database containing safety records and inspection records for Canadian trucking fleets operating in Canada and US.

F

Leveraging both the Canadian and US national ITS Architectures, and the CVRIA, these efforts will be of great value to Canadian provinces planning and/or participating in CV and AV research. For roadway authorities, a key area of interest will be the Vehicle to Infrastructure aspects and the requirements they would impose on roadside ITS infrastructure. In the future, supporting architectures, standards, and communications platforms should be incorporated into ITS designs and specifications as they become available. While this information may not be available for input into short-term projects, their evolution should be closely monitored so that, where possible, provisions can be made in a proactive fashion, since retrofitting roadside ITS infrastructure will cost more.

G

Both the US and Canadian programs and initiatives related to CV and AV are largely at the research and piloting stages, focusing on innovation, partnerships, architecture, and standards development, in support of downstream and wider-spread deployment. The policies, standards, and test-bed evaluation results emerging from current activities will be of great benefit to regions such as Manitoba as they pursue their ITS plans. During Phases 2 and 3 of this study, when ITS solutions are recommended for the PTH 75 and NHS routes, available and relevant policies and standards that could support future CV and AV initiatives will be referenced.

H

The North Dakota Statewide ITS Plan focuses on addressing needs consistent with Manitoba's, including ITS applications for rural settings and weather related events, as well as traveller information and goods movement. The plan also leverages the ITS Architecture for mapping needs to ITS strategies, and for aligning with applicable standards.

I

The Ontario – Quebec Smart Corridor Concept of Operations also focuses on addressing needs consistent with Manitoba's, including ITS applications related to goods movement at international borders, as well as traveller information and safety administration of carriers. The plan also leverages the ITS Architecture for mapping needs to ITS strategies, and for aligning with applicable standards.

J

Of relevance to Manitoba's needs and focus on goods movement efficiencies through e-screening, is BC's e-screening program which is known and marketed as Weigh2GoBC. The program uses the ASTM version 6 transponder protocol to maximize support for regional interoperability with neighbouring jurisdictions. Weigh2GoBC has implemented back office interoperability with Alberta's PIC Program and Washington State. The program has been open to all Canadian and US based carriers since 2014.

K

The map-based data visualization and dissemination tool built as part of the CentrePort benchmarking study may support future cost-benefit analysis associated with ITS investments targeted at improving truck traffic operations. In addition, the progress of the overarching project (to develop a truck traffic information system) which the benchmarking study is intended to support should be monitored for any harmonization opportunities with other traveller information services that may be recommended in this study.

L

E-screening has been identified by some Manitoba stakeholders as a priority for increased and enhanced deployment in Western Canada. British Columbia and Alberta are the two Western jurisdictions that currently have e-screening programs in place (Weigh2Go in BC, and the Partners in Compliance [PIC] Program in Alberta). Enhanced deployment of e-screening in Western Canada will support the core operating principles of the NWPTA, and Manitoba's membership in the NWPTA will be an opportunity for the Province of Manitoba and for other interested stakeholders to advocate for the expansion of existing initiatives, or the generation of new initiatives, to broaden the scope of e-screening in Western Canada.

Appendix

B

Stakeholder Inputs and ITS Themes

Inventory of Needs

STAKEHOLDER	NEED ID#	NEED DESCRIPTION	THEMES								
			A TRADE FACILITATION	B TRAVELLER INFORMATION	C DATA MGMT	D TRAFFIC MGMT	E ROAD WEATHER MGMT	F PEMBINA-EMERSON PORT OF ENTRY MGMT	G COMMERCIAL VEHICLE MGMT	H ASSET MGMT	I INTER-AGENCY COORDINATION AND OPEN DATA
Pembina–Emerson Port of Entry	1	Technology to monitor the performance of FAST systems for the northbound and southbound directions.	✓					✓			
Pembina–Emerson Port of Entry	2	Share road condition information and major road events (eg. flooding, hazardous material spill or emergency incident) to operations and the travelling public on both sides of the border.		✓			✓				✓
Pembina–Emerson Port of Entry	3	Data used for planning CBSA and CBP staffing levels. Requirement of reporting wait times greater than 1 hour with an explanation of mitigating factors. Not for traveller information.				✓		✓			✓
Pembina–Emerson Port of Entry	4	More signage to manage and direct traffic. Combination of static and dynamic lane assignment signage.				✓		✓			
Motor Carrier Operations	5	Automated permitting and routing system.							✓		
Motor Carrier Operations	6	Increased enforcement efficiency and align with federal standards through use of electronic log books for drivers.							✓		
Motor Carrier Operations	7	Focus on non-compliant vehicles, using smarter screening and weigh capabilities. (*ie. weigh scale bypass)							✓		
Motor Carrier Operations	8	Obtain better volume and collision data, and reporting capabilities.							✓	✓	
Motor Carrier Operations	9	Generate better before and after data for performance measurement of safety and enforcement programs.			✓				✓		
Motor Carrier Operations	10	Invest in technology at older weigh scale locations.							✓		
Motor Carrier Operations	11	Have better dangerous goods monitoring and scrutiny on provincial highways.							✓		
Trade, Centre Port and Urban Connections	12	Product preservation/tracking capabilities.	✓					✓	✓		
Trade, Centre Port and Urban Connections	13	Technology to help pre-clear at CentrePort and expedite dwell time through port of entry.	✓					✓	✓		
Trade, Centre Port and Urban Connections	14	Cargo security. Leveraging CentrePort and ITS for tracking/guaranteeing shipment with no tampering.	✓					✓	✓		
Trade, Centre Port and Urban Connections	15	Real time congestion info at borders and key highways allow commercial vehicle operators to make better travel decisions.		✓							
Trade, Centre Port and Urban Connections	16	Trade related data for strategic planning purposes.	✓		✓						
Trade, Centre Port and Urban Connections	17	Better institutional collaboration and support including the federal level.									✓
Trade, Centre Port and Urban Connections	18	Too many at grade intersections impacting operational efficiencies. Operators impacted by flooding events.				✓					
Trade, Centre Port and Urban Connections	19	Ensure compatibility of ITS solutions with federal and neighbouring jurisdictions for efficient movement and tracking of goods.	✓		✓			✓			✓

Inventory of Needs Continued

STAKEHOLDER	NEED ID#	NEED DESCRIPTION	THEMES								
			A TRADE FACILITATION	B TRAVELLER INFORMATION	C DATA MGMT	D TRAFFIC MGMT	E ROAD WEATHER MGMT	F PEMBINA-EMERSON PORT OF ENTRY MGMT	G COMMERCIAL VEHICLE MGMT	H ASSET MGMT	I INTER-AGENCY COORDINATION AND OPEN DATA
Planning and Construction	20	Continue the growth structure data collection and analysis program. More analysis of information in a semi-automated way could help with planning and enforcement.			✓					✓	
Planning and Construction	21	Implement further monitoring of water levels. Provide real time information to the 511 system for sharing of information with the public and other agencies.		✓			✓				
Planning and Construction	22	Looking for a system to collect data for real-time monitoring and management of rural traffic signals.				✓					
Planning and Construction	23	Continue to migrate specify systems to be more compatible with MI's GIS systems.			✓						✓
Planning and Construction	24	Add additional information to automated routing and permitting system for overdimensional and overweight loads. Tie system into 511 through automated routing.	✓		✓				✓		
Planning and Construction	25	511 To be more interactive to share the extents of highway projects and details of construction zones with travellers.		✓							
Planning and Construction	26	Very important and critical to have a well working information technology system and the ability to react to stakeholder needs to implement these systems nimbly.			✓						✓
Travel Information and Open Data	27	Better access to travel information including the number of visitors entering, staying and passing through the province would have some benefit for planning purposes.		✓	✓						
Travel Information and Open Data	28	Provide more real time information related to road conditions, events and closures.		✓			✓				✓
Travel Information and Open Data	29	Provide on-road messaging as there is often a lack of cell phone data coverage where these event are occurring and travellers are not aware of the issues until they area enroute.		✓		✓					
Travel Information and Open Data	30	More timely gathering and update of event information from 511.		✓							
Travel Information and Open Data	31	Recognize that travellers are used to receiving travel information in many forms and platform related to the devices that they use. Making data open to route finding applications.		✓							✓
Travel Information and Open Data	32	Share information in real time with neighbouring agencies.			✓						✓
Travel Information and Open Data	33	More availability of RWIS cameras would be of benefit to the public.		✓			✓				
Travel Information and Open Data	34	Management system to coordinate responses to call from the public. Prioritization and direction to the appropriate personnel.			✓					✓	
Travel Information and Open Data	35	Reduced reliance on visual inspections in some key areas with unique conditions including bridges on the Perimeter Highway, bridges over the floodway, the Westhawk area where there are 4 very steep grades, the slide area at Hwy 83 and at Selkirk and at the border to assist with snow clearing monitoring. Remote real-time monitoring of data collection devices.					✓			✓	

Inventory of Needs Continued

STAKEHOLDER	NEED ID#	NEED DESCRIPTION	A TRADE FACILITATION	B TRAVELLER INFORMATION	C DATA MGMT	D TRAFFIC MGMT	E ROAD WEATHER MGMT	F PEMBINA-EMERSON PORT OF ENTRY MGMT	G COMMERCIAL VEHICLE MGMT	H ASSET MGMT	I INTER-AGENCY COORDINATION AND OPEN DATA
Travel Information and Open Data	36	Frequent reporting on higher usage corridors such as the perimeter and Hwy 75 and the TransCanada.		✓							
Travel Information and Open Data	37	Better place naming in the traveller information system.		✓							
Travel Information and Open Data	38	Better translation of critical information by the media group related to information received from 511.		✓							✓
Travel Information and Open Data	39	Temporary mobile traffic cameras and DMS would be useful to set up at adhoc event locations. Variable speed control through flood areas. Additional surveillance and road messaging.				✓					
Travel Information and Open Data	40	Ensure that new ITS related equipment are included within existing and future asset management systems that provide a centralized ITS inventory to track maintenance, age and provide better planning for upgrades and replacements.			✓					✓	
Emergency Management	41	Emergency Management Operations is both a consumer and provider of 511 operations. There are not many issues that are not already being dealt within the existing protocol.									✓
Emergency Management	42	Data integration with the Multi-Agency Situational Awareness Systems (MASAS) may have some benefits.		✓	✓						✓
Emergency Management	43	Access to information related to highway elevations or dangerous goods that may be in play during an event.				✓				✓	
City of Winnipeg Transportation	44	Coordinate traffic signals on key commute corridors entering and leaving the city.				✓					✓
City of Winnipeg Transportation	45	The city will become the primary traffic data source for Waze related to signal operations/ malfunctions and planned events, emergency closures/roadworks. Potential opportunity to add MI 511 to the feed.		✓							✓
City of Winnipeg Transportation	46	Opportunity to expand city-wide travel data information collection to the Winnipeg region to include MI roadways.		✓							✓
City of Winnipeg Transportation	47	Opportunity to provide road closure permit and other closures data feed to MI 511 for greater regional awareness for travellers.		✓							✓
City of Winnipeg Transportation	48	Winnipeg's new TMC provides an opportunity for coordination of operations and data related to data sharing, video sharing, and RWIS data and forecasting services.			✓	✓					✓
City of Winnipeg Transportation	49	Obtain information from the Province related to weights, dimensions and dangerous goods for commercial vehicles that may be entering the city.							✓		✓

ITS Initiatives

Appendix

C

Initiative 1 | Critical Network Traffic Monitoring

Description

The purpose of this initiative will be to deploy network surveillance and monitoring technologies that will enable the collection of traffic and incident information. **Steps / Projects can include:**

- Deployment of sensor based detection at locations where lane specific queues provided congestion information for various uses such as FAST, NEXUS, and general purpose traffic lanes at PTH 75 approach to US border.
- Deployment of probe based monitoring along wider but critical network areas where congestion information can provide situational awareness during major events and incidents.
- Deployment of CCTV surveillance to supplement incident / event verification and confirmation in areas where sensor detection is added.

Location

Manitoba 75 | central

Manitoba ALL NHS

Needs Addressed

15 18 20 22 28 30 36 39 44 48

Enabling Service Packages

ATMS01	Network Surveillance
ATMS02	Traffic Probe Surveillance
ATMS04	Freeway Control
ATMS06	Traffic Information Dissemination
ATIS01	Broadcast Traveller Information

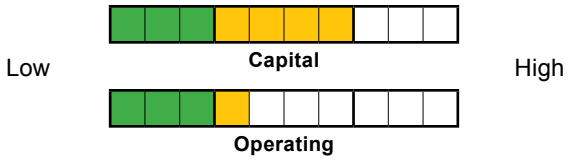
Agency Roles

RACI = Responsible, Actionable, Consulted, Informed	R	A	C	I
Manitoba Infrastructure	■			
NDDoT			■	
CBP, CBSA, GSA			■	
Other Municipalities		■		

Key Institutional Considerations

Implementation of sensor based technologies in the vicinity of the US border requires close coordination with CBP and GSA during planning, design, and operations/maintenance. Probe based technologies are rapidly gaining traction as a data source, but require agencies to consider ongoing data subscription costs as opposed to traditional capital projects.

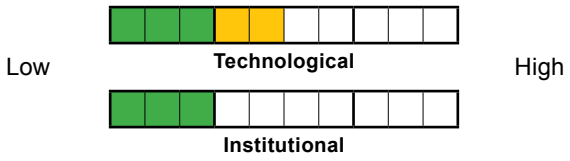
Costs



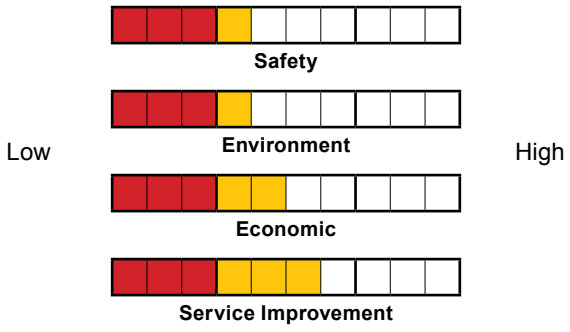
Benefits

- Enables lane based detection of traffic volumes, speeds, and queues.
- Data can be used for a wide range of applications from planning through to real time operations.

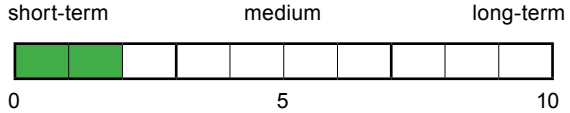
Barriers



Performance Indicators



Timeline (years)



Cross References to Other Initiatives

2 3 4 5 9 10 11

Initiative 2 | Expanded Network Environmental Monitoring

Description

The purpose of this initiative will be to deploy technologies that will enable the monitoring and detection of environmental conditions that could impact commercial vehicles and the travelling public, and use the information through various dissemination media to better inform users of the road network during inclement conditions. Data collected will also support real-time traffic management, maintenance operations and seasonal planning. **Steps / Projects can include:**

- RWIS and flood detection expansion at strategic locations.
- Automated integration to road-side signs at key junctions (north and southbound on Hwy 75 with provisioning for future in-vehicle signage interfaces where feasible.
- Upgraded road weather forecasting services.
- Updated operation procedures for more timely road condition information collection.

Location

Manitoba 75 | central

Manitoba ALL NHS

Needs Addressed

18 21 28 30 33 35 36 39

Enabling Service Packages

MC03	Road Weather Data Collection
MC04	Weather Information Processing & Distribution
MC11	Environmental Probe Surveillance
ATIS01	Broadcast Traveller Information
ATIS09	In-Vehicle Signing
EM06	Wide-Area Alert
EM07	Early Warning System

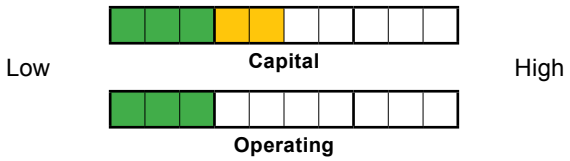
Agency Roles

RACI = Responsible, Actionable, Consulted, Informed	R	A	C	I
Manitoba Infrastructure	■	■		
Other Municipalities		■		

Key Institutional Considerations

Coordination will be required between 511 and highway operations. Increase winter road reporting will have a staff impact.

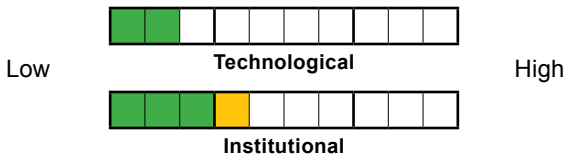
Costs



Benefits

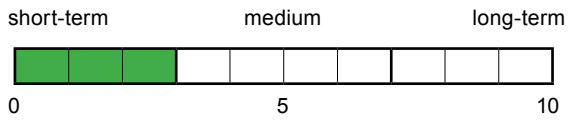
- Improved response to weather events.
- Increased situational awareness by MI.
- Improved enroute traveller information.
- Improved winter maintenance planning.

Barriers



Performance Indicators

Timeline (years)



Cross References to Other Initiatives

1 3 4 3 5 7 8

Initiative 3 | Enhanced Traveller Information

Description

The purpose of this initiative is to expand and enhance the traveller information systems and networks in the region to support the provision of both pre-trip and en-route information to the traveling public and partner agencies. **Projects that are part of this initiative may include:**

- Expansion and upgrade of the existing 511 system to incorporate a wide range or road condition and events information, such as flooding alerts, hazardous conditions and delays. Elements of the upgrade could include mapping enhancements, integration with public and private data feeds, and addition of local (Winnipeg-area) information.
- Refresh of the 511 user interface to provide more interactive and customizable information, user-friendly alerts, and to directly share information from ITS devices such as RWIS and cameras as well as open platforms to accommodate various methods of traveller's access.
- Deployment of en-route traveller information devices such as fixed and temporary dynamic message signs to provide information to travellers on the roadways, particularly approaching border crossing, areas where cellular communications are poor, and areas prone to hazardous conditions.
- Exporting and archiving of traveller information data to the Province-Wide Data Warehouse for reporting and analysis.

Location

central

Manitoba ALL NHS

Needs Addressed

2 15 18 21 23 24 25
27 28 29 31 32 33 36
37 38 39 41 45 46 47

Enabling Service Packages

ATMS06	Traffic Information Dissemination
ATMS101	Dynamic Roadway Management
MC04	Weather Information Processing & Distribution
ATIS01	Broadcast Traveller Information
ATIS06	Transportation Operations Data Sharing
EM06	Wide-Area Alert
EM07	Early Warning System

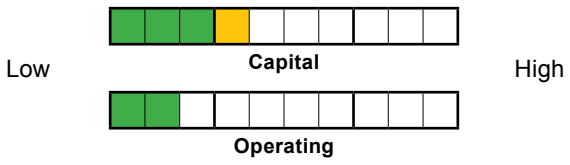
Agency Roles

RACI = Responsible, Actionable, Consulted, Informed	R	A	C	I
Manitoba Infrastructure	■			
NDDoT, SK, ON		■	■	
CBP, CBSA, GSA				■
City of Winnipeg		■	■	
Other Municipalities		■		

Key Institutional Considerations

Implementation of traveller information for border crossings requires close coordination with partnering agencies both within the province and in North Dakota, to provide information and alerts to travellers on both sides of the border. An open data approach will need to be followed to maximize data sharing opportunities.

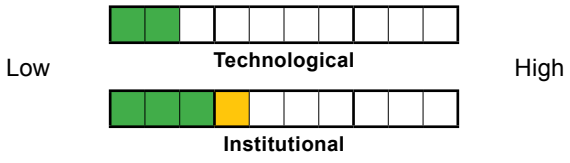
Costs



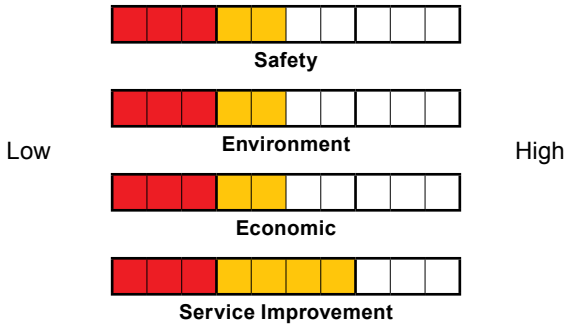
Benefits

- Leverages the investments in network and environmental monitoring to provide critical information to travellers and agency partners.
- Addresses a wide range of needs relating to a lack of real time information for events, delays and travel conditions.

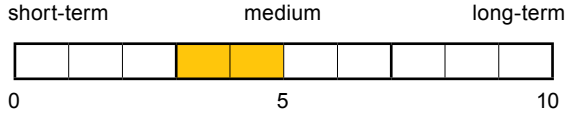
Barriers



Performance Indicators



Timeline (years)



Cross References to Other Initiatives

1 2 4 5 6 9 11

Initiative 4 | Traffic and Event Management

Description

The purpose of this initiative is to provide the physical and operational infrastructure needed to more actively and effectively manage traffic and environmental events that occur on the provincial road network. **Some of the types of projects that are part of this initiative may include:**

- Establishment of a centralized traffic operations control center as a facility that would be responsible for the province-wide management of NHS roadways and events, including the design and construction of a new/retrofitted physical facility or collocating with another operational entity.
- Procurement and implementation of traffic management system software that provides centralized, integrated control of all networked monitoring devices, incident detection and decision support functionality.
- Development of business management policies and processes and implementation of change management to deliver the best results from the investment and improve operations.

Location

Needs Addressed

15 21 22 34 35 36 39
43 44 48

Enabling Service Packages

ATMS03	Surface Street Control
ATMS04	Freeway Control
ATMS06	Traffic Information Dissemination
ATMS07	Regional Traffic Management
ATMS19	Variable Speed Limit And Enforcement
ATMS21	Roadway Closure Management
ATMS101	Dynamic Roadway Management
MC10	Maintenance & Construction Activity Coordination

Agency Roles

RACI = Responsible, Actionable, Consulted, Informed	R	A	C	I
Manitoba Infrastructure	■			
Saskatchewan, Ontario, NDDoT			■	
CBP, CBSA, GSA				■
City of Winnipeg			■	

Key Institutional Considerations

The implementation of a traffic operations center provides the opportunity for increased information sharing and better coordination with partner agencies, including emergency management and municipal traffic agencies, as well as North Dakota DOT, for improved event management and day-to-day operations. There are opportunities to consider collaboration with other agencies (i.e. Winnipeg) to reduce costs and improve situational awareness for operations.

Costs

Low — High

Capital

Operating

Benefits

- Leverages the investments in network and environmental monitoring to provide active management of the province's roadways.
- Provides the centralized operations and management needed to fully recognize the results of the ITS investment.
- Improves response time and coordination with operational resources, through better decision making to prevailing conditions.

Barriers

Low — High

Technological

Institutional

Performance Indicators

Low — High

Safety

Environment

Economic

Service Improvement

Timeline (years)

short-term | medium | long-term

0 5 10

Cross References to Other Initiatives

1 2 3 5 6 9 11

Initiative 5 | Cross-Border Traffic Management

Description

The purpose of this initiative is to deploy technologies that improve cross-border traffic management and information dissemination. Projects under this initiative will leverage the capabilities of initiatives 1 (Critical Network Traffic Monitoring) and 2 (Critical Network Environmental Monitoring) combined with planned physical improvements along the southbound PTH 75 approach to the border to proactively manage border traffic during major weather/incident events, and disseminate information related to weather, incidents, and wait-times. **Steps / projects can include:**

Cross-Border Traffic Management & Information System (CBTMIS)

- Planning Study: Jurisdictional Review, Consultation, Project Definition
- Concept of Operations, Architecture, and Business Case
- CBTMIS design and deployment

Location

Needs Addressed

2 3 4

Enabling Service Packages

ATMS04	Freeway Control
ATMS06	Traffic Information Dissemination
ATMS07	Regional Traffic Management
ATMS101	Dynamic Roadway Warning
ATIS01	Broadcast Traveller Information
ATIS02	Interactive Traveller Information
ATIS05	ISP Based Trip Planning and Route Guidance
ATIS09	In Vehicle Signing
EM06	Wide Area Alert

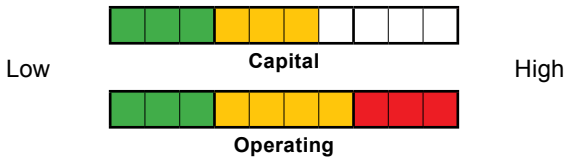
Agency Roles

RACI = Responsible, Actionable, Consulted, Informed	R	A	C	I
Manitoba Infrastructure	■			
NDDoT	■			
CBP, CBSA, GSA			■	
EMO			■	
Emerson – Franklin Municipality				■

Key Institutional Considerations

ITS Coordination between Manitoba Infrastructure and NDDOT for corridor management on both sides of the border. Cooperation with CBP, CBSA, and GSA will also be important.

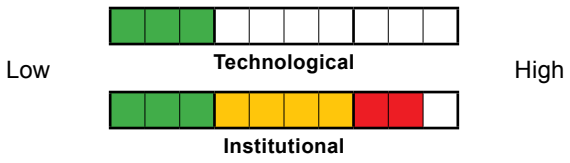
Costs



Benefits

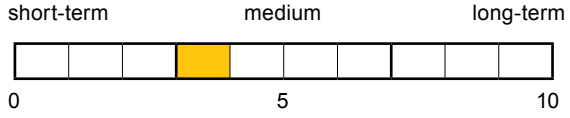
- Enhanced traffic management suited for border context.
- Increased border efficiencies for processing traffic and goods.
- Border traffic demand management.

Barriers



Performance Indicators

Timeline (years)



Cross References to Other Initiatives

1 2 3 4 7 8 11

Initiative 6 | ITS Asset Management

Description

The purpose of this initiative will be to develop and maintain an inventory of existing and new ITS assets for the purpose of efficient maintenance and life-cycle replacement activities. ITS asset management should leverage existing and future investments by MI in tracking various inventories. Key linkages to ITS asset management will be MI's bridge and pavement management systems, as well as the Spacial Data Infrastructure (SDI) initiative currently underway. **Some of the types of projects that would be part of this initiative may include:**

- ITS asset management integration with existing corporate systems.
- Enhancements to field sensors, mobile probes and communication networks for near-realtime reporting.
- Integration with and upgrade to corporate GIS standards.
- Population of the database or connection to existing systems in order have access to geographic data (i.e. elevations) during management of events.

Location

Needs Addressed

20 23 40 43

Enabling Service Packages

ATMS01	Network Surveillance
MC03	Road Weather Data Collection
MC10	Maintenance & Construction Activity Coordination
CVO10	Hazardous Material Planning and Incident Response
EM05	Transportation Infrastructure Protection
CVO11	Roadside Hazardous Material Security Detection & Mitigation

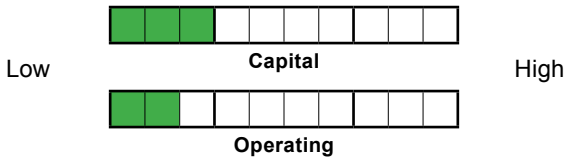
Agency Roles

RACI = Responsible, Actionable, Consulted, Informed	R	A	C	I
Manitoba Infrastructure	■			
Manitoba Land Initiative		■		
Emergency Measures Organization			■	

Key Institutional Considerations

Close coordination will be required internally with the provincial organization to interface with the GIS teams that already exists and may require effort to become integrated into the timelines of that program.

Costs

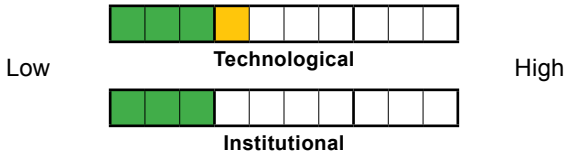


Benefits

The primary benefits to this initiative include:

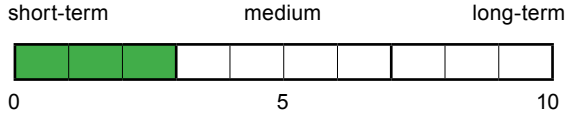
- Better understanding of assets, value and condition;
- A manage and lower cost program of maintenance & repair;
- Better planning horizon for capital lifecycle costs;
- Improved coordination with other departments and agencies during construction and planned events.

Barriers



Performance Indicators

Timeline (years)



Cross References to Other Initiatives

2 3 9 10

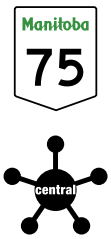
Initiative 7 | Border/CentrePort Applications for Trade

Description

The purpose of this initiative will be to leverage technology advances in container / cargo tracking, vehicle tracking, and driver identification systems to facilitate the exchange of clearance information between CentrePort and the border agencies as a means to minimize clearance processing times and thus facilitate the rapid movement of goods across the border. The Border Information ITS Architecture (BIFA) jointly developed by the Canadian and US transportation authority's includes a number of specific approaches intended to improved border clearance times, such as: Driver Security Authentication, International Border Registration, and International Border Pre-processing, and International Border Inspection. Use of technologies such as RFID container tracking and e-seals are rapidly contributing to the potential realization of these approaches for improved clearance. **Projects under this initiative would be "planning oriented" in the short to medium term:**

- Use of the BIFA ITS architecture to develop a regional ITS architecture for the Manitoba / US border context.
- Assessment of applicable container tracking and security technologies such as e-seals.
- Development of a Concept of Operations based on the architecture and applicable technologies.
- Pilot of technologies to aid in R&D and future deployment of cargo security and tracking technologies.

Location



Needs Addressed

1 12 13 14

Enabling Service Packages

CVO05	International Border Electronic Clearance
CVO08	On-board CVO & Freight Safety & Security
CVO13	Freight Assignment Tracking
CVO103	International Border Pre-processing
CVO104	International Border Inspection

Agency Roles

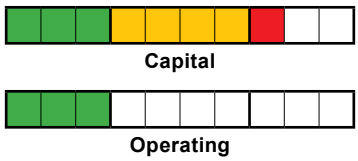
RACI = Responsible, Actionable, Consulted, Informed	R	A	C	I
Manitoba Infrastructure		■		
CBP, CBSA		■		
DHS, PSC			■	
Shippers & Freight Forwarders		■		
Distribution Centres		■		
Supply Chain logistics end users		■		
CentrePort	■	■		

Key Institutional Considerations

- Requires active collaboration during architecture and planning phases.
- Requires cooperation and technical integration between Canadian and U.S. customs and border agencies for achieving pre-clearance etc.
- Private sector adoption challenge – requires mass deployment of the E-Seals on all in-bond container operations at port and intermodal terminals.
- Technical integration of system across different Canadian provinces and between different public sector agencies.

Costs

Low — High

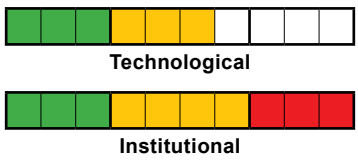


Service Improvement

- Travel time savings for motor carriers.
- Enforcement efficiencies.
- Harmonized security between U.S. and Canadian Customs.
- Increased use of Manitoba in-land port and corresponding economic activity.

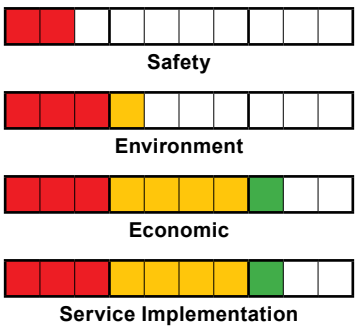
Barriers

Low — High

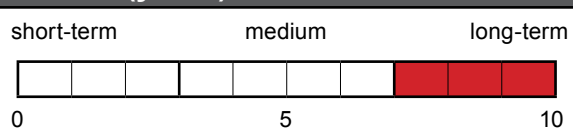


Performance Indicators

Low — High



Timeline (years)



Cross References to Other Initiatives

1 3 5 8 10 11

Initiative 8 | CV Credentialing, Screening & Inspections

Description

The purpose of this initiative is to enhance the management of commercial vehicles in Manitoba to improve efficiency, safety, impact on the infrastructure and to facilitate trade. Program objectives would be achieved through investments in electronic screening and credential administration and data sharing systems. Moving many manual paper based systems to a program of electronic records is a key element to this initiative, such as the current ARPS replacement project. **Some specific project activities may include:**

- ELD for commercial drivers, supported by intra-provincial ELD policy for Manitoba to complement the national policy under development by Transport Canada
- Automated electronic permitting and routing system with dangerous goods tracking.
- Weigh scale and inspection system upgrades.
- Pilot and deployment of an electronic screening program for weigh-scale bypass.
- Commercial vehicle routing and data sharing with the City of Winnipeg and Brandon.

Location

central

Manitoba ALL NHS

Needs Addressed

5 6 7 10 11 14 24 43 49

Enabling Service Packages

CVO01	Fleet Administration
CVO03	Electronic Clearance
CVO04	CV Administrative Processes
CVO06	Weigh-in-Motion
CVO07	Roadside CVO Safety
CVO08	On-Board CVO And Freight Safety and Security

Agency Roles

RACI = Responsible, Actionable, Consulted, Informed	R	A	C	I
Manitoba Infrastructure	■			
NDDoT, Ontario, Saskatchewan, Transport Canada		■		
CBP, CBSA, GSA				■
Centre Port				■
City of Winnipeg Transportation			■	
MTA			■	
EMO			■	

Key Institutional Considerations

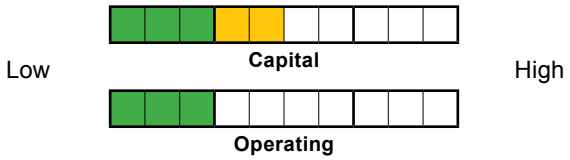
The primary institutional consideration will be related jurisdictional interoperability related to sharing of data on drivers, carriers, and goods.

Benefits

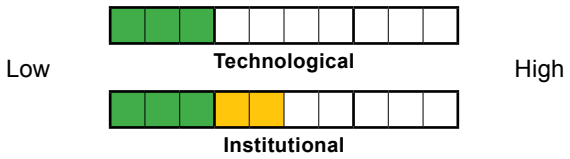
The primary benefits to this initiative include:

- Improved safety and efficiency for Commercial Vehicle Operators.
- Management of the infrastructure.
- Streamlined Manitoba Infrastructure administrative and enforcement operations.
- Improved response to incidents involving dangerous goods.
- Improved traveller information.

Costs

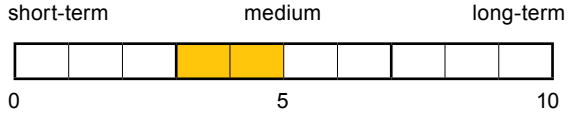


Barriers



Performance Indicators

Timeline (years)



Cross References to Other Initiatives

1 3 5 7 9 10 11

Initiative 9 | Province Wide Data Warehouse

Description

The purpose of this program is to pursue a central data storage, management, and sharing platform that can obtain and archive ITS related data from different systems and departments within MI and make that data available for reporting and analytics to authorized users inside and outside of the organization through a variety of tools, applications, and interfaces. An ITS data warehouse program can leverage related initiatives underway such as the Spatial Data Infrastructure (SDI) initiative and the Highway System Replacement project, and provide a coordinated approach to ensuring basic data quality, data privacy, and meta-data management common to ITS archives, while also including data transformations, data fusion, and interface specifications that maximize the accessibility and utility of the data to various stakeholders within MI. **Some of the types of projects that may be part of this initiative would include:**

- Undertaking an audit of available data, and related systems (such as SDI and HIS) as well as gaps in accessibility and reporting (backward looking)
- Development of minimum data and reporting requirements associated with upcoming ITS initiatives and projects (forward looking)
- Development of an architecture, design and subsequent procurement of a central data warehouse that can archive available data, and is provisioned for expansion
- Procurement of front-end tools for reporting and analytics

Location

Needs Addressed

A data warehouse program will address a large number (17) of the individual needs identified by stakeholders, related to better access and use of ITS and transportation data.

Enabling Service Packages

AD1	ITS Data Mart
AD2	ITS Data Warehouse

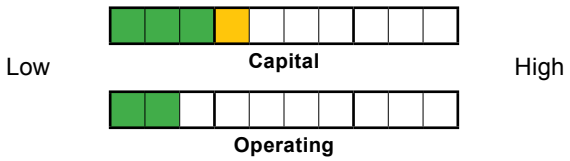
Agency Roles

RACI = Responsible, Actionable, Consulted, Informed	R	A	C	I
Manitoba Infrastructure	■	■		
City of Winnipeg			■	
Other private agencies sharing Data				■

Key Institutional Considerations

A successful data warehouse needs to be more than just central storage facility, but rather a data archive that has necessary data fusions and transformations that make the data useful; accordingly, a successful program will need active participation of end users of the data, to identify their analytics and reporting needs; this will form the foundation of a well-planned system targeted at using MI data to create business intelligence.

Costs

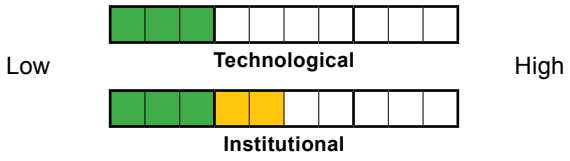


Benefits

The primary benefits to this initiative include:

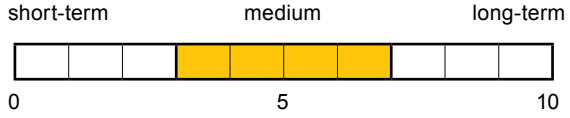
- Leveraging data from investments for business intelligence and decision making;
- Improving collaboration and information sharing;
- Supporting internal and external research and development.

Barriers



Performance Indicators

Timeline (years)



Cross References to Other Initiatives

ALL

Initiative 10 | Research & Development

Description

The purpose of this initiative is to follow a programmatic approach to undertaking ITS research related to emerging technologies that may have a positive operational impact to MI, by addressing needs and/or supporting other initiatives/projects of this plan. Research topics can be driven by departmental needs and interest areas, and/or driven by how this strategic plan is pursued and opportunities for emerging technologies to augment its projects. **Sample research activities can include:**

- Assessing the benefits and impacts of the driverless truck corridor between Manitoba and Mexico, being considered by the Central North American Trade Corridor Association.
- Assessing the requirements, standards, and feasibility of "in-vehicle" signage using Vehicle-to-Infrastructure communications.
- Periodic review of benefits and lessons learned of initiatives in other regions.
- Researching emerging technologies and impacts related to connected vehicles.
- Undertaking before/after evaluation studies to assess the benefits of ITS projects deployed from this strategy.

Location

Needs Addressed

Over-arching need to keep MI prepared for adapting and benefiting from new technologies and ITS applications.

Enabling Service Packages

N/A	N/A

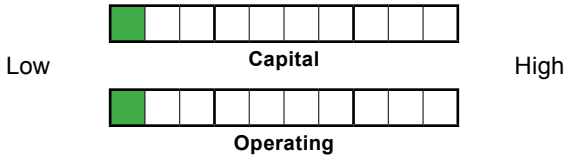
Agency Roles

RACI = Responsible, Actionable, Consulted, Informed	R	A	C	I
Manitoba Infrastructure	■	■		
Academia		■		
Other Jurisdictions and Agencies			■	

Key Institutional Considerations

A key consideration for MI will be the recognition of the importance of such a program over the long-term, and ensuring required departmental coordination and expertise. Close and collaborative coordination with the Council of Ministers, TAC, and ITS Canada will also be key.

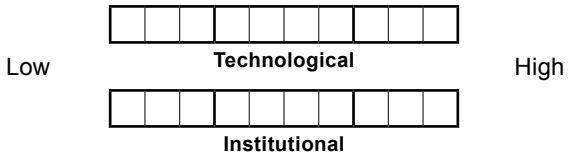
Costs



Benefits

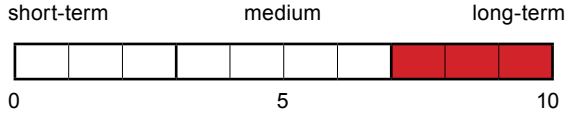
The primary benefit of this initiative will be the development of a general knowledge base within MI of emerging trends in ITS and their potential applicability to the projects pursued from this strategic plan. Undertaking monitoring and evaluation studies of ITS projects will also help generate statistics that can be used for business cases and funding applications.

Barriers



Performance Indicators

Timeline (years)



Cross References to Other Initiatives

ALL

Initiative 11 | Institutional Collaboration

Description

The purpose of this initiative is to develop a framework for an ongoing dialogue of cooperation and coordination with other agencies that either have common goals to Manitoba Infrastructure or will be impacted by the ITS program. **Collaboration will include leading discussions for:**

- Project coordination.
- Data and information sharing.
- Agreement on standards.
- Sharing knowledge of Research and Development as well as lessons learned.
- Sharing resources and/or costs.

A subset of this initiative may also include an internal governance structure and change management program to structure how ITS planning, implementation and operations is managed.

Location

Needs Addressed

8 9 17 19 21 26 34
38 44 45 46 47

Enabling Service Packages

N/A — N/A

Agency Roles

RACI = Responsible, Actionable, Consulted, Informed	R	A	C	I
Manitoba Infrastructure	■			
Other Manitoba Departments		■		
City of Winnipeg		■		
NDDoT, Ontario, Saskatchewan, Transport Canada		■		
CBP, CBSA, GSA		■		
Centre Port		■		
Private Sector			■	

Key Institutional Considerations

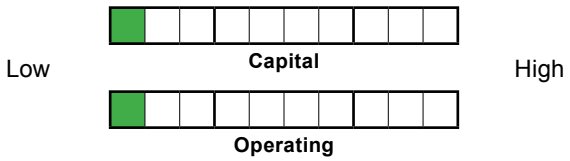
There a number of institutional barriers that will need to be overcome with each agency, in fact it is the role of this initiative to breakdown any barriers to foster more successful outcome of the other initiatives. Outreach and education will be a key consideration for building interest and buy-in from stakeholders.

Benefits

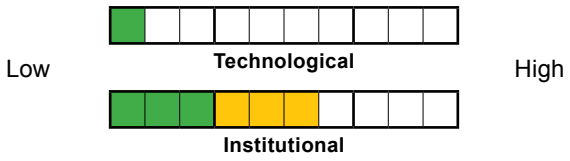
The primary benefits to this initiative include:

- Enhanced outcome for other initiatives that have inter-agency coordination or data sharing.
- Better data coordination and therefore quality of service delivery.
- Reduced costs related to coordinated projects and shared research.
- Better service to the public.
- Knowledge transfer and sharing.

Costs

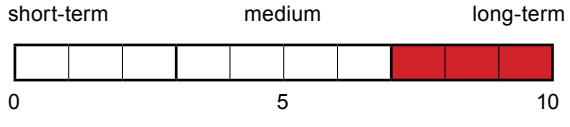


Barriers



Performance Indicators

Timeline (years)



Cross References to Other Initiatives

ALL

ITS Projects

Appendix

D

1 Sensor Based Traffic Monitoring [Foundational Project]

Description

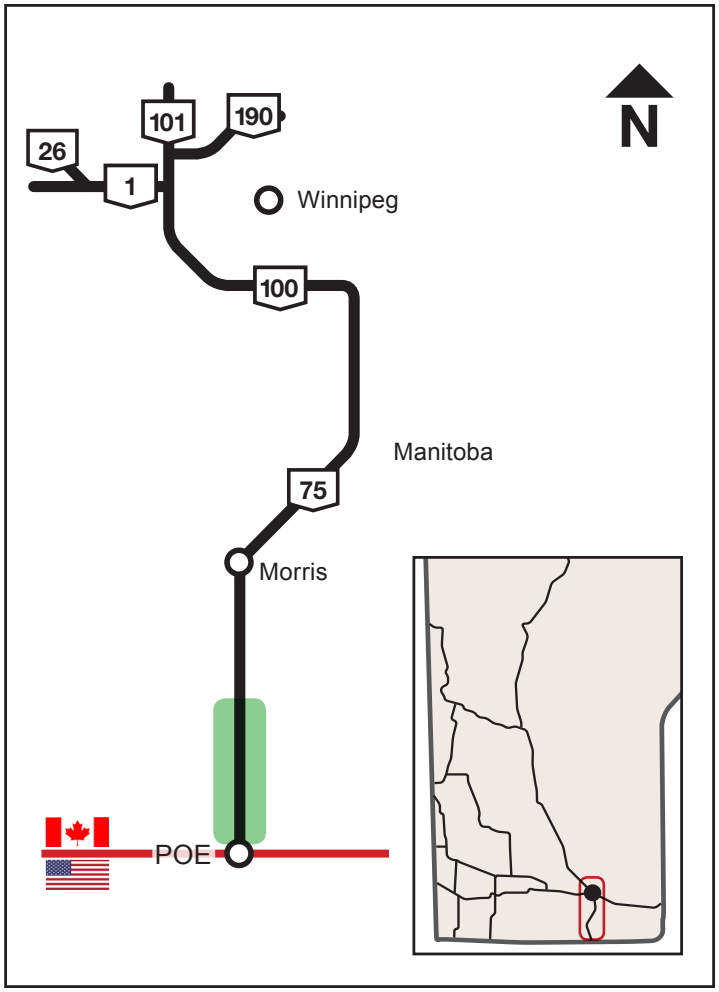
The purpose of this project will be to plan, design, and deploy sensor based traffic monitoring equipment along the approaches to the Pembina-Emerson border crossing sections of the PTH 75 Demonstration corridor. This is a foundational project generating data related to traffic volumes, congestion/queues, incidents, etc. along the critical sections of the border approach. It is also a pre-requisite to numerous other projects recommended in this plan. This project would encompass traffic detectors, CCTV cameras, roadside equipment for data collection and transmission to central systems and repositories via wired or wireless communications.

The focus of this project is to cover the immediate and more congested approaches to the border, where lane-based information – distinguishing between general purposes (GP), NEXUS, and FAST traffic lanes. This type of monitoring can be accomplished using in-pavement or overhead sensors providing volume, speed, and occupancy on a lane by lane basis, as opposed to probe-based traffic monitoring technologies which provide aggregate flow rates/samples.

The planning and design phase of this project will need to focus on the extent of coverage north of the border for which sensor based coverage is needed (estimated to be as far back as peak queues) north of which lower cost and probe based solutions would suffice (as presented in Project #2). This phase of the project should also determine the specific type of sensor technology to be used (loops, micro-wave, etc), and the general architecture of the system in terms of data transmission, storage, and processing for use by other projects and applications.

The design phase of this project should encompass the design, tendering, and implementation activities. The design phase will cover spacing of sensors (typically 500m) and CCTV cameras (typically 1 KM), location of roadside equipment, and connections to power and communications and any central systems/archiving etc.

Coverage



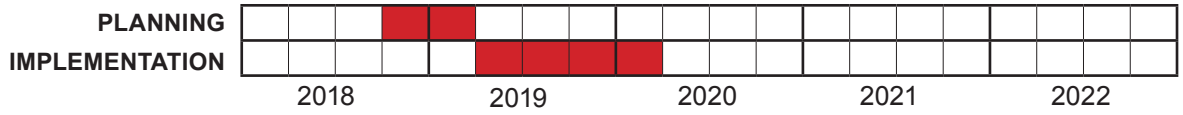
Outcomes

- Real-time data related to overall network performance in terms of traffic volumes, flow-rates, queue lengths and congestion
- Lane based usage information related to GP, NEXUS, and FAST traffic
- Real-time video feed

Technologies

- Traffic Sensors
- Telecom
- CCTV
- Central Hardware & Software

Timeline (Phase 1: 2018 - 2023)



Costs

Capital

- **$15,000** / Detection station
- **$25,000** / CCTV station
- Central Equipment **$25,000** to **$30,000**
- Telecommunications: TBD based on coverage

Operating & Maintenance Cost

- 15% of Capital

ROI

H

Related Initiatives

1 2

Pre-requisite Projects

N/A

Deployment Options

- Staged Deployment

2 Probe Based Traffic Monitoring [Foundational Project]

Description

The purpose of this project will be to plan and deploy probe-based traffic monitoring in critical roadway network areas (e.g., PTH 75 corridor from the City of Winnipeg to the border) and All NHS highways in Manitoba.

This project is issued as a supplemental traffic monitoring project for Project 1, the Sensor-Based Traffic Monitoring, along PTH 75 corridor and some NHS highway sections close to Winnipeg, by using several cost-effective mobile and roadside probe technologies, such as Dedicated Short Range Communications (DSRCs) or Bluetooth, to collect traffic data and relevant information, including vehicle operation status (e.g., volume, speed, flow rate, density, etc.), road conditions, road congestion, roadway maintenance and construction, major events and incidents. In addition, as a cost-effective and accurate option, this project will also use data subscription along all NHS highways in Manitoba from traffic data providers such as Inrix or Cellint.

The technical components of this project will include mobile probe and roadside probe devices for data collection and storage, telecom for data transmission to the central system, and repositories via wired or wireless communications. For both probe-collected data and subscribed data, they will be temporarily stored or directly sent to the central system for advanced calculation and analysis to generate decision-making information, which will be used by other projects, or be broadcast to road users, transportation operators, and traveller information providers.

The planning phase of this project will need to focus on the identification of specific locations to implement probe devices and traffic data subscription across the NHS network in Manitoba. Initial Corridors within the vicinity of Winnipeg have been shown as a standing point for ease of implementation and validation.

The implementation phase will encompass the selection of specification routes to implement, tendering, and implementation activities. It will cover mobile/roadside probe device selection and installation, connections to power and communications and any central systems/archives etc.

Coverage

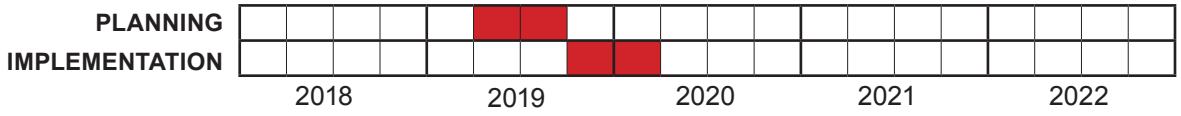
Outcomes

- Real-time traffic data collected by probe devices along PTH 75 corridor from the City of Winnipeg to the border, as well as NHS road sections close to Winnipeg
- Subscribed traffic data along all NHS highways in Manitoba
- Real-time video feed

Technologies

- Mobile Probe
- Roadside Probe
- Telecom
- Central Hardware & Software

Timeline (Phase 1: 2018 - 2023)



Costs

Capital

- **$10,000**/Mobile Probe Equipment per Vehicle
- **$10,000**/ Per Roadside Probe Device Installation and Operation
- Central Equipment **$25,000** to **$30,000**
- Telecommunications: TBD based on coverage

Operating & Maintenance Cost

- 15% of Capital used for Monthly Operation Fee for Data Subscription along all NHS Highways in Manitoba

ROI

H

Related Initiatives

1 2

Pre-requisite Projects

1

Deployment Options

- P3
- Agency Partnering
- Solution as a Service
- Staged Deployment

3 Traveller Information System Core Upgrade [Foundational Project]

Description

The purpose of this project will be to enhance the application of the existing traveller information systems such as the 511 system by implementing system core upgrade covering the full NHS network in Manitoba. This is a foundational project integrating collected real-time traffic and environmental data related to road conditions, environmental information, event information and incidents along all NHS roadways into the upgraded 511 system, similar to what is offered in British Columbia and under deployment in Alberta. It is a pre-requisite to numerous other projects recommended in this ITS plan. This core upgrade would include several components such as system mapping enhancements, integration with public and private data feeds, the addition of local (e.g. Winnipeg-area) information, and exporting and archiving of traveller information data to the province-wide data warehouse for reporting and analysis.

The focus of this project is to incorporate multi-source traffic and environmental data, as made available through the Project 1, 2, 5 and 6 into the upgraded 511 system.

Coverage

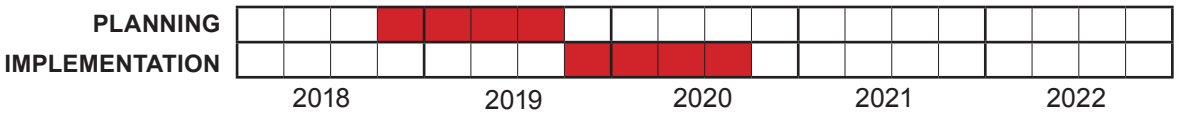
Outcomes

- Upgraded 511 System to consume and disseminate information from new traffic and environmental sensor sources
- Core datasets made available to third party providers

Technologies

- Data Integration
- Central Hardware & Software

Timeline (Phase 1: 2018 - 2022)



Costs

Capital

- 511 Core System **$500,000**
- Central Equipment **$25,000** to **$30,000**

Operating & Maintenance Cost

- $150,000 per year

ROI

H

Related Initiatives

1 2 3

Pre-requisite Projects

1 2 5 6

Deployment Options

- Agency Partnering
- Solution as a Service

4 Data Warehouse Audit and Architecture [Foundational Project]

Description

The objective of this project will be to audit and review the existing and future data requirements for MI and develop a new data warehouse architecture to the integrates the existing and emerging ITS data including spatial, event and asset management related data. The goal is to coordinate and develop an action plan for implementation and integration including supporting the short term department needs as well as the longer term enterprise approach.

The data warehouse will align with the planned corporate spatial data infrastructure requiring coordination with Corporate Services and Geo Manitoba. With this new architecture, the data warehouse may obtain and archive ITS-related data from many systems and departments within MI and make that data more available for reporting and analytics to authorized users, inside and outside of MI through a variety of tools, applications, and interfaces. This is a foundational project to leverage other data-related projects. The new data warehouse architecture will cover the functions of data storage, data management, data query and report access and data mining functions. The source of housed data will span across modal and jurisdictional boundaries. The initial data warehouse will be designed and deployed to enable foundational implementation and capture of existing data set.

The components of this project will include:

1) Auditing MI's existing data warehouse infrastructure (including hardware, software, ITS standards, content, administration etc.) as well as existing and new ITS data.

2) Developing a future data warehouse architecture to over lay, with above including an implementation and operations plan. The existing data warehouse infrastructures already underway by MI should be leveraged where possible.

3) Confirm operational and maintenance responsibilities including departments within MI, Corporate Services and possibly service providers.

4) Initial data warehouse deployment.

Coverage

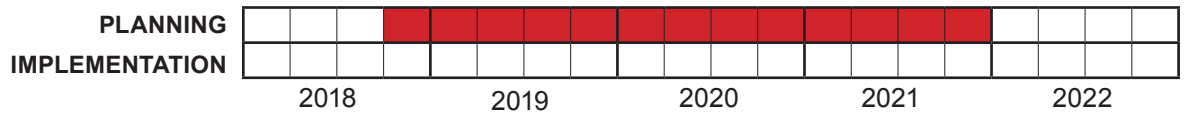
Outcomes

- An established "starting point" in terms of MI's existing data warehouse infrastructure and standards
- A new data warehouse architecture to overlay existing and future ITS data in the data warehouse
- An implementation plan and initial design
- Deployment of initial data warehouse to collect existing data available

Technologies

Central Hardware & Software

Timeline (Phase 1: 2018 - 2022)



Costs

Capital

- Audit Existing Data Warehouse - **$50,000**
- Inventory and identify existing and new ITS data - **$50,000**
- Develop new architecture and initial implementation plan - **$150,000**

ROI

M

Related Initiatives

1 2 9

Pre-requisite

1 2 5

Deployment Options

- Traditional Approach

5 RWIS and Environmental Detection Expansion

Description

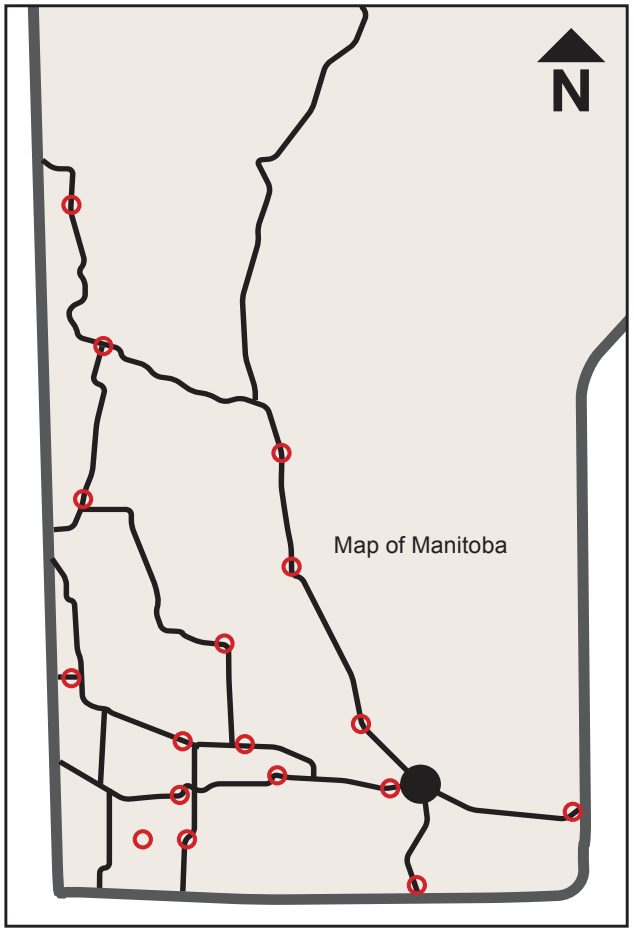
The purpose of this project will be to plan, design, and deploy additional Roadside Weather Information System (RWIS) and relevant environmental detection technologies along All NHS highways in Manitoba to generate improved responses to weather events, en route traveller information, winter maintenance planning, as well as to increase situational awareness by Manitoba Infrastructure (MI).

This project would encompass fixed roadside environmental sensors, mobile RWIS (i.e., sensor systems located on maintenance and construction vehicles) CCTV cameras, equipment for data transmission, and repositories via wired or wireless communications. Based on the locations of the existing RWIS installation and operation, additional roadside RWIS installations will be planned along the NHS network. Moreover, mobile RWIS applied on maintenance and construction vehicles will be widely deployed along the NHS roadways as a supplement. Both RWIS options will improve the real-time road and weather condition data collection. Data collected will be temporally stored or directly sent to the central system to detect weather related events (e.g., icy road conditions, high winds, dense fog, etc.) for travelling decision-making for road users, transportation operators, information providers and roadway maintenance personnel.

The planning phase of this project will need to focus on the identification of specific locations to implement roadside RWIS and mobile RWIS across the NHS network in Manitoba. This will be done in consultation with the various maintenance personnel.

The implementation phase of the project should determine the details and specifications of RWIS, system general architecture in terms of data collection, transmission and storage, connections to power and communications, and any central systems/archiving, etc.

Coverage



- Existing RWIS

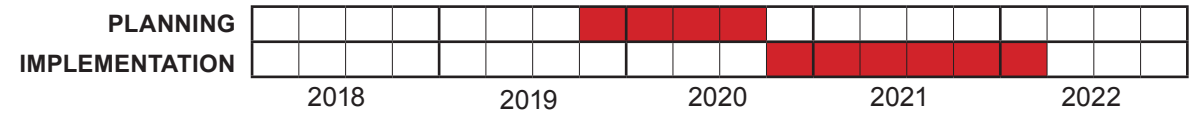
Outcomes

- Roadside RWIS-Collected real-time data, in terms of weather and road condition, air quality, temperature, roadway maintenance and construction, over the NHS network in Manitoba
- Mobile RWIS-Collected real-time data, in terms of weather and road condition, air quality, temperature, roadway maintenance and construction, over the NHS network in Manitoba
- Real-time video or image feed for event validation

Technologies

- Environmental Sensors
- Mobile RWIS
- Central Hardware & Software
- Telecom
- CCTV

Timeline (Phase 1: 2018 - 2022)



Costs

Capital

- **$10,000**/Mobile RWIS per Vehicle
- **$120,000**/Fixed Roadside RWIS Station
- **$5,000**/CCTV
- Central Equipment **$25,000** to **$30,000**
- Telecommunications. Central Hardware and Software Operation Cost: TBD

Operating & Maintenance Cost

- 15% of Capital

ROI

H

Related Initiatives

1 2

Pre-requisite Projects

1 2

Deployment Options

- Staged Deployment

6 Road Weather Forecasting and Operational Procedures

Description

The purpose of this project will be to develop procedures to forecast road weather conditions, monitor and detect potential natural weather events and provide operational guidance for road users all across the NHS network in Manitoba.

This project will include the following three components:

1) Enhanced regional and road-specific forecasting through customized weather forecasting services by the third party forecasting providers. They will use fixed and mobile RWIS data, as well as regional and worldwide meteorological data, to provide frequent local area and site-specific forecasts. This will enhance road maintenance planning and provide more targeted treatment and traveller information. Combining this project with Project 5 will allow for the current maintenance decision support system provider to use more site specific RWIS data to supplement the forecasting.

2) Enhanced road reporting through increased patrols and mobile RWIS to improve reporting accuracy and frequency on critical routes and routes with high numbers of incidents.

3) This project will implement partnerships with citizens, crowd-source providers, and transportation carriers on reporting road conditions in rural areas such as what occurs in Alberta.

Coverage

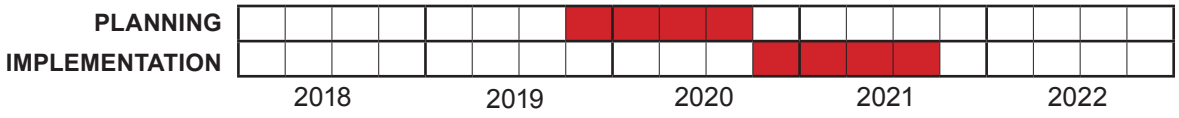
Outcomes

- More targeted deployment of resources and road treatment materials
- Advanced response to major weather events
- More accurate and timely road condition reporting

Technologies

- Third-Party Forecasting
- Environmental Sensors
- Mobile RWIS

Timeline (Phase 1: 2018 - 2022)



Costs

Capital

- **$200,000** Development of forecasting service requirements and Procurement.
- **$150,000** Public Reporting System

Operating & Maintenance Cost

- Weather Services-**$250,000**/year

ROI

M

Related Initiatives

1 2

Pre-requisite Projects

3 4

Deployment Options

- Traditional Approach

7 Traveller Information System Public Interface Upgrade

Description

The purpose of this project will be to enhance the application of the existing traveller information systems such as 511 system, by implementing system interface upgrades.

This project will integrate and present collected real-time traffic and environmental data related to road conditions, environmental information, event information and incidents along all NHS roadways. This system interface upgrade would include several components such as GIS-friendly interface development, open data interface development, and interface improvement for data sharing among all relevant agencies. The interface development will include a mobile phone ready interface and mobile phone app.

With the interface upgrade, the new 511 system will provide more interactive and customizable information, user-friendly alerts (email, text and app alerts), direct information sharing, open platforms to accommodate various methods of traveller's access, and exporting and archiving of traveller information data to the province-wide data warehouse for reporting and analysis. Alberta, British Columbia and Ontario are or have implemented more open and user customizable systems.

The focus of this project is to incorporate multi-source traffic and environmental data, as made available through the Project 1, 2, 3, 5 and 6, into the upgraded 511 system.

Coverage

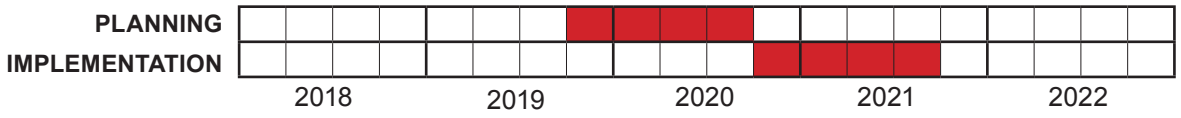
Outcomes

- Open data sources available for the third party providers
- User friendly customizable data access by the public

Technologies

Central Hardware & Software

Timeline (Phase 1: 2018 - 2022)



Costs

Capital

- 511 System Interface Upgrade **$250,000**

Operating & Maintenance Cost

- 15% of Capital

ROI

H

Related Initiatives

1 2 3

Pre-requisite Projects

1 2 3 5 6

Deployment Options

- Traditional Approach

8 Border Traffic Management & Information System Concept of Operations

Description

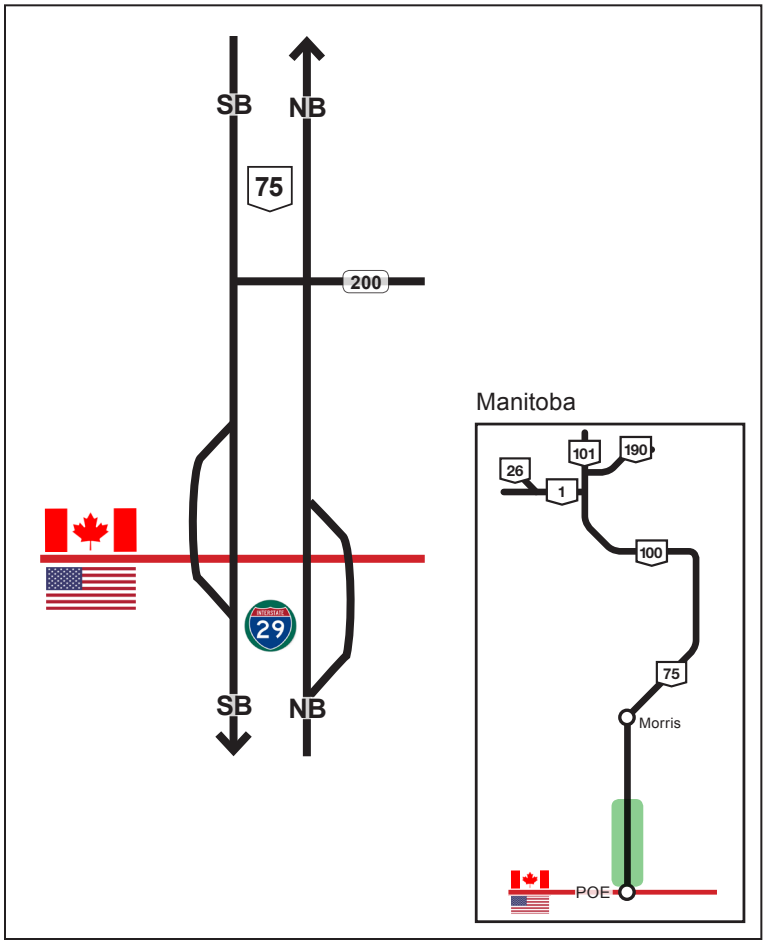
The purpose of this project will be to develop a concept of operations to assess and define how the outcomes of Projects 1, 2, 5 and 6 could be used in the border context for traffic management and information system improvement.

To develop this concept of operations, new conceptual and logic ITS architecture at the border will be planned, based on the existing Border Information ITS Architecture (BIFA), to deal with collected traffic, roadway and weather data/information input, analysis, decision-making, and dissemination. In addition, some business cases will be developed to cover the needs of all border agencies by focusing on cooperation and coordination among all border agencies.

This project would be developed base on the active collaboration/cooperation and technical integration between Canadian and US transportation authorities, customs and border agencies and institutions.

It is expected that, with the development and application of this border concept of operations, traffic management at the border will be optimized and border operation information system will be upgraded based on more data-sharing demands. It will help establish a platform for more accurate information for port through put reducing delays and congestion.

Coverage



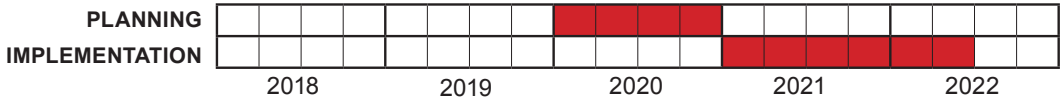
Outcomes

- ITS logic and architecture plan for new concept of operations at the border
- Improved border agency coordination
- Business cases for implementation of all agency coordination in terms of the needs from all parties
- Well defined requirements for institutional cooperation
- More accurate information for port throughput reducing delays and congestion

Technologies

- Central Hardware & Software
- Roadside Probe
- Mobile Probe
- Mobile RWIS
- Environmental Sensors
- CCTV
- Telecom
- Traffic Sensors

Timeline (Phase 1: 2018 - 2022)



Costs

Capital

- **$150,000** Development of Concept of Operations
- **$50,000** Development of ITS Architecture
- **$50,000** Development of Business Cases

ROI

H

Related Initiatives

1 2 7

Pre-requisite Projects

1 2 5 6

Deployment Options

- Traditional Approach

9 Automated Electronic Permit and Routing System Enhancements

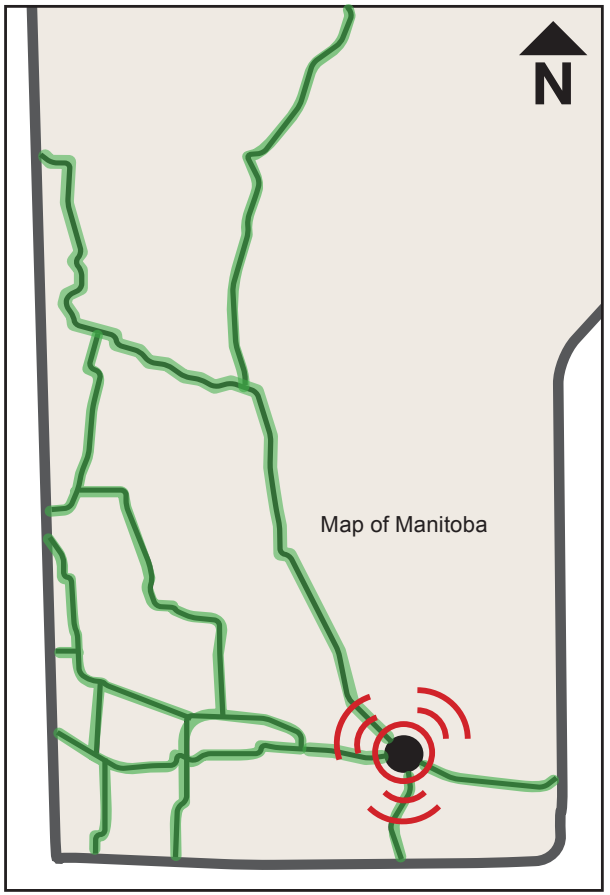
Description

The purpose of this project will be to build on the already implemented advanced routing and permitting system (ARPS) that will enable commercial operators enhanced access to the self-service 24/7 method of applying for and receiving auto-approved permits as well as integration with other MI systems including traveler information. The future ARPS will be able to identify conflicting permits, identify recommended corridors, produce schedule maps and share information between the system, commercial vehicle operators and the traveler information system. Data will be collected and shared through the provincial data warehouse allowing for the department and other agencies to use the information to guide longer term planning and policy decisions. MI resources will be freed-up, allowing MI staff to focus its expertise on applications that require more in-depth review and planning because of the size of the load or challenges on the route etc.

These improvements should result in a more efficient and timely permitting process, better tracking of overweight and over dimension loads as well as enable improved information sharing with affected stakeholders such as the City of Winnipeg or Brandon, border operations and the traveling public.

Ultimately, further enhancements to ARPS will help the commercial vehicle industry get goods to market faster, by automatically approving permits and showing drivers detailed information on the approved (and safe) route to follow – improving safety for the carriers and the communities they travel through. Specific near term activities planned include upgrades to the permitting system for over-dimensional/overweight trucks including automated routing and self-issuance.

Coverage



Outcomes

- Improved information on commercial vehicle and dangerous goods movements.
- Improved tracking and traveller information of road disruptions (i.e. wide loads).
- Improved collaboration during events related to commercial vehicle movements.
- Improved operations for commercial carriers.

Technologies

Central Hardware & Software

Timeline (Phase 1: 2018 - 2022)

Costs

- $200,000

ROI

M

Related Initiatives

8

Pre-requisite Projects

3 4

Deployment Options

- Solution as a Service

10 Electronic Screening for Commercial Vehicle Inspection Bypass

Description

The purpose of this project will be to deploy electronic screening technologies that enable Commercial Vehicle Operators (CVO) to bypass key weigh scale and inspection stations on the NHS.

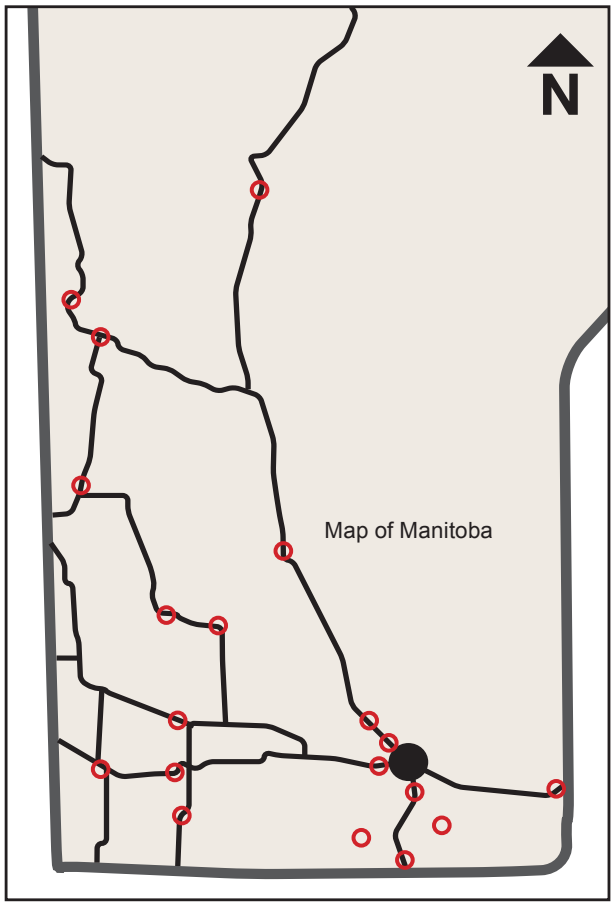
The electronic screening system will employ vehicle identification technology (either transponder or mobile device/apps) and weigh-in-motion devices that allow real time weight and credentialing screening of commercial vehicles before they arrive at an inspection station. If a commercial vehicle is in compliance with applicable regulations, it will be allowed to pass the inspection site and avoid any undue delay.

Electronic screening will optimize use of resources by allowing them to focus on non-compliant vehicles, while reducing unnecessary delays and costs for compliant operators.

This project will require close collaboration with the commercial vehicle carriers (to achieve a high degree of adoption for on-board vehicle identification) and neighbouring agencies (for the exchange of carrier safety data). Since the project is already in the planning phase with MI review of the technology options as part of the design phase should be considered including consideration for transponder and mobile applications as well as consideration for costs, ease of implementation and consistency with neighbouring jurisdictions.

The pursuit of this project will require the following key components: a) selection of key inspection sites; b) coordination and collaboration with neighbouring agencies for the exchange of carrier safety data; c) evaluation of technologies; d) design and construction of field equipment and supporting civil works; and e) communications and marketing to carriers.

Coverage



Existing Weigh Stations

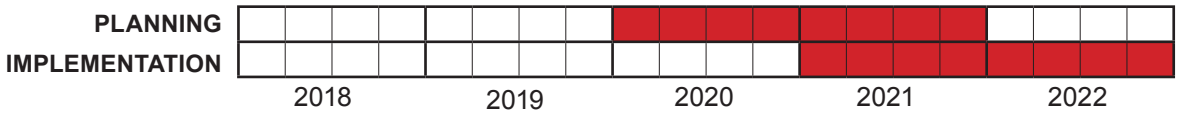
Outcomes

- Improved ability to monitor CVO weight adherence
- Improved ability to monitor CVO maintenance
- Improved ability to monitor CVO driver compliance
- Reduced CVO infractions
- Reduced wear on infrastructure
- Ability to target most likely offenders
- Optimized use of resources
- Reduced delays and costs for compliant operators

Technologies

- Central Hardware & Software
- Automatic Vehicle Identification
- Weigh in Motion
- Dynamic Message Signs
- In-Vehicle Signage

Timeline (Phase 1: 2018 - 2022)



Costs

- **$1.5M** to **$3.0M** per station
- Costs can vary significantly based on the extent of supporting civil works for the construction of bypass lanes and if weigh-in-motion is included.

ROI

H

Related Initiatives

8

Pre-requisite Projects

N/A

Deployment Options

- Staged Deployment

11 Business Process and Policy Development

Description

The purpose of this project will be to develop policies to support the implementation of all other ITS projects across the NHS network in Manitoba.

This project will develop the policies to regulate the items such as operation and maintenance procedures, open data sharing requirements and internal coordination to provide fast response to major events for other ITS projects.

With the role out of technology, services and central management systems policies will need to be developed such that operations can support and leverage the technology for improved operations.

Internal business processes and policies should also be developed to ensure coordination of technology projects to maximize investments across the organization. This will enable multiple business units to leverage benefits from the technology.

Coverage

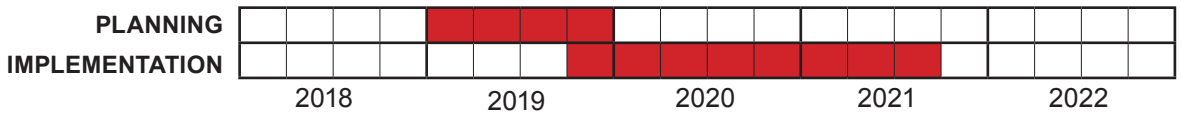
Outcomes

- Policies on data sharing
- More coordination internally during the response to major events
- Clear business processes that leverage technology for more efficient operations

Technologies

This project sets operational frameworks to take advantage of technologies implemented by other projects.

Timeline (Phase 1: 2018 - 2022)



Costs

- 5% of total cost from each ITS project could be allocated to fund this effort

ROI

H

Related Initiatives

4

Pre-requisite Projects

N/A

Deployment Options

- Traditional Approach

12 Develop and Monitor ITS Research Program

Description

The purpose of this project will be to develop and monitor ITS research programs related to emerging technologies for MI to obtain knowledge of trends in ITS development and its potential applicability for business cases. This project will proceed based on a programmatic approach to address needs and interest areas from MI including research topics that can be used to support other short-term projects. This project will be driven mainly by application opportunities for emerging ITS technologies and funding applications.

The potential components of this project will include:

1) Researching emerging trends: this component will focus on the new ITS technology inventory, as well as MI's potential research opportunities on emerging ITS technologies in collaboration with Universities in Manitoba and other provinces in Canada. An ITS Governance and Collaboration committee with MI will be developed to direct the research and lead the partnership with universities and other research sources.

2) Monitoring and evaluation program: this component will focus on establishing a new program to monitor and evaluate ITS research process and the value of the research results and conclusions.

3) Business case development: this component will focus on how to apply the successful ITS research outcomes into ITS-related business projects.

In addition, departmental coordination within MI and coordination between MI and the Council of Ministers, TAC, ITS Canada and other agencies are also important impact factors for this project.

This project has strong ties to project 11 and will require strong coordination throught the recommended management structure.

Coverage

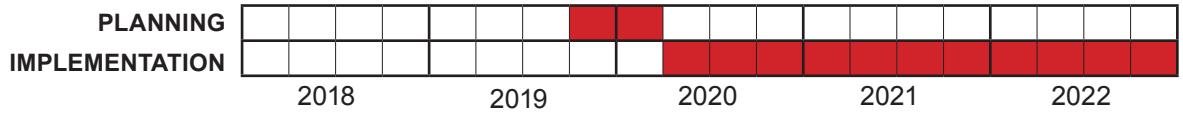
Outcomes

- Collaboration with research institutions
- Monitoring and evaluation program for ITS research
- ITS research lead technology transfer to industry

Technologies

N/A

Timeline (Phase 1: 2018 - 2022)



Costs

- Internal On-Going Cost (TBD)

ROI

M

Related Initiatives

10

Pre-requisite Projects

N/A

Deployment Options

- Traditional Approach

13 Automated Weather Response Deployment

Project Description

Establish and operate automated response systems that will monitor and automatically respond to specific weather events in areas where conditions are known to repeat. Some examples may include snow and visibility events, flooding, high winds etc. The integration of collected weather data and pre-determined response will allow for more timely notification of events for operations staff and travellers directly at the location affected. An example may be a regular occurring bridge icing situation where the sensor realize the issue and immediately notify drivers Notification would include on route messages (active signs), updates to the 511 systems and potentially feeds to the media (via 511).

Pre-Requisites

5 6

Outcomes

- Better informed travellers during weather related events.
- Improved response by maintenance operations.
- Improved Safety.

Technologies

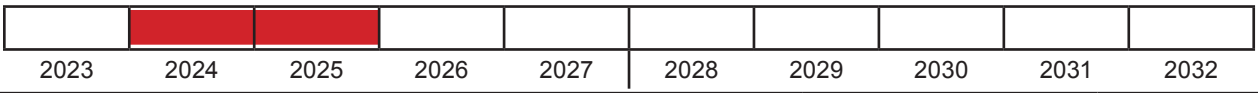
Central Hardware & Software

Dynamic Message Signs

ROI

M

Timelines (2023 - 2033)



14 Enroute Traveller Information

Project Description

Deployment of enroute traveller information devices such as fixed and temporary dynamic message signs to provide information to travellers on the roadways, particularly approaching the border crossing. These signs would be deployed upstream of areas prone to hazardous conditions where travellers can made route choices.

Mobile message signs would be made available at key locations throughout the province with cellular communications for quick deployment in response to adhoc events.

Pre-Requisites

3 7

Outcomes

- Better informed travellers en-route during traffic related events.
- Improved management of travellers.
- Improved Safety.

Technologies

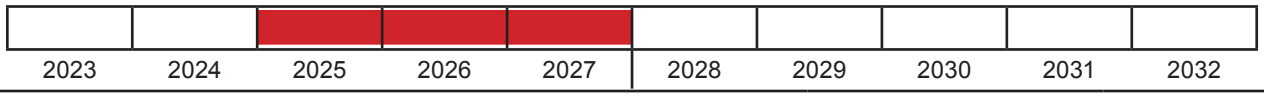
Central Hardware & Software

Dynamic Message Signs

ROI

M

Timelines (2023 - 2033)



15 Traveller Information System Data Exchange

Project Description

Development of agreements and technology to exchange traveller information between agencies. This would include making MI data available to assist with reporting and response to events by agencies adjacent to Manitoba. Similarly Manitoba would receive weather and road condition data from neighbouring provinces and states as well as traffic data from the City of Winnipeg, highway 1 in Ontario, North Dakota and border operations.

Pre-Requisites

3 7

Outcomes

- Improved traveller information.
- Better response to events adjacent to the NHS that will have a potential impact on operations.
- Improved operations on other agency roads.

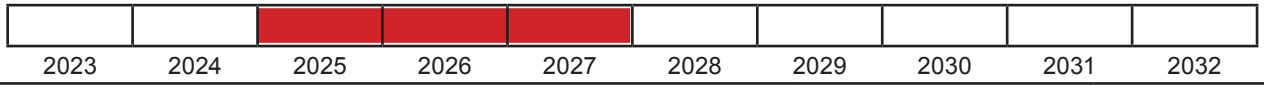
Technologies

Central Hardware & Software

ROI

L

Timelines (2023 - 2033)



16 Traffic Management Centre

Project Description

Establishment of a centralized traffic operations control center as a facility that would be responsible for the province-wide management of NHS roadways, including the design and construction of a new/retrofitted physical facility or collocating with another operational entity (Winnipeg). The TMC would leverage ITS investments by enabling monitoring, management, and response to incidents and events impacting the NHS.

Pre-Requisites

1 2 3 4 11

Outcomes

- Maximize benefits of the short-term ITS investments.
- Improved operational response to events.
- Improved Situational awareness and collaboration both internally and externally.

Technologies

Central Hardware & Software

Dynamic Message Signs

ROI

M

Timelines (2023 - 2033)

17 Border Traffic Management System Deployment

Project Description

Design and deployment of the ITS equipment required to support the Concept of Operations (Con-Ops) developed under Project 13. Primary focus will be on leveraging the traffic and environmental monitoring capabilities deployed as part of the short-term projects, to manage and inform border traffic on adverse conditions (i.e., extreme weather and incidents/congestion).

Pre-Requisites

8

Outcomes

- More efficient border travel for all modes.
- Optimize benefits from other programs FAST, NEXUS, etc.

Technologies

Dynamic Message Signs

Web/Mobile App

ROI

M

Timelines (2023 - 2033)

18 Industry and Technology Detailed Assessment for Secure Tracking

Project Description

Assessment of applicable container tracking and security technologies such as e-seals. This would include development of a Concept of Operations based on the architecture and applicable technologies. To Support this, a starting point would be to use of the BIFA ITS architecture to develop a regional ITS architecture for the Manitoba / US border context.

Pre-Requisites

8

Outcomes

- Better understanding for the issues and opportunities to leverage technology to improve the efficiency and security of trade.
- Identification of next steps to support a pilot deployment.
- Improved collaboration with other agencies.

Technologies

E-Seals

Container Tracking

ROI

M

Timelines (2023 - 2033)

19 MI Asset Monitoring Sensor Expansion

Project Description	Pre-Requisites
Enhancements to field sensors and deployment of additional sensors for near-real-time reporting of MI assets including bridge structures and key roadway segments that are prone to instability over time. This project could also include additional frost probes to assist with management of the weight restriction program. Additional telecommunications services will also be required to support this monitoring effort.	N/A

Outcomes	Technologies	ROI
• Improved management and preservation of assets. • Improved response to events impacting traffic or travellers safety.	Field Sensors; Central Hardware & Software; Telecom	L

Timelines (2023 - 2033)

20 Corporate Asset Management System Integration

Project Description	Pre-Requisites
Integration of all (new and old) ITS field systems into the corporate asset management system. Development of maintenance and lifecycle replacement program for ITS technologies.	19

Outcomes	Technologies	ROI
• Improved monitoring and maintenance of ITS assets. • Improved planning for maintenance and lifecycle replacement budgets.	N/A	L

Timelines (2023 - 2033)

21 Integration of Asset Management GIS Data with Traffic Management Centre

Project Description	Pre-Requisites
Integration with and upgrade to corporate GIS standards. Population of the database or connection to existing systems in order have access to geographic data (i.e. elevations) during management of events.	19

Outcomes	Technologies	ROI
• Improved coordination and sharing of information with other departments during events. • Improved access to relevant information during events.	Central Hardware & Software	M

Timelines (2023 - 2033)

22 Data Warehouse Development and Deployment

Project Description

Design and deployment of a central data warehouse that can archive available data and consume and integrate new data sets as they become available. This project will also have provisions for data sharing with other systems and agencies supported by the corresponding data sharing policies and agreements. Following the data warehouse audit, smaller portions of this project could be piloted with new data sets as they come available.

Pre-Requisites

4

Outcomes

- Improved data sharing between departments and agencies.
- Improved situational awareness for operations.
- Improved TMC and 511 operations.

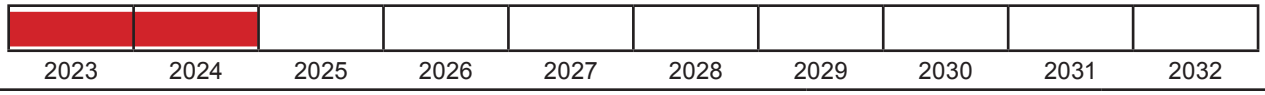
Technologies

Central Hardware & Software

ROI

H

Timelines (2023 - 2033)



23 Traffic Management System

Project Description

Design and deployment of a system that ingests real-time information from sensors an dother systems including RWIS, traffic monitoring, and CCTV. The system will monitor and deploy resonses to operators and motorists through DMS, traveller information and the data warehouse. This project will also have provisions for data sharing with other systems and agencies supported by the corresponding data sharing policies and agreements.

Pre-Requisites

1 2 4 11 16

Outcomes

- Improved safety.
- Reduced congestion.
- Efficient use of roadway capacity.

Technologies

Central Hardware & Software

ROI

H

Timelines (2023 - 2033)

24 Border Approach Demand Management

Project Description

Functional and geographical expansion of the Border Traffic Management system capabilities, to provide weather, incident, and wait-time information along the extended approach to the border to allow travellers to change the time or mode of their trip.

Pre-Requisites

8 17

Outcomes

- More efficient border travel for all modes.
- Optimize benefits from other programs FAST, NEXUS, etc.

Technologies

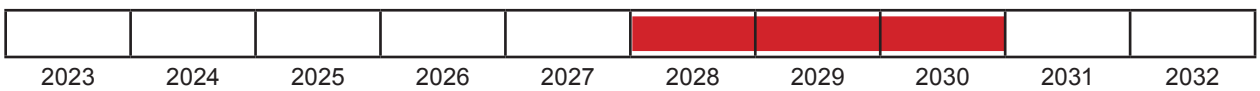
Dynamic Message Signs

Web/Mobile App

ROI

L

Timelines (2023 - 2033)



25 Pilot Program for Secure Container Tracking

Project Description

Pilot of cargo security and tracking technologies identified in the concept of operations, likely on the Hwy 75 corridor from the PoE to Centre Port.

Pre-Requisites

8 9 10 18

Outcomes

- Determination of longer term program rollout.
- Improved goods movement.
- Improved collaboration with other agencies.

Technologies

E-Seals

Container Tracking

ROI

L

Timelines (2023 - 2033)

26 Data Sharing and Analytics

Project Description

Procurement of front-end tools for reporting and analytics that will improve operations based on the ongoing collection of data. This project will be based on a solid data warehouse and the Identification of operational improvements desired. This will form the foundation of a well-planned system targeted at using MI data to create business intelligence.

Pre-Requisites

4 22

Outcomes

- Improved system performance reporting.
- Enhanced tools for improving operations.

Technologies

Central Hardware & Software

ROI

M

Timelines (2023 - 2033)

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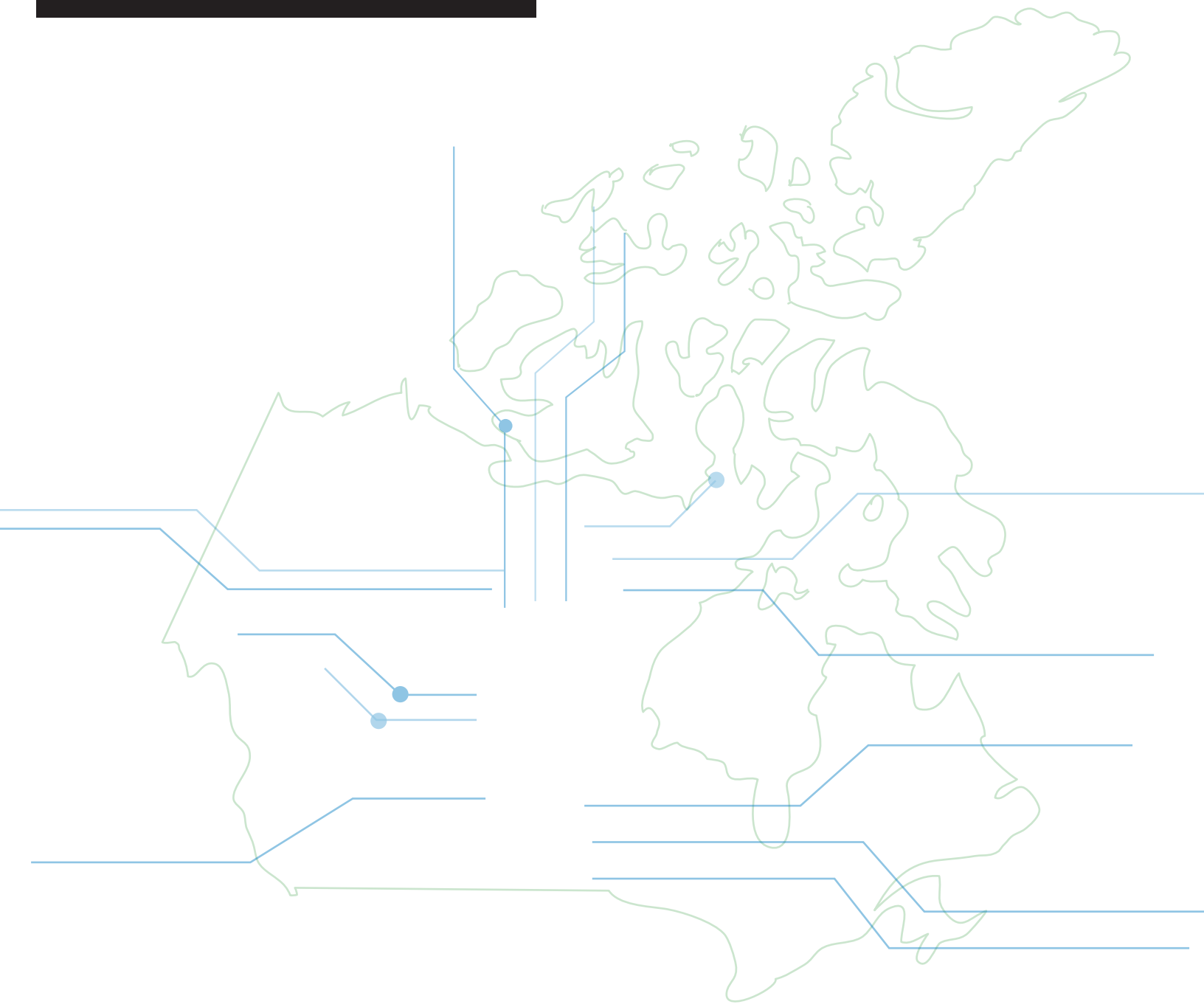

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