# INTELLIGENT TRANSPORTATION SYSTEMS

## STRATEGIC PLAN JUNE 2018




PREPARED BY:

Associated Engineering

GLOBAL PERSPECTIVE. LOCAL FOCUS.

stalbert.ca

City of St. Albert Cultivate Life

**CONFIDENTIALITY AND © COPYRIGHT**

This document is for the sole use of the addressee and Associated Engineering Alberta Ltd. The document contains proprietary and confidential information that shall not be reproduced in any manner or disclosed to or discussed with any other parties without the express written permission of Associated Engineering Alberta Ltd. Information in this document is to be considered the intellectual property of Associated Engineering Alberta Ltd. in accordance with Canadian copyright law.

This report was prepared by Associated Engineering Alberta Ltd. for the account of City of St. Albert. The material in it reflects Associated Engineering Alberta Ltd.'s best judgement, in the light of the information available to it, at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Associated Engineering Alberta Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

# ACKNOWLEDGEMENTS

The St Albert ITS Strategic Plan was developed with support from various staff within St. Albert, supporting agencies and a diverse consultant team, who are recognized here.

Project Steering Committee:
Dean Schick, Manager of Transportation and Engineering Services, Project Sponsor
Travis Peter, St. Albert Smart City and Innovation Manager
Marius Vlad, St Albert ITS Strategic Plan, Project Manager

Stakeholders submitted responses to an ITS questionnaire and attended a workshop, providing valuable input to the Needs Assessment phase of the ITS Plan. Attendees at the workshop included:

Associated Engineering:
Kent Eklund, Monique Kealey, Keenan Kitasaka, and Alex Yang

City of St Albert:
Dean Schick, Travis Peter, Gordon Coulman, Tammy Kobliuk, Christian Benson, Jennifer Becker, Shelley Sawchuk, Percy Janke, Will Stebllyk (St Albert Transit), Marius Vlad, Alyson Lendzion, Derek Dallorto, Joan Barber and K. Peter

Technical Consulting Team:
Kent Eklund, Associated Engineering, Division Manager (Transportation), ITS Plan Project Manager
Keenan Kitasaka, P.Eng., Associated Engineering, ITS Specialist, ITS Technical Lead
Jessica McLennan, EIT, Associated Engineering, ITS Engineer
Ian Steele, P.Eng., PBX Engineering, Principal and Senior Design Engineer

# SUPPORTING DOCUMENTS

The development of the ITS Strategic Plan was informed by:

- The St. Albert Transportation Master Plan (https://stalbert.ca/dev/engineering/transportation/master-plan/)
- The St. Albert Smart City Master Plan (https://stalbert.ca/dev/smart/masterplan/)
- St. Albert Transit Long Term Development Plan (https://stalbert.ca/uploads/PDF-reports/Long_Term_Dept_Plan_APPROVED.pdf)

These documents provided strategic direction and guidance to ensure that the ITS Strategic Plan addressed the unique challenges that face St. Albert.

# EXECUTIVE SUMMARY

## Background

The Intelligent Transportation Systems (ITS) Strategy is the first for the City of St. Albert and it identifies the commitment of the community towards supporting the safest and most efficient transportation network for all forms and levels of mobility. It has been developed with direction provided from aligned municipal policies and plans, influence from industry practice and stakeholder feedback on priority needs and incorporates the current state of the transportation network to enable and support ITS in enhancing community service levels.

The St. Albert ITS Strategic Plan enables a wide range of applications that process and share information with road users, assists in easing congestion through improved traffic management, minimizes environmental impacts and increases benefits of transportation services for commercial goods movement and to residents and visitors of the City. By formalizing the vision, mission and objectives for ITS within the community, there may be a transparent integration of new technologies and partnerships created between stakeholders to maximize on innovative solutions as the City and Edmonton Metropolitan Region grow.

## Strategic Framework

Aligned to Council Strategies and the Corporate Plan, a strategic framework has been developed to guide the development and implementation of this strategy. This framework consists of a vision, mission, guiding principles, and objectives.

The vision for the Intelligent Transportation Systems Strategy is:

***Building a better community through transportation innovation.***

In support of achieving this vision, the City of St. Albert has developed a mission statement:

***We bring technology and innovation together, applying them to transportation challenges to protect the City's quality of life.***

The principles that will guide the City and its partners in its mission to achieve the stated vision are identifiable through ten principles, aligned to the acronym SMART IDEAS and are described as follows:

- **Safety**: As a priority, ITS integration will support the City's safety vision of no fatalities or serious injuries occurring due to motor vehicle collisions on public roadways.
- **Measurable**: Deliverables of ITS strategies shall be evaluated, with ongoing network monitoring and measures of effectiveness.
- **Adaptive**: ITS will enable the transportation network to adapt to demand and need of road users in real time; maximizing on service delivery and the capacity of the network.

- **Regional**: Although ITS innovation shall be placed to benefit the priorities and needs of St Albert, its integration shall consider regional context, partnership opportunities, and larger demand needs for the Edmonton Metropolitan Region.
- **Teaming**: Developing the relationships and partnerships between stakeholders, research groups and industry to collaborate on ITS integration with a focus on opportunity of regional consideration and collaboration.
- **Integration**: Ensuring ITS considerations are made in project planning, program management, community design, construction and communications.
- **Developing**: In recognition that ITS is consistently expanding and new technology is being developed, the City's network shall be capable of supporting forthcoming technology and ITS advancements.
- **Environment**: Intelligent systems will increasingly support the monitoring, evaluation and mitigation of the environmental impact of transport.
- **Accessible**: ITS shall enable and support Open Data; with information made available for public use in network decision making and for commercial benefit of advancing innovative ideas and applications.
- **Supportive**: ITS shall support the needs of multiple users and modes, while the community shall encourage innovation and technology by removing potential barriers through applicable municipal policy and governance.

The overall objective of the Intelligent Transportation Systems Strategy is to pursue a set of strategies (in partnership with others, where appropriate) that will support the development and deployment of technologies to maximize safety, efficiency and provide the highest levels of service to network users. Actions shall enable improved data collection, management and information sharing; and although a primary focus surrounds the integration of ITS to the City of St. Albert, the strategy is aligned to open discussion and collaboration with partners of the Edmonton Metropolitan Region for larger scale implementation.

Key goals of the ITS Strategy are:

- Improve efficiencies of the transportation network;
- Increase safety;
- Support livability and sustainability;
- Enhance economic prosperity and goods movement;
- Support regional transportation;
- Develop active and transit transportation network;
- Encourage innovation and technological excellence; and
- Support and enhance data management.

Specific projects have been developed for each of the individual focus areas. These actions may generate opportunity of collaboration between internal City departments, or between the City and industry or regional partners. To support the strategy's implementation and identify further considerations moving forward, there have been five discussion papers developed. These papers provide background on:

1) Data management;
2) Telecommunications;
3) City wide ITS implementation;
4) Regional Integration;
5) Imagine autonomous vehicles in St. Albert

These papers informed the projects selected, and the conclusions of the strategic plan.

### ITS Strategies and Projects

The St. Albert ITS Strategy follows the national ITS architecture in Canada and framework for programs and projects. The architecture defines nine user service "bundles" with corresponding sub-services. The key nine service "bundles" are:

1) Traveller Information
2) Traffic Management
3) Public Transportation
4) Electronic Payment
5) Commercial Vehicle Operations
6) Emergency Management
7) Vehicle Safety / Control
8) Data and Information Management
9) Maintenance and Construction Management

Specific strategies have been developed that are aligned to each of the nine service bundle areas., In addition, there have been five general ITS strategies developed. Within these strategies, there are 41 projects proposed that will support the goals and objectives of the ITS plan, as well as the Smart City Master Plan and the Transportation Master Plan. Each project is phased over 10 years in short, medium and long-term horizons.

A separate implementation strategy will be generated for integration of strategies and projects proposed from this plan. The ITS Strategy itself shall be monitored and evaluated moving forward. The document shall be reviewed for projects completed, measures of effectiveness of the strategies incorporated to the transportation network and partnerships developed that are aligned to this strategy. An update is expected to occur to the strategy following at approximately five years in, that will allow for alignment to City strategies and priorities, acknowledgment of actions completed to date and integration of new technologies.

# TABLE OF CONTENTS


| SECTION | | | PAGE NO. |
|---|---|---|---|
| ACKNOWLEDGEMENTS | | | i |
| SUPPORTING DOCUMENTS | | | ii |
| EXECUTIVE SUMMARY | | | iii |
| TABLE OF CONTENTS | | | vi |
| LIST OF ABBREVIATIONS | | | vii |
| **1** | **INTRODUCTION AND BACKGROUND** | | **1-1** |
| | 1.1 | SUMMARY OF BACKGROUND DOCUMENTS | 1-1 |
| | 1.2 | TRAFFIC VOLUMES | 1-2 |
| | 1.3 | INVENTORY OF INFRASTRUCTURE | 1-4 |
| | 1.4 | ENVIRONMENTAL SCAN AND BEST PRACTICES | 1-5 |
| **2** | **NEEDS ASSESSMENT AND STAKEHOLDER ENGAGEMENT** | | **2-1** |
| | 2.1 | ITS PRIMER AND QUESTIONNAIRE | 2-1 |
| | 2.2 | ITS WORKSHOP | 2-2 |
| | 2.3 | QUESTIONNAIRE RESPONSES | 2-2 |
| **3** | **ITS VISION, MISSION, PRINCIPLES, GOALS AND OBJECTIVES** | | **3-1** |
| **4** | **DISCUSSION PAPERS** | | **4-1** |
| | 4.1 | DATA MANAGEMENT | 4-1 |
| | 4.2 | TELECOMMUNICATIONS | 4-2 |
| | 4.3 | REGIONAL INTEGRATION | 4-3 |
| | 4.4 | CITY WIDE ITS DEPLOYMENT | 4-3 |
| | 4.5 | AUTONOMOUS VEHICLES | 4-4 |
| **5** | **ITS STRATEGIES AND PROJECTS** | | **5-1** |
| **6** | **CONCLUSIONS AND RECOMMENDATIONS** | | **6-1** |
| Appendix A – Technical Memos | | | |
| Appendix B – Discussion Papers | | | |
| Appendix C – Network Diagram | | | |

# LIST OF ABBREVIATIONS

| | |
|---|---|
| APC | Automated Passenger Counter |
| ATIS | Advanced Traveller Information System |
| ATMS | Advanced Traffic Management Services |
| AV | Autonomous Vehicle |
| CV | Connected Vehicle |
| CVE | Commercial Vehicle Enforcement |
| DG | Dangerous Goods |
| EPS | Electronic Payment Services |
| HD | High Definition |
| HOV | High Occupancy Vehicle |
| ICM | Integrated Corridor Management |
| IoT | Internet of Things |
| ITS | Intelligent Transportation System |
| KPI | Key Performance Indicators |
| LPR | License Plate Recognition |
| LRT | Light Rail Transit |
| MDT | Mobile Data Terminal |
| NTCIP | National Transportation Communications for Intelligent Transportation System Protocol |
| OCR | Optical Character Recognition |
| PIC | Partners in Compliance (Alberta) |
| PTZ | Pan Tilt Zoom |
| RFID | Radio Frequency Identification |
| RWIS | Road Weather Information System |
| TDM | Travel Demand Management |
| TMC | Traffic Management Centre |
| TMP | Transportation Master Plan |
| TSP | Transit Signal Priority |
| WIM | Weigh In Motion |
| VLU | Vehicle Logic Unit |
| VMS | Variable Message Sign |




# 1 INTRODUCTION AND BACKGROUND

The St. Albert Intelligent Transportation System (ITS) Strategic Plan considers the City's established strategic priorities, policies and plans, the state and characteristics of the transportation system, the existing inventory of ITS related infrastructure, and established best practices by other jurisdictions in ITS documentation. This information provided a baseline as input to the development of the strategic plan.

## 1.1 SUMMARY OF BACKGROUND DOCUMENTS

The development of the City of St. Albert ITS Strategic Plan was supplemented by policy and planning documents. The objectives, goals, and interventions related to transportation and technology identified in the documents provided direction to the ITS Strategic Plan. Further, these documents provided valuable input into the Needs Assessment report. The two key documents to support the development of the ITS Strategic Plan were the St. Albert Transportation Master Plan (TMP), and the St. Albert Smart City Master Plan.

### 1.1.1 St. Albert Transportation Master Plan (2015)

The St. Albert Transportation Master Plan (TMP) provides high level direction to other working plans. It focuses on five key areas, which include:

- The road network
- The active transportation network
- The public transportation network
- The goods movement network
- Intelligent Transportation Systems (ITS)

The Transportation Master Plan identifies ITS as having the ability to support many of the strategies outlined in the TMP, inclusive of improving efficiency, safety and security of the transportation network.




### 1.1.2 St. Albert Smart City Master Plan (October 2016)

The St. Albert Smart City Master Plan (October 2016) was developed to apply new technologies and data sources for the public benefit. This plan was designed to support St. Albert's goals and priorities, including Social, Economy, Built Environment, Natural Environment, Culture, Governance, and Service Delivery. The key outcomes of the plan are greater efficiency, dynamic economic development, and enhanced service delivery. Overall, the Smart City Master Plan is comprised of 22 distinct strategies of which eight are high priority and fundamental to the City's advancement in this initiative. In addition to the TMP, the Smart City Master Plan is considered a key document in developing the ITS program, with several common areas of interest and projects.

### 1.1.3 Other Documents

Other policy and planning background documents that were examined to provide direction to the ITS Strategic Plan include:

- Transit Long Term Development Plan (2013)
- City of St. Albert Utility Master Plan Update (2013)
- St. Albert Trail and Boudreau/Giroux Road Corridor Safety Review (2015)
- St. Albert Business and Tourism Development Long Term Departmental Plan (2008)
- Information Technology Services and Geographical Information Services Departmental Long Term Plan (2014)
- City of St. Albert Economic Development Master Plan (2004)
- Public Works Long Term Plan (2009).

It is important to note that the projects in the ITS Strategic Plan fundamentally support the initiatives in these higher-level documents. Summaries and details of the above documents can be found in **Appendix A – Technical Memos**.

## 1.2 TRAFFIC VOLUMES

The primary data source of network traffic and pedestrian volumes was information collected during the 2015 TMP development. During this period, the analysis of data incorporated corridor and intersection level of service review to which there were identifiers of network capacity issues and locations of congestion / delay. Although network road improvements were recommended as strategies within the TMP, constraints that exist for physical construction improvements places emphasis on the demand for ITS to support further development and growth of the City and region while maintaining levels of desired service

### 1.2.1 Commercial Goods Movement

The St. Albert TMP contains a Proposed Truck Route Plan, which identifies industrial areas, restricted truck routes, and current and future dangerous goods routes. The routes provide connections between industrial areas and commercial sites within the boundaries of St. Albert, as well as regional connections to Sturgeon Country and the City of Edmonton. The dangerous goods routes were selected to reduce the exposure and impact on residential areas and avoid school zones where possible. Information on the volumes of goods vehicles, and goods movement peak hours are not readily available.

### 1.2.2 Transit

St. Albert Transit (StAT) operates commuter bus routes that travel to and from Edmonton and local bus routes which stay within the boundaries of St. Albert. They strive to provide optimal, affordable, and accessible service to their customers for travel within St. Albert and to key commuter destinations in Edmonton.

Saturdays, Sundays, and weekdays have different transit schedules, with varying routes available all day and during peak hours. Only one local bus route operates after 7:00 PM on weekdays, with Dial-a-bus providing "as needed" transit service during low demand periods, including evenings. Dial-a-bus is available on request to travel to bus stop locations within St. Albert where riders wish to board or be dropped off.

There are two transit centres in St. Albert: St. Albert Exchange and Sturgeon River and Village Transit Centre. Both are hubs for local bus routes, and provide park and ride spaces. A future park and ride and transit hub – Campbell Park – has been approved and the required land has been purchased. This transit centre will replace the current Village Transit Station. The Campbell Road transit centre and park and ride facility remains in the current capital plan (Transit Long Term Department Plan, 2013-2027) for St Albert Transit. The City also intends to develop an additional park and ride in the north of the city, and operate it as a transit hub.

A Light Rail Transit (LRT) service connecting to the Edmonton LRT network along the St. Albert Trail corridor is planned. This LRT expansion will provide faster service to downtown Edmonton, NAIT, and the University of Alberta. Transit ridership in St. Albert is forecast to have the potential to significantly increase by 30%, and improve mode share.

### 1.2.3 Motor Vehicle Collisions and Traffic Safety

The Transportation Branch at the City of St. Albert provides traffic collision statistics annually. This data is gathered from the provincial report form, which is completed by members of the Royal Canadian Mounted Police (RCMP). The database reflects all reported collisions on public roadways in the City that result in property damage of CAD $2,000 or greater and/or any collision that results in an injury or fatality.

At the time of this strategy's development, the most recent report available was from 2015. Highlights from the 2015 report include:

- 868 collisions on public roadways (which excludes collisions on private parking lots), of which 521 occurred at intersections (60%) and 347 at midblock locations (40%).
- 0 fatal collisions, and 127 injury collisions occurred.
- 29 vulnerable road user collisions occurred, including 16 pedestrian collisions.
- 57% of the at-fault drivers were non-residents of St. Albert, while 61% of traffic violations were issued to non-residents. This reflects the impact of the non-resident traffic on the City.
- Of the non-resident at-fault drivers, 44% were from Edmonton, 23% were from Sturgeon Country, and 33% were from elsewhere.

- Following too closely and backing unsafely were the two most common collision types.
- The intersection of St. Albert Trail and Giroux Road/Boudreau Road had the highest number of total collisions.
- Approximately 49% of all intersection collisions involved rear-end collisions.
- 31% of intersection collisions occurred between 15:00 and 18:00.
- Seven of the top ten collision prone intersections are located along St. Albert Trail.
- St. Albert Trail had the majority of midblock collisions, which is likely due to high traffic volumes and high number of access and exit points on the roadway. Some 45% of midblock collisions in 2015 involved a parked car, 15% were related to residential driveways and drivers backing up unsafely.

These results show a clear need to address safety on the public roadways in St. Albert.

### 1.2.4 Active Transportation

Active transportation encompasses human-powered modes of transportation, including walking and cycling. The St. Albert Transportation Master Plan (TMP) references active transportation, sustainable transportation, and alternative transportation in three out of four guiding principles. Developing an active transportation network is a main goal of the TMP. The TMP states that in 2015, less than 1% of trips were taken by bicycle, and 5% of trips by walking. Cycling in St. Albert is done primarily for recreational purposes. Pedestrian and cycling connections to major destinations are currently limited, according to the TMP.

To fully understand the state of active transportation in St. Albert and to perform future analysis or evaluation for network priorities, data surrounding pedestrian / cyclist volumes, travel routes and connections to alternate modes is required. ITS has the potential to support the development of an active transportation network through improved safety and traveller information using technology.

## 1.3 INVENTORY OF INFRASTRUCTURE

St. Albert currently owns and operates or is testing ITS infrastructure, including Road Weather Information Systems (RWIS), vehicle counters, planned pan-tilt-zoom (PTZ) cameras, traffic signal pre-emption technology, and a fiber optic network. Central monitoring software coordinates the operation and connectivity of intersections with communications.

St. Albert is testing three RWIS stations which automatically monitor the weather and pavement conditions. The data generated from the sensors can be used to support decision making including snow and ice removal and the provision of road advisories.

Permanent vehicle counters operate 24/7 to count and classify the size of vehicles. This process supports planning decisions and monitoring of strategies as changes in traffic volumes are quantified.

Microwave radar sensors are being tested to detect vehicles, which can be counted and classified, or to modify signal timings. Video sensors are used to count and classify vehicles, pedestrians, and cyclists. The data generated by these types of sensors can be used in planning decisions and incident management.

PTZ cameras are scheduled for implementation at areas of St. Albert Trail. They will be used by traffic control centre operators for incident management and provide real-time traffic conditions to the public. This information will allow residents or visitors to make informed decisions regarding traveling, such as routes and mode (walk / cycle, drive, transit).

**Figure 1-1** shows the locations of various ITS infrastructure in St. Albert

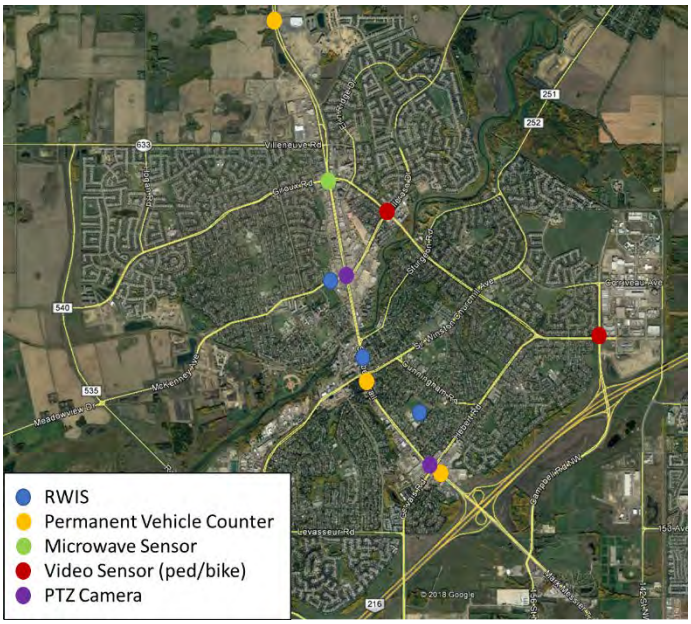



**Figure 1-1**
**Locations of ITS Infrastructure**




**Figure 1-2**
**Locations of Signals with Pre-Emptive Control**

St. Albert presently operates 63 fully signalized intersections, 23 of which have pre-emptive signal control, currently used by emergency medical services to improve response time. The transportation network also currently operates with:

- 23 signalized pedestrian activated intersections
- 12 pedestrian "amber flashing" crosswalks
- 30 pedestrian crossings with Rectangular Rapid Flashing Beacons (RRFBs)
- 14 school zones contain warning flashers
- 3 fire hall warning flasher sites
- 25 driver feedback signs

**Figure 1-2** shows the locations of the signals with pre-emptive control, which are in the St. Albert Trail, and Boudreau/Giroux Road corridors. The full inventory of signals, and the fibre optic network can be seen in **Appendix A – Technical Memos**.

## 1.4 ENVIRONMENTAL SCAN AND BEST PRACTICES

An environmental scan of ITS "best practices" in similar jurisdictions across Canada was conducted to validate the approach of the St. Albert ITS Strategic Plan. This scan assisted in assessing appropriate technologies, applications and programs. The Environmental Scan in its entirety is available in **Appendix A – Technical Memos**. The Environmental Scan was comprised of two sections:

- A review of other ITS plans in similar jurisdictions; and
- A review of ITS user services in various projects and activities, focusing on technologies.

### 1.4.1 ITS Plans in Similar Jurisdictions

Many municipalities have Transportation Master Plans (TMP), which contain ITS chapters, components and programs. Municipal ITS plans and transportation master plans with ITS components were reviewed as part of this Environmental Scan for the following cities:

- Durham
- Toronto
- Edmonton
- Calgary
- Ottawa

- New Westminster
- Coquitlam
- Hamilton
- Victoria
- Montreal

It was found that few municipal areas had strategic ITS plans; however, several regional and provincial plans have been prepared. The transportation challenges and priorities for provinces are generally "higher level" and different than those found in municipal transportation networks. Municipal plans tend to address local issues in more detail than provincial ITS plans which are more focused on provincial concerns including highways. The most common ITS area of focus in municipalities was transit signal priority, followed by traveller information. Targeted user services most common throughout the ITS plans were:

- Traveller Information Systems
- Priority Corridors
- Data Collection and Management
- Transit Priority
- Smart Work Zones
- Intelligent Fleet Management

These areas of focus in ITS are consistent with the St. Albert requirements and the approach.

### 1.4.2 Technologies and Applications

Technologies and communication form the backbone of ITS programs. Starting with the field devices and on-board systems that collect data, the information is transported to a traffic management centre, often via wireless or fiber optic network. The traffic management centre houses data hubs and operator work stations where the status of the various corridors and intersections as part of the network are monitored.

The following technologies were found within the ITS programs that were reviewed in this Environmental Scan:

- Traffic monitoring CCTV cameras
- Adaptive traffic signal control systems
- Variable message signs
- Traffic operations and management centres
- Traffic detectors
- Road-weather information systems (RWIS)
- Global positioning systems (GPS)

Overall, the technologies and applications in the St. Albert ITS plan are consistent with those proven systems in other plans.





# 2 NEEDS ASSESSMENT AND STAKEHOLDER ENGAGEMENT

## 2.1 ITS PRIMER AND QUESTIONNAIRE

A St. Albert ITS Primer is a brochure developed to explain ITS and its benefits. The primer explained what ITS can do for St. Albert, what the future could look like using ITS, and how the livability of St. Albert could be improved through ITS. The primer was sent to internal project stakeholders. Inclusive of City department representatives who are impacted in their operational considerations or service deliveries by the transportation network.




Accompanying the primer was a questionnaire for the internal stakeholders. This questionnaire was developed to better understand the transportation needs and issues of the stakeholders. Information on corridors of interest, ownership of transportation related equipment (i.e. snow plows), safety issues, and transportation information issues was collected. Suggestions for improvement of the road and highway network were requested.

## 2.2 ITS WORKSHOP



Following the distribution of the ITS Primer and Questionnaire, a workshop was held in June 2017 with the internal stakeholders. Internal stakeholders included operations supervisors, GIS analysts, transportation coordinators, transit planning, community services, fire and rescue services, recreation and parks, planning, environment, economic and smart city coordinators. The purpose of the workshop was to finalize the feedback for the Needs Assessment report. This workshop further explained ITS, associated technologies, general benefits, ITS architecture, and examples of ITS deployments.

The St. Albert ITS Strategic Plan was discussed regarding structure, what the plan will do, and how it will be used. Regional integration and understanding the needs that the plan will address were discussed and next steps outlined.

The internal stakeholder workshop uncovered numerous additional ITS needs in St. Albert. Some of these needs include:

- Weather management on roadways
- Emergency vehicle pre-emption
- Incident information
- Traffic counts
- Traffic signal coordination
- Smart buses
- Smart bus fare system
- Transit signal priority
- Real time traffic data
- Pedestrian counts
- GIS data
- Photo enforcement
- Vehicle re-routing during emergencies
- Traffic modelling to predict air quality
- Parking management.

## 2.3 QUESTIONNAIRE RESPONSES

Responses from the questionnaire were received from internal stakeholders and used as insight into potential "gaps" and "needs" of the network.

Issues highlighted by the questionnaire responses included:

- Signal coordination and timings of corridors
- Pedestrian safety
- Integration with other services and data sharing
- Transit priority
- Increasing mode transfer from cars
- Incident detection
- Parking management
- Speed monitoring
- Real time information
- Goods vehicle routing and monitoring
- Adaptive snow clearance plans

Traffic signal controls, with coordination and associated drive times / driver frustration was the most frequently mentioned comment and concern. Next priority concerns stemmed around increasing mode share and transfer from cars, providing priority movement for transit and monitoring. routing of large loads through the city.




# 3 ITS VISION, MISSION, PRINCIPLES, GOALS AND OBJECTIVES

St. Albert is a vibrant and prosperous community with amenities that attract residents and professionals to live and work. Anyone who walks or drives in the City can see that it values its heritage and "small town" qualities. The architecture and beauty of the City reflects these qualities.

The Community Vision of St. Albert is:

*"A vibrant, innovative and thriving city that we all call home, that sustains and cherishes its unique identity and small town values. We are the Botanical Arts City."*

St. Albert and the surrounding region is facing many urban challenges as it tackles residential and economic growth. These challenges are apparent on every commuting day with increasing congestion and delay, motor vehicle collisions, and increasing demand by varying road user types. The 2016 population of St. Albert was 65,589, and it ranked 85th in Canada at a "healthy" growth rate of 6.71%. The City estimates that it will grow to over 91,000 people by 2035, an addition of 30,000 residents. It continues to grow and evolve, while users face the daily transportation challenges.

To protect and support the quality of life and amenities in St. Albert, the City has developed several key documents that provide high level direction:

a. **City of St. Albert Transportation Master Plan** (TMP) in 2015




Addresses roads, active transportation, public transportation, commercial goods movement, and ITS.

Several areas of focus:

- Maximize the benefit of the existing transportation infrastructure
- Prioritize improvements to regional infrastructure
- Improve St. Albert Trail as a user friendly main street
- Improve transportation choice

Recommended ITS strategies are:

- Integrated corridor management on key corridors including Ray Gibbon Drive, St. Albert Trail, and Anthony Henday Drive. Transit signal priority (TSP), adaptive signal control, next bus arrival systems, and traffic management are some of the ITS functional measures that are recommended in the TMP.
- Data management including integration between modes, online media, real time "Bluetooth" travel information between nodes and telecommunication networks.
- Traffic management centre (TMC) development.
- Customer services including traveller information for weather advisories and trip planning, as well as parking management.
- Safety initiatives including speed monitoring, "smart" work zones, and road-weather information systems.
- Integration with regional agencies.
- Goods movement enforcement on key corridors.

**b. City of St. Albert Smart City Master Plan** in October 2016 which is a blueprint for developing St. Albert into a "Smart City Centre of Excellence".

- Identifies three key outcomes of greater municipal efficiency, enhanced service delivery and dynamic economic development.
- There are 22 "smart city" prioritized strategies of which 8 strategies are of the highest priority. These strategies are called "foundational" to achieving the goals of the Smart City initiative.
- ITS was ranked tied for the 2nd highest priority. This strategy was described as: evolve to an optimized/intelligent transportation system, improving efficiency,

safety, and ease of travel in and through St. Albert.

In addition to the ITS plan, the "ITS related" recommendations included:

- Work with regional neighbours to coordinate intersection timing on key transportation corridors and actively share transportation data.
- Provide transportation data and digital trip information, directly and indirectly, to travellers considering all modes of mobility.
- Pilot parking management systems within high traffic areas to better understand, communicate and control usage.
- Offer real time transit service notification tools, electronic fare payment, and on-board convenience technologies.
- Equip transit vehicles with technologies to facilitate adaptive priority at local intersections.
- Conduct a local review of the future opportunities related to connected and autonomous/self driving vehicles, and serve as a pilot community for new vehicle technologies.
- Have in place flexible municipal policy that responds to transportation innovations and evolving modes, including those within the sharing economy.
- Deploy a wide-scale St. Albert sensor array supported by device-to-device communications capacity between all connected things. Developing this connected environment brings the City closer to achieving the "Internet of Things" network. The sensor array would include infrastructure, transportation and mobility, environmental, solid waste, lighting and utilities, and residents.
- Consolidate transportation management, emergency operations, security oversight, asset tracking and controls, and other municipal operations within a Smart City control centre.
- Establish a centralized location for local data through negotiations on long-term regional protocols and data sharing agreements.

**c. St. Albert Transit Master Plan**, now called the Transit Long Term Department Plan Development of key transit strategies included:

- Supporting implementation of the Light Rail Transit (LRT) Alignment Study (2015) and use these recommendations in developing network scenarios in future traffic forecasts.
- Investigate implementation of "non-traditional" modes of transit and ensure aspects of any ITS strategy aligns with forthcoming technology.
- Land use integration to support density around LRT stations through adoption of appropriate land use planning instruments.

These documents are supported by the St. Albert ITS Strategic Plan which is intended to be transformative and foundational to the Smart Cities Plan.

In obtaining feedback for the early development of the ITS plan, the following input was part of the stakeholder outreach work:

- ITS steering committee meetings
- Internal ITS workshop June 2017
- ITS stakeholder questionnaire responses

This work provided input to the Needs Assessment report which then led to the development of a Vision Statement with supporting Goals and Objectives. The Vision for the ITS plan aligns to the City's strategic plan and priorities, with related goals and objectives as well as key performance indicators (KPI) which are more detailed and measurable.

In the TMP, there are numerous common themes:

- Livable community
- Safe access
- Environmental health
- Economic prosperity

- Affordable transit and active transportation

These themes were also common throughout the stakeholder input and workshop.

The transition from the Needs Assessment to Vision, Mission, Goals and Objectives, and ultimately to ITS Strategies and Project, followed this process of:




## *Vision Statement*

Based on the Needs Assessment Report, a Vision Statement was developed to provide direction for integration of ITS to the City's ITS program.

*Building a better community through transportation innovation.*

## *Mission Statement*

The following Mission statement shall support achieving the Vision of the ITS Strategy.

*"We support research, partnership and applications of technology and innovation to enable solutions to transportation challenges."*

The Mission Statement reflects the guidance provided through this strategy as well as the TMP and Smart City Master Plan.

The integration of Intelligent Transportation Systems shall follow general principles that have been developed with this strategy. They are intended to give guidance on key considerations and intent moving forward. For ITS in St. Albert, there have been ten principles established that align to the acronym ***SMART IDEAS***; they are described as follows:

- **Safety:** As a priority, ITS integration will support the City's safety vision of no fatalities or serious injuries occurring as a result of motor vehicle collisions on public roadways.
- **Measurable:** Deliverables of ITS strategies shall be evaluated, with ongoing network monitoring and measures of effectiveness.
- **Adaptive:** ITS will enable the transportation network to adapt to demand and need of road users in real time; maximizing on service delivery and the capacity of the network.
- **Regional:** Although ITS innovation shall be placed to benefit the priorities and needs of St Albert, its integration shall consider regional context, partnership opportunities, and larger demand needs for the Edmonton Metropolitan Region.
- **Teaming:** Developing the relationships and partnerships between stakeholders, research groups and industry to collaborate on ITS integration with a focus on opportunity of regional consideration and collaboration.

- **Integration:** Ensuring ITS considerations are made in project planning, program management, community design, construction and communications.
- **Developing**: In recognition that ITS is consistently expanding and new technology is being developed, the City's network shall be capable of supporting forthcoming technology and ITS advancements.
- **Environment:** Intelligent systems will increasingly support the monitoring, evaluation and mitigation of the environmental impact of transport.
- **Accessible**: ITS shall enable and support Open Data; with information made available for public use in network decision making and for commercial benefit of advancing innovative ideas and applications.
- **Supportive:** ITS shall support the needs of multiple users and modes, while the community shall encourage innovation and technology by removing potential barriers through applicable municipal policy and governance.

## *Goals and Objectives*

The Vision Statement provides broad, general direction for the ITS plan – in other words, "where are we going"? The Mission Statement provides a simple description of the role and purpose of the ITS plan – "why are we doing this plan"? The goals and supporting objectives give areas of focus for the plan – "how will we get to our goal"? The Principles are the values to which, if held true, will ensure priorities are maintained – "what is important in reaching our goals"?

In addition, the goals and objectives have corresponding key performance indicators (KPI) which are measurable and should be monitored for progress – in other words, "how will we know that we have succeeded"? Each goal and objective aligns with the St. Albert Transportation Master Plan, which ultimately supports the City strategic plan and priorities.

Based on the Vision Statement, with the needs assessment from the background information and stakeholder feedback, the following corresponding goals and supporting objectives are recommended:

### 1. Support the Transportation Network

This goal seeks to support and maximize the efficient movement of people on key corridors in St. Albert, including St. Albert Trail, Ray Gibbons Drive and Boudreau / Giroux Road. The goal is focused on the movement of people within and between all modes in the network. As well, this goal will enable an increase in mobility, accessibility, and reliability of intermodal trips at intersections or at key nodes. This goal will address the needs of the users, prioritize the project, and apply the technology to generate real time information and achieve the efficiency. In a Smart City environment, the devices on these corridors will generate data that will be transmitted to a traffic centre for processing and action.

The **supporting objectives** for this goal are as follows:

- Develop Integrated Corridor Management (ICM) plans for all modes in key corridors. These ICM plans may entail designating key corridors for a specific function. For example, St. Albert Trail is envisioned to become more user and pedestrian friendly whereas other corridors will be targeted to carry more vehicular traffic.
- Support traffic signal improvements and coordination throughout the road network including the Adaptive Signal Control program in key corridors in the City. Reducing traffic congestion maximizes person throughput of the corridor.
- Develop an integrated Traffic Management Centre (TMC) as part of the Smart City Control Centre, providing a traffic hub for ITS functions.
- Transform St. Albert Trail into a showcase "pilot" project for a Smart Corridor that

combines signal progression, incident management, traveller information, data and transit/active transportation.

- Develop real time traffic data collection and management program throughout the network.
- Support more efficient and safer maintenance and construction management through better information.

The ***key performance indicators*** include:

- Reduced delay at key intersections
- Increased person throughput on corridors and at intersections.
- Improved travel time by corridor
- Better "transportation quality" on St. Albert Trail which will measure the user experience for pedestrians, cyclists and others. This KPI may require user surveys to obtain feedback on the transportation corridor.
- Prioritization of transit, emergency vehicles, snow clearing vehicles and road maintenance.
- Availability of traffic data for staff and stakeholders
- Better traffic data for construction and maintenance crews.

**The outcome for this goal is better traffic flow.**

## 2. Increase Safety

This goal looks to support the Traffic Safety Strategy and Vision Zero program through public safety improvements on the roads and highway systems in St. Albert to eliminate injuries and fatalities. This goal will address the many accidents and safety issues in St. Albert's transportation network as well as coordinate advisories and customer services.

The **supporting objectives** are as follows:

- Improve traffic flow by reducing stop and go conditions, remove choke points, and decrease speeding and other unsafe driving behaviour.
- Increase pedestrian safety throughout the road network.
- Improve cyber security at key locations in St. Albert.
- Monitor speeds at key locations, provide driver feedback advisories and increase bylaw enforcement for excessive speeding.
- Use of collaborative traffic and collision data to improve network safety analysis and result in evidence based and prioritization of safety improvements.
- Develop incident management plans and responses for St. Albert key corridors involving improved incident detection, verification,



stakeholders and leads, response activities, removal of incidents and final reporting.
- Develop access to all City areas for emergency vehicles through signal pre-emption.
- Monitor and manage dangerous goods movement in the City (incorporate incident management aligned to dangerous goods).
- Discourage truck traffic through residential and school areas.
- Develop road-weather information systems (RWIS), integrated with traffic management and traveller information.
- Develop supporting safety software that identifies near miss incidents and conflicts. The software will assist in evaluating causes and locations of these conflict points to mitigate accidents. The software will also be available to the public (or include a module to allow its wide use) to report near miss locations and situations for further investigation.

The ***key performance indicators*** include:

- Decreased vehicular accidents at key intersections and corridors (particularly on St. Albert Trail). Target the 7 or 8 high accident locations for improvement on St. Albert Trail. Primary focus should be around reduction of sever (injury or fatality resulting) style collisions.
- Reduction and eventual elimination (as per Vision Zero program) of severe injuries and fatalities in accidents.
- Improved detection and response times for incidents.
- Reduced pedestrian collisions and conflicts.
- Decreased conflicts in school zones.
- Reduce conflicts and incidents in work zones.
- Lower recorded travel speeds and reduced violations for speeding.
- Reduced stopped and delayed times for corridor travel.

**The outcome for this goal is fewer motor vehicle collisions, reduced injuries and fatalities.**

## 3. Support Livability and Sustainability

This goal seeks to ensure that the transportation network supports affordable, accommodating and accessible use of all modes of travel and links within and to the region. As well, this goal will improve the level of customer services throughout the City.

The **supporting objectives** are as follows:

- Improve access to traveller information including real time weather advisories, congestion information and trip planning tools.
- Provide data and information directly or indirectly to the travellers via on-board or enroute devices such as variable message signs (VMS) and in-vehicle navigation systems. Bluetooth systems measure travel times between nodes and display them on local VMS.
- Support real time and archived data availability
- Develop parking management as a service including electronic payment, real time availability and location of stalls, and mobile access to data and digital information.
- Develop wayfinding (electronic signage) for city venues and facilities.
- Protect environmental health of the City for its green space and minimize vehicle emissions.

The ***key performance indicators*** include:

- Greater availability of real time traveller information.
- Better management of trips for the public.
- Reduced circulation time for customers seeking parking stalls.
- Increased parking revenues and ease of payment for users.
- Reduced proportionate greenhouse gas (GHG) emissions relative to traffic volumes.

**The outcome for this goal is more affordable opportunities and choices for residents and visitors with mobility challenges.**

## 4. Enhance Economic Prosperity and Goods Movement

A key goal is to improve the economic competitiveness of the Region and support the prosperity of the City. This goal must balance the demand for trucks to access and provide services to the businesses in the City (thus contributing to the economy) while preserving the community and mitigating noise and pollution. This initiative will attract business into the City and Region.

The **supporting objectives** are as follows:

- Promote the City as a centre of excellence for innovation, integration and testing of new technologies and collaboration on pilot projects. The collaboration will strengthen St. Albert's ability to support real time information to carriers by updating road conditions, travel restrictions, and closures.
- Support commercial vehicle enforcement (CVE) including protection of traffic conditions while shifting "through movement" commercial vehicles on St. Albert Trail. CVE can utilize numerous truck monitoring systems including weigh-in-motion (WIM), licence plate readers and optical character recognition (OCR) software to identify vehicles that do not have an origin or destination within the City.
- Update the TRAVIS system conditions and regulations for the City.
- Identify "trusted travellers" through Alberta Transportation's Partners in Compliance (PIC) program. The compliant carriers can be identified via weigh-in-motion scales, CCTV cameras, and licence plate readers. The City can work with Alberta to provide benefits to compliant carriers for access and bypass of regulatory weigh scales.
- Initiate and develop electronic fare payment for additional City services
- Support community growth in key areas by developing transportation corridors/access to two business parks – Campbell and Riel.
- Support regional growth by developing transportation corridors and monitoring goods movements that are bypassing the City on:
    - Ray Gibbon Drive
    - Fowler Way
    - Stakeholder on 127 Street
- Support designated truck routes in the City and monitor the use of restricted truck routes

The ***key performance indicators*** include:

- Active protection of public infrastructure and enforcement of goods movement regulations through deployment of WIM, CCTV and LPR stations.
- Identification of violators on restricted corridors.
- Shift of through movement of goods and materials off St. Albert Trail.
- Availability of electronic fare payment for customers, increased revenues for City services.
- Greater economic activity in terms of goods and value.

**The outcome for this goal is a stronger economy.**

## 5. Support Regional Transportation

This goal seeks to integrate and improve regional transportation around and through the City. St. Albert is located within a region of neighbouring counties and communities which share traffic within and through each. This goal supports the vision of St. Albert as a leader for regional transportation.

The **supporting objectives** of this goal are as follows:

- Support development of regional road infrastructure to take traffic off the local network and reduce "pass through" traffic. ITS technology should be embedded in new designated regional corridors, or during corridor improvements that are built to monitor and maximize traffic flow and information sharing.

- Support integration and development of regional corridors that cross jurisdictional boundaries. These regional corridors include St. Albert Trail, Ray Gibbon Drive, Anthony Henday Drive and 127 Street. These corridors carry regional trips that start or end outside of St. Albert.
- Encourage sharing of regional traffic data to protect signal progressions and improve traffic flow between jurisdictions. Improved data sharing will support seamless services such as signal progressions across jurisdictional boundaries.
- Encourage collaboration between modes and service providers such as YEG, Villeneuve Airport, CN Rail and Greyhound.
- Support integration of signal priority / pre-emption for emergency services through the region to improve response times
- Support integration of regional travel information systems including real time weather advisories, congestion information and trip planning tools

The ***key performance indicators*** are:

- Reduced regional traffic on local roads and arterials.
- Development and implementation of correlated information that supports regional travel of people and goods.
- Increased information at the intermodal connection points for regional travel.
- Development of the regional road and highway network segments.
- Uninterrupted and continuous ITS functions across regional boundaries.

**The outcome for this goal is smoother, seamless inter-jurisdictional travel in the region.**

## 6. Develop an Active and Transit Transportation Network

This goal maximizes and supports St. Albert's initiatives to develop the transit and active transportation network. The goal will support the City's goal of building a sustainable community committed to a green and healthy lifestyle.

The **supporting objectives** of this goal are as follows:

- Support transit network customer improvements such as the "next bus" arrival system, transit signal priority (TSP), and electronic fare payment ("smart cards").
- Develop travel demand management (TDM) tools for managing traffic flow such as high occupancy vehicle (HOV) lanes and bus queue jumpers.
- Investigate transit technologies such as automated passenger counting (APC) systems, WiFi on-board and at transit stations, and CCTV cameras.
- Develop a light rail transit (LRT) integrated transportation plan that considers traffic and land use.
- Support development of the active transportation network including walking and cycling throughout the City. Use ITS technologies such as wayfinding, counting and advisory signage. The wayfinding, data and advisory signage should also support and identify regional connectivity across jurisdictions.
- Increase the quality, coverage and functions of the transit network in the City.

The ***key performance indicators*** are:

- Improved customer satisfaction.
- Reduced single occupant vehicle volumes, increased high occupant vehicle volumes.
- Improved traffic flow in general purpose lanes.
- Access to high speed broadband networks on-board transit.
- Improved security on-board buses and at terminals.
- Availability of real time customer data including bus loadings.

- Increased transit and active transportation users.
- Better regional information on the active transportation network.
- Increased % of trips for transit, pedestrian and cyclist modes.

**The outcome for this goal is better use of alternative transportation choices.**

## 7. Encourage Innovation and Technological Excellence

This goal is focused on supporting St. Albert as a centre of excellence for innovation and technological advancement. This goal is where technology and ideas converge.

The **supporting objectives** are as follows:

- Support and implement the SMART City recommendations.
- Develop a City pilot initiative to raise public awareness of Connected Vehicles (CV) and Autonomous Vehicles (AV) and support field testing in a designated area or community of the City. Assess the impacts of CV and AV on staff functions such as land use planning, engineering, and traffic forecasting. The pilot project will incorporate the latest technological vehicles/models of AV for autos, trucks and buses.
- Increased automation and artificial intelligence (AI) as part of ITS performance and operation of the traffic management centre.
- Investigate "Mobility as a Service" (MaaS) as options in the future. An example of MaaS is car sharing as an alternative to ownership.
- Develop and support academic partnerships in research for test beds, such as ACTIVE-AURORA, technological assessments, and pilot projects.

The ***key performance indicators*** are as follows:

- Market penetration of AV in traffic
- Evolution of the City as a centre of excellence for Connected and Autonomous Vehicles
- Development of academic partnerships for technological research.
- Migration towards the recommended goals in the Smart City Master Plan.
- Initiation of innovative ideas and programs within the City.
- Reduced manual work effort due to adoption of ITS or other technologies

**The outcome for this goal is the City as a leader in technology and innovation.**

## 8. Support and Enhance Data Management

This goal relates to the efficient and accessible management of the vast amounts of data and information in support of ITS applications and functions in the City. It shall include data acquisition, processing, transmission, storage and distribution. The "Internet of Things" Data Management Strategy is the fundamental layer of this Smart City environment in which all devices will be in a connected world.

This goal supports a clear progression starting by identifying all types and qualities of data in the City, migrating towards full integrated network monitoring, as well as evaluation, effective usage and sharing of data. This process will involve identifying the appropriate data types and sources that will be acquired for internal and external use.

The **supporting objectives** are as follows:

- Assess the network requirements of the users including timing (scheduled data collection and use) and relative priorities.
- Develop the fiber optic network in support of the network requirements, ITS user services and Smart City initiatives.
- Support data sharing between City services (businesses) and departments.
- Increase collection and access to real time data through an "open data" initiative in the City.
- Develop necessary data sharing policies between stakeholders.

- Support the development of the "Internet of Things" Data Management Strategy as the fundamental foundation layer for a "Smart City".
- Provide a platform for open data and access to transportation data.

The ***key performance indicators*** are:

- Build-out of the fiber optic network including testing and commissioning of the system.
- Development of the data management processes in the Internet of Things layer for the Smart City concept.
- Access of open data for the public including increased availability of data types, quantities, and sources.
- Integration of data into the City network operations and for public data sharing.

**The outcome for this goal is efficient and accessible data management.**




# 4 DISCUSSION PAPERS

Five discussion papers were prepared for consideration during the production of the St. Albert ITS Strategic Plan. They represent key target and strategic focus areas, which due to their involvement and scope, are highlighted for further detail and consideration.

These papers include:

- Data Management
- Telecommunications
- Regional Integration
- City Wide ITS Deployment
- Integration of Autonomous Vehicles

The discussion papers are available in Appendix B. The following is a summary of each of the discussion papers.

## 4.1 DATA MANAGEMENT

Data management is a foundational component of an ITS Strategic Plan as it directly supports other ITS functions and initiatives. Vehicles and hand-held devices are increasingly capable of systematically collecting and communicating a broad range of data. Modern wireless communication technology permits an active exchange of data with and between vehicles, travellers, roadside devices, and system operators. As the City implements and expands ITS initiatives, managing the vast amount of data will require strategic planning and careful choices in emerging technologies. Adopting key technologies within the framework of a comprehensive and integrated service strategy will help to expand the City's ability to service consumer's data throughout the region.

For many technologies, bandwidth and storage will become important factors in efficiently managing

the systems. Emerging best practices clearly point to the need for a "Big Data" strategy and architecture that promotes incremental deployments and agility in development and adoption of new technology components. Within the transportation context, Big Data has the ability to both overwhelm and inform. If not handled with care, Big Data can easily add to the complexity of a corporate IT environment.

The Internet of Things (IoT) is described as a network of physical objects - devices, vehicles, buildings and other items - embedded with electronics, software, sensors, and network connectivity that enables these objects to collect and exchange data. These devices collect useful data with the help of various existing technologies, and then autonomously flow the data between other devices.

IoT is expected to generate large amounts of data from diverse locations with the consequent need for quick aggregation of the data and an increase in the need to index, store, and process such data more effectively. The IoT Platform represents a progressive approach toward sensor system management and lays the foundation for a system that will enable the City and residents to leverage vast amounts of data generated by current and future applications. Current and historical data stored in a central location will be available to be used for data analysis and reporting tools servicing the City's public and private interests alike.

## 4.2 TELECOMMUNICATIONS

Telecommunications infrastructure needs to be implemented in parallel to data management and ITS field device deployments and is therefore a core component of an effective ITS strategy.

A robust telecommunications network that supports transmission of field data to a central hub, as well as inter-agency data exchange, is essential to the operation of ITS. The key objective of the telecommunications discussion is to improve the scope and reliability of the network, so that current and future sensor capacity and functionality requirements can be satisfied with confidence.

The bandwidth required to support field device data transmission will affect the transmission medium selected. The current and planned ITS devices represent a broad spectrum of bandwidth and protocol requirements. Where possible, the use of standards-based devices and software should be employed. In particular, the National Transportation Communications for ITS Protocol (NTCIP) standards set is important to consider, as standards-based controllers greatly simplify installation and reduce costs. NTCIP compliant devices all speak the same "language" and are capable of seamlessly sharing information with one another with interoperability and interchangeability.

Fibre optics are considered the gold standard for telecommunications networks due to their high bandwidth capacity and overall reliability. Fibre optic technology is continually being improved. Single mode fibre optic cables, the type used for long distance paths such as those required for inter-building connections within a city, can support very high data throughputs.

In areas where coverage exists, cellular data is an excellent solution for field device communication. It is straightforward to implement and is used extensively by transportation agencies throughout North America. LTE-M1 is a highly efficient, low-bandwidth (100kbps) solution that is designed to operate on battery power without the need for supporting infrastructure, ideal for area wide IoT applications. These LTE-M1 devices enter a "deep sleep" mode whenever they are not transmitting data resulting in low power consumption allowing these devices to go years on a single charge.

WiFi technology (IEEE 802.11 protocol) is widely used by municipalities due to its high data rates with relatively low implementation and operational costs. While the data transfer rates are capable of

streaming devices like HD video, WiFi has significantly shorter range than other wireless technologies.

Cyber security is a critical and an ever-evolving concern. Network disruptions from "Denial of Service" attacks, data theft or tampering, or device misappropriation are all real-world examples of the threats public agencies face in today's interconnected world. As the data management strategy develops and new device and communication infrastructure is brought on line, appropriate network security and data integrity policies will need to be planned and implemented to ensure complete integrity of data and continued safe and secure operations.

ITS deployments within the region will continue to evolve. Deployed networks need to be sufficiently scalable to support the inevitable increase in devices and demand. New requirements will present themselves, requiring modifications or enhancements to the network. The increase in connected devices drives a commensurate increase in network bandwidth requirements.

## 4.3 REGIONAL INTEGRATION

Albert does not operate in isolation; ultimately the highest service to our residents and visitors accounts for information and considerations at a regional level. Links with neighbouring communities are vital to support the economic and social well-being of the citizens. As transportation does not stop at the City borders, integrating ITS into a region wide network increases the benefits of ITS.

Some of the benefits of regional integration include:

- Avoiding duplication of efforts
- Sharing of information and data
- Coordination of road maintenance activities
- Improved incident management
- Transit integration and priority
- Corridor management
- Freight management and routing
- Reduced travel time variability

There are varying degrees of integration. Lower degrees may be only sharing information and a greater degree would be relinquishing some control of sensors and cameras. Total integration would be allowing other jurisdictions to view, control, influence and use ITS deployments in other jurisdictions.

To facilitate and garner regional collaboration, ITS technology must consider the needs, priorities and objectives of various stakeholders and ensure that technology is institutionally feasible for all parties involved. Issues such as privacy and regulatory constraints will reduce the potential for regional integration, as some parties may withdraw from difficult projects. Ensuring that the ITS technology to be implemented has established benefits can help bring stakeholders to the table.

Systems that can grow, engage and have interoperability allow for regional integration. The National Transportation Communications for Intelligent Transportation Systems Protocol (NTCIP) reduces the risks of non-compliance with standards and interoperability goals.

Regional integration will remove barriers between jurisdictions, and can be applied to all modes of transportation, including vehicular traffic and transit to assist people through their journeys.

## 4.4 CITY WIDE ITS DEPLOYMENT

St. Albert faces similar challenges as many other Canadian municipalities; providing services that result in a high quality of life, attracting residents and businesses, while avoiding traffic congestion, motor vehicle collisions, and negative environmental impacts.

The transportation network must support and provide for large scale community "needs" which stem from various road users. The system must accommodate for various travel modes (walking,

cycling, driving, public transportation use) and also ensure accessibility for differing mobility levels and capabilities.

Acknowledging that all modes and traveler needs are important and linked ensures that ITS considerations will be made at network wide level and account for connectivity, interface, and service delivery.

Projects critical to City-wide ITS deployment are:

- Data Management
- Telecommunications
- Traffic Management Centre
- Short Term and Early Winners Projects
- Integration:
  - ✓ Data management includes the Internet of Things which will link the ITS deployments around the City.
  - ✓ Telecommunications is the method and infrastructure that the devices will use to communicate.
  - ✓ The Traffic Management Centre will be the hub through which the ITS deployments are managed.
  - ✓ The short term and early winner projects have high payback and low effort.
  - ✓ Integration involves embracing a role as a centre of excellence for transportation technology and innovation through integrating with regional partners, as well as research and technology groups.

## 4.5 AUTONOMOUS VEHICLES

Autonomous vehicles have evolved significantly over the years with every manufacturer having a driverless prototype for testing.

There are six levels of autonomy for vehicles ranked as “zero to five”; zero representing no automation and five being full automation. The middle levels have varying degrees of control on the breaking, steering, and critical functions.

Governments are at varying stages of development in their readiness for autonomous vehicles. Some governments are currently looking at legislation and operating rules for the use of autonomous vehicles on roads and highways whereas others, such as Canada, are in earlier stages of development.

The potential impacts of autonomous vehicles are significant, and they include changes to land use planning, engineering standards, safety, parking, mobility for seniors and youth, transit, trucking, taxis, car sharing, cyber security and data management.

The introduction of autonomous vehicles will be restricted by legislation and liability issues. They will be one of the most “disruptive” technological events in human history.



# 5 ITS STRATEGIES AND PROJECTS

Three main sources of information were used to identify focus areas for which potential projects for the plan were developed:

- Consultation: consultation was conducted throughout the project. The information obtained from the steering committee, internal stakeholders, and external stakeholders provided a local perspective on "gaps" and "needs" which can be addressed through ITS integration.
- Research - ITS strategies have been developed and are being used by other agencies in Canada and abroad. A review of other municipalities as well as industry best practices and emerging trends was conducted. This process provided valuable information regarding current ITS practice. Projects related to this topic were included in the plan when deemed appropriate for St. Albert.
- City Plans / Policies / Priorities: Support for strategic priorities and for higher level City strategic plans, such as the Transportation Master Plan and Smart City Master Plan. Transportation is a focus of Council and Corporate priority; to which the TMP and Smart City plans provide target areas and objectives which are further supported by the ITS strategy.

Various strategies and projects have been identified that will help achieve the City's vision of ITS integration and support the mission of this strategy, while following the overarching principles. Although local context is the priority, the ITS strategy aligns to federal and provincial ITS processes and structure which will strengthen regional collaboration efforts and make St Albert's successes transferable to other communities.

## ITS ARCHITECTURE

In Canada (and indeed, virtually every country with ITS infrastructure), the process of developing ITS solutions is enabled by a national ITS architecture which acts as a framework and a starting point for ITS programs and projects. The ITS architecture defines solutions into nine (9) user service "bundles" as follows:

1. Traveller Information Services
2. Traffic Management Services
3. Public Transportation Services
4. Electronic Payment Services
5. Commercial Vehicle Operations
6. Emergency Management Services
7. Advanced Vehicle Safety and Control Systems
8. Information Warehousing Services
9. Maintenance and Construction Management

These user service bundles are further structured into "sub-services" that may be more commonly known. For example, the Traffic Management Services bundle is organized into the following sub-services:

- Traffic control
- Incident management
- Travel demand management
- Emissions testing and mitigation
- Highway-rail intersection
- Automated dynamic warning and enforcement
- Non-vehicular road user safety

The ITS Architecture also provides physical and logical views of the systems, users and the data flows between them. Understanding the priorities of the community and needs of stakeholders allows for solutions to be assigned based on the aligned ITS architecture. The strategies and projects represent opportunities of solutions to issues or filling network needs.

## ITS STRATEGIES

ITS Strategies are basically categories of projects that are similar. Based on the Vision, Mission, Principles, Goals and Objectives, the plan recommends two types of ITS Strategies:

**Specific ITS Strategies** – these strategies are directly related to one of the nine ITS user service bundles in the ITS architecture. All nine user service bundles in the national ITS architecture are part of the menu of ITS solutions for St. Albert.

**General ITS Strategies** – these strategies span or support more than one user service bundle and are typically "general" in nature. Many technologies in this category may be part of several user services.

Each ITS strategy contains a set of distinct and related projects, with a brief description of each.

## ITS PROJECT PHASING

The St. Albert ITS Strategic Plan spans ten (10) years, organized into three (3) phases:

**Short term (1 to 3 years):** This phase includes the preliminary and functional planning work on initiatives, business cases, and working level studies to develop "proof of concept" pilot projects. In the City, some pilot projects and research are already underway and their results will be included in the recommended work. The "low hanging fruit" which are so-called "early winner" projects that are low cost and high return, are typically in the short term.

**Moderate term (3 to 5 years):** This phase may continue work from the short term, or involve collaborative projects between partners that require early communication and planning. Actions may be focused around starting more detailed engineering and deployments. Typically, the moderate term phase includes a mid-point review of the ITS plan's progress. Groundwork may be started for long term projects as well.

**Long term (5 to 10 years):** This phase involves the projects that require a longer time horizon which may include technological change and research. Addressing autonomous vehicles are an example in this phase.

## ITS PROJECT PRIORITIES AND EVALUATION

Each project is evaluated against a set of priorities based on how it achieves specific goals and objectives. On a scale of 1 (lowest) to 5 (highest), the projects were evaluated for performance in these priority areas. The priority scores are weighted in order of importance and used to rank the projects:

1. ***Data and Safety (weight = 1.0)*** – any project that addresses any task or goal related to data management, including acquisition, transmission, processing, storage and distribution or a documented safety problem that involves transportation. These tasks are also related to progress towards the Internet of Things vision. Any recommendations in the discussion paper and the Smart City Master Plan are included. The data is used to feed other programs to improve safety and efficiency. Projects that are related to the City's Vision Zero initiative are ranked high. The safety of autos, trucks, pedestrians, and cyclists is included.
2. ***Efficiency and Economy (weight = 0.8)*** – any project that improves efficiency and related congestion is important. Corridor and intersection efficiency for various modes will be part of this. In some cases, efficiency and safety are related in the same project. Improving efficiency, and decreasing congestion has a beneficial impact on the economy for St. Albert. Projects that will support businesses in St. Albert are ranked high.
3. ***Social and Environmental (weight = 0.6)*** – any project that improves the well-being of the citizens of St. Albert or the natural environment requires recognition. Reducing greenhouse gas emissions, improving social equity, and encouraging mode shift are all ranked highly with these priorities. Projects that include these priorities likely also include aspects of safety and efficiency.

The following sections describe specific and general ITS strategies.

## SPECIFIC ITS STRATEGIES

### Strategy 1: Traveller Information Services

Road users benefit from knowing up to date and current information of the road network. Information may influence decisions on how a person travels (walk, cycle, drive, take public transit) or the routes chosen.

Advanced Traveller Information Systems (ATIS) provide users with data and information in pre-trip and enroute formats. Technologies in this user service include broadcast services (radio/TV), internet websites and electronic signage.

There are currently no active real time traveller information web sites for St. Albert and no traffic cameras for public access. As a service, the City may integrate technologies and provide traveller information via the City website, ensuring information is also open for further use by industry.

Some ATIS initiatives are in progress, with others under consideration, that will provide content for the City web page or may allow further use by third party businesses, including:

- A CCTV pilot using pan-tilt-zoom (PTZ) cameras which will provide broadcast quality images of road corridors allowing for traffic conditions and road conditions to be viewed remotely (see Project 1.2).
- Permanent count stations that capture vehicle volumes and classification which may be used to show traffic patterns and also for planning purposes by development groups.
- A Bluetooth based initiative Bluetooth based initiative to capture route drive times, providing real-time travel time information for route and trip planning (see Project 1.3).

The St. Albert ATIS program will be developed in conjunction with the results of these pilot tests and research as well as the data management initiative. Projects proposed that align to Traveller Information Services are:

### Project 1.1: St. Albert Real Time Traveller Information

This project will develop a "real time" traveller information web site or page that is linked to or part of the existing City website.

The project will review current available traffic information and data and develop an updated interactive City ATIS site with links to social media. Specific tasks of the project include:

- Develop functional requirements for a traveller information web page to demonstrate the benefits of the technology.
- Seek partnership and collaboration from other regional agencys to share on the web site for regional ATIS purposes. Information on the web site may include:
  - Real time traffic flow including speeds and volume
  - Real time corridor drive times; or point to point travel times
  - Real time weather advisories
  - Congestion information and hot spots
  - Incident alerts
  - Construction and maintenance activity
  - Access to CCTV cameras and VMS
- Prepare a work plan with ranked projects for design and implementation to feed the web site.
- Develop prototype for St. Albert ATIS site with interfaces to devices (identified in the following sections).

### Project 1.2: St. Albert Real Time Web Cameras

Closed-Circuit Television (CCTV) cameras today are reliable and sturdy with a host of features including pan-tilt-zoom (PTZ), high definition (HD) lenses and an excellent optical suite of features such as night vision. CCTV cameras can be used for traveller information systems (ATIS) as well as incident management tools.

This project supports Project 1.1 and involves the development of a web cam program to demonstrate the benefits of "know before you go" so residents can access images prior to their trips. Specific tasks of this project involve:

- Review results of the pilot project and effectiveness of tested cameras.
- Collect baseline data on traffic flows including congestion locations.
- Identify candidate locations of CCTV camera placement and develop evaluation criteria for ranking of locations
- Ensure remote access / communication is available to sites
- Ensure IT needs for information and data storage are met for applying information sharing to the city website
- Initiate a pilot project to demonstrate the benefits of live web cams. The work will involve preliminary and detailed design of all hardware including poles, foundations, clamps, electrical, telecommunications, and software. The project will review all current CCTV technologies, integration into the network and testing.
- Document results of benefits to build the business case for future work.

The St. Albert web cam project is intended to be "proof of concept" for the technology. The project will also feed real time content to the City Traveller Information web site in Project 1.1.

### Project 1.3: St. Albert Bluetooth ATIS Program

Bluetooth is a wireless communication standard that is used to exchange data between devices over short distances. Bluetooth ATIS technology is reliable and mature, and is regularly used in many jurisdictions. Most devices such as cell phones, computers, headphones, in-vehicle navigation units,

and others have "Bluetooth" technology. The units have unique identifiers called MAC addresses (media access control) which form part of the network interface. Bluetooth readers placed at key points in the corridor, such as intersections can detect the MAC address and perform a time stamp from passing vehicles. When the readers detect the same MAC address between two points, the elapsed time and known distance is measured to calculate average speed and travel time. The system then publishes the travel times on a VMS or an online map.

Bluetooth ATIS is effective and generally accurate providing a level of confidence in live travel times Primary focus of the Bluetooth ATIS program will focus on corridors with key access points into St Albert, but is influenced by locations having communication connectivity (fiber communications for example) which allow information to be accessed remotely.

If the trips are known to be outside of the City, the Bluetooth system could be expanded to include other regional destinations which will require cooperation of regional stakeholders. Optimally, the published travel times would display an array of regional destinations.

Specific tasks of this project involve:

- Develop evaluation criteria for Bluetooth deployment. Typically, these corridors may have variations in travel times due to non-recurring congestion or other factors.
- Develop a candidate list of corridors including the end points for the Bluetooth System
- Prepare functional requirements, detailed design and specifications for the Bluetooth system.
- Ensure remote access / communication is available to sites
- Ensure IT needs for information and data storage are met for applying information sharing to the city website
- Deploy the pilot and document benefits, using the results to feed a business case for future deployments.
- Prepare a ranked implementation plan for the Bluetooth ATIS program.
- Seek partnership and collaboration from other regional agency's to implement Bluetooth technology to allow for regional "point to point" travel times.

Specific travel times can be published on the City web site in Project 1.1

### Project 1.4: St. Albert Real Time Trip Planner

Trip planning has migrated into a mobile, dynamic environment that now involves multiple modes. Users are interested in monitoring real time location and direction, as well as profiles (elevation) for active transportation options.

This project will develop a "city-based" trip planning tool that provides options for various modes and journeys. The trip planner will be a customized version of Google maps to show travel times/directions between an origin and destination. Part of the customization may be to use the profile data to calculate the cardio or health benefits of active trips.

The trip planning tool is envisioned to provide the following:

- A mobile app that allows direct access to various modal options in St. Albert between an origin and destination. The app should update the road network continuously.
- Information on transit, auto, pedestrian, and cycling routes plus intermodal transfer points between modes.
- GPS based tracking of progress for users.
- Security feature to protect users that prompts pedestrians if the location doesn't change for extended periods for personal security.

- A voice activated option. This app should be available for download via the City's web site.

### Project 1.5: St. Albert Road-Weather Information System (RWIS)

A Road-Weather Information System (RWIS) is a safety-related ITS user sub-service. It is particularly important in areas that are prone to severe weather changes, for example, by passing through more than one climatic zone or by changes in elevation. Some locations are more prone to black ice formation due to the tracking of sun, causing shadows.

RWIS stations contain an array of sensors that measure environmental and local factors to provide relevant information for possible advisories or even road closures. Environmental variables include ambient air temperature, barometric pressure, wind speed and direction, and relative humidity. Local variables include current surface pavement temperature, freezing point of liquids on the surface, depth of snow and rain, and pavement conditions (slush, icy, etc.). A current RWIS pilot project is testing three (3) sites. The results with "lessons learned" should be incorporated into this program.

Locally, the scenario of black ice formation and hazardous road conditions may be addressed by this program. RWIS stations can be simple with optical sensors and aligned to CCTV camera locations and be connected to a traffic management centre. This project supplements traffic data by collecting and analyzing environmental and local data. Specific tasks of this project involve:

- Review results of the RWIS pilot project.
- Develop a list of candidate sites for RWIS stations and prioritize potential installations based upon project needs or location benefits
- Ensure remote access / communication is available to sites
- Ensure IT needs for information and data storage are met for applying information sharing to the city website.

It is envisioned and important that the RWIS data be assessed and integrated with the traffic management and ATIS programs. In severe events, traffic management (road closures) with ATIS (travel advisories) will benefit from and protect the public using the RWIS data. RWIS, when combined with traffic management and ATIS, can save lives.

### Project 1.6: St. Albert Speed Advisory System

Simple and effective, this project uses equipment and technology that measures the vehicular speeds of approaching cars and trucks, and provides direct notification to the driver of their travel speed. Additionally the devices may influence the driver's speed by flashing when the measured velocity exceeds the posted limit by a set amount. The LED signs can be posted at locations prone to speeding or at key vulnerable road user areas such as school / playground zones, or in construction sites (may be on temporary fixtures). High collision locations are also evidence-based criteria for selecting this system. In many jurisdictions, these systems have been proven to be effective in decreasing speeding and resulting collisions and can be used as an enforcement tool.

In St. Albert, there are commitments to two important initiatives that provide the framework and context in these safety projects:

- Vision Zero is a commitment to reduce and ultimately eliminate fatalities and serious injuries that result from motor vehicle collisions.; The City's Transportation Safety Plan, focuses attention on the City's commitment towards Vision Zero and safety initiatives that may be supported by ITS.
- Safe Journeys to School: This initiative targets the mitigation of negative impacts of vehicle movement through school zones, generating higher confidence for active modes to and from these high vulnerable road user locations.

- Neighbourhood Traffic Calming: This initiative targets the mitigation of negative impacts of vehicle movement through neighbourhoods; where residents are active and directly impacted in their day to day lives.

Speed advisory systems combine speed detection with LED advisory signs to encourage drivers to slow down.

Specific tasks of this project involve:

- Collect collision data and history for primary St. Albert corridors and neighbourhoods.
- Review locations and speed and collision data for school and playground zones.
- Review the Transportation of Canada (TAC) Guidelines on Driver Feedback placement.
- Prepare evaluation criteria for prioritizing system implementation.
- Review and evaluate effectiveness of speed displays at current locations

This project supports section 5.3 of the Draft Traffic Safety Strategy and specifically section 5.3.4 that recommends "speed display devices". This section also supports safer speeds.

### Project 1.7: St. Albert Traffic Data Collection Program

St. Albert requires baseline data to assess the current traffic conditions on City corridors and intersections. Turning movements counts, volumes, speeds and classification data are critical to network monitoring for safety and operational review.

This project will provide a city-wide traffic data collection program using the latest technologies, combined with the fiber optic network, to collect real time data and send it directly to the traffic management centre.

Specific tasks of this project involve:

- Best practice review of traffic collection programs for similar size municipalities.
- Review of Transportation Association of Canada (TAC) Guidelines on Traffic Data Collection and Management.
- Identification of what current data and processes are followed in the City.
- Completion of a "needs assessment" for traffic related data.
- The program will include safety data including incidents of collisions, injuries and property damage. Traffic conflicts, speeds, and intersection collisions will also be collected.
- Identify technologies available to collect required data throughout the network.
- Develop pilots for use of technology currently not capitalized on by the City
- Review results of current pilot tests for technologies.
- Prepare a phased plan to develop and implement a traffic and safety data collection program with a mix of technologies.
- Develop a storage and retrieval system using an administrative portal.

The project will be done in a step-wise manner as development occurs. The work may be incorporated into the City's annual program for traffic operations and sensors may be aligned to development requirements.

## Strategy 2: Traffic Management Services

Traffic Management seeks to manage the transportation network efficiently and safely. On a "normal" commuting day in St. Albert, Traffic Management sub-services will work to ensure that the travelling public's journeys are safe and efficient.

Traffic Management contains a broad set of sub-services that are more commonly known including:

- Traffic control (signal coordination)
- Incident management (detection, verification, response and removal)

- Travel demand management (high occupancy vehicles or "HOV" lanes)
- Emissions testing and mitigation (environmental testing)
- Highway/rail intersection (rail/road interface, signal systems)
- Automated dynamic warning/enforcement (connected vehicles, photo-radar)
- Active transportation road user safety (audible pedestrian signals).

This suite of sub-services will be visible and generate public interest in terms of the benefits of ITS. The following projects are recommended in this user service:

### Project 2.1: Integrated Corridor Management (ICM)

This project will develop an Integrated Corridor Management (ICM) plan in St. Albert for traffic. The concept of ICM considers that transportation corridors are underutilized, and modal assets are often operated by different agencies. departments, or the road users may have different needs and priorities. Simply put, ICM is the integrated management of freeway, transit, arterial (vehicle and pedestrian / cyclist), rail, and parking systems within a corridor using ITS technologies and innovative practices. It is the management of a corridor as a system rather than the management of the individual transportation networks (e.g., rail lines, bus routes, arterials, freeways) within a corridor. The efficiency and throughput of a corridor is improved by integrating these assets together, focused on the objective of the most effective and efficient movement of goods and people. By using existing infrastructure (modal assets) and integrating them, the underutilized capacity can improve performance of a corridor.

In doing so, an integrated corridor effectively creates a linear community in which movement is enabled throughout for users. The modes include autos, trucks, pedestrians, transit and cyclists. The integration of these assets can create benefits for the users through signal coordination, incident management and traveller information systems.

The ICM Plan will focus on key corridors including St. Albert Trail, Boudreau / Giroux Road and Ray Gibbon Drive.

Specific tasks of this project involve:

- Identify the St. Albert corridors for the ICM plan and in particular, the networks for roads, pedestrians walkways, cycling routes, and goods movement corridors.
- Identify alternative routes – often parallel or connecting routes and opportunities for integration
- Collect and compile background data on each corridor including:
  - Traffic volumes
  - Travel time
  - Collisions and safety reports
  - Mode split
  - Pedestrian and cyclist volumes
  - Telecommunication infrastructure
- Identify intermodal transfer or coordination points where users can move from one mode to another. Capacity of transfer points (for example, park and ride lots) should be considered.
- Develop alternate modal routes for corridors – if one route was blocked, other corridors can relieve the traffic load.

The ICM plan is envisioned as the "backbone" of the initiatives to develop corridor-based services.

### Project 2.2: Adaptive Signal Control

The Adaptive Signal Control concept is based on measuring all traffic flows into and out of a roadway segment, while dynamically changing (or "adapting") the signal timing plans to fit the traffic load.

The objective of this project is to improve the function of corridors by reducing travel time, delay and congestion. A smoother traffic flow with less

"stop and go" conditions will decrease collisions. Adaptive signal control is also aligned to the Traffic Safety Strategy and may assist the City in achieving the goal of Vision Zero. Environmental benefits will also be realized through the reduction of vehicle emissions, while the City will realize resource benefits resulting from reduced signal timing plan updates.

Integration of adaptive signal control is proposed to be first performed as a pilot project along the key corridor of St Albert Trail. This will involve a multi-jurisdictional collaboration between the City and Alberta Transportation (for the signals at the Anthony Henday), and may be a first step towards further partnership with the City of Edmonton.

This project will be a pilot for adaptive traffic signal control at fifteen intersections on St. Albert Trail, which are shown on **Figure 5-1**, and include:

- Anthony Henday Drive interchange (2 signals)
- St. Albert Trail and Commercial Access (Superstore)
- Hebert Road / Gervais Road
- Gate Avenue
- Green Grove Drive / Sterling Street
- St. Anne Street / Sturgeon Road
- St. Vital Avenue / Rivercrest Crescent
- McKenney Avenue / Bellrose Drive
- Lennox Drive / Inglewood Drive
- Boudreau Road / Giroux Road
- Villeneuve Road/Erin Ridge Road
- Coal Mine Road / Commercial Access
- Everitt Drive North / Jensen Lakes Boulevard
- Neil Ross Road

Specific tasks of this project involve:

- A best practice review of other jurisdictions that have implemented similar adaptive traffic signal control corridor programs, including lessons learned;
- Gathering of all geometrics and lane configurations on the corridor and intersections;
- Identification of any trip generators mid-block and assessment of their traffic flows;
- Partnership and collaboration with signal control manufacturers on innovative technology
- Partnership and collaboration (an agreement developed) between St Albert and Alberta Transportation on the integration of the Anthony Henday signals
- Integration of travel time equipment to collect baseline data of the corridor.
- Integration of necessary sensors and equipment relevant to support adaptive signal control.
- Collection of baseline traffic volume data for the assessment of corridor improvement;
- Assessment of the communication links in the St. Albert Trail corridor, which will be required for the operation of the adaptive signal control;
- Developing a concept of operations describing the quantitative and qualitative characteristics,

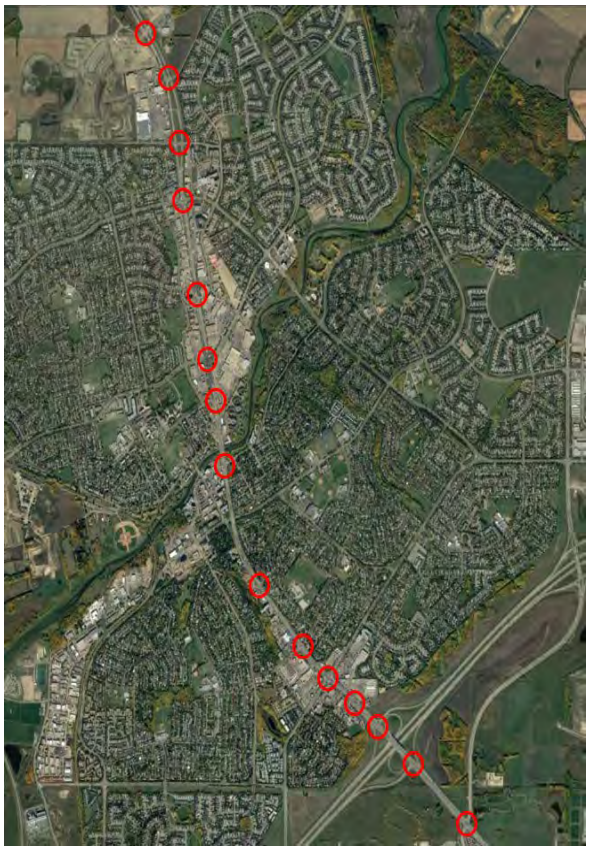


**Figure 5-1: Locations for St. Albert Trail Adaptive Signal**

and requirements of the equipment and software for the adaptive signal control system;
- Developing a functional assessment of the system required for an adaptive signal control system; and
- Undertaking a "before-and-after" assessment of corridor conditions, including travel time surveys during AM peak, PM peak, and mid-day periods.

### Project 2.3: Incident Management Program

In many cities and communities, daily incidents occur that cause congestion and safety problems. The overall goal of incident management is to minimize the duration of these incidents, thereby reducing the probability of secondary incidents and improving overall safety. Typically, incident management involves several phases:

- ***Detection of incidents***: This phase uses various technologies from loops to cameras to wireless radar detectors. The detectors are scanning for "unusual" patterns that algorithms deem are a high likelihood of an incident – high density but zero speed on a road or highway is one scenario.
- ***Verification of incidents***: Once detected, the system will alert an operator at the traffic management centre and display CCTV cameras to verify details. The operator will confirm the number of vehicles involved, lanes affected, possible injuries, fuel spills, and other details.
- ***Response***: The operator will coordinate the response to the incident which may involve multiple emergency agencies arriving at the scene. The operator will also update the Advance Traveller Information Systems (ATIS), which can then alert drivers planning trips and also inform Variable Message Signs (VMS) to alert drivers on the roadway..
- ***Removal/Restoration***: The operator will coordinate removal of the vehicles at the incident site and ensure that the incident is recorded. The operator will ensure the corridor is restored to normal operation.

During the development of the strategy, the background data review and stakeholder engagement identified St. Albert Trail as a priority – it contains the seven worst intersections in terms of collision frequency and incident occurrence result in extensive impact to operations. The incident management program will focus on improving safety on St. Albert Trail as the priority and may be expanded to additional corridors.

Specific tasks of this project involve:

- Identify primary corridors in St. Albert for incident management including Provincial and adjacent stakeholder jurisdictions.
- Investigate ITS infrastructure on each corridor including:
  - Traffic detection
  - CCTV cameras
  - Variable message signs
  - Telecommunications network
- Ensure IT needs for information and data storage are met
- Develop functional requirements for incident management program by corridor to a traffic management centre.
- Undertake preliminary design of integrated and centralized incident management for the network including hardware and software.
- Develop detailed design and specifications for field devices, telecommunications and software

It is envisioned that the incident management system will be scalable, capable of expansion throughout the City and support integration or transfer of information and operations for other regional agencies including Alberta Transportation.

### Project 2.4: Traffic Safety Strategy and Vision Zero Improvements

The following projects support the City's Transportation Safety Strategy and the goal of Vision Zero, to which no serious injuries or fatalities

occur on city roadways as a result of motor vehicle collisions. These tasks are a priority for the City in its safety program, as it supports the Safety Strategy's Vision of:

***A Community Working Together so Your Family Arrives Safely***

The Transportation Safety Plan will pursue a series of strategies and projects. ITS will be a key enabler of these safety benefits with the following related projects:

**Intersection Safety Cameras**

- Review the best practices and current technologies for intersection safety cameras.
- Develop functional requirements and concept of operations for the intersection safety program.
- Review data management needs including image storage and transmission. Prepare network design and diagram.
- Develop site selection criteria to prioritize locations. Develop pilot project locations.
- Prepare preliminary and integration for the pilot location into the traffic centre.
- Prepare detailed design and specifications
- Baseline data collection.
- Implementation and monitoring of operations.
- Collect "after" data and prepare a business case for full deployment.

**Adaptive Signal Control Program** – *see Project 2.2*

- This project is supported by the Transportation Safety Plan in section 5.1.4.

**School and Playground Zones** – *see Project 1.6*

- This project is part of the Transportation Safety Plan in section 5.2.4.

**Vehicular Speed Reduction** – *see Project 1.6*

The following initiatives are recommended in this project:

- Speed display devices – see Project 1.6 for LED speed signs.
- Variable speed limits – these systems monitor traffic and local environmental conditions such as snow and extreme weather to recommend variable speed limits. The system would combine data and information from the traffic counters, CCTV cameras, and RWIS stations to provide the recommended speed changes.

**Autonomous and Connected Vehicles** – *see Projects 7.1 and 7.2*

Connected Vehicles features have already been embedded in many automobiles today with such features as "lane keeping" and "collision avoidance".

Autonomous vehicles (AV) are the so-called "driverless cars" that will be on the market in the coming years with the potential to significantly reduce auto accidents. AV have an array of technologies including video cameras, LIDAR and ultra sonic sensors to allow it to "see" objects, people, vehicles, lane lines, and basically everything around it. Driverless vehicles are a disruptive technology in terms of changing transportation.

AV and CV are part of the Transportation Safety Strategy and are discussed in Project 7.1 and 7.2.

## Strategy 3: Public Transportation Services

This strategy supports all forms of public transportation within St. Albert and adjacent communities that support intra and inter-city transit services. Examples of this user service include "next bus" arrival notification, automated passenger counting systems and transit signal priority. This ITS strategy supports regional transportation programs. The following projects are envisioned:

### Project 3.1: On-Demand Transit

This project involves the development of a "point to point" transit service which is effectively customized transit. In addition to supporting general resident needs, the project will support the sector of public transport users called "paratransit users" that cannot access conveniently the transit services that

are available due to physical mobility or mental disabilities.

Serving a community of over 65,000 + will require a system approach. The system will require real time location of each service vehicle, accessing the electronic manifest, directionality and speed. The project will involve implementing a central system for users (web based or telephone) for ride requests. The system monitors vehicle locations, assigns rides and monitors status.

Specific tasks of this project involve:

- Develop functional requirements for the on-demand transit system.
- Prepare a concept of operations and system network design.
- Review on-board technologies including GPS antennae, vehicle logic unit (computer), real time mobile display terminal (MDT) monitor, and integration.
- Develop detailed software design of central system.
- Procurement and implementation.
- Testing and evaluation.

Network testing will be done on a small number of vehicles prior to full scale deployment.

### Project 3.2: Next Bus Arrival System Upgrade

St. Albert currently utilizes a "Next Bus" system with GPS and a central system that allows users to monitor buses as they progress through a route. For example, Route #203 is the primary route between the University of Alberta and St. Albert, tracked by Next Bus. The system operates and displays the information on a computer or smart phone. However, the current Next Bus locations show as error messages, with questionable reliability.

This project involves developing improvements to the current next bus arrival system including reliability. St. Albert buses are equipped with automatic vehicle location (AVL) devices such as GPS.

Specific tasks of this project involve:

- Develop test plan for on-board GPS, computer and antennae for signal strength, accuracy, directionality, and speed.
- Current buses will be tested for predictions against "ground truth" data including arrival time.
- Current technology specifications and network architecture will be reviewed.
- Specifications and design will be updated and revised to reflect state of the art system.
- Real time mobile app for next bus arrival information will be improved for the latest version of android or iPhone unit.
- Next bus arrival information on LED signs at stations will be implemented.
- Next Bus will integrate real time location via traveller information system in Project 1.1.

### Project 3.3: Transit Signal Priority (TSP)

Transit Signal Priority (TSP) involves granting priority at signalized intersections for transit vehicles, typically by extending green or truncating opposing red phases. The TSP system uses real time location, directionality and speed of the buses as well as their schedules to estimate schedule adherence. Jurisdictions can grant unconditional priority to buses at TSP-equipped intersections when they are behind schedule, regardless of passenger load. Schedule adherence is often set to a threshold, such as 2 minutes, to trigger the TSP sequence.

The system detects the approaching bus, reviews schedule adherence, and determines if TSP should be granted. If so, the network will direct the extension of the green phase to allow the bus to proceed through the intersection. If the approach is red, TSP will direct truncation of the phase. At strategic congested locations, the bus can maintain schedule adherence or catch up, if behind.

Specific tasks of this project involve:

- Review bus routes and schedules on the signalized network.
- Assess traffic conditions on network locations including congested locations.
- Develop evaluation criteria for TSP. requirements at intersections to rank TSP needs.
- Prepare functional requirements and concept of operations including data management.
- Identify corridors and locations where TSP will be deployed.
- Develop a TSP workplan for network deployment.
- Conduct baseline data collection.
- Develop a TSP pilot project with baseline and "after" data collection.
- Detailed design of TSP at intersections including software interface to controllers.

### Project 3.4: Smart Bus On-Board Architecture

Transit technology on board buses are becoming more complex and powerful, yet less costly and widely available to cities and agencies. Buses today have a wide array of on-board systems such as:

- Vehicle logic unit (VLU) which acts as a central computer
- Mobile Display Terminal (MDT) which shows the driver information
- Automated Passenger Counting (APC) units which are infrared beams that count passengers as they board and alight.
- Automated fare boxes
- Electronic fare payment systems
- CCTV cameras on-board and outside the bus for security and liability assurance.
- Blind spot detection and sensors
- On-board LED and annunciators for passengers
- WiFi access
- Automated Vehicle Location devices such as GPS.

Most, if not all, of these units have "IP" addresses and are online. Additionally, the buses require specialized cabling and installation. Considerations must also be made to align with future expectation of public transport fleets moving towards autonomous capability..

As buses become filled with complex technology and the data generated become critical, it is necessary to develop an on-board road map or "architecture" for buses that will connect passengers with the Smart City data platform.

It is important in a Smart City environment that transit technology is integrated and managed in terms of data. This project will review current deployed systems and future technology. On-board ITS related units and architecture for technology and data management will be developed.

### Project 3.5: Transit Infrastructure

Transit services are a combination of vehicles, on-board ITS and field technologies, information networks, software and infrastructure. As the City grows, transit vehicles will require infrastructure (as well as technology) to provide mobility. Infrastructure may include:

- Bus only lanes and access
- Bus only queue jumpers at strategic locations
- "Transit only" signals to allow buses to proceed through an intersection before general purpose vehicles
- Bus bays at transit stops
- Transit exchanges with passenger information

This project will review the current transit network performance and determine each application and locations. The infrastructure may be strengthened by hardware or software (for example, transit only signals) to improve operations and performance.

## Strategy 4: Electronic Payment Services (EPS)

Electronic payment services systems support a variety of services, typically providing customers with an easy convenient payment method. In a Smart City environment, EPS is an enhancement to

service delivery and efficiency mechanism for the City.

Typical examples of possible regional transportation related services include use of Radio Frequency ID or "RFID" transponders to support tolling, access to port facilities by trucks and a "green light" type of weigh-in-motion (WIM) bypass system. Typical examples of city services may include "smart card" fare payment systems for transit, libraries, clinics, parking and community centres. Some of these features are already operational in some networks in St. Albert. The following project is envisioned:

### Project 4.1: St. Albert Electronic Payment System (EPS)

Specific tasks of this project involve:

- Review current transportation and City services.
- Review goods movement functional requirements.
- Develop a concept of operations for a city-wide smart card program for parking, buses and facilities.
- Prepare network diagram for communication network in support of EPS, integrated into the traffic centre.
- Develop best practice review for municipal EPS including state of the art technologies.
- Develop specifications for readers, ID devices (cards, GPS, transponders) and network infrastructure.
- Develop framework for software and operating system.
- Preliminary design and technology assessment reports.
- Detailed design and software development including material reports.
- Acceptance testing (factory and field) and evaluation.

## Strategy 5: Commercial Vehicle Operations and Enforcement

This strategy supports all systems that provide safe and efficient goods movement as well as the commercial vehicle enforcement of provincial regulations. This strategy includes the use of technologies such as "weigh-in-motion" (WIM), CCTV and licence plate readers to regulate and support fixed and portable truck scales.

In the City, the regulation of goods movement is a "shared" responsibility that involves the Province (Alberta Transportation), the City of St. Albert, City of Edmonton, and the Regional Counties and agencies. Integration with national trade corridors and systems may also be a future requirement.

An important part of a livable community and indeed, a Smart City, is the quality of life and goods that are available to residents. Transport of commercial goods needs to be supported but the infrastructure and neighbourhoods require protection. A thriving City will require that balance to be maintained and to support the key role of goods movement.

Development of two major business parks (Campbell and Riel) will create additional truck traffic that will originate or terminate in the City. The St. Albert TMP targeted three strategies:

- Provide good connections between industrial areas and commercial sites in the City.
- Discourage heavy vehicle traffic from residential and school areas.
- Provide regional connections to Sturgeon County and the City of Edmonton.

Supporting these strategies will require ITS infrastructure to monitor and enforce the City policies and bylaws as well as Provincial regulations.

The following projects are envisioned:

### Project 5.1: Regional Truck Survey and Workshop

This initiative will involve two phases:

1. Document "in the field" the volume, speed, classification and frequency of truck traffic on major goods movement corridors by time of day and cargo type. If possible, the collection of

this truck data will also include origin and destination. This task will require development of a truck survey plan to collect data.

2. The data will be used as input to update the regional truck model and the development of the commercial vehicle enforcement strategy.
3. Develop Workshop for the Trucking Community:
    - Prepare an online questionnaire with a "Primer" that will summarize the issues to the trucking community and an invitation to attend an workshop.
    - Present results of the data collection in the field.
    - Display the future goods movement network.
    - Discuss other issues such as dangerous goods movement through the urban area.
    - Working with the trucking association and province, develop a workshop to inform the trucking community of the future network, obtain feedback and input for improvements.

The regional truck workshop serves as the stakeholder input and needs assessment of the goods movement community.

### Project 5.2: Commercial Vehicle Enforcement Strategy

Development of a regional commercial vehicle enforcement (CVE) strategy will require coordination with the province and regional agencies. It is important that the CVE strategy capture and respect the needs of the province and national trade corridors as well as the requirements of the local community.

The CVE Strategy will examine the following to support the goods movement objectives of the region:

- Infrastructure – fixed weigh scales
- Resources – enforcement staff and mobile units
- Technology – ITS with WIM and CCTV

In the City, monitoring corridors such as St. Albert Trail and Boudreau Road, to discourage unnecessary heavy trucks from using them requires ITS technology. There are numerous options as follows:

- Radar sensing data collection which includes installation of the sensor on a pole with a cell modem to transmit the data to the traffic centre.
- Radar sensing data collection (same as above) with built-in alarms to alert authorities in real time of a violator.
- Virtual weigh scale system using bending plate WIM scales, loops, CCTV, plate readers and cell modems.

These systems can be strategically located throughout the City to detect violators and issue notices.

This project will consider the feedback from the Goods Movement stakeholder workshop (Project 5.1) and the survey responses. Together, the agencies including St. Albert, will develop operational policies and rules to enforce on key urban corridors using ITS technology.

### Project 5.3: Dangerous Goods (DG) Monitoring Program

Dangerous goods movement includes explosive and hazardous materials. The issuance of permits allows carriers to move these dangerous goods on certain corridors, typically in designated time periods.

St. Albert Trail is currently a designated 24-hour dangerous goods movement corridor. However, future development of St. Albert Trail as a multi-modal active transportation corridor will require re-evaluation for dangerous goods transport. Development and completion of 127$^{th}$ Street and Ray Gibbon Drive expansion will also support moving dangerous goods away from St. Albert Trail.

Additional tasks to support this project include:

- Review legislation in Alberta governing dangerous goods movement.

- Review input from trucking community in stakeholder workshop in project 5.1.
- Assess dangerous goods types that require transport in and around St. Albert.
- Develop list of designated carriers and fleets for transportation of DG.
- Prepare best practices of DG monitoring programs in similar municipal and regional environments.
- Review technologies and systems for monitoring DG.
- Prepare functional requirements and concept of operations for DG monitoring.
- Prepare preliminary design of DG monitoring system.
- Develop specifications of systems (hardware and software) and detailed design.
- Procurement and testing.
- Alignment of Incident Management preparedness for an event involving dangerous goods.
- Engagement and collaboration with CN Rail for identification, monitoring and incident management plans for dangerous goods being transported via rail.

## Strategy 6: Emergency Management

This strategy provides data and information to support efficient and effective response by emergency services during incidents and call-outs. Examples include pre-emption of traffic signals for emergency vehicles and warning / information systems. The following projects are envisioned:

### Project 6.1: Emergency Pre-Emption System System

In medical emergencies, it is critical that first responders reach the incident site as quickly as possible. Travel through congested corridors and intersections are risks to the responders and public safety.

The City currently utilizes emergency vehicle pre-emption, allowing for the "on route" emergency vehicle(s) to be prioritized and adjust the traffic signal controls to allow for faster progression down the corridor or through an intersection.

This project will examine the locations where further signal pre-emption is needed. The following tasks are envisioned:

- Confirm the locations of firehalls, police stations and hospitals.
- Review locations of signalized intersections and expected primary travel routes of emergency vehicles
- Develop functional requirements for signal pre-emption at selected locations
- Identify pre-emption "ready" intersections (infrastructure is in place to support implementation)
- For priority areas not capable of supporting pre-emption, install necessary equipment
- Develop partnerships and communicate with Regional stakeholders (Alberta Health Services, City of Edmonton) on opportunity to expand emergency vehicle pre-emption to a regional level; focus on key corridors and health service destinations.

## Strategy 7: Vehicle Safety and Control Systems

This strategy supports the development, implementation and operation of safety technologies on-board vehicles and on the roadside. The current initiatives with connected and autonomous vehicles provide a glimpse into potential initiatives with collision avoidance and lane departure systems that are now standard in some vehicles as well as the so-called "driverless cars" of the future.

The following projects are recommended:

### Project 7.1: Connected Vehicle Impacts

Connected Vehicles (CV) use on-board technologies to communicate between them and infrastructure. CV technologies are now common and found in

many vehicles, even in older models. Examples of CV technologies include backup CCTV cameras, collision avoidance sensors, warning systems for vehicle components, and transponders in support of tolling and access. Many newer vehicles today come with lane keeping, braking and other safety related features.

This project will undertake the following tasks:

- Review current and future CV technologies.
- Investigate how CV systems can benefit the City services.
- Develop innovative methods of integrating the CV technologies into the City's Smart City systems and Internet of Things (IoT) platform.
- Leverage the CV technologies to improve safety and efficiency in the transportation network.
- Develop data flows to support CV functions.

### Project 7.2: Autonomous Vehicle Impacts

This project involves research into autonomous (driverless) vehicle impacts on the City services and staff functions. As driverless vehicles penetrate the market, the impact on the City will increase. The specific City staff functions are described in Project 11.3 (Autonomous Vehicle Working Group) and are addressed in the Discussion Paper in Appendix B.

This project will use the Discussion Paper and input from the Working Group to develop a report, based on results and experiences in other jurisdictions. The report will allow the City to prepare for the eventual deployment of autonomous vehicles over time.

### Project 7.3: Research Partnerships

The City has an extensive number of current and future pilot projects to provide proof of concept results and testing. The Smart City Master Plan envisioned that the City would be a "living lab" to promote the use of the network to test these new technologies. The City can be a national leader in implementing autonomous and digital technologies.

In this project, there will be a pursuit of partnerships with the academic and industrial communities to facilitate these research projects. It may also involve expansion of existing partnerships with the research community.

The result will include seeking federal and provincial funding for these innovative initiatives.

## Strategy 8: Information Warehousing

This strategy addresses the vast amounts of data that are generated by the devices, vehicles and equipment involved in transportation. The primary elements of this strategy pertain to the management of data and telecommunications. Both topics are addressed in detail in Discussion Papers in Appendix B and are summarized in Chapter 4.

#### Data

Data management is a key fundamental component of the City's ITS Strategic Plan and the foundational layer of a Smart City environment. Within St. Albert's Smart City Master Plan, data management directly affects the following actions and is thus critical to its goals:

- C.1.1 Expedite the development and implementation of an intelligent transportation system.
- C.1.2 Work with regional neighbours to coordinate intersection timing on key transportation corridors and actively share transportation data.
- C.2.1 Provide transportation data and digital trip information, directly and indirectly, to travellers considering all modes of mobility.

ITS is dependent on data that is generated by or from field devices, vehicles, people and other sources, transmitted to a central hub, processed and stored before it is distributed to stakeholders. Data is a powerful and necessary part of the ITS and Smart City plans, but requires careful planning and management.

Data management is a challenging and ever-changing process for numerous reasons:

- Data volume is increasing constantly, for example each time someone travels, utilizes a credit card, or simply uses a device with GPS. It is estimated that a stunning 2.5 exabytes of data is generated on Earth each day (1 exabyte = 1 billion GB).
- Data sources are becoming more diverse and plentiful as new ITS technologies evolve and develop.
- Data generated by different sources often vary in quality, speeds, and size. The data must often be combined and assessed to develop an accurate picture of road conditions.
- Data is commonly exchanged by vehicles, people and devices. Connected Vehicles (CV) is a national program to establish the network and communications necessary to support data transfer between vehicles and infrastructure. Communications between vehicles and infrastructure is already occurring.
- Big Data refers to data sets that are usually larger and beyond the ability of most software tools to handle. While St. Albert may handle its current data requirements, the trend with Big Data and with new emerging technologies in ITS will increase the volume and complexity of data beyond the City's capabilities.

Thus, "Data Management" is rapidly evolving from a static to a very mobile and data rich environment. Traditional systems in the past used fixed (static) and passive data sources which were quite sparse. Today, more "intelligent" networks use dynamic, mobile and integrated systems, often with shorter update periods and multiple data streams.

Finally, the concept of the "Internet of Things" (IoT) envisions an environment where every device is "IP" enabled and connected. Today, many communities are rapidly progressing to this state as many devices have an IP address. Infrastructure such as field devices, vehicles, mobile units, and even building components have IP addresses.

The City of St. Albert cannot handle the data without more intelligent tools. For St. Albert, ITS applications and use of such tools as artificial intelligence (AI) are critical to sort through the massive amounts of data in our future and transform it to actionable information for the public, providing function through an integrated platform that is useful to our residents.

For St. Albert, the "Internet of Things" (IoT) is the base layer of the Smart City data management network to which it must migrate. The starting point of this transformation is the development of a central hub called the "IoT Platform" which is essentially a software platform that connects field devices to applications. Embedded within the IoT platform are the intelligence and components to support the following:

- Deployment of applications to monitor, manage and control connected devices.
- Remote data collection from connected devices.
- Independent and secure connectivity between devices.
- Management of devices and sensors.
- Integration of third party systems.

Thus, the IoT platform will support the integrated and efficient deployment and management of devices, data collection, and distribution. Basically, the IoT platform links the devices that generate data to the consumers that use them through public facing applications.

Within the IoT platform, the IoT "hub" supports and maintains the data flows to and from the field devices, acting as a "gateway" to all other components in the IoT platform.

The data flows and functional components are shown in **Figure 3** in the Data Management Discussion Paper in Appendix B. **Figure 5.2**, St. Albert ITS Network Diagram below, illustrates the collection, repository and distribution of the data.

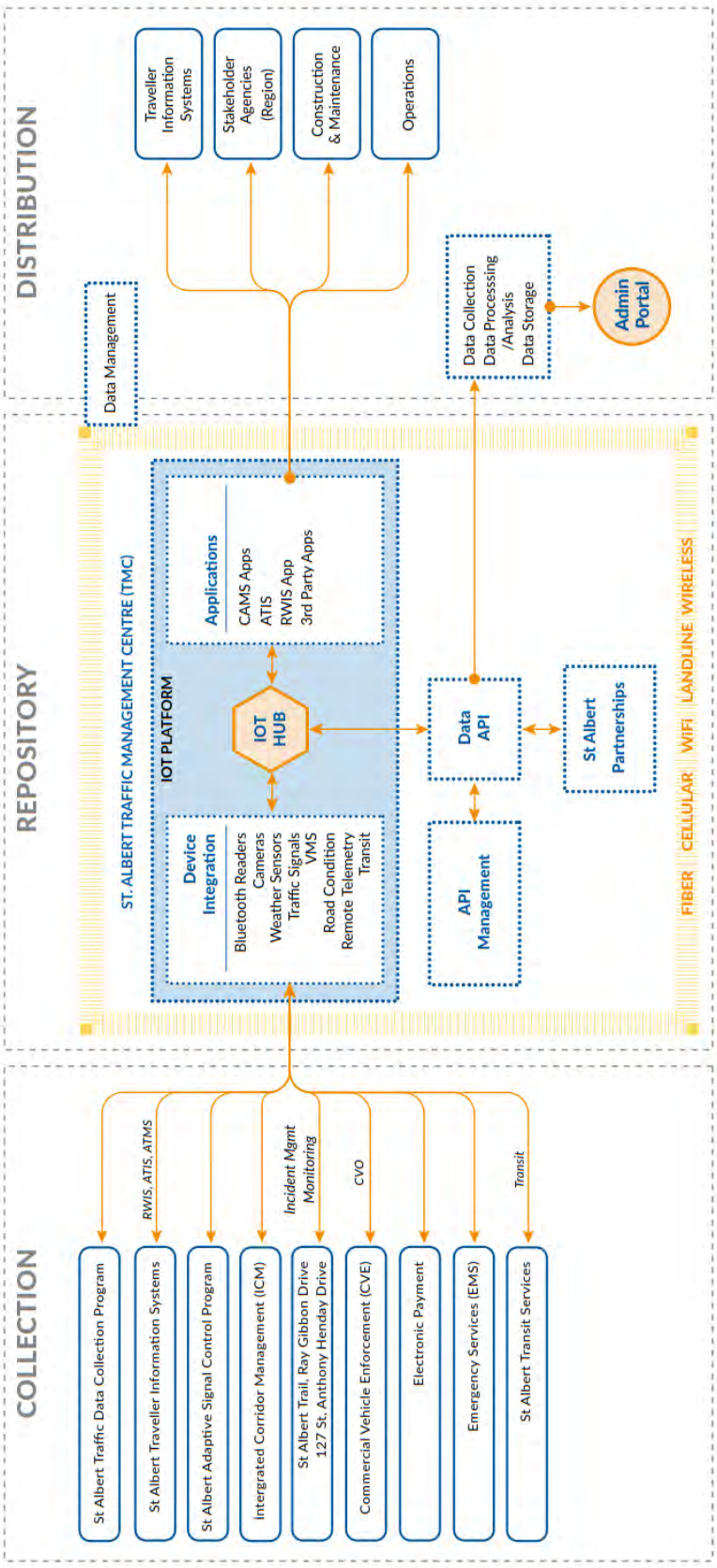



**Figure 5-2**
**St. Albert ITS Network Diagram**

The following sub-projects are recommended in this strategy:

### Project 8.1: Data Management Strategy

It is recommended in the short term that the data management strategy focus on deployment of infrastructure to improve data collection services, eventually using them to develop applications such as traveller information. The data collection improvements will also reinforce the benefits of ITS to the public and stakeholders.

In the medium term, it is recommended that the City consider the use of a commercial off the shelf advanced traffic management system (ATMS) that will support device and data management. The City can support integration with field devices and other systems using the ATMS as an interim measure. Additionally, the City can review the "lessons learned" from other jurisdictions that are transitioning to an IoT platform.

In the long term, it is recommended that the City migrate the interim ATMS towards the complete IoT platform and data management strategy.

Specifically, the following tasks are recommended as part of this data management strategy:

1. **Define ITS and Smart City Data Flows.** Review ITS plan and Smart City Master Plan to define the components and data flows and structures between them. This process should be used for all new technology deployments. This task is a high priority for the short term.
2. **Develop functional requirements for a new Traveller Information web page** (see Project 1.1) that can integrate data from devices in the short term. The projects in ITS Strategy 1 (Traveller Information Services) should be deployed in the short term to demonstrate ITS related benefits.
3. **Develop functional requirements for the Internet of Things (IoT) Platform.** This work will define the needs for device management, data collection, processing and storage, application programming interfaces, cyber security and monitoring.
4. **Develop a phased migration strategy for the IoT Platform.** The project will map the current processes, devices, and people to the needs of the new IoT platform. The migration strategy will include tasks for design, procurement and testing.

Design and implementation of the IoT platform will follow including technology and best practice review, preparation of specifications and testing.

The Data Management Discussion Paper is attached in Appendix B and a visual representation of the data management network is shown after the telecommunications strategy below.

### Telecommunications

As a parallel process to data management, telecommunications is critical and essential to transmit data between field devices and a central hub, typically located at the Traffic Management Centre (TMC). Telecommunications technologies are constantly evolving and now include a vast array of different media, ranging from high speed wireless networks to fiber optic lines. Telecommunications supports the ITS functions as well as inter-agency coordination and data sharing.

It is important that the current and future ITS devices and infrastructure are accommodated by the telecommunications network so that data is efficiently and reliably transmitted. Thus, long term requirements of the Transportation Master Plan and Smart City Master Plan need to be considered in this network.

For the Smart City vision, the telecommunications network supports the actions discussed above in Data Management, specifically C.1.1, C.1.2, and C.2.1.

Within the broad telecommunications strategy, there are numerous technical considerations as follows:

**1. Bandwidth**

Bandwidth is essentially a measure of capacity of a wired or wireless link to transmit data from one point to another via a computer network or network connection within a given amount of time (usually one second). Thus, bandwidth is a "data transfer rate" supported by the connections or interfaces to a telecommunications network. The rates are usually expressed in bits or bytes per second. Bandwidth is not a measure of network speed.

On wireless networks, bandwidth is the spectrum of frequencies that are used to transmit data.

Bandwidth requirements of various ITS field devices vary widely. Not surprisingly, the highest bandwidth demand is generated by CCTV cameras (0.5 to 3 Mbps) and the lowest is by detectors, signs and signal controllers (< 100 kbps).

When planning the telecommunications network, it is important that current and planned future devices are used in calculating bandwidth demand which in turn, will influence the type of media that is chosen.

**2. ITS Standards for Devices and Centres**

In many jurisdiction's inventories, field devices and software vary with respect to age and corresponding standards. Device standards determine the ease with which integration is possible. Perhaps the most important is the National Transportation Communications for ITS Protocol (NTCIP) which is a family of standards that define device-to-centre and centre-to-centre data communications. Field devices connected to traffic centres with ATMS software that are NTCIP compliant essentially "speak the same language" and can transmit data seamlessly between them. Any future devices that are NTCIP compliant are basically "plug and play" for integration into the ITS infrastructure. This environment minimizes the costs of device integration and supports the City's goal of future expansion.

It is possible to integrate non-NTCIP compliant devices but it will require development of a software interface (application program interface or API) that is more costly.

It is recommended that St. Albert consider a policy of NTCIP compliance for devices and centres.

**3. Fiber Optic Networks and Topology**

Fiber optic telecommunications is increasingly being used as costs decrease and demands increase. Fiber optic networks have high bandwidth and speeds as well as greater reliability. With the proper network design and topology, redundancy can be built into the system. As well, the durability is high as fiber optic network transmits light pulses which imposes minimal "wear and tear". A disadvantage of fiber optics is the higher capital cost of installation, compared to other networks.

**4. Current and Future Fiber Optic Network**

Network topology is the physical arrangement of a system and all the components. For fiber optics, the topology is comprised of numerous components:

- *Nodes:* these are usually points of connection between other networks or devices. Within the City, a node may connect a building to the network.
- *Segments:* these are typically part of the path for a given fiber optic cable and may include multiple nodes.
- *Links:* these are typically the sections between two nodes.

These components are physically arranged in a network in a defined topology of which there are several types:

- *Star Network:* as the name suggests, this topology resembles a "hub and spoke" network with a defined central node and links that emanate outwards. The central node is often a key hub such as a traffic management centre. However, this type of topology does not provide much redundancy as any outage on a spoke (link) may eliminate the path for the devices.

- *Ring Network:* a ring topology connects nodes to adjacent ones in concentric circles that are often connected, providing good redundancy as data always has an alternate path. This topology has higher reliability and lower costs (due to fewer fiber optic requirements).
- *Mesh Network:* this topology is characterized by a mesh or net type design in which all nodes are connected. This offers high redundancy and reliability.

St. Albert's fiber optic network is in a "Star" topology with the primary backbones on St. Albert Trail, Giroux and Boudreau. Most of the City buildings connect to the fiber optic network as it exists today. In 2018, there are plans to expand the fiber optic network to connect more of the City facilities as shown in **Figure 5-3** below. When the fiber optic network is expanded, the City should consider additional redundancy, migrating towards a "hybrid" Star/Ring or Mesh topology. This topology would minimize risk to services due to outages.

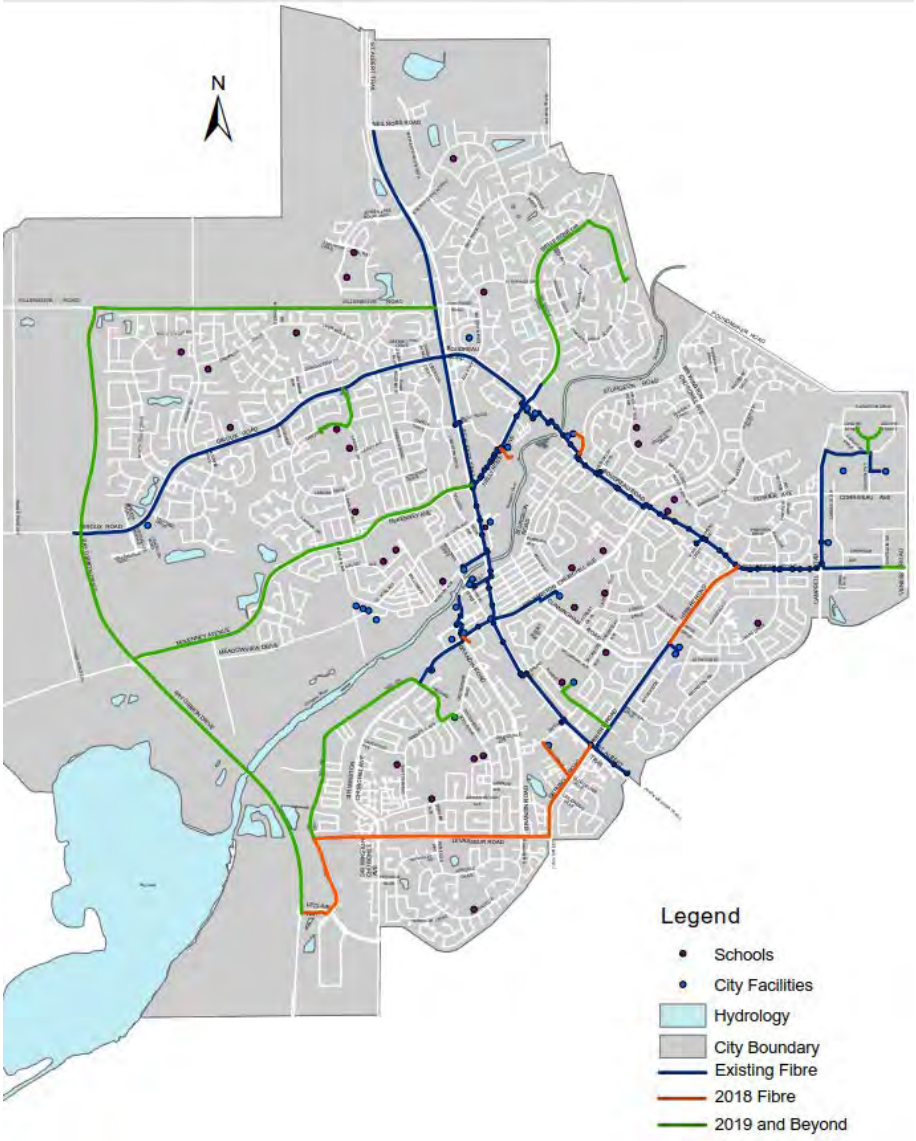



**Figure 5-3**
**St. Albert Fibre Optic Network (Existing and Planned)**

As the City's infrastructure undergoes construction or rehabilitation, implementation and/or expansion of the fiber optic network should be considered as roads and sidewalks become constructed or rebuilt. Conduit can be installed and remain empty but accessible when needed in the future. Alternatively, conduit and fiber optics can be installed with other utilities and left "unlit" to be activated when the demand occurs. These segments are the so-called "dark fiber" sections.

For the ITS and Smart City programs, installing fibre optics is capital intensive and may be challenging to connect field devices to the system. "Last mile connectivity" refers to the use of alternate technologies such as wireless networks to connect devices to the system. These technologies should be considered as options:

- Wireless mesh consists of numerous nodes connected via radio links, forming a small network to support a corridor or a specific location. Mesh networks are often used to link intersections on a corridor (for example for an adaptive signal control system).
- Point-to-Point is a configuration in which two nodes are connected such as a field device and a signal controller.
- Cellular modems are used when there is coverage. The connection is simple. Smart Cities have begun to track assets such as winter maintenance vehicles using long term evolution (LTE) 4G networks. LTE-M1 is specifically designated for IoT applications and supports low bandwidth requirements.
- Wi Fi (IEEE 802.11) is available used for connecting to the City's network. The current and newest Wi Fi standard is 802.11ac which supports higher data transfer rates (up to 1300 mbps).

**5. Network Design**

The network design of St Albert's telecommunications system should meet the current and future needs of the City, including ITS infrastructure. The following components should be considered in the network design:

- *Bandwidth and speeds* – by far, the bandwidth and speed of the network will be dependent on the quality and number of CCTV cameras on the system. Today, HD quality camera images are commonly used in traffic management centres. However, the image quality will be affected by bandwidth, speeds and frame rate which should be reviewed.
- *Network availability* – continuous availability of the network (and consequently, the ITS devices on the system) can be interrupted by power outages, equipment failure (for example, the fiber optic switches), damage to fiber optics and other sources. Mitigation requires planning for a redundant path, stocking of spare inventory, UPS, and proper asset management practices such as annual condition surveys.
- *Scalability* – as the City and networks grow, it is important that there is an ability to add more roads in the network, with the ITS infrastructure and fiber optics.
- *Manageability* – monitoring the condition of a telecommunications network, in which the City has invested millions, is critical to maximize performance and life cycle. In support, management tools such as software to continually monitor diagnostic measures and policies to support backups and maintenance are important.
- *Cyber security* – unauthorized intrusion can interrupt services and is a continual threat. The City should consider a cyber security audit including a penetration test to examine readiness. As well, a regularly updated cyber security plan should be considered.

These technical considerations should be part of the City-wide telecommunications strategy (see Project 8.2 below).

### Project 8.2: Telecommunications Strategy

St Albert's telecommunications network must support a growing requirement to connect evermore devices to the network to transmit data to and from a central hub. The Internet of Things data requirements will increase as the City grows into the Smart City future. Thus, there will be increased requirements for bandwidth, city-wide and it is critical that the telecommunications network is constructed in parallel with the City's road and ITS networks.

The following sub-projects are recommended in the telecommunications strategy in support of the St Albert ITS Plan:

**1. Develop Network Interconnection Standards**

A key task is to ensure that the devices can connect to the network. As discussed, NTCIP is a family of ITS standards that can facilitate data transfer and connection. This project is high priority in the short term and will define how the City and stakeholder agencies will connect to the network to access data.

**2. Prepare a Bandwidth Analysis of the Current and Future ITS Infrastructure**

This project will develop a bandwidth forecast of current and future ITS infrastructure by corridor to determine the network capacity. The forecast should consider the phasing of ITS projects. Undertaking a bandwidth forecast will often assist in locating the traffic management centre which should be on a high capacity corridor. This project is a high priority in the short term.

**3. Prepare a Detailed Network Architecture Design**

This project will use the results of Projects 1 and 2 to develop a detailed network architecture that includes future expansion. The network design will include and consider future functional requirements, cyber security, redundancy, and disaster recovery. This project is a medium priority in the short term.

**4. Prepare a Network Deployment Plan**

The network architecture will be the focus of a phased deployment plan that will allow the City to grow the telecommunications network in support of the ITS and Smart City projects. This deployment plan will coordinate and integrate with the fiber optic network and "last mile connectivity" requirements to support the City's ITS and Smart City work. This project is a medium priority in the short term.



## Strategy 9: Maintenance and Construction Management

This strategy addresses the management and organization of data and information that supports maintenance and construction activities in the City. The following projects are recommended:

### Project 9.1: Smart Work and Playground Zones

Section 5.2 of the St Albert Transportation Safety Strategy addresses the need to protect "vulnerable road users" such as pedestrians, cyclists, motorcyclists, and the disabled or impaired with mobility aids. These users are not protected and are particularly vulnerable in a collision with vehicles. Part of the effort to increase public safety is with the deployment of LED speed signs in Project 1.6 to reduce speeds of vehicles.

In work, school and playground zones, it is equally important to protect children and workers who may not be anticipating speeding vehicles. Data from this project can be shared with the City and enforcement staff to target locations where speeding is common. This project involves the following tasks:

- Review best practices and current technologies used to monitor vehicular speeds through crowded areas such as work and school zones, and playgrounds.
- Prepare evaluation criteria to select pilot project locations for the system.
- Develop functional requirements and concept of operations for the smart. work/school/playground zone system. The system will compare actual with posted speeds, develop a speed profile by time of day and identify the locations of most frequent violations for police in real time.
- Components may include speed detectors (radar unit) to measure speeds, CCTV cameras to identify frequent violators, and LED signs to advise motorists to reduce speeds.
- Prepare preliminary and integration for the pilot location into the traffic centre.
- Baseline data collection should include local speeds, volumes, accidents, and vehicle types.

### Project 9.2: Fleet Management Program

St Albert's owns and operates a fleet of vehicles including buses, snow plows, salt trucks, maintenance vehicles, construction vehicles, construction vehicles, fire trucks, and garbage trucks. As the City grows, it will be critical for the safe and efficient operation to track fleet vehicles in real time. The data can be analyzed to assess the effectiveness of services, in real time. For example, knowing the corridors that have been serviced by snow plows can assist in planning the next location and can be used to inform residents for trip planning.

This project involves the development of a GPS based tracking system for the City's mobile assets, primarily vehicles, in terms of their real time locations, direction and condition. This work supports Project F.1.3 in the Smart City Master Plan.

These vehicles will communicate their locations continually with the City's network, allowing the tracking of services as part of the Smart City environment.

As a starting point, the following tasks are recommended:

- Prepare a functional requirements study for the fleet management program to identify needs. The work will include preparing a business case for the next phase.
- Develop concept of operations and system design for the on-board technologies, communication network as well as the operating software.
- On-board hardware will include GPS antennae, cameras (front and rear), hands-free communications, remote diagnostics, and interfaces to each specific truck (for example, monitoring of sand, chemicals, etc.).

- Snow plows may include a signal pre-emption unit to the traffic controller that will allow the formation of plows (or individual plows) to proceed through intersections without stopping.
- Monitoring of vehicles will be supported at the Traffic Management Centre. Data will be archived for future analysis.
- Detailed design, procurement and testing will be part of this project.

The project will produce a "lessons learned" report for the City.

### Project 9.3: Asset Management

As part of the Smart City future, it is expected that all municipal buildings and assets will be connected via high speed broadband telecommunications. In a connected world with the IoT platform, it is expected that most, if not all, infrastructure will have an "IP" address and be online. The list of infrastructure and assets is virtually endless and includes such items as:

- All mobile vehicles such as trucks and buses.
- All equipment on the vehicles such as fareboxes on transit buses.
- Field devices such as CCTV cameras, variable message signs and others.
- Road infrastructure such as parking meters.
- Buildings and the networks in them.

This project develops an asset management system to monitor and assess the condition and in some cases, the locations, of assets for St Albert. The project would be coordinated closely with the data management work.

Specific tasks of this project involve:

- Developing an inventory of all City assets, mobile and stationary.
- Preparing functional requirements and concept of operations for the asset management system.
- Data management system and interfaces will be reviewed.
- Detailed design of software and related modules.
- Procurement and testing.

The asset management system will help to operate and maintain assets, monitor performance and optimize life cycle. The system will also make the services of the City more accessible as per Project IM.3 and IM.4.

### Project 9.4: Database for Construction, Maintenance and Utility Crews

The purpose of the database is to provide real time information of the City crews' construction and maintenance activities. The database would act as a source of input to the City Traveller Information web site in Project 1.1 and this information would allow the residents to make trip decisions in terms of route choice, time, and mode. The database would also act as a record of work for construction, maintenance and utility crews. City planners could use the database as a tool for the capital program.

Specific tasks of this project involve:

- Develop a summary of various city crews that work on roads / trails / sidewalks and processes or programs that involve closures that impact drivers or pedestrians / cyclists.
- Prepare a functional requirement and concept of operations document that summarizes the system. The work would include developing the central software on the network with an interface to the ATIS web site.
- Mobile tablets on the crews' trucks could utilize an interface to input details of the work (duration, number of lanes closed, etc.) and the GPS coordinates can update the location in real time on the City map.
- Prepare best practices and technology assessment of hardware and software.
- Prepare preliminary design with software.

- Detailed design and procurement, specifications and testing.

## GENERAL ITS STRATEGIES

### Strategy 10: Traffic Management Centre (TMC)

As the systems and networks evolve, the agencies will require a common facility or primary hub from which to monitor and manage transportation corridors. This need is particularly critical for those urban centres that are developing into future smart cities with connected technology. These centres often act as central repositories of data as well as traffic management and operations hubs, through the IoT platforms. Further, these centres are often the most visible part of an ITS and Smart City program, other than field devices, to the public and media. Traffic Management Centres are often noted as a visible sign of progress and sophistication for a city. Viewing windows are often designed into adjacent rooms for public and staff to see the control room, operator work stations and video wall.

In St Albert, the traffic management centre should be located on a highspeed telecommunications corridor such as a major fiber optic backbone. The TMC would support future IoT data sharing within the City and region.

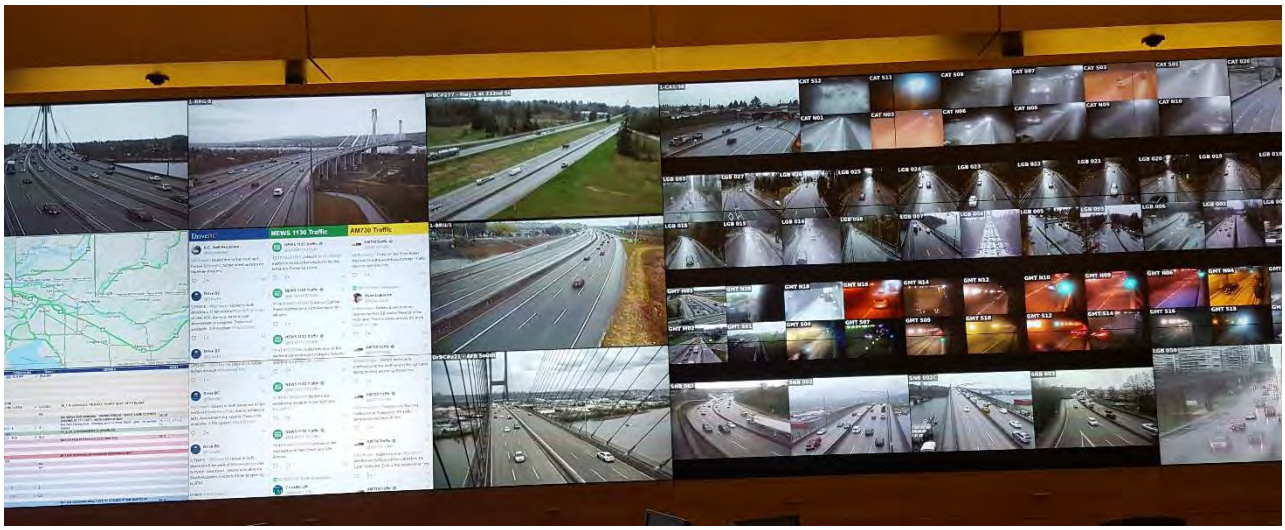
The Smart City Masterplan envisions a "smart" Traffic Management Centre in Project F.5.1 which is the central "brain" of the City. Functionally, the TMC would monitor and control traffic management, emergency services, general operations and fleet, security oversight, transit systems, signal network and other functions.

The TMC supports all ITS and Smart City functions and user services. The following projects are envisioned for this strategy:

#### Project 10.1: Traffic Management Centre (TMC) Functional Program and Concept of Operations

This project would include the following tasks:

- Review of the ITS strategic plan and related projects including the telecommunications network. In particular, the task looks at each ITS user service and application.
- In St Albert, the role of the TMC would be critical especially with respect to the regional agencies. Data sharing, seamless operations on common corridors, and acting as a redundant back up to another TMC are three such roles.
- Functional programming involves development of specific functions in the TMC, primarily based



on the user services in the ITS and Smart City Plans.
- Concept of operations includes conversion of each supported ITS user service into tasks at the TMC operator work stations. This task would determine the components including the number of operator work stations, supervisory stations, and other spaces such as the data room, fiber optic end termination equipment room, mechanical and electrical facilities, staff space and offices.
- Develop a floor plan that illustrates locations for operator work stations, offices, and video wall. Data rooms and other spaces would also be shown. Human factors guidelines would be used in developing the design.
- Assess video wall requirements including support and air flow (cooling).
- Governance and operations.
- Review operational policies
- Prepare a cost estimate for the preliminary design of the TMC including capital, operations and maintenance.

### Project 10.2: Traffic Management Centre Site Selection

This project will review various factors in confirming the optimal site for the TMC and evaluate them:

- Availability of a highspeed telecommunications backbone.
- Cost and availability of property.
- Protection from flooding, earthquakes, wind, and catastrophic explosions.
- Accessibility by the public including all modes (transit, roads and highways, pedestrians, and cyclists).
- Accessibility for staff and public including guidelines for disabled (wheelchair) access.
- Parking
- Scalability for future expansion
- Systems support
- Potential for procurement options such as through a "P3" model or some innovative leasing.

The information will be used to prepare a business case for the development and location of the TMC.

### Project 10.3: TMC Preliminary Design

The preliminary design of the TMC will focus on the selected site which may be a standalone (new) or retrofitted location. The work will require a preliminary design of the site services including structural, utilities, HVAC, mechanical, transportation, electrical, telecommunications, water/sewer, emergency services and UPS, and the physical spaces.

The work will include a cost estimate and drawings for site preparation, servicing, and construction. Hardware and software engineering will be included.

### Project 10.4: TMC Detailed Design

The detailed design will include full tender-ready drawings and specifications for the TMC including all hardware and software. The work will include material approvals for all hardware and software components as well as factory and field acceptance test plans.

### Project 10.5: TMC Expansion

The design and implementation of the TMC will be done in accordance with the ITS plan which covers 10 years. This project covers future expansion beyond the ITS plan's horizon which may require additional space or conversion of systems.

## Strategy 11: Institutional Management and Innovation

One important outcome of an ITS strategy is it can encourage agencies to cooperate, coordinate and plan their ITS programs. Regional integration of ITS is important for highest service delivery to residents.

Ensuring considerations are made for prioritization, technology cohesiveness, network expansion, and long-term needs of the Edmonton Metropolitan Region will be important moving forward.

This strategy captures innovative ideas and supports their evolution to strengthen regional partnership and enable regional integration. The following projects are recommended:

### Project 11.1: ITS Committee

The initiation of an ITS Committee will guide the City's ITS needs and interests to support the ITS and Smart City programs. The ITS Committee should be nominated, starting with the steering committee for the ITS Plan. The following tasks are recommended:

- Develop an ITS Committee Charter which should consider:
  - Membership – various City departments
  - Roles and responsibilities including Chair
  - Mandate
  - Frequency of meetings and administration
  - Reporting
  - Working groups to address specific issues
- The ITS Committee's primary role is to develop and execute the projects in the ITS Plan. The committee is also responsible to develop updates.
- Seek opportunity to expand such a Committee to a regional level; involving representatives from regional agencies that may lead and support ITS integration.

### Project 11.2: Innovation Committee

The Innovation Committee is a unique group and sub-committee to the ITS Committee that is recommended to be mandated to develop new, innovative initiatives that support the ITS and Smart City programs. Examples of innovative projects may include:

- ITS and Smart City policies for developing additional functionality.
- IoT platform improvements.
- Market and user testing of various ITS and Smart City proposals
- Revenue opportunities with respect to data.
- ITS outreach for residents to participate in forming the next generation services.
- Autonomous and connected vehicles.

Optimally, the scope of work associated with this working group would be performed at a regional level – with representatives from agencies from the Edmonton Metropolitan Region joining to deliver on the increased preparedness of the region for autonomous vehicles.

The St Albert Autonomous Vehicle Working Group would be represented on the Regional group and report back to the ITS Committee and work on the specific initiatives for driverless vehicles.

### Project 11.3: Autonomous Vehicle Working Group

This working group would assess the specific impacts of autonomous vehicles on the City of St Albert, with the goal of preparing the City for their introduction.

The Autonomous Vehicle Working Group would essentially execute the recommendations of the Discussion Paper and will consider the following impacts:

- Land use planning
- On-site and off-site parking
- Traffic demand
- Engineering and standards
- Traffic forecasting and modelling
- Enforcement
- Liability (City)
- Transit vehicles
- Goods movement
- Medical services
- Legal services

Optimally, the scope of work associated with this working group would be performed at a regional level – with representatives from agencies from the

Edmonton Metropolitan Region joining to deliver on the increased preparedness of the region for autonomous vehicles.

The St Albert Autonomous Vehicle Working Group would be represented on the Regional group and report back to the ITS Committee and work on the specific initiatives for driverless vehicles.

## Strategy 12: Regional Transportation

This ITS strategy includes initiatives that are deployed across multiple jurisdictions within the region.

### Project 12.1: Regional Transportation Project

Regional integration of ITS will maximize on benefits and efficiency for all agencies involved; and result in best service delivery to residents. Collaboration and coordinated implementation may be achieved through review of details such as:

- Traffic flows on corridors that span multiple regional agencies. Typical deployments include regional signal progressions.
- Centre to centre TMC coordination between jurisdictions.
- TMC data sharing including access to files and CCTV images.
- Cross-jurisdictional or multi-jurisdictional transit services.
- Regional traveller information systems.
- TMC back up services.
- Coordination of user services such as commercial vehicle enforcement.

## Strategy 13: Active Transportation

This strategy involves support of pedestrian and cycling modes within the City. Transit management is addressed in specific strategy #3 Public Transportation Services.

There is a clear trend in St Albert towards urban densification and complete streets with a focus on pedestrian and cycling modes. It is critical that the ITS plan support the development of active transportation networks to achieve this goal. If St Albert Trail is to be developed as a multi-modal, active transportation corridor, the infrastructure must be implemented to support it.

### Project 13.1: Active Transportation Support

Active transportation includes any human-powered mode of transportation such as pedestrians, cyclists, and even skateboarding, in-line skating, and wheel chairs. Development of the network for active transportation modes is important for safety and to support relief of vehicle demand on roads.

This project includes design and implementation of ITS technologies to support the development of active transportation networks including:

- Pedestrian and cycling counting systems to collect data on usage which enables prioritization for network investment and supports network monitoring and evaluation.
- Advanced safety warning systems for shared networks where pedestrians and cyclists may impede each other
- Wayfinding (signage) to support accessibility
- Development of a mobile app to allow users to quickly access information on a trail or route, grades, length, and O/D information.
- Integration on the traveller information system per Project 1.1.

## Strategy 14: Marketing and Education

This strategy addresses the need to raise awareness of ITS and improve the information on ITS. The strategy deals with the media, development of materials and access to ITS data.

### Project 14.1: Marketing Plan

The project includes development of the following:

- ITS information brochures on user services, benefits and specific examples in the City
    - For ITS technology integration, prior to deployment of testing, ensure there are set criteria for

evaluation, set expectations of service delivery or enhancement of service delivery, program identification (type of equipment, actions of equipment, timeframe, locations, how users interface with technology)

- Online versions of the brochures
- Development of "media ready" packages for the public including a short video of the ITS improvements
- TMC tours for public and media
- Open houses for ITS
- Development of power point presentations to be used as materials for introduction in schools
- Open data for ITS.

## EVALUATION OF PROJECTS

The results of the prioritization of ITS projects are summarized in the following table which illustrates:

- Data and telecommunications projects with autonomous vehicles scored the highest in terms of overall priority.
- Operational projects such as TMC, maintenance/construction and traffic management initiatives scored high
- Traveller information received an "average" score.

These ratings reflect the combined weighting based on the priorities of the Steering Committee. To the extent possible, these weightings have been reflected in the phasing of the projects in the ITS plan.



| ITS Project | Data | Safety | Efficiency | Economy | Society | Environment | Total | Weighted Total |
|---|---|---|---|---|---|---|---|---|
| ***Traveller Information*** | | | | | | | | |
| **1.1 Real Time ATIS** | 5<br>5 | 3<br>3 | 3<br>2.4 | 3<br>2.4 | 4<br>2.4 | 1<br>0.6 | 19 | 15.8 |
| **1.2 Real Time Web Cams** | 5<br>5 | 2<br>2 | 3<br>2.4 | 0<br>0 | 4<br>2.4 | 0<br>0 | 14 | 11.8 |
| **1.3 Bluetooth ATIS** | 5<br>5 | 0<br>0 | 3<br>2.4 | 2<br>1.6 | 4<br>2.4 | 0<br>0 | 14 | 11.4 |
| **1.4 Trip Planner** | 3<br>3 | 2<br>2 | 4<br>3.2 | 2<br>1.6 | 4<br>2.4 | 0<br>0 | 15 | 12.2 |
| **1.5 St Albert RWIS** | 4<br>4 | 5<br>5 | 3<br>2.4 | 0<br>0 | 4<br>2.4 | 0<br>0 | 16 | 13.8 |
| **1.6 Speed Advisory** | 5<br>5 | 5<br>5 | 0<br>0 | 0<br>0 | 4<br>2.4 | 0<br>0 | 14 | 12.4 |
| **1.7 Traffic Data Collection** | 5<br>5 | 4<br>4 | 4<br>3.2 | 2<br>1.6 | 4<br>2.4 | 2<br>1.2 | 21 | 17.4 |
| ***Traffic Management*** | | | | | | | | |
| **2.1 ICM Program** | 5<br>5 | 4<br>4 | 5<br>4 | 4<br>3.2 | 2<br>1.2 | 1<br>0.6 | 21 | 18.0 |
| **2.2 Adaptive Signals** | 3<br>3 | 5<br>5 | 5<br>4 | 4<br>3.2 | 4<br>2.4 | 2<br>1.2 | 23 | 18.8 |
| **2.3 Incident Management** | 3<br>3 | 5<br>5 | 5<br>4 | 3<br>2.4 | 3<br>1.8 | 0<br>0 | 19 | 16.2 |
| **2.4 Vision Zero Safety** | 5<br>5 | 5<br>5 | 2<br>1.6 | 2<br>1.6 | 5<br>3 | 0<br>0 | 19 | 16.2 |
| ***Public Transportation*** | | | | | | | | |
| **3.1 On-Demand Transit** | 3<br>3 | 0<br>0 | 4<br>3.2 | 2<br>1.6 | 4<br>2.4 | 2<br>1.2 | 15 | 11.4 |
| **3.2 Next Bus Upgrade** | 4<br>4 | 0<br>0 | 2<br>1.6 | 2<br>1.6 | 4<br>2.4 | 1<br>0.6 | 13 | 10.2 |
| **3.3 Transit Signal Priority** | 3<br>3 | 0<br>0 | 4<br>3.2 | 2<br>1.6 | 3<br>1.8 | 2<br>1.2 | 14 | 10.8 |
| **3.4 Smart Bus Architecture** | 5<br>5 | 0<br>0 | 0<br>0 | 0<br>0 | 2<br>1.2 | 0<br>0 | 7 | 6.2 |
| **3.5 Transit Infrastructure** | 5<br>5 | 2<br>2 | 4<br>3.2 | 0<br>0 | 4<br>2.4 | 3<br>1.8 | 18 | 14.4 |
| ***Electronic Payment*** | | | | | | | | |
| **4.1 Electronic Payment** | 5<br>5 | 0<br>0 | 2<br>1.6 | 4<br>3.2 | 4<br>2.4 | 0<br>0 | 15 | 12.2 |
| ***Commercial Vehicle Ops*** | | | | | | | | |
| **5.1 Regional Truck Survey** | 5<br>5 | 0<br>0 | 0<br>0 | 0<br>0 | 0<br>0 | 0<br>0 | 5 | 5.0 |
| **5.2 CVE Strategy** | 2<br>2 | 4<br>4 | 4<br>3.2 | 4<br>3.2 | 3<br>1.8 | 2<br>1.2 | 19 | 15.4 |
| **5.3 Dangerous Goods** | 5<br>5 | 5<br>5 | 0<br>0 | 0<br>0 | 4<br>2.4 | 4<br>2.4 | 18 | 14.8 |
| ***Emergency Management*** | | | | | | | | |
| **6.1 Emergency Pre-Emption** | 3<br>3 | 5<br>5 | 3<br>2.4 | 0<br>0 | 4<br>2.4 | 0<br>0 | 15 | 12.8 |
| ***Vehicle Safety/Control*** | | | | | | | | |
| **7.1 Connected Vehicles** | 5<br>5 | 5<br>5 | 2<br>1.6 | 2<br>1.6 | 3<br>1.8 | 1<br>0.6 | 18 | 15.6 |

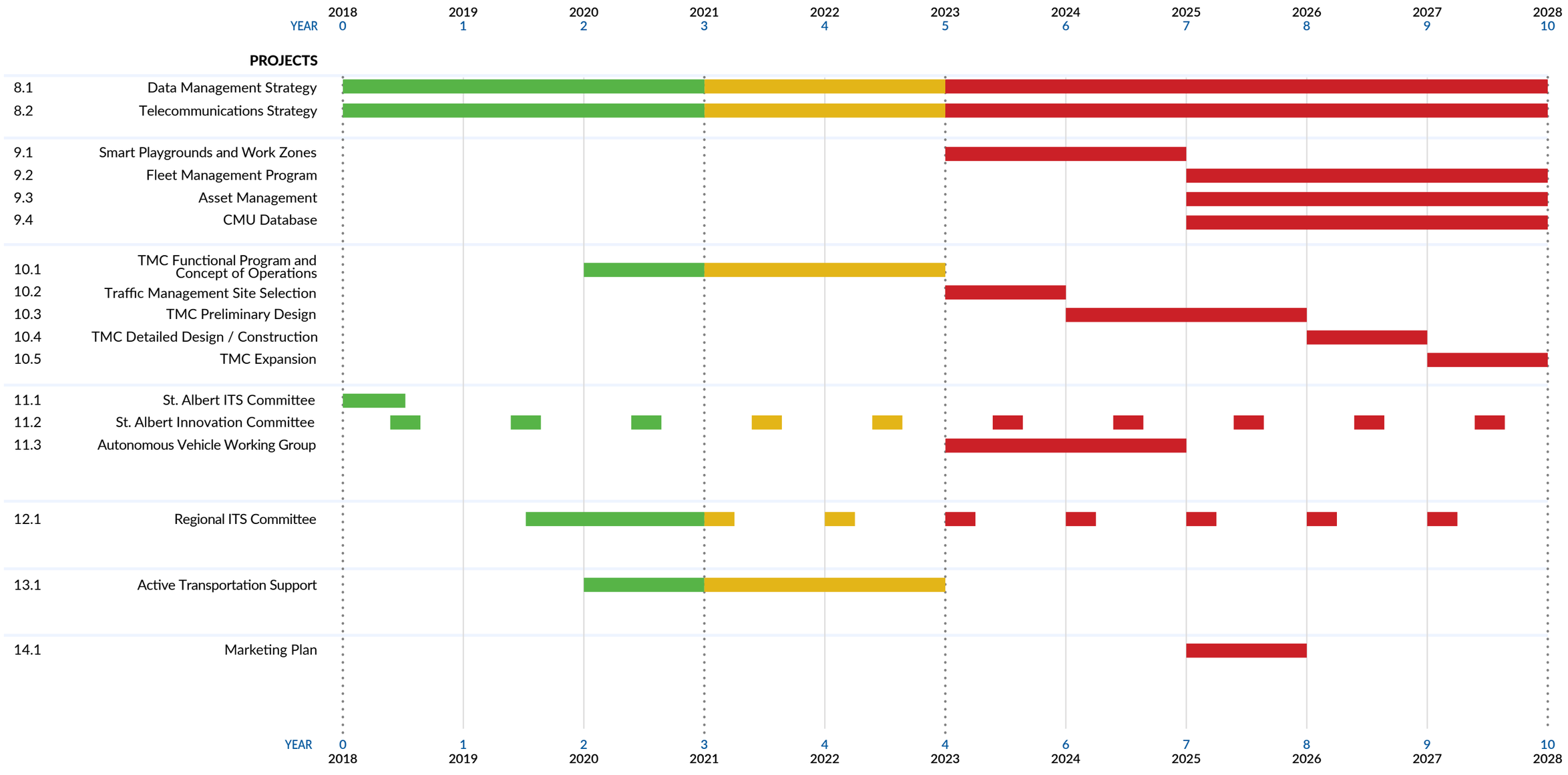
| ITS Project | Data | Safety | Efficiency | Economy | Society | Environment | Total | Weighted Total |
|---|---|---|---|---|---|---|---|---|
| **7.2 Autonomous Vehicles** | 5<br>5 | 5<br>5 | 5<br>4 | 5<br>4 | 3<br>1.8 | 3<br>1.8 | 26 | 21.6 |
| **7.3 Research Partnerships** | 5<br>5 | 3<br>3 | 3<br>2.4 | 5<br>4 | 3<br>1.8 | 3<br>1.8 | 22 | 18.0 |
| ***Data/Info Warehousing*** | | | | | | | | |
| **8.1 Data Management** | 5<br>5 | 3<br>3 | 5<br>4 | 5<br>4 | 5<br>3 | 2<br>1.2 | 25 | 20.2 |
| **8.2 Telecommunications** | 5<br>5 | 3<br>3 | 5<br>4 | 5<br>4 | 5<br>3 | 2<br>1.2 | 25 | 20.2 |
| ***Maint/Construction Mgmt*** | | | | | | | | |
| **9.1 Smart Work Zones** | 3<br>3 | 5<br>5 | 4<br>3.2 | 1<br>0.8 | 3<br>1.8 | 0<br>0 | 16 | 13.8 |
| **9.2 Fleet Mgmt. Program** | 4<br>4 | 4<br>4 | 4<br>3.2 | 3<br>2.4 | 4<br>2.4 | 3<br>1.8 | 22 | 17.8 |
| **9.3 Asset Management** | 5<br>5 | 0<br>0 | 3<br>2.4 | 3<br>2.4 | 2<br>1.2 | 0<br>0 | 13 | 11.0 |
| **9.4 CMU Database** | 5<br>5 | 3<br>3 | 3<br>2.4 | 2<br>1.6 | 2<br>1.2 | 2<br>1.2 | 17 | 14.4 |
| ***Traffic Management Centre*** | | | | | | | | |
| **10.1 TMC Con Ops** | 5<br>5 | 3<br>3 | 3<br>2.4 | 2<br>1.6 | 3<br>1.8 | 2<br>1.2 | 18 | 15.0 |
| **10.2 TMC Site Selection** | 5<br>5 | 3<br>3 | 3<br>2.4 | 2<br>1.6 | 3<br>1.8 | 2<br>1.2 | 18 | 15.0 |
| **10.3 TMC Prelim Design** | 5<br>5 | 2<br>2 | 3<br>2.4 | 2<br>1.6 | 3<br>1.8 | 2<br>1.2 | 17 | 14.0 |
| **10.4 TMC Detailed Design** | 5<br>5 | 2<br>2 | 3<br>2.4 | 2<br>1.6 | 4<br>2.4 | 2<br>1.2 | 18 | 14.6 |
| **10.5 TMC Expansion** | 5<br>5 | 2<br>2 | 4<br>3.2 | 2<br>1.6 | 1<br>0.6 | 1<br>0.6 | 15 | 13.0 |
| ***Institutional/Innovation*** | | | | | | | | |
| **11.1 St Albert ITS Committee** | 0<br>0 | 0<br>0 | 0<br>0 | 0<br>0 | 5<br>3 | 0<br>0 | 5 | 3.0 |
| **11.2 St Albert Innovation Committee** | 0<br>0 | 0<br>0 | 0<br>0 | 0<br>0 | 5<br>3 | 0<br>0 | 5 | 3.0 |
| **11.3 St Albert Autonomous Vehicle Working Group** | 5<br>5 | 5<br>5 | 4<br>3.2 | 3<br>2.4 | 5<br>3 | 2<br>1.2 | 24 | 19.8 |
| ***Regional Transportation*** | | | | | | | | |
| **12.1 Regional Transp. Proj.** | 5<br>5 | 2<br>2 | 4<br>3.2 | 4<br>3.2 | 5<br>3 | 3<br>1.8 | 23 | 18.2 |
| ***Active Transportation*** | | | | | | | | |
| **13.1 Active Transp. Plan** | 5<br>5 | 5<br>5 | 4<br>3.2 | 2<br>1.6 | 5<br>3 | 3<br>1.8 | 24 | 19.6 |
| ***Marketing*** | | | | | | | | |
| **14.1 Marketing Plan** | 2<br>2 | 0<br>0 | 0<br>0 | 0<br>0 | 5<br>3 | 0<br>0 | 7 | 5.0 |

The ITS projects are phased over 10 years in short, medium and long term horizons. The phasing is illustrated in the Gantt chart in the following section.

## St. Albert ITS Strategic Plan



**Short Term** 0 to 3 years
**Medium Term** 3 to 5 years
**Long Term** 5 to 10 years





# 6 CONCLUSIONS AND RECOMMENDATIONS

St. Albert is a growing, vibrant community that provides an attractive quality of life for residents, a thriving economy and wonderful amenities. Conversely, as the City grows with a constrained transportation network, it creates urban problems such as traffic congestion, delay and safety issues that threaten that quality of life. St. Albert is seeking to find the balance between economic growth and the "small town" qualities.

The Intelligent Transportation Systems (ITS) Strategic Plan provides an overarching vision, mission and objectives with key strategies for the City's success towards implementing ITS that will achieve a movement towards becoming a Smart City, support the City's Vision Zero initiatives (where no serious injuries or fatalities occur as a result of motor vehicle collisions) and create enhanced services and experiences to residents and visitors through increased system efficiency and improved individual mobility.

The adoption and integration of ITS will supplement road network improvements or expansion proposed within the Transportation Master Plan by:

- Increasing capacity of intersection locations and improving efficiency of corridors
- Enabling collection and use of data to strengthen an evidence-based and effective timed approach for capital investment
- Empowering road users in mode and route choice through provision of new and live network information
- Supporting enhanced public transportation service delivery, and improving on overall system services connectivity to encourage and support mode shift (movement from vehicles to alternative modes such as transit, walking, cycling)

- Supporting innovation and new technologies that may vastly shift the transportation network needs; such as connected and autonomous vehicles

Implementing ITS and supporting new technologies in parallel with strategic network road construction will maximize the benefits to the road network.

This plan is intended to be a dynamic document, with evaluation performed not only on the strategies recommended and completed, but review and updates performed on the strategy itself. With this being the City's first ITS Strategy, a formal Implementation Plan will be developed, allowing for strategic integration of actions into the City's capital planning and for regional discussion and possible partnership.

By formalizing the City's objectives and plans to move forward with ITS, the opportunity will be generated to create partnerships within industry and more importantly to align with regional partners on larger scale integration which could maximize effectiveness of ITS, result in higher service levels to residents and visitors of the region, and strengthen the Edmonton Metropolitan Region's economy by improving goods movements and enabling innovation. An opportunity may occur for St Albert and other agencies to be contributors in developing an Edmonton Metropolitan Region ITS Strategy. This would allow for municipalities to develop or update ITS Strategies that would support this regional strategy.

The timeline of this strategy is intended to be from 2018 to 2028, with an update to be prepared just prior to 2025 which may then capture where the City is at in terms of ITS integration, align to updated community or regional priorities, capture emerging issues and acknowledge new technology or trends.

The St. Albert ITS Strategic Plan is comprised of 14 specific and general ITS strategies with 41 projects, phased over 10 years. The projects are presented in a Gantt chart below. The Strategic Plan is built around a data management network that will support the acquisition, transmission, processing, storage, and distribution of information.

Although regional integration and expansion of ITS is a long-term goal and consideration, this Strategic Plan will as a priority, protect the unique character of St Albert and support the economic, social and environmental well being of the City and its residents through the vision of:

***Building a better community through transportation innovation.***

This report was prepared for the City of St. Albert to develop an Intelligent Transportation Systems (ITS) Strategic Plan, which is an important step in the development and evolution of the transportation network.

The services provided by Associated Engineering Alberta Ltd. In the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,
Associated Engineering Alberta Ltd.




Keenan Kitasaka, P.Eng.
ITS Technical Lead

ASSOCIATED ENGINEERING
QUALITY MANAGEMENT SIGN-OFF
Signature:
Date: Aug 17, 2018
APEGA Permit to Practice P 3979

# Appendix A – Technical Memos

- ITS Strategic Plan Development Background Summary
- ITS Strategic Plan Development St. Albert Background Transportation Data
- Signal Inventory
- St. Albert Fibre Optic Network
- ITS Strategic Plan Development Environmental Scan

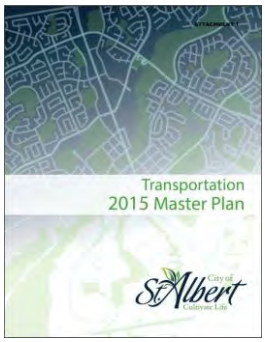
Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

| | | | |
|---|---|---|---|
| **Date:** | October 5, 2017 | **File:** | 2017-3919.00.A.04.02 |
| **To:** | Dean Schick | | |
| **From:** | Keenan Kitasaka, P.Eng., Jessica McLennan, EIT | | |
| **Project:** | ITS Strategic Plan Development | | |
| **Subject:** | Background Summary | | |

# MEMO

The development of the City of St. Albert Intelligent Transportation Systems Strategic Plan will be supplemented by key policy and planning documents. The objectives, goals, and interventions related to transportation and technology identified in the following summarized documents will provide key direction to the ITS strategic plan. Further, these documents provide valuable input into the Needs Assessment report. It is important to note that the projects in the ITS Strategic Plan should fundamentally support the initiatives in the higher-level documents.

## 1 ST. ALBERT TRANSPORTATION MASTER PLAN (2015)




The St. Albert Transportation Master Plan (TMP) was completed by Associated Engineering in April 2015 and presented to Council in April 2016. The document provides high level direction to other working plans. The St. Albert TMP centralizes on 5 key areas:

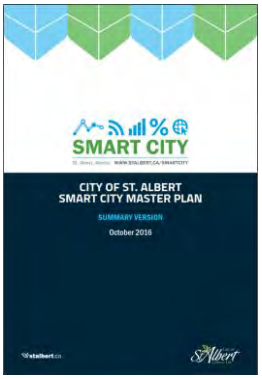
- The road network
- The active transportation network
- The public transportation network
- The goods movement network
- Intelligent Transportation Systems (ITS).

The Transportation Master Plan (TMP) identifies ITS as having the ability to support many of the strategies outlined in the TMP, including to improve the efficiency, safety and security of the transportation network. The TMP summarizes the various types of ITS and the services that ITS can provide, such as corridor management, safety initiatives, and data management. Developing an ITS strategy as a travel demand management strategy is a recommended action in the TMP. The Recommended 10-Year Roads Plan contains a number of ITS based solutions to improve efficiency, rather than increasing road capacity, such as traveller information, transit signal priority, data management and more.

It should be noted that the vison of the St. Albert TMP extends to 2042, which is within the phasing horizons for the ITS Plan. The St. Albert Transportation Master Plan is available at the following link:
https://stalbert.ca/dev/engineering/transportation/master-plan/

CANADA'S BEST MANAGED COMPANIES Platinum member

## 2 ST. ALBERT SMART CITY MASTER PLAN (OCTOBER 2016)




The City of St. Albert has recognized and moved towards developing its communities into a smart city. To apply new technologies and data sources for the public benefit, the integrated Smart City Master Plan was developed. This plan was designed to support St. Albert's goals and priorities, including Social, Economy, Built Environment, Natural Environment, Culture, Governance, and Service Delivery. The key outcomes of the plan are greater efficiency, dynamic economic development, and enhanced service delivery. Overall, the Smart City Master Plan is comprised of 22 distinct strategies of which eight are considered to be high priority and fundamental to the city's advancement in this initiative. In addition to the TMP, the Smart City Master Plan is considered a key document in developing the ITS program.

The development of an ITS program was rated as the second most important intervention in the Smart City Action Plan, and ITS was used as an example of a characteristic of a smart city repeatedly throughout the report. The plan recognises that ITS can make a significant contribution to all of St. Albert's goals and priorities, including supporting economic development, improving service delivery, and realizing organizational efficiencies.

## 3 TRANSIT LONG TERM DEPARTMENT PLAN (2013)

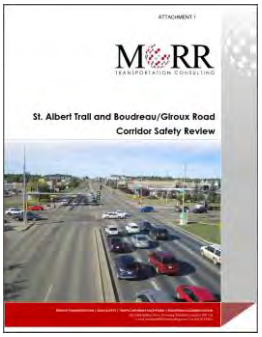



The Transit Long Term Department Plan does not directly reference the term ITS specifically, however, many of the operating values of the Transit Service (seamless, fast, reliable, safe, efficient, easily navigated) may be supported and improved though identified ITS measures. A number of initiatives, such as transit priority signals, bus video surveillance, smart card payment, real-time trip planners, automated stop announcements were identified as high and medium priority projects, and are in fact ITS measures. This Department Plan recognizes the benefits that ITS measures can provide to transit operations, and prioritizes such projects.

## 4 CITY OF ST. ALBERT UTILITY MASTER PLAN UPDATE (2013)

The key objectives and recommended system servicing strategy for the water distribution, wastewater collection, and storm water management systems are outlined in the Utility Master Plan. Although this plan does not discuss ITS or transportation, ensuring that upgrades to the transportation network are phased appropriately with upgrades to the water and wastewater management systems will increase efficiencies; efficiencies in data management may also be possible.

## 5 ST. ALBERT TRAIL AND BOUDREAU / GIROUX ROAD CORRIDOR SAFETY REVIEW (2015)




This report presents the findings of a comprehensive road safety review of St. Albert Trail, and Giroux/Boudreau Road. This report identified a number of interventions to improve safety along the corridor and at intersections, however none of the identified interventions involved the use or implementation of ITS. The review did highlight inadequate intersection capacity at three intersections and recommended traffic signals, with which ITS could provide corridor progression benefits through signal coordination.

## 6 ST. ALBERT BUSINESS AND TOURISM DEVELOPMENT LONG TERM DEPARTMENTAL PLAN (2008)

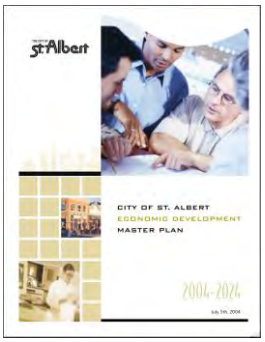



The Business and Tourism Development plan outlines strategies to reduce the city's reliance on the residential tax base to a more balanced tax base of industry and business. This goal requires increasing and expanding businesses in St Albert. This plan recognizes transportation as a required element for development, both for employees getting to work, and for the movement of goods and services. The plan recommends providing focused attention to transportation to attract and retain businesses in the commercial sector and in the transportation and warehousing sector.

## 7 INFORMATION TECHNOLOGY SERVICES AND GEOGRAPHICAL INFORMATION SERVICES DEPARTMENTAL LONG TERM PLAN (2014)

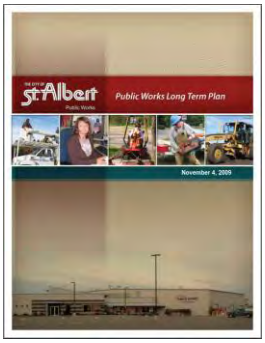
The IT Services Department Long Term Plan defines which IT services are required to support the City's goals, and the required steps to achieve those goals. The plan recognises current IT support in transit operation and planning, and that traffic signals are essential in the operation of the City. There is a "Medium Sized Project" for 2014 listed in the plan to support the Engineering Department to complete a monitoring and control system for the City's traffic lights. This project involves installing a WiFi network between traffic lights including a server, firewall and training Engineering personnel to monitor and control the system from a central location. A Metropolitan Area Network (MAN) is deemed to be critical to supporting infrastructure and consolidating all of the City's network requirements into one high bandwidth system.

## 8 CITY OF ST. ALBERT ECONOMIC DEVELOPMENT MASTER PLAN (2004)




The Economic Development Master Plan outlines the objective to provide vision and direction to the City through 2024 regarding future economic development activities. This plan recognizes the need to reduce and manage congestion. A key strategy in the plan is to ensure that the transportation networks in St. Albert support targeted economic growth.

## 9 PUBLIC WORKS LONG TERM PLAN (2009)




The Public Works Plan integrates with other municipal plans to ensure the integrity and reliability of the City's infrastructure. Public Works in St. Albert is responsible for snow and ice control and pavement maintenance amongst other non-transportation related functions. Although this report does not reference ITS, the recommended standards for snow and ice control require annual traffic volume review, which may be assisted through the implementation of ITS. Other ITS measures may improve the efficiency of Public Works that are not identified in this plan, such as fleet management measures including GIS, RFID, and automatic vehicle locators.

Prepared by:

Keenan Kitasaka, P.Eng.,
Jessica McLennan, EIT

JM/mc

| | | | |
|---|---|---|---|
| **Date:** | October 24, 2017 | **File:** | 2017-3919.00.A.04.02 |
| **To:** | Kent Eklund | | |
| **From:** | Keenan Kitasaka, P.Eng., and Jessica McLennan, EIT | | |
| **Project:** | Intelligent Transportation System Strategic Plan Development | | |
| **Subject:** | St. Albert Background Transportation Data | | |

# MEMO

## 1 INTRODUCTION

St. Albert is a vibrant, prosperous and growing community in Alberta that values its heritage and "small town" qualities. However, St. Albert and the surrounding region is experiencing delays, congestion and accidents on key corridors within its transportation network that makes it more challenging to preserve these quality of life benefits.

This memo is a summary of the background transportation conditions and data available for St. Albert for key municipal corridors and facilities. This data will be used to support the St. Albert ITS Strategic Plan, which will provide a future ITS vision for the City. The transportation data covered in this memo includes:

- Traffic volumes;
- Goods movement;
- Transit data;
- Motor vehicle collisions, and other safety related data; and
- Active transportation.

An aerial view of St. Albert is shown below in Figure 1. This figure also labels the primary corridors through and around the city. Available in Appendix A is a figure that highlights the boundaries of St. Albert, along with the arterials, collectors and local roads. The St. Albert road network is shown in Appendix A, Figure 1. This figure highlights the boundaries of St. Albert, the arterials, collectors, and local roads.

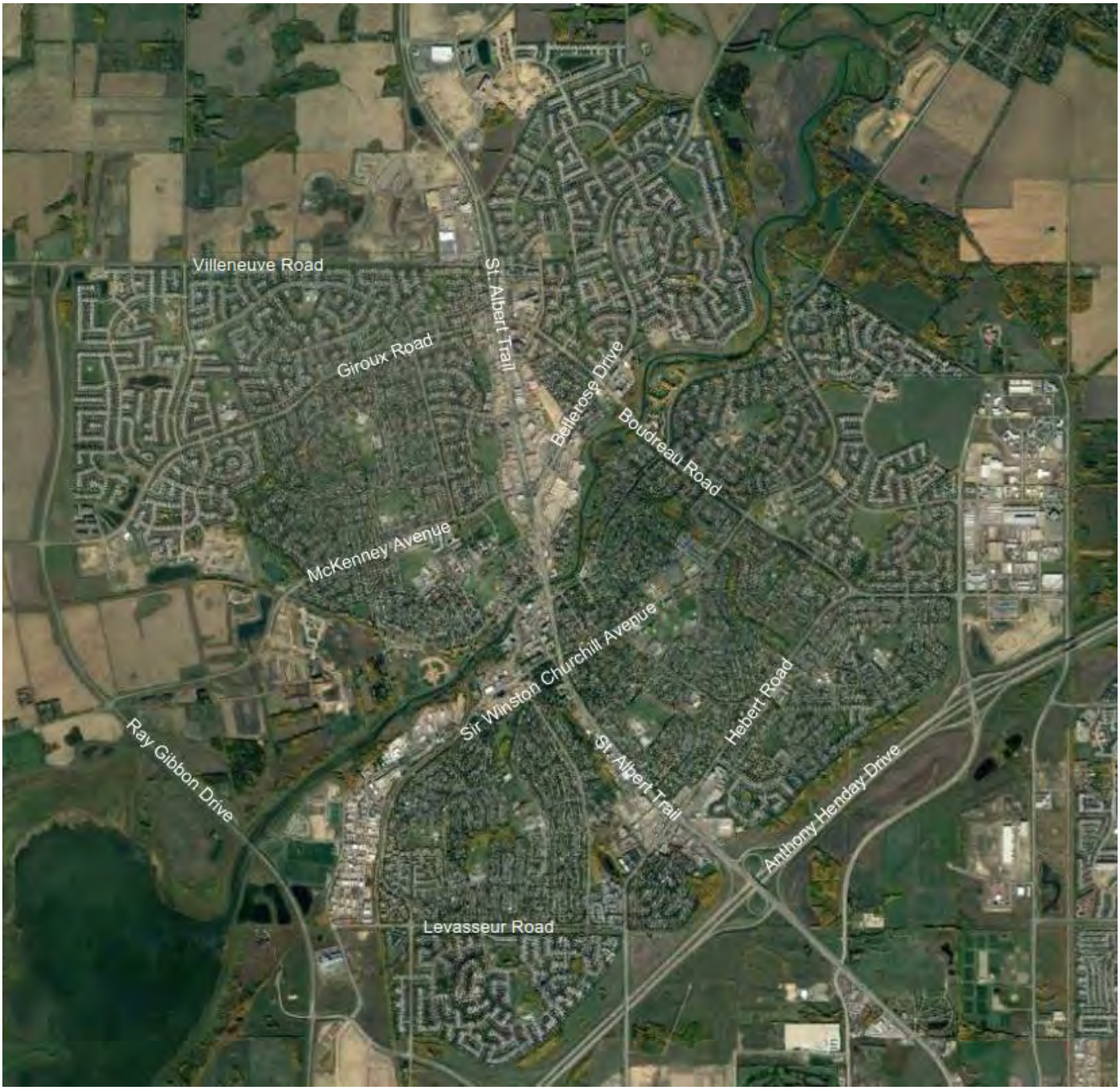



Figure 1-1
St. Albert Boundary and Road Network

## 2 TRAFFIC VOLUMES

The City of St. Albert Transportation Branch has a number of different responsibilities, including traffic signs, signals, pedestrian and cycling issues, construction planning, and permits. To support their projects, the Branch collects data regarding vehicle collisions, volumes and averages speeds. They conduct annual traffic counting programs using portable pneumatic road tube counters.

In 2016, traffic volumes were surveyed on arterial, collector, and local roads as a part of the St. Albert traffic counting program. These counts were completed between May and October, as weather generally permitted the placement of the traffic counting equipment during those months. Appendix A, Figures 2, 3, and 4 are from the St. Albert Transportation Branch, and show the two-way average daily volumes on arterials, collectors, and local surveyed roads respectively. Figure 2 indicates that on St. Albert Trail (20,000 to 30,000+ ADT) and Ray Gibbons Drive (20,000 ADT), the traffic volumes are significant.

### 2.1 Required Traffic Information

To more fully understand the state of St. Albert traffic, additional information is required, including:

- Major intersection level of service (LOS);
- Intersection delay;
- Journey times along major corridors; and
- Turning movement volumes at major intersections.

This data is not readily available.

## 3 GOODS MOVEMENT

The St. Albert Transportation Master Plan (TMP) contains a “Proposed Truck Route Plan”, which identifies industrial areas, restricted truck routes, and current and future dangerous goods routes. The routes provide connections between industrial areas and commercial sites within the boundaries of St. Albert, as well as regional connections to Sturgeon Country and the City of Edmonton. The dangerous goods routes were selected to reduce the exposure and impact on residential areas and avoid school zones where possible. Figure 5 in Appendix A shows the proposed truck route map from the Transportation Master Plan.

### 3.1 Required Goods Movement Information

To more fully understand the goods movement traffic flow through St. Albert, additional information is required, including:

- Volumes of goods vehicles; and
- Goods movement vehicle peak hours.

# 4 TRANSIT

St. Albert Transit (StAT) operates commuter bus routes, which travel to and from Edmonton, and local bus routes, which stay within the boundaries of St. Albert. They strive to provide optimal, affordable, and accessible service to their customers for travel within St. Albert and to key commuter destinations in Edmonton.

Transit commuter routes servicing destinations in Edmonton by StAT include:

- Downtown Edmonton via Kingsway;
- NAIT, Kingsway Transit Centre (light rapid transit), Royal Alexandria Hospital;
- University of Alberta via Westmount;
- West Edmonton Mall; and
- Downtown Edmonton Express.

Saturdays, Sundays, and weekdays have different transit schedules, with varying routes available all day and during peak hours. On weekdays, some local routes are available all day, while others are available only during AM and PM peak hours. Only one local bus route operates after 7:00 PM on weekdays, with Dial-a-bus providing “as needed” transit service during low demand periods, including weekday evenings (until 11:35 PM), Saturday evenings (until 11:35 PM), and Sundays (until 6:35 PM). Dial-a-bus is available on request to travel to bus stop locations within St. Albert where riders wish to board or be dropped off. Dial-a-bus operates along existing bus routes and “collector” roadways. They provide local service and connect to commuter buses going to and from Edmonton. Figure 6 in Appendix A shows the weekday peak hour and all day, local transit routes as of September 3, 2017.

There are two transit centres in St. Albert: St. Albert Exchange, and Sturgeon River and Village Transit Centre. Both are hubs for local bus routs, and provide park and ride spaces.

Bus ticket prices are $3.25 for local trips remaining within St. Albert and $6.00 for commuter trips to and from Edmonton. Local monthly passes are valid for travel within St. Albert for the price of $72.25, while commuter monthly passes are $114.25, and are valid for travel on the commuter bus routes to and from Edmonton, as well as within St. Albert. Students attending some post secondary institutions are eligible for the U-Pass system, which provides transit passes to students at a discount.

An Light Rail Transit (LRT) service connecting to the Edmonton LRT network along the St. Albert Trail corridor is planned. This LRT expansion will require lane closure on St. Albert Trail, but will provide faster service to downtown Edmonton, NAIT, and the University of Alberta. It has the potential to increase transit ridership in St. Albert by 30%, and increase mode share.

## 4.1 Required Transit Information

To more fully understand the transit use in St. Albert, additional information is required, including:

- Route travel times;

- Transit delays;
- Passenger counts; and
- Transit vehicle dwell times.

## 5 MOTOR VEHICLE COLLISIONS AND TRAFFIC SAFETY

The Transportation Branch at the City of St. Albert provides traffic collision statistics annually. This data is gathered from the provincial report form, which is completed by members of the Royal Canadian Mounted Police. The database reflects all reported collisions on public roadways that result in property damage of CAD $2,000 or greater and/or any collision that results in an injury or fatality. The 2015 Traffic Collision Statistics report contains the most recent available statistics.

The most recent report available is from 2015. Highlights from the 2015 report include:

- 868 collisions on public roadways (which excludes collisions on private parking lots), of which 521 occurred at intersections (60%) and 347 at midblock locations (40%).
- 0 fatal collisions, and 127 injury collisions occurred.
- 29 vulnerable road user collisions occurred, including 16 pedestrian collisions.
- 57% of the at-fault drivers were non-residents of St Albert, while 61% of traffic violations were issued to non-residents.
- Of the non-resident at-fault drivers, 44% were from Edmonton, 23% were from Sturgeon Country, and 33% were from elsewhere.
- Following too closely and backing unsafely were the two most common collision types.
- 61% of speeding and red-light violations were issued to non-residents.
- The intersection of St. Albert Trail and Giroux Road/Boudreau Road had the highest number of total collisions.
- Approximately 49% of all intersection collisions involved rear-end collisions.
- 31% of intersection collisions occurred between 15:00 and 18:00.

60% of collisions occurred at intersections. The intersections along the St. Albert Trail corridor and Boudreau Road corridors are identified as having the most reported collisions, with the intersection St. Albert Trail and Boudreau Road having the most collisions. Figure 5-1 shows the density of intersection collision incidents in 2015, with the majority of intersection collisions occurring at intersections on St. Albert Trail.

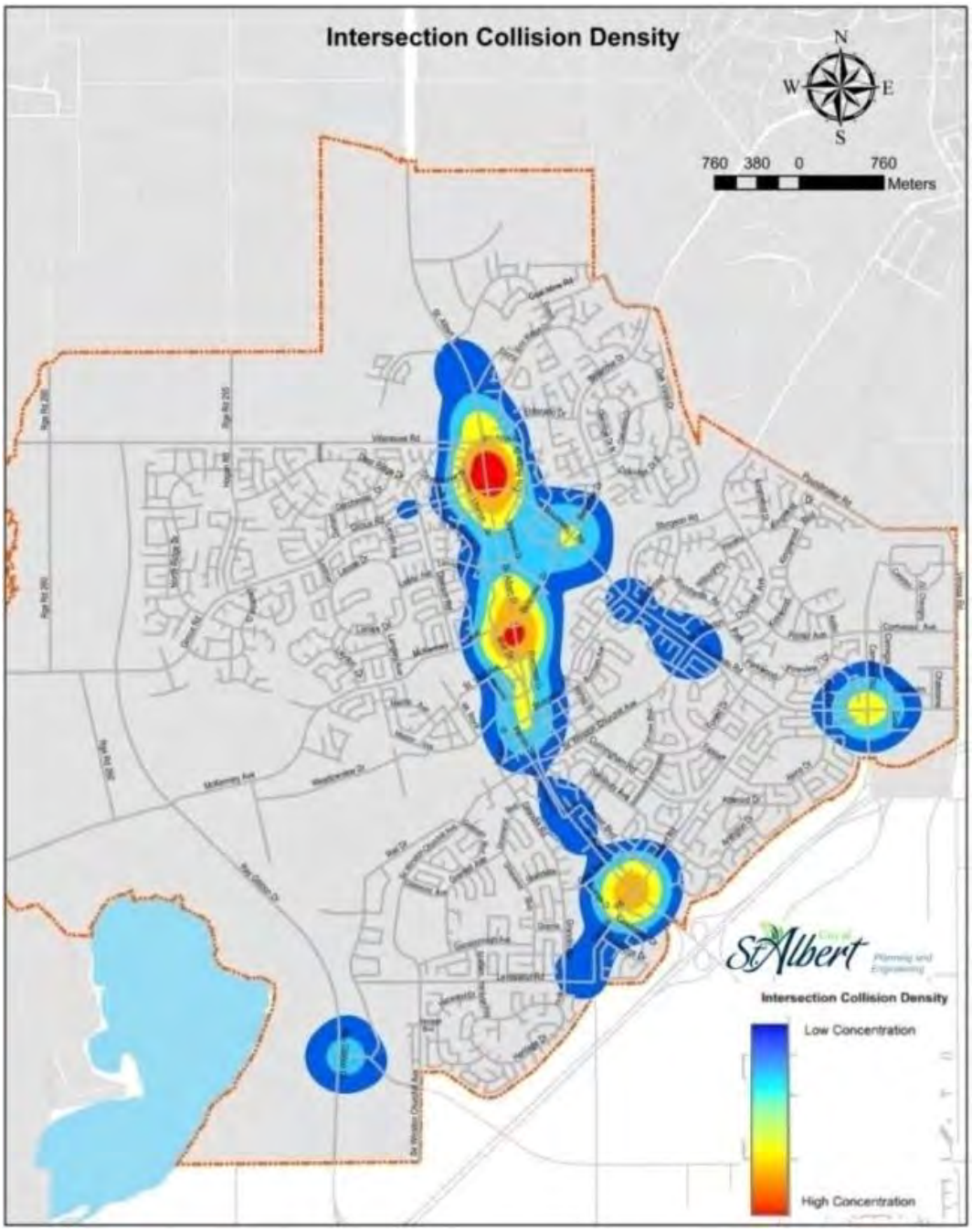



Figure 5-1
2015 Intersection Collision Density

Table 5-1 shows the top ten collision intersections based on total collisions for all types.

**Table 5-1**
**2015 St. Albert Top Ten Collision Intersections**

| Rank | Intersection Name | Number of 2015 Collisions |
|---|---|---|
| 1 | St. Albert Trail and Giroux Road/Boudreau Road | 32 |
| 2 | St. Albert Trail and Villeneuve Road/Erin Ridge Road | 26 |
| 3 | St. Albert Trail and McKenney Avenue/Bellerose Drive | 26 |
| 4 | St. Albert Trail and Hebert Road/Gervais Road | 25 |
| 5 | Boudreau Road and Campbell Road | 22 |
| 6 | Ray Gibbon Drive and LeClair Way | 16 |
| 7 | St. Albert Trail and St. Vital Avenue/Rivercrest Crescent | 14 |
| 8 | St. Albert Trail and Lennox Drive/Inglewood Drive | 13 |
| 9 | St. Albert Trail and St. Anne Street/Sturgeon Road | 13 |
| 10 | Boudreau Road and Sir Winston Churchill Avenue | 12 |

In 2015, 40% of the total collisions occurred at midblock locations. St. Albert Trail had the majority of the midblock collisions, which is likely due to the high traffic volumes and high number of access and exit points on the roadway. 45% of midblock collisions in 2015 involved a parked car, while 15% were related to residential driveways and drivers backing up unsafely. Figure 5-2 shows the midblock collision density in 2015.

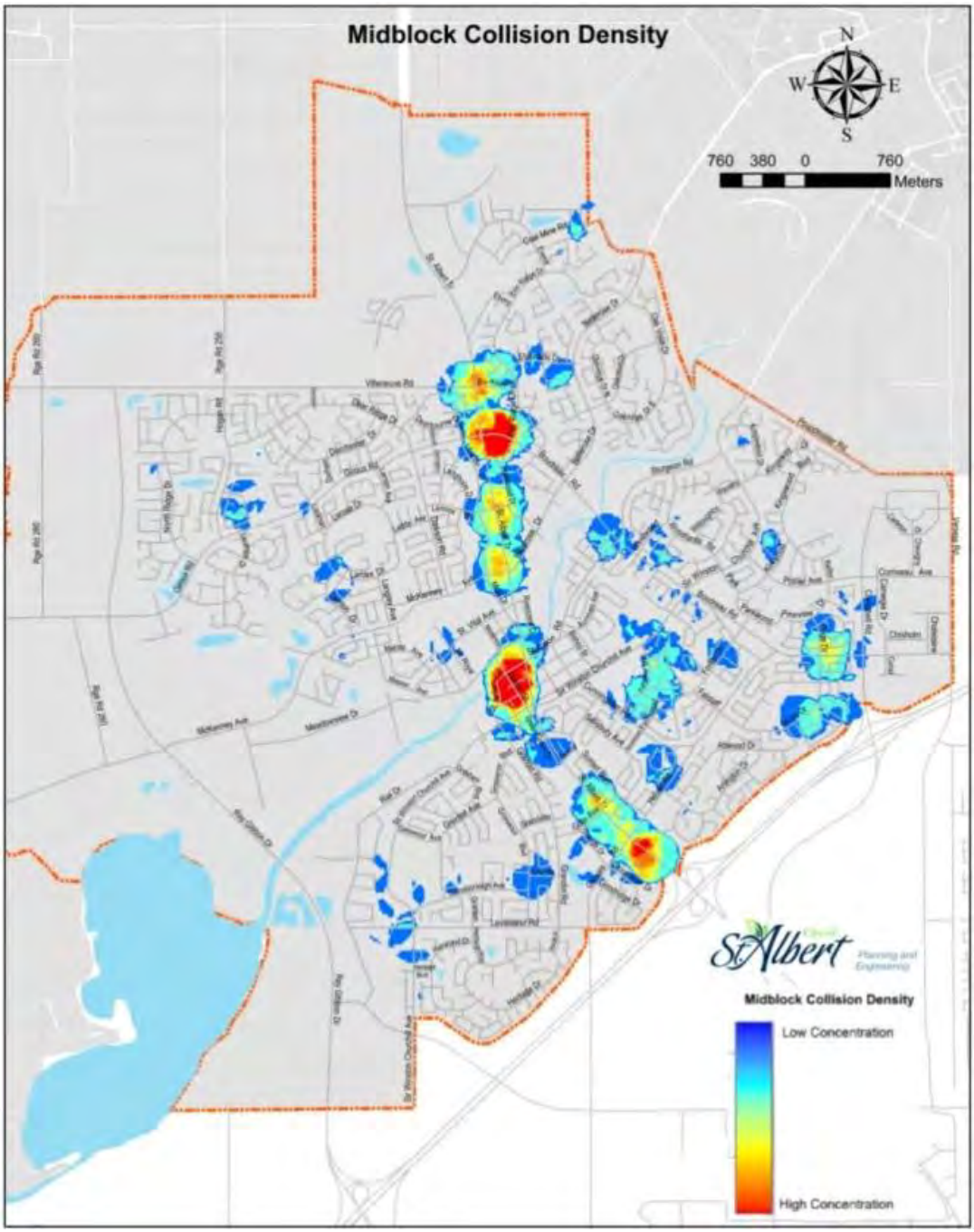



Figure 5-2
2015 Midblock Collision Density

## 6 ACTIVE TRANSPORTATION

Active transportation encompasses human-powered modes of transportation, including walking and cycling. The St. Albert Transportation Master Plan (TMP) references active transportation, sustainable transportation, and alternative transportation in three out of their four guiding principles. Developing an active transportation network is a main goal of the TMP. The TMP states that in 2015, less than 1% of trips were taken by bicycle, and 5% of trips by walking. Cycling in St. Albert is done primarily for recreational purposes. Pedestrian and cycling connections to major destinations is currently limited, according to the TMP.

The Red Willow Trail network is an active transportation network that provides trails through local parks. Additional active transportation links exist on collector roads and arterial roads, which generally have sidewalks on at least one side of the street. Key pedestrian crossing locations are marked and, in some cases, are signalized or use warning flashers. Figure 7 in Appendix A shows the Red Willow Trail network in St. Albert.

St. Albert piloted a crisscross or “scramble” crosswalk at the intersection of Perron Street and St. Anne Street. A survey was available for residents until September 30, 2017 to provide feedback on the new crosswalk. St. Albert is currently tabulating that feedback.

Between 2013 and 2015 there were 33 collisions involving pedestrians in St. Albert, 16 of which were in 2015. 79% of pedestrian collisions have occurred at intersections, with 54% of the collisions occurring at intersections operating with full traffic signals. 27 of the pedestrian collisions between 2013 and 2015 occurred on arterial roadways and/or intersections.

### 6.1 Required Active Transportation Information

To more fully understand the state of active transportation in St. Albert, additional information is required, including:

- Volumes of pedestrians and cyclists at key locations; and
- Routes and/or areas favoured by cyclists and pedestrians.

## 7 REQUIRED INFORMATION

St. Albert does have a significant amount of transportation information available. However, to more fully understand the state of transportation in St. Albert additional information is required. This information has been listed in each section, and is summarized below. Required information includes:

- Major intersection level of service (LOS);
- Intersection delay;
- Journey times along major corridors;
- Turning movement volumes at major intersections;
- Volumes of goods vehicles;
- Goods movement vehicle peak hours;
- Transit route travel times;
- Transit delays;

- Transit passenger counts;
- Transit vehicle dwell times;
- Volumes of pedestrians and cyclists at key locations; and
- Routes and/or areas favoured by cyclists and pedestrians.

Jessica McLennan, B.Sc., M.E.L., EIT
Transportation Planning Engineer

Keenan Kitasaka, B.A.Sc., M.Eng., P.Eng.
Intelligent Transportation System Specialist

JL/KK/lp

APPENDIX A

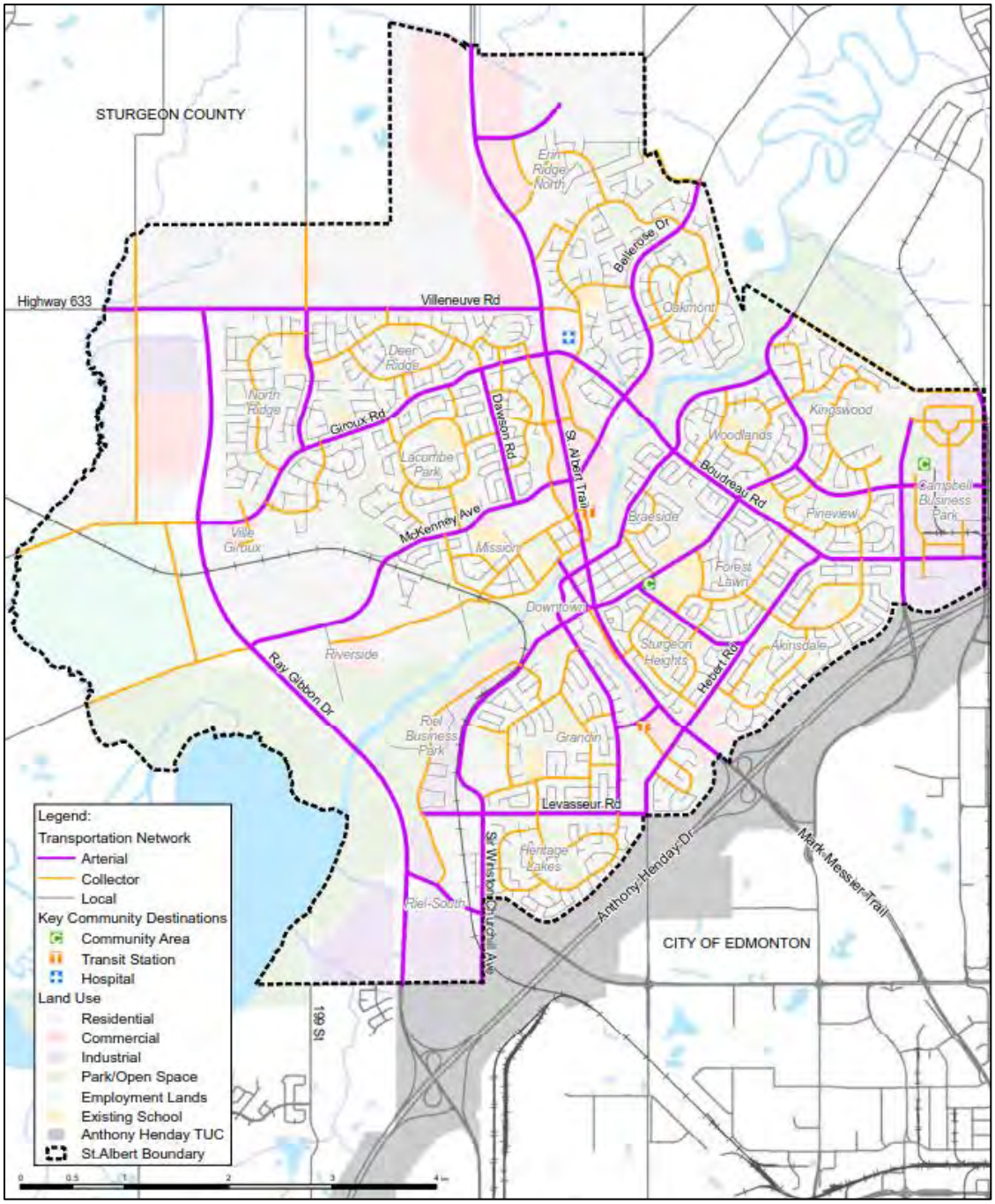



Figure 1
St. Albert Road Network

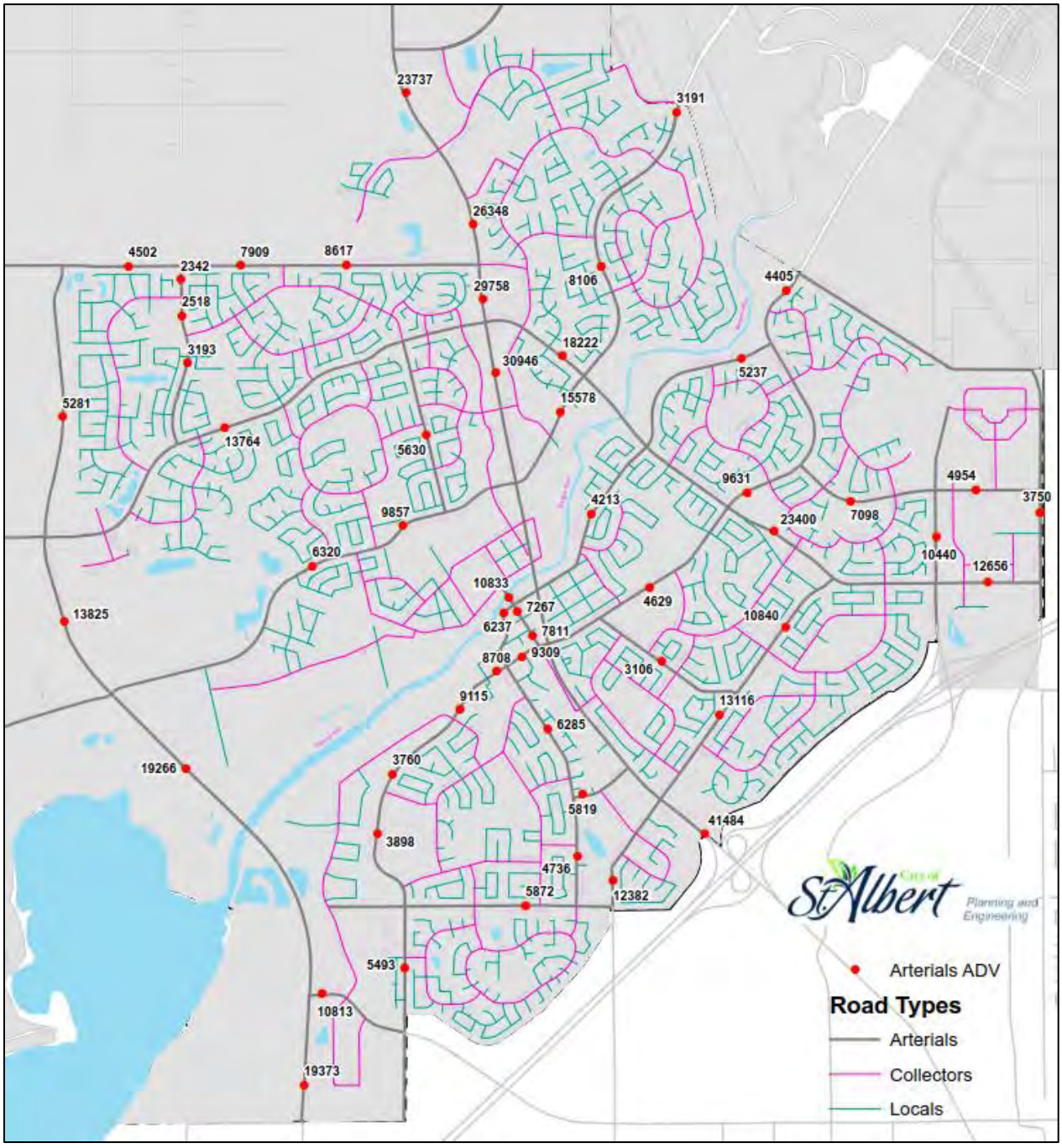



Figure 2
Two-Way Average Daily Traffic Volumes on St. Albert Arterials

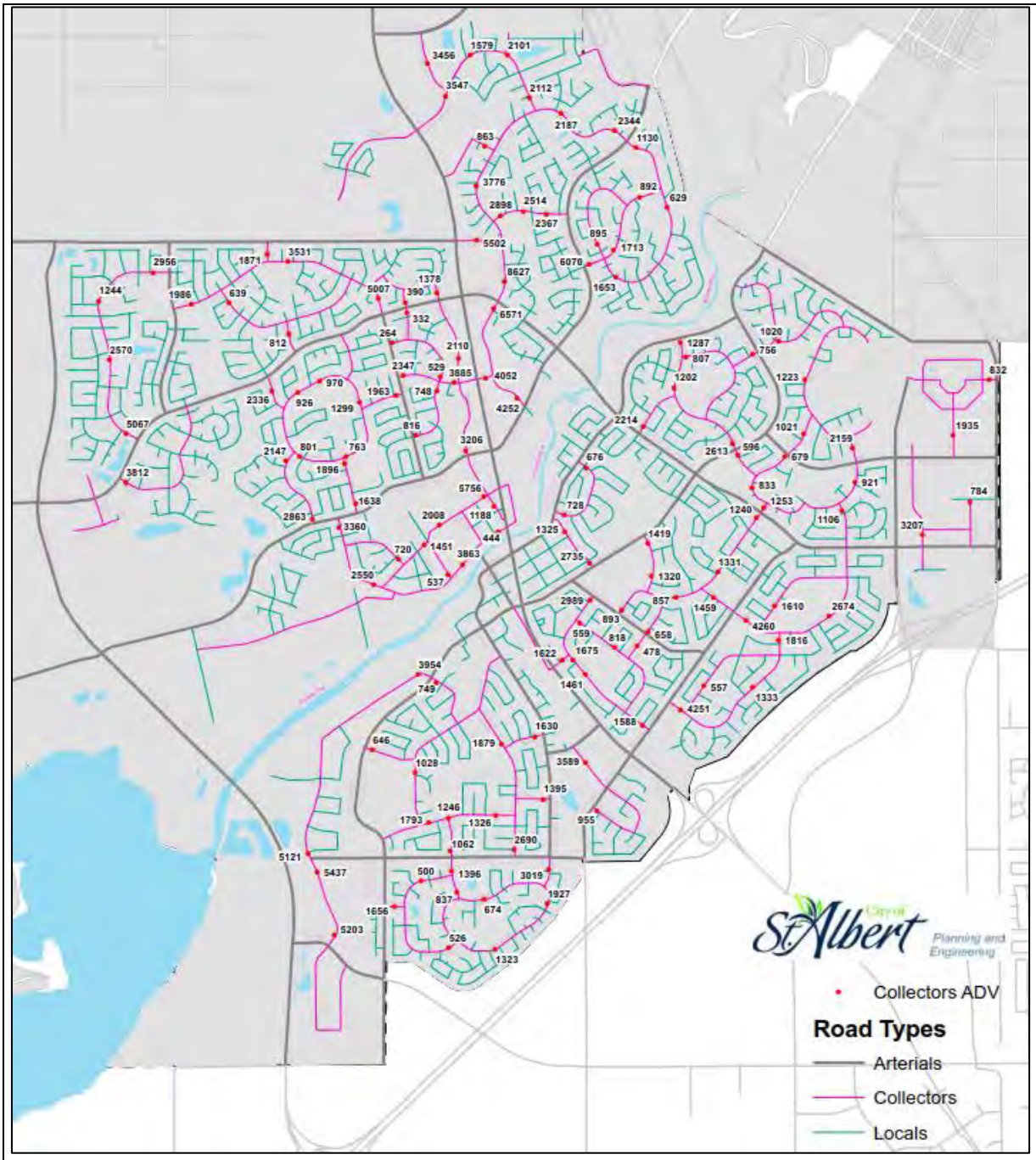



Figure 3
Two-Way Average Daily Traffic Volumes on St. Albert Collectors

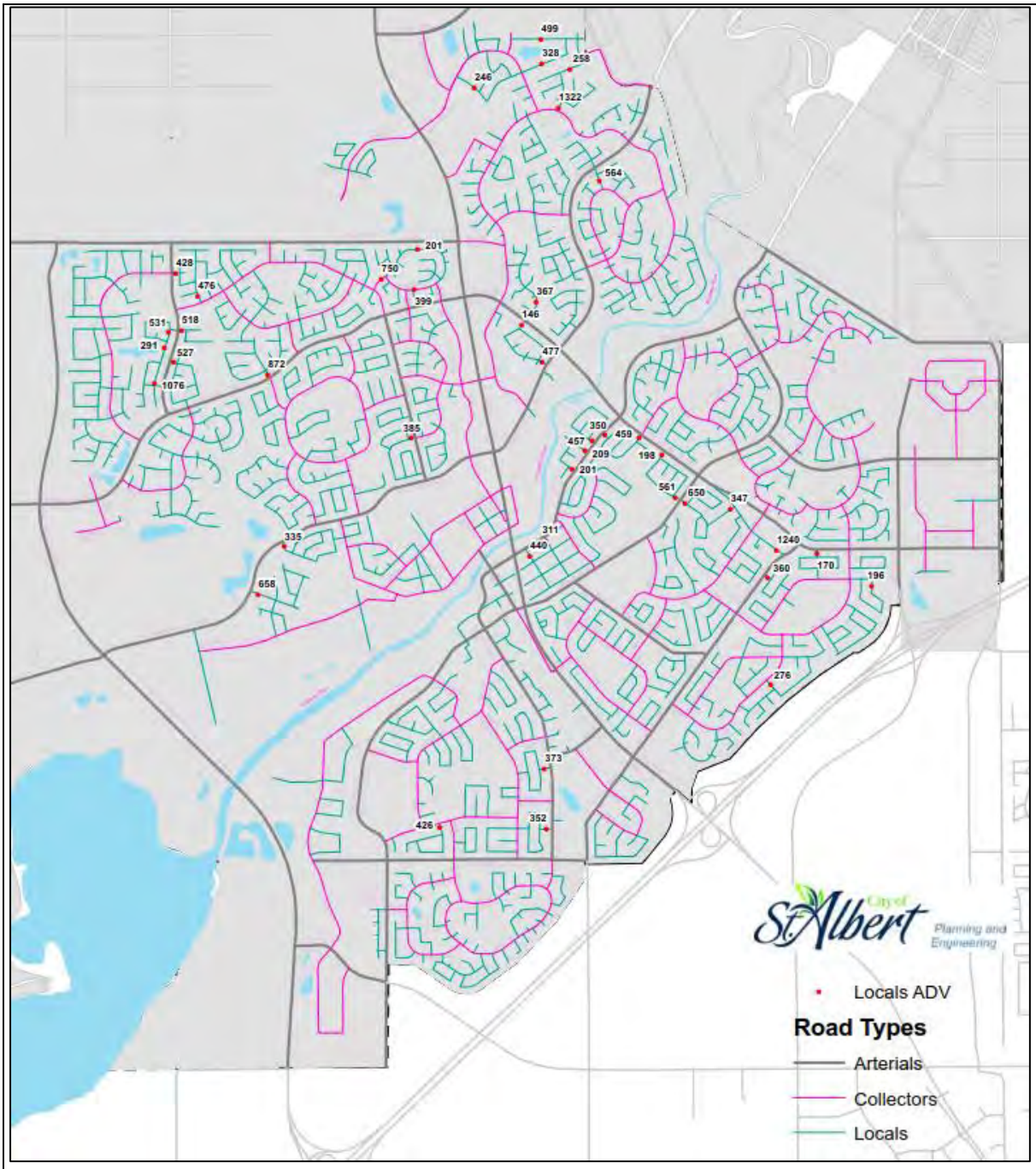



Figure 4
Two-Way Average Daily Traffic Volumes on St. Albert Local Roads

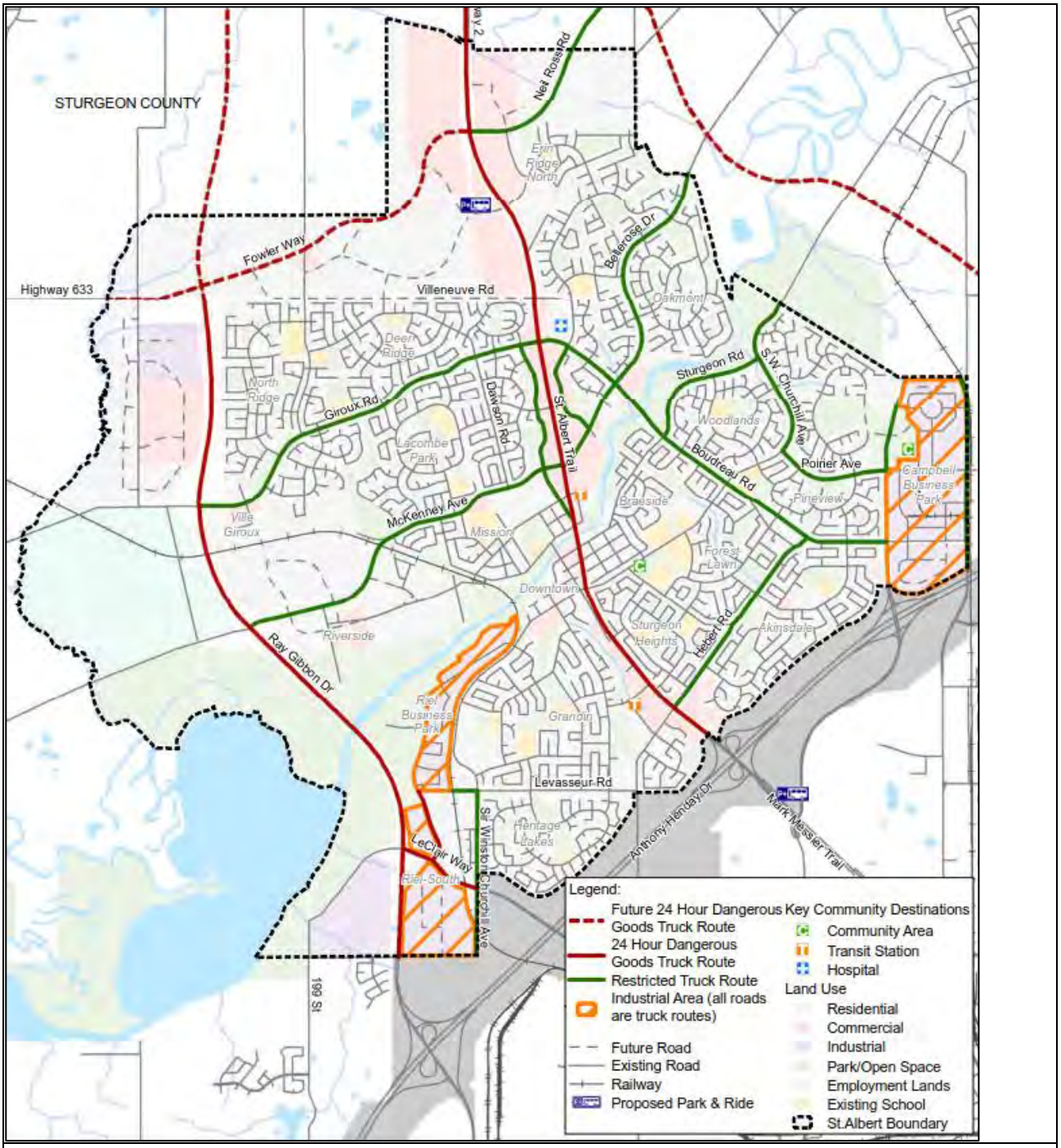



Figure 5
Proposed St. Albert Truck Route Plan

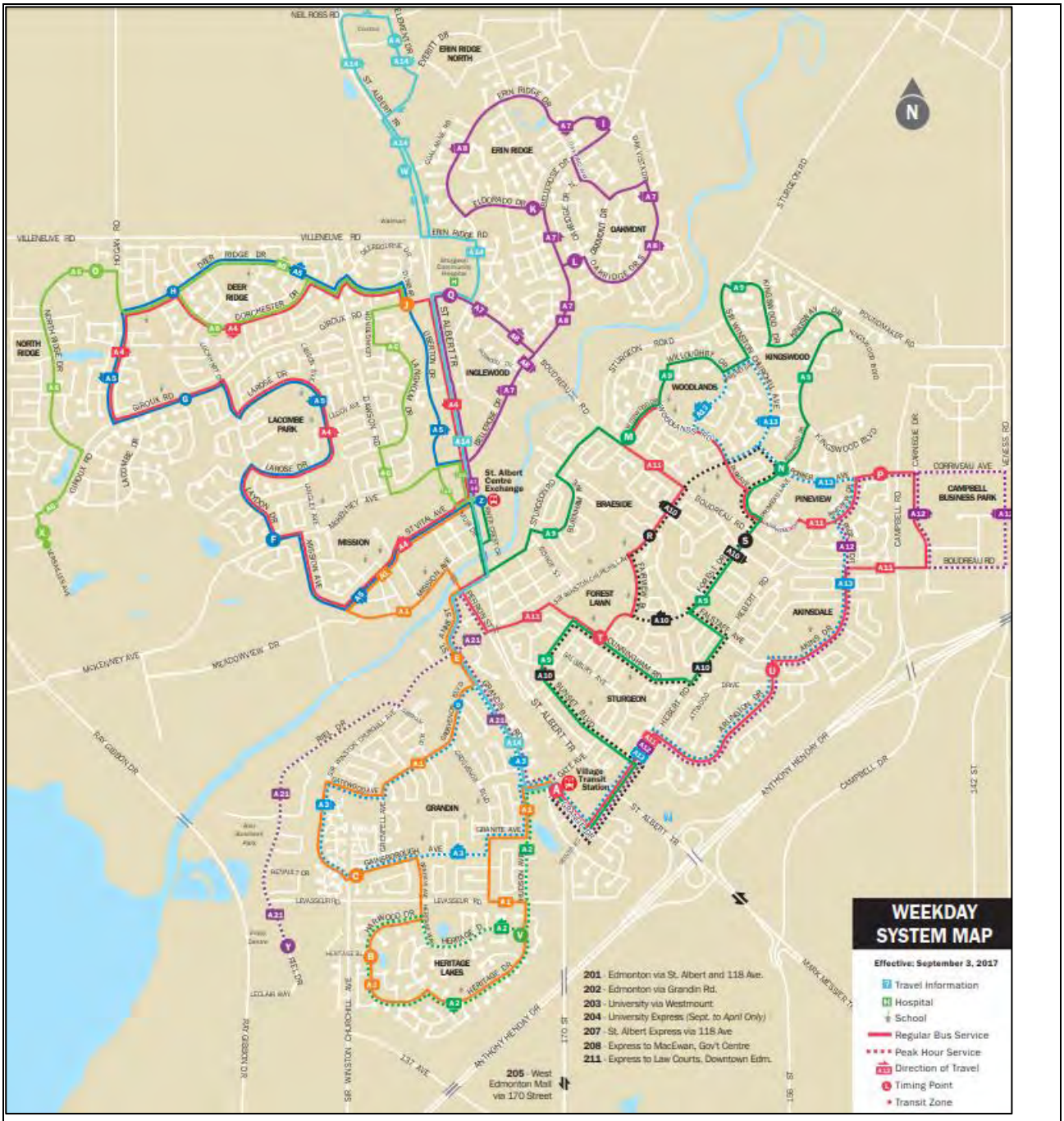



Figure 6
St Albert Weekday Local Bus Service Routes

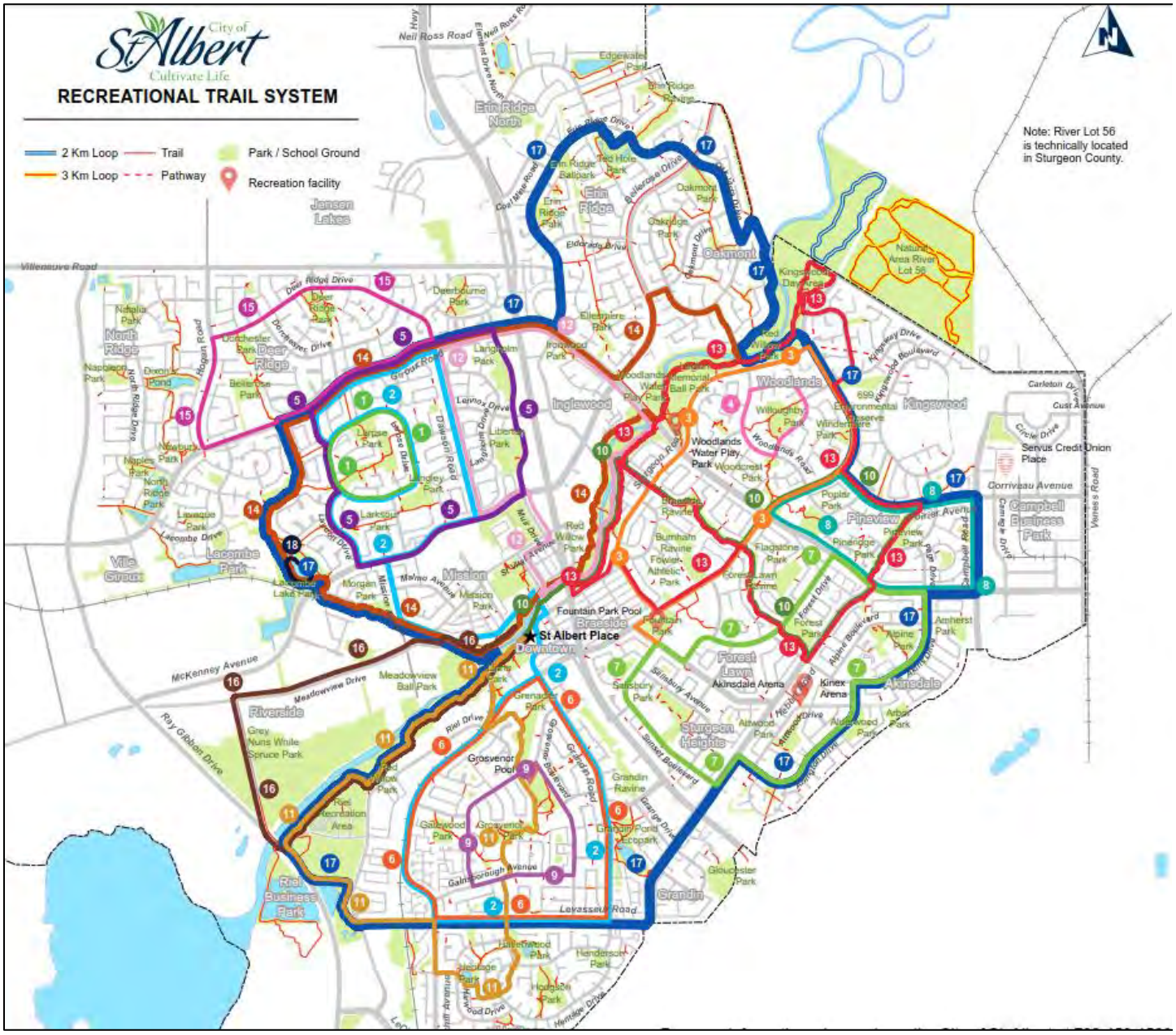



Figure 7
Red Willow Trail network

City of St Albert
Engineering Services

# TRAFFIC SIGNAL LOCATION INVENTORY

Updated February 2016

| Signal ID | Intersection Location | Signal Cabinet | Signal Cabinet Make | Signal Controller | Signal CMU / MMU | Video Detection | Pedestrian Countdowns | UPS | Accessible Pedestrian Crossing | Comm. | Pre-emption | Street Light Ext |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TS-01 | Bellerose @ Inglewood | TS-2; Type 1 | Econolite Type MSX | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | **Regular** | FIBRE | NONE | NONE |
| TS-02 | Bellerose @ Mall Access | TS-2; Type 1 | Econolite Type MSX | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | APS POLARA | FIBRE | NONE | NONE |
| TS-03 | Boudreau @ Bellerose | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | PCS 259-16"x18" LED | Econolite DBL 1400 | APS POLARA | FIBRE | Yes | NONE |
| TS-04 | Boudreau @ SWCA | TS-2; Type 1 | Econolite Type MSX | ASC/3-1000 | Econolite 16 LE | Econolite Solo Terra | PCS 259-16"x18" LED | Econolite DBL 1400 | APS POLARA | Encom Wireless 5.8 Gz | Yes | NONE |
| TS-05 | Boudreau @ Sturgeon | TS-2; Type 1 | Econolite Type MSX | ASC/3-1000 | Econolite 16 E | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | FIBRE | Yes | NONE |
| TS-06 | Boudreau @ Akins | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | Econolite 16 E | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | APS POLARA | FIBRE | NONE | NONE |
| TS-07 | Boudreau @ Campbell | TS-2; Type 1 | Econolite Type MSX | ASC/3-1000 | 16LE ip Smart MMU | Econolite Solo Terra | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | Encom Wireless 5.8 Gz | NONE | NONE |
| TS-08 | Gervais @ Grange / Glouchester | TS-2; Type 1 | Econolite Type MSX | ASC/3-1000 | 16LE ip Smart MMU | Econolite Solo Terra | Dialight 430-6479-001X LED | Econolite DBL 1400 | Novax Sound Safe | Encom Wireless 5.8 Gz | NONE | NONE |
| TS-09 | Gervais @ Levasseur | TS-2; Type 1 | Econolite Type MSX | ASC/3-1000 | 16LE ip Smart MMU | Econolite Solo Terra | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | None | NONE | NONE |
| TS-10 | Giroux @ Dawson | TS-2; Type 1 | Econolite Type MSX | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | RED MUSHROOM PB | Encom Wireless 5.8 Gz | Yes | 1 |
| TS-11 | Hebert @ Arlington | TS-1; Type 2 | Econolite Type MSX | ASC/3-2100 | Econolite MMU 16 LE | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | REGULAR | FIBRE | NONE | NONE |
| TS-12 | Boudreau @ Hebert | TS-2; Type 1 | Econolite Type MSX | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | REGULAR | Encom Wireless 5.8 Gz | NONE | NONE |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TS-13 | Hebert @ Sunset | TS-2; Type 1 | Econolite Type MSX | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | NOVAX PB | NONE | NONE | NONE |
| TS-14 | SWCA @ Levasseur | TS-1; Type 2 | Econolite Type MSX | ASC/3-1000 | 16LEip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | Polara PB | NONE | NONE | 1 |
| TS-15 | McKenney @ Dawson | TS-2; Type 1 | Econolite Type MSX | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | NONE | NONE | 1 |
| TS-16 | St. Anne @ Perron | TS-1; Type 2 | Econolite Type MSX | ASC/3 2100 | 16LEip Smart MMU | Econolite Encore | PCS 259-16”x18” LED | NONE | APS Polara | NONE | NONE | NONE |
| TS-17 | SWCA @ Kingswood | TS-2; Type 1 | Econolite Type MSX | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | NONE | NONE | NONE |
| TS-18 | SWCA @ Riel / Gresham | TS-1; Type 2 | Econolite Type P44 | ASC/3-1000 | Econolite MMU 16 LEip | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | NONE | NONE | NONE |
| TS-19 | SWCA @ St. Anne | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | APS Polara | NONE | NONE | NONE |
| TS-20 | SWCA @ Tache | TS-1; Type 2 | Econolite Type M | ASC/3 1000 | 16LEip Smart MMU2 | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | APS Polara | NONE | NONE | NONE |
| TS-21 | SWCA @ Perron / Greengrove | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU2 | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | APS Polara | NONE | NONE | NONE |
| TS-22 | SAT @ Superstore | TS-2; Type 1 | Econolite Type MSX | ASC/3-1000 | 16LE ip Smart MMU | Econolite Solo Terra | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | NONE | Yes | NONE |
| TS-23 | SAT @ Hebert / Gervais | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Solo Terra | PCS 259-16”x18” LED | Econolite DBL 1400 | Novax Sound Safe | NONE | Yes | NONE |
| TS-24 | SAT @ Gate | TS-2; Type 1 | Econolite Type MSX | ASC/3-1000 | 16LE ip Smart MMU | Econolite Solo Terra | PCS 259-16”x18” LED | Econolite DBL 1400 | Regular | NONE | Yes | NONE |
| TS-25 | SAT @ Greengrove / Sterling | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Solo Terra | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | NONE | Yes | NONE |
| TS-26 | SAT @ Boudreau / Giroux | TS-2; Type 1 | Econolite Type P44 | Cobalt | 16LE ip Smart MMU | Econolite Encore | PCS 259-16”x18” LED | Econolite DBL 1400 | APS Polara | FIBRE | Yes | NONE |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TS-27 | SAT @ Lennox / Inglewood | TS-1; Type 2 | Econolite Type P44 | ASC/3-1000 | Econolite 16 LEip MMU | Econolite Solo Terra | Dialight 430-6479-001X | Econolite DBL 1400 | APS NOVAX | FIBRE | Yes | NONE |
| TS-28 | SAT @ Bellerose / McKenney | TS-1; Type 2 | EPCOR Type P44 | ASC/3-2100 | EDI SSM – 12 LE | Econolite Solo Terra | PCS 259-16"x18" LED | Econolite DBL 1400 | APS Polara | FIBRE | Yes | NONE |
| TS-29 | SAT @ St. Vital | TS-1; Type 2 | Econolite Type P44 | ASC/3-2100 | 16LEip Smart MMU | Econolite Solo Terra | PCS 259-16"x18" LED | Econolite DBL 1400 | APS Polara | FIBRE | Yes | NONE |
| TS-30 | SAT @ Sturgeon / St. Anne | TS-2; Type 1 | Econolite Type MSX | Cobalt | 16LE ip Smart MMU | Econolite Solo Terra | Dialight 430-6479-001X LED | Econolite DBL 1400 | APS NOVAX | FIBRE | Yes | NONE |
| TS-31 | Rivercrest Bus Terminal | TS-1; Type 2 | Econolite Type M | ASC/3-1000 | 16LEip Smart MMU | N/A Loops | Dialight 430-6479-001X LED | Econolite DBL 1400 | APS Polara | None | NONE | none |
| TS-32 | Gervais @ Galarneau | TS-1; Type 2 | Econolite Type M | ASC/3-1000 | 16 LEip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | APS Polara | Encom Wireless 5.8 Gz | NONE | NONE |
| TS-33 | Levasseur @ Grandin | TS-1; Type 2 | EPCOR Type P44 | ASC/3-1000 | 16LEip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | NONE | NONE | NONE |
| TS-34 | SAT @ Villeneuve | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | APS Polara | FIBRE | Yes | NONE |
| TS-35 | Hebert @ Akins / Falstaff | TS-1; Type 2 | EPCOR Type M | ASC/3-2100 | 16 LE Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | APS Polara | Encom Wireless 5.8 Gz | NONE | NONE |
| TS-36 | SAT @ Coalmine | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | FIBRE | Yes | 2 |
| TS-37 | McKenney @ Liberton | TS-1; Type 2 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | NONE | NONE | 2 |
| TS-38 | Boudreau @ Erin Ridge | TS-1; Type 2 | Econolite Type M | ASC/3-1000 | 16LE ip Smart MMU2 | Econolite Solopro | PCS 259-16"x18" LED | Econolite DBL 1400 | Regular | FIBRE | NONE | 2 |
| TS-39 | Bellerose @ Oakmont | TS-1; Type 2 | Econolite Type MSX | ASC/3 - 1000 | Econolite MMU 16LEip | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | APS Polara | NONE | NONE | 4 |
| TS-40 | SWCA @ Poirier | TS-1; Type 2 | Econolite Type MSX | ASC/3-2100 | Econolite MMU 1600 | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | NONE | NONE | 2 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TS-41 | Campbell @ Poirier | TS-1; Type 2 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU2 | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | NONE | NONE | 2 |
| TS-42 | Hebert @ Safeway | TS-1; Type 2 | EPCOR Type M | ASC/3-2100 | EDI SSM – 12 LE | Econolite Encore | PCS 259-16”x18” LED | NONE | Regular | NONE | NONE | 2 |
| TS-43 | Ray Gibbon Dr @ McKenney | TS-2; Type 1 | Econolite Type MSX | ASC/3-1000 | Econolite MMU 16 LE | Econolite Encore | No Pedestrian Movements | Econolite DBL 1400 | NONE | NONE | NONE | 2 |
| TS-44 | Giroux @ Liberton / Dunbar | TS-1; Type 2 | Econolite Type M | ASC/3-1000 | 16LE ip Smart MMU2 | Iteris (side street) + Loops | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | Encom Wireless 5.8 Gz | Yes | 2 |
| TS-45 | Giroux @ Dufferin / Lockhart | TS-1; Type 2 | Econolite Type M | ASC/3-1000 | 16LE ip Smart MMU2 | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | NOVAX | Encom Wireless 5.8 Gz | Yes | 1 |
| TS-46 | Hebert @ Cunningham | TS-1; Type 2 | Econolite Type M | ASC/3-1000 | MMU 1600 | Econolite Encore | PCS 259-16”x18” LED | Econolite DBL 1400 | Regular | Encom Wireless 5.8 Gz | NONE | 1 |
| TS-47 | Ray Gibbon Dr @ LeClair | TS-1; Type 2 | Econolite Type MSX | ASC/3-2100 | Econolite MMU 16E | Econolite Solo Terra | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | NONE | NONE | 3 |
| TS-48 | Riel @ Levasseur | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Solo Terra | PCS 259-16”x18” LED | Econolite DBL 1400 | NOVAX | FIBRE | NONE | 2 |
| TS-49 | Giroux @ Hogan | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Solo Terra | PCS 259-16”x18” LED | Econolite DBL 1400 | NOVAX | Encom Wireless 5.8 Gz | Yes | 3 |
| TS-50 | Giroux @ Larson | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Solo Terra | PCS 259-16”x18” LED | Econolite DBL 1400 | NOVAX | Encom Wireless 5.8 Gz | Yes | 2 |
| TS-51 | SWCA @ LeClair Way /137 Ave | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | NONE | NONE | 4 |
| TS-52 | Boudreau @ Veness | TS-2; Type 1 | Econolite Type M | ASC/3-1000 | 16LE ip Smart MMU | Econolite Solo Terra | Dialight 430-6479-001X LED | Econolite DBL 1400 | NOVAX | NONE | NONE | 3 |
| TS-53 | SWCA @ Cunningham | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | NONE | NONE | 1 |
| TS-54 | SAT @ NE Arterial Road | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Aldis Gridsmart | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | FIBRE | Yes | 3 |
| TS-55 | SAT @ Everitt Dr | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Aldis Gridsmart | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | FIBRE | Yes | 4 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TS-56 | SAT @ Midlot Entrance | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Aldis Gridsmart | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | FIBRE | Yes | 3 |
| TS-57 | Ray Gibbon Dr @ Giroux Rd | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | NONE | Econolite DBL 1400 | NONE | FIBRE | NONE | 3 |
| TS-58 | Ray Gibbon Dr @ Villeneuve Rd | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | NONE | Econolite DBL 1400 | NONE | NONE | NONE | 2 |
| TS-59 | Boudreau @ Beaverbrook | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Solopro | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | FIBRE | NONE | NONE |
| TS-60 | Boudreau @ Forest / Primeau | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular | FIBRE | NONE | NONE |
| TS-61 | Giroux @ Nevada | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | NOVAX | FIBRE | Yes | NONE |
| TS-62 | Bellerose @ Evergreen | TS-2; Type 1 | Econolite Type P44 | ASC/3-1000 | 16LE ip Smart MMU | Econolite Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | APS Polara | NONE | NONE | 1 |
| TS-63 | Boudreau Rd @ Carnegie Dr | TS-2 Type 1 | Econolite Type P44 | Cobalt | 16LE ip Smart MMU2 | Vision Encore | Dialight 430-6479-001X LED | Econolite DBL 1400 | Regular Touch PB | NONE | NONE | NONE |

**PEDESTRIAN ACTIVATED SIGNALS**

| Signal ID | Intersection Location | Signal Cabinet Make | Signal Controller | Signal CMU / MMU | Pedestrian Countdowns | Accessible Pedestrian Crossing | Radio Comm. | Street Light Ext | Transit Detection |
|---|---|---|---|---|---|---|---|---|---|
| PS-01 | Boudreau @ Brunswick | Econolite Signal Pole Mount | Econolite ASC/3-1000 | Econolite MMU 16 LEip | Dialight430-6479-001X LED | Regular PB | None | None | None |
| PS-02 | Boudreau @ Ironwood | Intrex Signal Pole Mount | Econolite ASC/3-2100 | EDI SSM 3L | Dialight430-6479-001X LED | Regular PB | Encom Wireless 5.8 Gz | None | None |
| PS-05 | Cunningham @ Sycamore / Farmstead | Intrex Type M Signal Cabinet with Base | Econolite ASC/3-2100 | EDI NSM 3L | Amber flashers | Regular PB | none | none | None |
| PS-06 | Dawson @ Leddy | Intrex | Econolite | EDI NSM 3L | Amber Flashers | Regular PB | none | none | None |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Signal Pole Mount | ASC/3-2100 | | | | | | |
| PS-07 | Gainsborough @ Graham | Econolite Signal Pole Mount | Econolite ASC/3-1000 | Econolite MMU 16 E | PCS 259-16”x18” LED | Regular PB | none | none | None |
| PS-08 | Giroux @ Durham | Intrex Type M Signal Cabinet Pole mount | Econolite ASC/3-2100 | EDI-NSM 3L | PCS 259-16”x18” LED | Novax | Encom Wireless 5.8 Gz | none | None |
| PS-12 | McKenney @ Langley | Intrex Signal Pole Mount | Traconex TMP 390 | EDI SSM 3E | Dialight430-6479-001X LED | APS Polara | none | none | none |
| PS-13 | SWCA @ Bishop | Intrex Type M Signal Cabinet with Base | Traconex TMP 390 | EDI NSM 3L | PCS 259-16”x18” LED | Regular PB | none | none | none |
| PS-14 | SWCA @ Fairview | Intrex Type M Signal Cabinet with Base | Econolite ASC/3-1000 | Econolite MMU 16 E | PCS 259-16”x18” LED | Regular PB | None | none | none |
| PS-15 | SWCA @ Gainsborough | Intrex Pedestal Mount | Econolite ASC/3-2100 | EDI SSM 3L | PCS 259-16”x18” LED | Regular PB | None | none | none |
| PS-16 | SWCA @ Woodlands / Park Ave | Intrex Signal Pole Mount | Econolite ASC/3-2100 | EDI NSM 3L | Dialight430-6479-001X LED | Regular PB | none | none | none |
| PS-17 | St Anne @ SAP | Econolite Type M Base mount | Econolite Cobalt G14615 | MMU2-16LEip | Dialight430-6479-001X LED | APS Polara | none | none | none |
| PS-18 | SWCA @ Hawthorne | Intrex Signal Pole Mount | Traconex TMP 390 | EDI SSM 6LE | Dialight430-6479-001X LED | Regular PB | none | none | none |
| PS-19 | Levasseur @ Heritage / Graham | EPCOR Type M Cabinet with Base | Traconex TMP 390 | EDI SSM 6LE | PCS 259-16”x18” LED | Regular PB | none | none | h |
| PS-20 | Grosvenor @ Grandville | EPCOR Type M Cabinet with Base | Traconex TMP 390 | EDI SSM 3L | PCS 259-16”x18” LED | Regular PB | none | none | none |
| PS-22 | Larose @ Leddy | EPCOR Type M Cabinet with Base | Traconex TMP 390 | EDI SSM 3L | Dialight430-6479-001X LED | Regular PB | none | none | none |
| PS-23 | Giroux @ Bellerose High (wbound) | Econolite | Econolite ASC/3-1000 | Econolite MMU 16 E | Dialight430-6479-001X LED | NOVAX | Encom Wireless 5.8 Gz | none | none |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| PS-24 | Giroux @ Bellerose High ebound | | | | | | | | |
| PS-25 | McKenney @ Morgan | Econolite Type M Cabinet with Base | Econolite ASC/3-1000 | Econolite MMU-16E | Dialight430-6479-001X LED | APS Polara | none | 1 | none |
| PS-26 | Grange Dr @ Village Tree Transit Center | Econolite Signal Pole Mount | Econolite ASC/3-1000 | Econolite MMU-16E | Dialight430-6479-001X LED | NOVAX | none | none | h |
| PS-27 | Giroux @ Lacombe Dr EAst | Econolite Type M Cabinet with Base | Econolite ASC/3-1000 | Econolite MMU-16E | Dialight430-6479-001X LED | Regular PB | none | 1 | none |

**PEDESTRIAN AMBER FLASHING CROSSWALKS**

| Signal ID | Intersection Location | Signal Cabinet | Accessible Pedestrian Crossing | Street Light Ext |
|---|---|---|---|---|
| PA-01 | Langley @ Lester | NONE | Regular PB | NONE |
| PA-02 | Grandin @ Grandville | ASC3-1000 | Regular PB | 1 |
| PA-04 | Akins @ Elmer Gish School | ASC3-1000 | Regular PB | NONE |
| PA-05 | Sturgeon @ Waterpark | NONE | Regular PB | NONE |
| PA-06 | Sturgeon @ Woodlands | NONE | Regular PB | NONE |
| PA-07 | Woodlands @ Westwood | NONE | Regular touch PB | NONE |
| PA-08 | SWCA @ Waverly | NONE | Regular PB | NONE |
| PA-09 | Deer Ridge @ Murial Martin School | NONE | Regular Touch PB | NONE |
| PA-10 | Gervais Rd @ Good ridge Dr | NONE | Regular Touch PB | NONE |
| PA-11 | Bellrose Dr @ Oakvista Dr | NONE | Regular Touch PB | NONE |

| | | | | |
|---|---|---|---|---|
| PA-12 | St Vital Ave @ Youville Home | NONE | Regular Touch PB | NONE |
| PA-13 | LED Crosswalk Poirer ave @ Parkwood Dr | NONE | Regular Touch PB | NONE |
| PA-14 | | | | |

**SCHOOL ZONE WARNING FLASHERS**

| Signal ID | School Name | Roadway | Quantity of Flashers | Solar Panels | Controller Make |
|---|---|---|---|---|---|
| SZ-01 | Vital Grandin School | Sunset Blvd | 2 | 2 | Eltec |
| SZ-02 | Leo Nickerson School | Sycamore Ave | 2 | 1 | Eltec |
| SZ-03 | JJ Nearing School | Deer Ridge Dr | 2 | 2 | Eltec |
| SZ-04 | Neil M Ross School | Woodlands Rd | 2 | 1 | Eltec |
| SZ-05 | Ecole Father Jan | Mission Ave | 2 | 2 | JSF Technologies Model SZ-7412-P |
| SZ-06 | Ecole La Mission | Heritage Dr | 2 | 2 | Eltec |
| SZ-07 | Wild Rose | Grenfell Ave | 2 | 2 | Eltec |
| SZ-08 | Albert Lacombe | Gainsborough Ave/ Graham Ave | 3 | 3 | Eltec |
| SZ-09 | Sturgeon Heights | Hogan Rd/North Ridge | 3 | 3 | Eltec |
| SZ-10 | Muriel Martin | Deer Ridge Dr/ Dennison Dr | 3 | 3 | Eltec |
| SZ-11 | Marie Poburan | SWCA | 2 | 2 | JSF |
| SZ-12 | Neil Ross | Woodlands | 2 | 1 | Eltec |

| | | | | | |
|---|---|---|---|---|---|
| SZ-13 | Elmer S Gish | Akins Dr | 2 | 2 | Eltec |
| SZ-14 | Fowler/SAM | SWCA | 2 | 2 | Eltec |

**FIRE HALL WARNING FLASHERS**

| Signal ID | Fire Hall Station | Roadway | Style of Signs | Pre-Emption | Installed | Controller |
|---|---|---|---|---|---|---|
| FS-01 | Fire Hall Station 1 | Sir Winston Churchill Ave – North / east of Gresham Blvd | ID-22 | No | 2012 | Novax Control System |
| FS-02 | Fire Hall Station 2 | Boudreau Rd - South / east of Bellerose Dr | ID-22 | No | 2016 | Novax Control System |
| FS-03 | Fire Hall Station 3 | Giroux Rd – South / west of Lacombe D (west) | ID-22 | No | 2007 | Novax Control System |

**STREET LIGHTS**

| Roadway | Section | Quantity of Streetlights | Style | Details |
|---|---|---|---|---|
| Ray Gibbon Drive Stage 1 | South City Limit to McKenney Ave | 54 | OVF Flat Glass Luminaire<br>310 W Cooper Lighting | 13.0 m Glavanized Pole<br>2.5 m Davit<br>Ballast Connected 347 Volt |
| Ray Gibbon Drive Stage 2 | McKenney Ave to Giroux Rd | 23 | OVF Flat Glass Luminaire<br>310 W Cooper Lighting | 13.0 m Glavanized Pole<br>2.5 m Davit<br>Ballast Connected 347 Volt |
| Ray Gibbon Drive Stage 3 | Giroux Rd to Villeneuve Rd<br>Note – to be constructed in 2013 | 38 | OVF Flat Glass Luminaire<br>310 W Cooper Lighting | 13.0 m Glavanized Pole<br>2.5 m Davit<br>Ballast Connected 347 Volt |
| Rodeo Drive | Riel Dr to west end of Rodeo Dr | 10 | 250 W Helios Luminaire c/w<br>Integral Photocell | 13.0 m Galvanized Pole<br>Galvanized “Heritage”<br>Decorative Arm |
| TOTAL QUANTIY | | 125 | | |

**RRFBS**

| Signal ID | Roadway | Flashers | Solar Panels | Push Buttons | Controller Make |
|---|---|---|---|---|---|
| RFB-1 | 22 AKINS DR | 2 | 2 | 2 | Carmanah |
| RFB-2 | 36 ALPINE BLVD | 2 | 2 | 2 | Carmanah |
| RFB-3 | 87 AKINS DR | 2 | 2 | 2 | Carmanah |
| RFB-4 | 76 AKINSDALE | 2 | 2 | 2 | Carmanah |
| RFB-5 | 101 ARBOR CRES | 2 | 2 | 2 | Carmanah |
| RFB-6 | 39 AKINS DR | 2 | 2 | 2 | Carmanah |
| RFB-7 | 110 AKINS DR | 2 | 2 | 2 | Carmanah |
| RFB-8 | 1 ARLINGTON DR | 2 | 2 | 2 | Carmanah |
| RFB-9 | 48 ALPINE BLVD | 2 | 2 | 2 | Carmanah |
| RFB-10 | 102 EASTCOTT | 2 | 2 | 2 | Carmanah |
| RFB-11 | 30 ERIN RIDGE DR | 2 | 2 | 2 | Carmanah |
| RFB-12 | 41 EVERITT DR | 2 | 2 | 2 | Carmanah |
| RFB-13 | 2 ELISE PL | 2 | 2 | 2 | Carmanah |
| RFB-14 | 120 EVERITT DR | 2 | 2 | 2 | Carmanah |

| | | | | | |
|---|---|---|---|---|---|
| RFB-15 | 60 SWC AVE | 2 | 2 | 2 | Carmanah |
| RFB-16 | 31 GROSVNER BLVD | 2 | 2 | 2 | Carmanah |
| RFB-17 | 1 GENEVA CRES | 2 | 2 | 2 | Carmanah |
| RFB-18 | 58 GRENFELL AVE | 2 | 2 | 2 | Carmanah |
| RFB-19 | 21 GRENFELL AVE | 2 | 2 | 2 | Carmanah |
| RFB-20 | 5 GRENFELL AVE | 2 | 2 | 2 | Carmanah |
| RFB-21 | 27 GRENFELL AVE | 2 | 2 | 2 | Carmanah |
| RFB-22 | 77 LORRAINE CRES | 2 | 2 | 2 | Carmanah |
| RFB-23 | 149 LAROSE DR | 2 | 2 | 2 | Carmanah |
| RFB-24 | 15 MISSION AVE | 2 | 2 | 2 | Carmanah |
| RFB-25 | 74 MISSION AVE | 2 | 2 | 2 | Carmanah |
| RFB-26 | 34 MISSION AVE | 2 | 2 | 2 | Carmanah |
| RFB-27 | 44 SUNSET BLVD | 2 | 2 | 2 | Carmanah |
| RFB-28 | 39 SUNSET BLVD | 2 | 2 | 2 | Carmanah |
| RFB-29 | 60 WOODLANDS CRES | 2 | 2 | 2 | Carmanah |
| RFB-30 | 91 WOODCREST AVE | 2 | 2 | 2 | Carmanah |

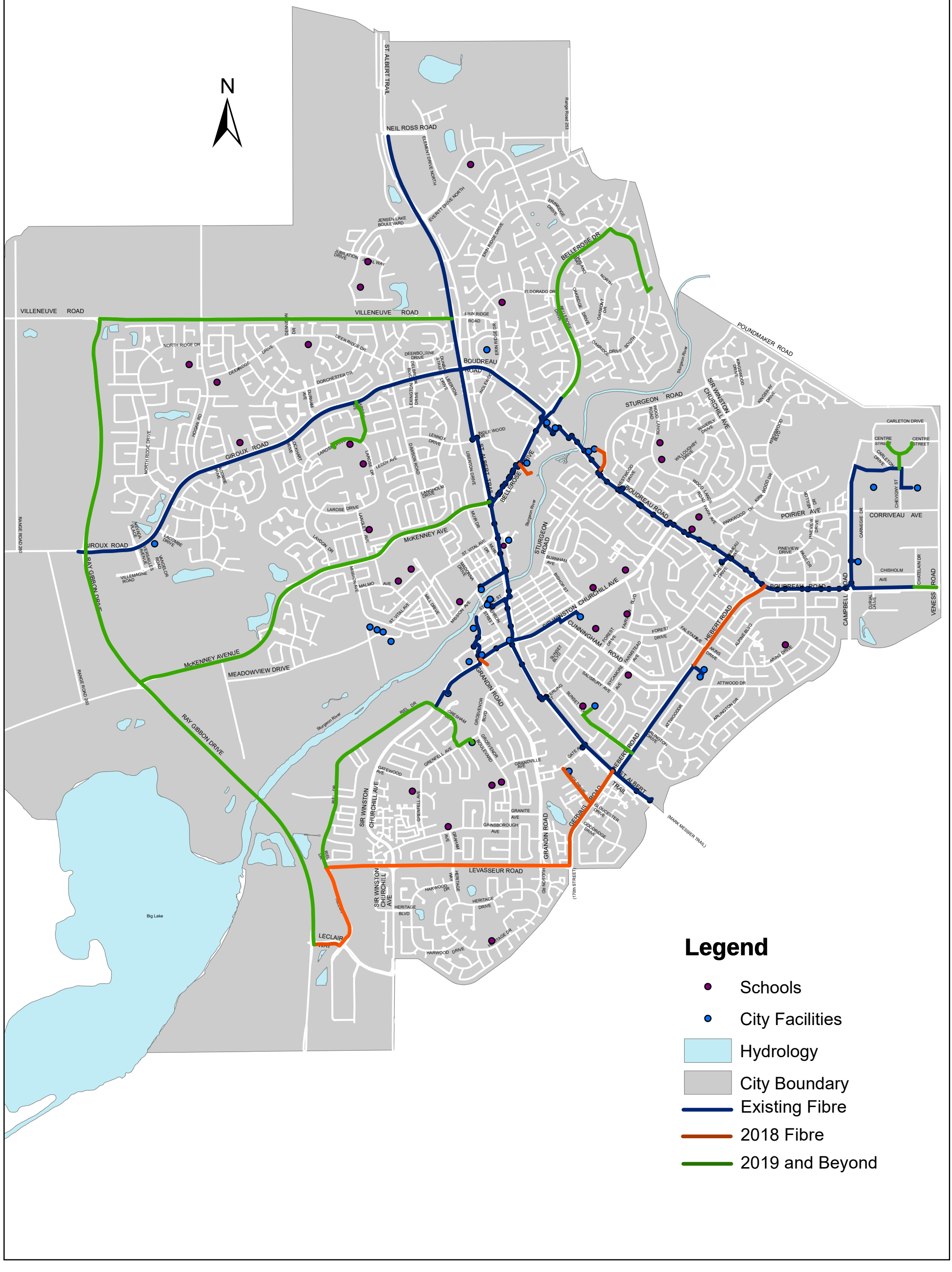
**DFBS**

| Signal ID | Roadway | Quantity of Units | Solar Panel | Controller Make |
|---|---|---|---|---|
| DFB-1 | SWC @ Bishop EB | 1 | 1 | Traffic Calm Systems |
| DFB-2 | SWC @ Fairview WB | 1 | 1 | Traffic Calm Systems |
| DFB-3 | Grosvenor @ Grandville NB | 1 | 1 | Traffic Calm Systems |
| DFB-4 | Grosvenor @ Grosvenor Park SB | 1 | 1 | Traffic Calm Systems |
| DFB-5 | Graham @ Albert Lacomb WB | 1 | 1 | Traffic Calm Systems |
| DFB-6 | Glenwood @ Albert Lacomb EB | 1 | 1 | Traffic Calm Systems |
| DFB-7 | Arbor Cres @ Akins NB | 1 | 1 | Traffic Calm Systems |
| DFB-8 | Arbor Cres @ Akins SB | 1 | 1 | Traffic Calm Systems |
| DFB-9 | Sunset Blvd @ Vital Grandin School NB | 1 | 1 | Traffic Calm Systems |
| DFB-10 | Sunset Blvd @ Vital Grandin School SB | 1 | 1 | Traffic Calm Systems |
| DFB-11 | Gate wood Ave @ Grenfell Ave SB | 1 | 1 | Traffic Calm Systems |
| DFB-12 | Gould Pl @ Grenfell Ave NB | 1 | 1 | Traffic Calm Systems |
| DFB-13 | Father Jan @ Mission Ave WB | 1 | 1 | Traffic Calm Systems |

| | | | | |
|---|---|---|---|---|
| DFB-14 | Mount Royal @ Mission Ave EB | 1 | 1 | Traffic Calm Systems |
| DFB-15 | SWC @ Woodcrest Park EB | 1 | 1 | Traffic Calm Systems |
| DFB-16 | SWC @ Woodlands WB | 1 | 1 | Traffic Calm Systems |
| DFB-17 | Erin Ridge Dr @ Hospital NB | 1 | 1 | Traffic Calm Systems |
| DFB-18 | Erin Ridge Rd @ Citadel Village EB | 1 | 1 | Traffic Calm Systems |
| DFB-19 | Erin Ridge Rd @ Citadel Village WB | 1 | 1 | Traffic Calm Systems |
| DFB-20 | Erin Ridge Dr @ Emera Terrace SB | 1 | 1 | Traffic Calm Systems |
| DFB-21 | Erin Ridge Dr @ Alexander Tache School NB | 1 | 1 | Traffic Calm Systems |
| DFB-22 | Eldorado Dr @ Alexander Tache School EB | 1 | 1 | Traffic Calm Systems |
| DFB-23 | Eldorado Dr @ Eaglewood Village WB | 1 | 1 | Traffic Calm Systems |
| DFB-24 | Everitt Dr North @ Lois Hole School WB | 1 | 1 | Traffic Calm Systems |
| DFB-25 | Everitt Dr North @ Lois Hole School EB | 1 | 1 | Traffic Calm Systems |

**Permanent Count stations**

| Signal ID | Roadway | Quantity of Units | Communication | Manufacturer |
|---|---|---|---|---|
| RDR-1 | SAT @ SWCA | 1 | Fibre | Speed lane |
| RDR-2 | SAT @ City welcome sign North | 1 | Radio | Wavetronix |


N
ST. ALBERT TRAIL
NEIL ROSS ROAD
Range Road 253
ELEMENT DRIVE NORTH
EVERITT DRIVE NORTH
JENSEN LAKE BOULEVARD
JUBILATION DRIVE
VILLENEUVE ROAD
ERIN RIDGE ROAD
ERIN RIDGE DRIVE
BELLEROSE DR
ELDORADO DR
OAKRIDGE DRIVE
OAKRIDGE DRIVE SOUTH
POUNDMAKER ROAD
Sturgeon River
SIR WINSTON CHURCHILL AVE
STURGEON ROAD
BOUDREAU ROAD
NORTH RIDGE DR
DEERIDGE DRIVE
DEER RIDGE DR
DORCHESTER DR
DEERBOURNE DRIVE
DUNBAR STREET
LIBERTON DRIVE
INGLEWOOD DR
INGLE WOOD DR
LEXINGTON DRIVE
DURHAM AVE
OAKHART DRIVE
LAROSE DRIVE
LEDDY AVE
LENNOX DRIVE
DAWSON ROAD
LANGHOLM DRIVE
GIROUX ROAD
HOGAN RD
NORTH RIDGE DRIVE
LACOMBE DRIVE
MEVOR RIDGE
VERSAILLES AVENUE
WINDSOR ROAD
VILLEMAGNE ROAD
RANGE ROAD 260
RAY GIBBON DRIVE
LAYDON DR
LANGLEY AVE
MUIR DR
McKENNEY AVE
ST. VITAL AVE
MADEWNA DRIVE
MISSION AVE
MALMO AVE
WILL DRIVE
BURNHAM AVE
BISHOP ST
ST. ANNE ST
ST. HUBERT STREET
McKENNEY AVENUE
MEADOWVIEW DRIVE
RANGE ROAD 250
RIEL DR
GRESHAM
GROSVENOR BLVD
GROSVENOR BOULEVARD
GRENFELL AVE
GATEWOOD AVE
GRANDVILLE AVE
GRANDIN ROAD
SIR WINSTON CHURCHILL AVE
GRAHAM AVE
GRANITE AVE
GAINSBOROUGH AVE
LECLAIR WAY
LEVASSEUR ROAD
HARWOOD DR
HERITAGE WAY
HERITAGE DRIVE
HERITAGE BLVD
HERITAGE DR
HARWOOD DRIVE
HUDSON RD
(170th STREET)
(MARK MESSIER TRAIL)
Big Lake
SIR WINSTON CHURCHILL AVENUE
CUNNINGHAM ROAD
FOREST DRIVE
FARMSTEAD AVE
SUNSET BLVD
SYCAMORE AVE
SALISBURY AVE
STERLING CRESCENT
HEBERT ROAD
FALSTAFF AVE
ALPINE BLVD
AKINS DRIVE
ATTWOOD DR
ATTWOODDR
ARLINGTON DR
ARLINGTON DRIVE
GATE AVE
ST. ALBERT TRAIL
GERVAIS ROAD
GLOUCESTER DRIVE
GOODRIDGE DRIVE
WOOD LANDS ROAD
WOOD LANDS DRIVE
WESTWOOD DRIVE
WAVERLY DRIVE
WILLOUGHBY DRIVE
KINGSWAY DRIVE
KINGSWOOD DRIVE
KIRK WOOD DR
PARK AVE
PARKWOOD DR
POIRIER AVE
NELLIGAN DR
PINEVIEW DRIVE
EAGLE DR
FORESTBEAU DRIVE
BOURBEAU ROAD
CARLETON DRIVE
CENTRE STREET
CHEVIGNY ST
CORRIVEAU AVE
CARNEGIE DR
CHISHOLM AVE
CHATELAIN DR
CAMPBELL ROAD
VENESS ROAD
OURAL DRIVE
Legend
Schools
City Facilities
Hydrology
City Boundary
Existing Fibre
2018 Fibre
2019 and Beyond

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

**Date:** October 6, 2017 **File:** 2017-3919.00.A.04.02

**To:** Dean Schick

**From:** Keenan Kitasaka, P.Eng., Jessica McLennan, EIT

**Project:** ITS Strategic Plan Development

**Subject:** Environmental Scan

# MEMO

Conducting an environmental scan of ITS "best practices" in similar jurisdictions across Canada will validate the approach of the St. Albert ITS Strategic Plan and assist in assessing appropriate technologies, applications and programs. This type of scan provides awareness of the approaches, successes, technologies, budgets, resource requirements, and data management issues found in other plans. The Environmental Scan is comprised of two sections:

1. A review of other ITS plans in similar jurisdictions
2. A review of ITS user services in various projects and activities, focusing on the technologies.

## 1 ITS STRATEGIC PLANS IN SIMILAR JURISDICTIONS

An investigation into ITS plans in Canada found several regional or provincial plans, but few plans for municipal areas. The transportation challenges and priorities for provinces are generally "higher level" and different than those found in municipal transportation networks. Municipal plans tend to address local issues in more detail than provincial ITS plans which are more focused on provincial concerns. Many municipalities have Transportation Master Plans (TMP), which contain ITS chapters, components and programs. Table 1 summarizes the municipal ITS plans and transportation master plans with ITS components that were reviewed as part of this Environmental Scan.

**Table 1**
**ITS Plans in Other Municipal Jurisdictions**

| Jurisdiction | Title | Published | Duration | ITS Areas of Focus |
|---|---|---|---|---|
| Durham | Intelligent Transportation Systems Strategic Plan | 2006 | 10-15 years | Traffic control and management, incident management, traveller information, public transportation services, parking control and management, emergency management, fleet management, data collection and management |
| Toronto | Congestion Management Plan 2016-2020 | 2016 | 5 years | Congestion management, incident and event response, construction coordination, curbside management, supporting all modes, traveller information, transportation operations centre, state of good repair |
| Edmonton | Transportation Master Plan | 2009 | 10 years | Traveller information, signal coordination, transit priority, incident management, congestion monitoring, data collection |
| Calgary | Calgary Transportation Plan | 2009 | 60 years | Transit priority, traffic control and management |

CANADA'S BEST MANAGED COMPANIES Platinum member

| Jurisdiction | Title | Published | Duration | ITS Areas of Focus |
|---|---|---|---|---|
| Ottawa | Transportation Master Plan | 2013 | 18 years | Transit priority |
| New Westminster | Master Transportation Plan | 2015 | 25 years | Transit Priority, traveller information, |
| Coquitlam | Strategic Transportation Plan | 2012 | 29 years | Signal systems upgrades, vehicle detection, traffic management signage, transit priority |
| Hamilton | Transportation Master Plan | 2007 | 30 years | Transit priority, optimizing road capacity |
| Victoria | Capital Regional District Regional Transportation Plan | 2014 | 25 years | Data collection, traveller information |
| Montreal | Transportation Plan | 2008 | 10 years | Traveller information, optimizing road capacity, data collection, signal system upgrades, transit priority |

The most common ITS area of focus in municipalities was transit priority, followed by traveller information. The time period that plans were designed to cover ranged from five to thirty years. The earliest plan was the Durham Region's ITS Strategic Plan from 2006. Although this is the oldest plan, it is one of the most comprehensive. The plan recognizes the unique needs of the city, outlines strategies and technologies to meet these needs, provides a long-term deployment schedule, and develops a monitoring and evaluation plan and methodology.

The Durham ITS plan has eight functional areas that were identified through stakeholder consultation, which include:

- Traffic control and management
- Traveller information
- Incident management
- Public transportation services
- Parking control and management
- Emergency management
- Fleet Management
- Data collection and management.

The functional areas are then divided into “clusters” of initiatives; for example, traffic control and management is comprised of traffic signal control, corridor traffic management, smart work zones, and transportation management centre. Each cluster of initiatives outlines short-term, medium-term, and long-term tasks to support the needs identified by stakeholders. In many ways, the Durham ITS Plan mirrors the approach of St. Albert’s plan.

The Toronto Congestion Management Plan (2016-2020) was developed to manage congestion and improve safety through innovation and technology to maximize efficiency, reliability and sustainability of the road network. This plan is an update from Toronto’s first Congestion Management Plan (2014-2018). The Congestion Management Plan sets out the following goals:

- Improve the safety of the transportation network
- Maximize the transportation system efficiency and reliability
- Improve the City of Toronto’s ability to detect and respond to incidents, events and changing traffic conditions
- Improve the availability and reliability of information for the public
- Reduce the impact of transportation on the environment.

Each of the goals are supported through measurable objectives, such as reduce the number of traffic collisions, or reduce travel time variability. These measurable objectives allow the city to see where they are having successes and failures. The key accomplishments related to each goal of the 2014-2018 plan are outlined, along with the next steps for the City to build on their prior accomplishments.

From a Provincial perspective, the Saskatchewan ITS Technical Strategy spans 10 years from 2015 to 2025, focusing on developing and building upon the “core” ITS infrastructure to be implemented in and around the urban area of the City of Regina. The core ITS infrastructure in Regina includes the following:

- Traffic data counters using microwave radar units by Wavetronix
- CCTV cameras by Axis
- Variable message signs
- “Smart” traffic signals by Econolite
- Road-weather information system (RWIS) by Campbell Scientific
- Wireless network by Sasktel
- Commercial vehicle pre-screening stations with weigh-in-motion (WIM), cameras and licence plate readers by IRD
- Data management centre as a hub for data and traffic operations.

The vision of this plan was that the core infrastructure would be expanded to include ITS devices outside of the Regina Bypass, thereby evolving into a Provincial network.

These technologies will support the user services and strategies of traveller information, traffic management, public transportation, electronic payment, commercial vehicle operations and enforcement, emergency management and safety,

vehicle safety and control systems, information warehousing, data management, traffic management centre, institutional management and marketing/education.

## 2 ITS USER SERVICES AND STRATEGIES

The ITS user services and strategies in the above ITS plans vary according to the needs of each jurisdiction. These user services and strategies evolve over time because the jurisdictions' needs may change. The following user services are most common in these plans.

### 2.1 Traveller Information Systems

Traveller information systems update users, generally drivers or transit riders, on current conditions, including delays, incidents, weather conditions, travel times, emergency alerts, and alternative routes. Providing this type of information to travellers before and during their trips allows them to make more informed, effective and efficient travel decisions. These decisions could include changing routes, modes, departure times, destinations or even cancelling the trip. Some examples of traveller information systems include variable message signs, highway advisory messages on the radio, in-vehicle and smart phone navigation, and transit wait times and routing at stations.

### 2. 2 Priority Corridors

Priority corridors allow the city to select routes for improved signal progression, traveller information provision, and safety measures. This approach is often referred to as "Integrated Corridor Management" and consider corridors as a collection of assets for transportation. These corridors can increase efficiency, and reduce pollution due to vehicle emissions. A variety of technology can be implemented along priority corridors to meet the individual needs of each corridor and allow integration with the whole network.

### 2.3 Data Collection and Management

Data collection and management is necessary for ITS technology to operate. Within the ITS architecture, the data management user service addresses how data is acquired, transmitted, processed, stored and distributed in support of ITS applications and user services. ITS programs require some form of information management and system to transport data from the field devices to a central hub. Devices such as CCTV cameras require significant bandwidth and speeds to transport video images. Fiber provides enough speed and capacity, such that there are no bandwidth issues. Where there is no fiber backbone, wireless networks can be a solution, such as with the Regina Bypass Project.

### 2.4 Smart Work Zones

Smart work zones work to alleviate bottlenecks leading to congestion due to construction. They use mobile trailers equipped with cameras and variable messaging signs to monitor and control traffic in work zones. The equipment must have the characteristics of being portable, automated, and reliable and operating in real-time. Construction creates conditions that don't align with driver expectations and can lead to frustration. Smart work zones can reduce frustration, encourage alternative routes, reduce congestion, clear incidents, and improve safety for drivers and highway workers.

### 2.5 Intelligent Fleet Management

Intelligent fleet management uses technology to improve routing, fuel usage, maintenance, and safety. Cities have vehicles for a variety of reasons including transit, snow and ice removal, maintenance, parking control, and construction purposes. Technology that can be installed includes vehicle tracking, telematics, vehicle self-diagnostics, remote disabling systems, and smart surveillance. Smart surveillance can collect data on mileage, speed, braking style, and fuel consumption. Pothole detection technology can inform local authorities about the location and severity of potholes, and reduce the need to inspect roads.

### 2.6 Transit Priority

Transit priority gives preferential treatment to public transport vehicles. Transit priority can be in various forms include signal priority, transit queue jumpers, and bus only lanes. Transit Signal Priority (TSP) allows transit vehicles (including buses and light rail trains) to travel through a signalized intersection by first detecting a transit vehicle and extending or truncating green cycle times at traffic signals to allow the transit vehicle to travel more efficiently and better adhere to schedules. This service increases reliability, and consistency, reduces commutes, fuel usage and fleet costs. Improving transit operations and efficiency can increase rider satisfaction and overall ridership.

## 3 TECHNOLOGY AND APPLICATIONS

Technologies form the backbone of ITS programs. Starting with the field devices and on-board systems that collect data, the information is transported to a traffic management centre, often via wireless or fiber optic network. The traffic management centre houses data hubs and operation work stations that monitor the status of the various corridors and intersections as part of the network.

Many technologies are common to several ITS user services and applications. For example, CCTV cameras are often used in incident management and traveller information systems. Some technologies are very common and visible, whereas others are unique and new. The following technologies are found within the ITS programs that were reviewed as part of this Environmental Scan.

### 3.1 Traffic Monitoring Cameras

Traffic monitoring cameras can detect problems on the road, work with emergency responders, and provide public travel information. These types cameras are placed near traffic signals, along busy roads, or on poles or gantries on highways. The cameras can be used to support various programs, policies or data collection purposes. They can be used to record traffic patterns for future study, monitor traffic, issue tickets for violations, and encourage safe driving. They can inform traveller information systems or be used for vehicle presence detection instead of installing sensors in the road. The current CCTV cameras on the market are quite versatile, with zooms of 30+ and temperature ranges of -40 to +50 degrees C.

### 3.2 Adaptive Traffic Signal Control Systems

Adaptive traffic signal control systems are tools to respond automatically and intelligently to fluctuations in traffic flow through the use of on-street detectors and central software. Adaptive signal control varies from the more common signal progression schemes in that it monitors every traffic movement into and out of a road segment. In addition, adaptive signal control strategies will dynamically alter or “adapt” the signal timing plans in upstream or downstream intersections, based on the real time traffic flows that are detected. It coordinates the operation of all the traffic signals in an area or corridor to improve progression to vehicles through the network. It removes the dependence on signal timing plans and the requirement to periodically update those plans. The use of real-time traffic data allows signals to update automatically to events that cannot be anticipated, such as accidents and road construction.

### 3.3 Variable Message Signs

Variable message signs (VMS), or dynamic message signs are electronic traffic signs that give travellers enroute information about special events, congestion, accidents, roadwork, speed limits, safety warnings, or travel times. They are versatile and the fonts are monochrome (often amber) or color. VMS are often installed on the roadside or overhead on a gantry or pole. The sizes of the VMS vary and can depend on the available road right-of-way. The VMS on the Regina Bypass are three lines high by 25 characters wide.

### 3.4 Traffic Operations and Management Centres

Traffic operations and management centres (TMCs) function as a focal point for all communications, traffic monitoring and control. TMCs receive and analyze information on traffic flow and conditions, evaluate them to detect accidents, and make decisions on a response. Traffic operation and management centres usually consist of a central computer system, communications equipment, a video wall comprised of CCTV monitors, camera control equipment, and equipment to dispatch emergency and maintenance vehicles to problem locations. Geographically, TMCs tend to be central and accessible to highway corridors and the road network.

### 3.5 Traffic Detectors

Intrusive traffic detectors (loops, and in-pavement sensors) are still in use throughout North America; however, the use of loops in some areas have experienced failures due to many factors including increasing traffic (particularly trucks), water damage, and pavement degradation. The trend for many jurisdictions in the plans that were reviewed is towards non-intrusive technologies such as microwave radar counters. These units are attached to poles or gantries on the roadside and can provide accurate lane-by-lane data, including traffic volumes, speeds, headway, density, and vehicle classification (by length).

### 3.6 Road-Weather Information Systems (RWIS)

The technologies in many RWIS user services, such as in the Regina Bypass, contain a variety of sensors that will monitor environmental and local weather conditions. Parameters such as air temperature, barometric pressure, surface

pavement temperature, conditions (ice, snow) and other factors are often measured. Overall, the RWIS station is used as a tool for public safety when there are extreme changes in weather and are often linked to traveller information and traffic management to inform drivers or close roads.

### 3.7 Global Positioning Systems (GPS)

GPS is a space-based navigation system, originally created by the US military. The locations of GPS satellites are known with high precision. Generally, any earth-based receiver can obtain its latitude, longitude and elevation when at least 4 satellites are within line of sight. Thus, GPS receivers are part of most ITS technologies to provide exact locations and navigation. Common devices such as in-vehicle navigation and traveller information systems contain GPS units. In addition, even stationary objects such as transit stops have GPS locations to monitor them against moving objects such as transit vehicles.

This Environmental Scan reviewed the best practices of similar jurisdictions in the areas of ITS strategic planning, ITS user services and strategies and technologies and applications. The review confirms that the approach of the St. Albert ITS Strategic Plan and the expected ITS project and applications are consistent with the current best practices in the ITS industry.

Prepared by:

Keenan Kitasaka, P.Eng.,
Jessica McLennan, EIT

JM/mc

# Appendix B – Discussion Papers

- Data Management
- Telecommunications
- Regional Integration
- City Wide ITS Deployment
- Integration of Autonomous Vehicles

PBX Engineering Ltd.

300-131 Water Street
Vancouver, BC, V6B 4M3
T + 604.408.7222
F + 604.408.7224

201-2612 Bridge Street
Victoria, BC, V8T 4S9
T + 250.388.7222
F + 778.433.9130

www.pbxeng.com

# Technical Memo

**Associated Engineering Ltd.**
Suite 300 – 4940 Canada Way
Burnaby, BC
V5G 4M5

March 02, 2018

**Attn: Keenan Kitasaka P.Eng.**

**Subject: City of St. Albert ITS Strategic Plan – Technical Memo: Data Management**

Keenan,

A key attribute of Intelligent Transportation Systems (ITS) lies in their ability to generate extensive and diverse data sets. This includes immediately actionable data, such as real time video, as well as other sources such as vehicle detectors. Such data can be an immensely powerful tool to support all aspects of transportation infrastructure, from real time traffic management to long term transportation planning.

However, making use of the data generated by ITS necessitates an effective approach to data management. Data sets can be very large, disparate, and vary significantly in quality and completeness. Data Management involves the acquisition, transmission, processing, storage, and distribution of data generated by ITS devices. An effective data management approach is a core component of a long term ITS strategy.

The growing number of data sources and resultant increase in data volume necessitates a comprehensive data management strategy, where appropriate digital infrastructure should be chosen in order to meet current and future demands. Today, demands continue to evolve, where more sophisticated real-time and historical analysis tools consume larger volumes of data. Further, advances in technology and new approaches to data integration and sharing offer opportunities to optimize and enhance ITS infrastructure.

This technical memo will discuss aspects of an effective data management strategy and a strategy for a future data management platform. Recommended next steps are provided at the end to guide subsequent activities. The transmission of ITS data is covered in the corresponding technical memo entitled Telecommunications for ITS.

## *1.1 Overview*

Data management is a foundational component of an ITS Strategic Plan in that it directly supports other ITS functions and initiatives.

Management and control of transportation systems are dependent on data sources describing the performance of the system. Because managers cannot simply look out of a window and understand how well a large and complex system is performing, the nature and quality of data streaming from available sources to a large degree dictate how transportation systems can be understood and managed. Traditional data streams for transportation system management are based on the deployment of infrastructure-based sensors passively detecting vehicles as they pass selected locations in the system. Several concurrent technological trends have the potential to reshape the traditional infrastructure-based, passive acquisition data paradigm.

First, vehicles and hand-held devices are increasingly capable of systematically collecting and communicating a broad range of probe data. Vehicles capable of acting as probes span the full range of light vehicles, roadway and rail transit vehicles, and freight carriers. Second, modern wireless communication technology permits an active exchange of data with and between vehicles, travelers, roadside devices, and system operators. An active paradigm allows for a systematic yet dynamic and selective exchange of vehicle status and traveler behavior data. This is inherently different than the uniform capture of vehicle location and speed data generated through passive detection. Integrating probe data sources with traditional infrastructure-based data sources into multi-source data streams may enhance the capability of current forms of system control or significantly reduce their costs. Multi-source data streams may also enable nontraditional, transformative forms of system control and management. These transformative forms of management may have the potential to increase system productivity and traveler mobility significantly while concurrently reducing environmental and safety impacts.[1]

All participants of ITS act as data generators and sources leading to a huge amount of available data with short update rates. This growth in data production is being driven by individuals and their increased use of media, novel types of sensors and communication capabilities in vehicle and traffic infrastructure, and the application of modern information and communication technologies[2].

In the context of Smart Cities, data management directly supports a number of the Proposed Actions identified in the St. Albert Smart City Master Plan[3], including:

- C.1.1 Expedite the development and implementation of an intelligent transportation system strategy for St. Albert.
- C.1.2 Work with regional neighbours to coordinate intersection timing on key transportation corridors and actively share transportation data.
- C.2.1 Provide transportation data and digital trip information, directly and indirectly, to travellers considering all modes of mobility.

Key elements of overall data management include: acquisition, transmission, processing, storage, and distribution. In addition, governance of data management processes requires attention be paid to data ownership, data security, and data privacy.

As the City implements and expands Intelligent Transportation Systems (ITS) initiatives, managing the vast amount of data will require strategic planning and careful choices in emerging technologies. Adopting key technologies within the framework of a comprehensive and integrated service strategy will help to expand the City's ability to service data consumers throughout the region.

The recommended data management and warehousing model will collect and manage real-time data streams from disparate sources across the City (and region), and store this data in a central and secure repository. For many technologies, such as CCTV cameras, bandwidth and storage will become important factors in efficiently managing the systems. The data warehouse system will likely also be required to link with devices and data sources located in adjacent areas of the region that may not necessarily be under the City's control. Current and historical data stored in a central location will be available to be used to generate data analysis and reporting tools servicing the City's public and private interests alike.

[1] Data Capture and Management Program Vision, US DoT ITS JPO, https://www.its.dot.gov/research_archives/data_capture/datacapture_management_vision1.htm

[2] Big Data Processing and Mining for Next Generation ITS, Fiosina-Muller-Fiosina, June 2014, [P1]

[3] City of St. Albert Smart City Master Plan, October 2016 [P59, 61, 62]

The core objective of this initiative is to improve the reliability and efficiency of the City's road network, so that current and future sensor capacity and functionality requirements can be satisfied with confidence. In addition, this program aims to increase data quality delivered from the City, to citizens, and third-party business interests.

As the components of traffic systems become more autonomous and smarter, there is an increasing need for cooperation among systems for transportation management and environmental monitoring in order to improve traffic management strategies[4]. Live and current communications along the City's streets, supported by a scalable data management system, will enable the City to adopt a forward looking vision for transportation initiatives. By leveraging emerging ITS and other technologies, the City will be positioned to enhance their level of service, increase reliability, and improve transportation safety.

## *1.2 Big Data and ITS*

Any modern discussion of data management would not be complete without mentioning the concept of Big Data. Big Data usually includes data sets with sizes beyond the ability of commonly used software tools to capture, curate, manage, and process the data within a tolerable elapsed time[5]. Within the transportation context, Big Data has the ability to both overwhelm and inform. If not handled with care, Big Data can easily add to the complexity of a corporate IT environment[6]. Particularly, as emerging technologies such as Connected and Autonomous Vehicles move closer to real world deployments, the sheer volume of data produced has the potential to grow immensely. Emerging best practices clearly point to the need for a Big Data strategy and architecture that promotes incremental deployments and agility in development and adoption of new technology components[7]. Even now, mobile devices provide a large and rich data source and commercial vehicles are a veritable suite of rolling sensors. Data sets grow in size because they are being gathered increasingly by ubiquitous information sensing mobile devices, aerial sensory technologies, software logs, cameras, radio frequency identification readers, and wireless sensor networks[8].

While cities may currently have modest data management needs, the growth of new technologies and corresponding growth in data production will further reinforce the need for a comprehensive data management strategy. In particular, an effective data management strategy will support the realization of value from these new and large data sets by enabling effective analytical processing to be implemented. While Big Data may be a future consideration for a given City, it is prudent to plan ahead.

## *1.3 The Internet of Things*

Historically, data collection and dissemination has followed a very standard set of Information Technology processes and procedures, whereby agencies collected data from devices, stored it in discrete storage media, and accessed it with disparate software applications.

[4] Big Data Processing and Mining for Next Generation ITS, Fiosina-Muller-Fiosina, June 2014, [P1]
[5] Big Data Processing and Mining for Next Generation ITS, Fiosina-Muller-Fiosina, June 2014, [P1]
[6] Six Patterns of Big Data and Analytics Adoption, Dan Vesset, June 2015 [P1]
[7] Six Patterns of Big Data and Analytics Adoption, Dan Vesset, June 2015 [P2]
[8] Big Data Processing and Mining for Next Generation ITS, Fiosina-Muller-Fiosina, June 2014, [P1]

The rapid proliferation of IP-enabled devices has changed the technology landscape. Today, almost every technical device people use or interact with on a daily basis has an IP address. The proliferation and penetration of this addressable technology has led to a new level of connectivity and data gathering: The Internet of Things. The Internet of Things (IoT)[9] is described as a network of physical objects - devices, vehicles, field infrastructure, buildings, and other items - embedded with electronics, software, sensors, and network connectivity that enables these objects to collect and exchange data. These devices collect useful data with the help of various existing technologies, and then autonomously flow the data between other devices. IoT is expected to generate large amounts of data from diverse locations, with the consequent need for quick aggregation of the data and an increase in the need to index, store, and process such data more effectively.

The IoT extends into all areas of modern living, including transportation. Many agencies, including transportation agencies, are working to establish frameworks for supporting and leveraging this inevitable technology direction. IoT has even driven a new communication framework: LTE-M. **LTE-M** is the abbreviation for LTE Cat-M1 or Long Term Evolution (4G), category M1. This technology has been developed specifically to support the connection of IoT devices directly to a 4G network, without a gateway[10].

The recently released Canadian Transportation Act Review Report[11] notes that the Internet of Things (IoT) is one of the major disruptive technologies that is poised to change transportation in Canada.

Forward-looking data management strategies therefore need to consider and plan for the IoT.

## *1.4 IoT Platform Strategy*

### *1.4.1 Architecture*

In consideration of the technology landscape and the long range vision of the ITS Strategic Plan, the recommended data management strategy is centred around the creation of an information hub called an IoT Platform. This represents a more modern approach, consistent with the strategies being employed by other agencies; one that better leverages modern application development and data integration principles. This is intended to be a longer term implementation plan that moves the City from current practices into a comprehensive system, which will ensure that scalable and trusted services are delivered well into the future for many different types of field devices with varying bandwidth and data streaming requirements.

An IoT platform is the support software that connects hardware, access points, and data networks to other parts of the value chain (which are generally the end-user applications). An IoT Platform will be able to meet the demands of major services, such as ITS programs.

[9] Source: Wikipedia (paraphrased)

[10] https://www.link-labs.com/blog/what-is-lte-m

[11] http://www.tc.gc.ca/eng/ctareview2014/canada-transportation-act-review.html

ITS data management components, such as field device management, data collection and data distribution, will largely be implemented by the core functionality of an IoT Platform. The deployment of field devices on top of the IoT Platform requires minor integration effort, instead of the significant effort required to develop and deploy adhoc, "siloed" systems with a mix of management, collection and distribution implementations. By centrally locating core system services within a single platform, it will be possible to realize direct benefits to multiple field sensor and camera systems whenever additional investments in the underlying IoT Platform are made.

An IoT Platform consolidates the management, collection and distribution services into a single platform upon which sensor systems can more easily be deployed. It represents an easily-consumable repository of data that can be leveraged in conjunction with other enterprise data sources within government, or data sources outside of government, to explore new sensor data applications. The IoT Platform will better enable innovation and rapid development of new data applications within the government and private sectors.

IoT platforms typically handle ongoing management tasks and data visualization, which allow users to automate their environment. These platforms can be conceptualized as the middleman between the data collected from field devices and the user-facing application.

An IoT platform is a suite of components that enable:

- Deployment of applications that monitor, manage, and control connected devices
- Remote data collection from connected devices
- Independent and secure connectivity between devices
- Device/sensor management
- Integration with 3rd party systems

The IoT Platform enhances the discoverability of available field devices, extends the reach of sensor networks, and establishes a single source of truth for field data that is all available through a single service endpoint. It will enable investments in existing and future ITS systems to be leveraged by a greater number of users and services, both within and outside the City, in a reliable manner.

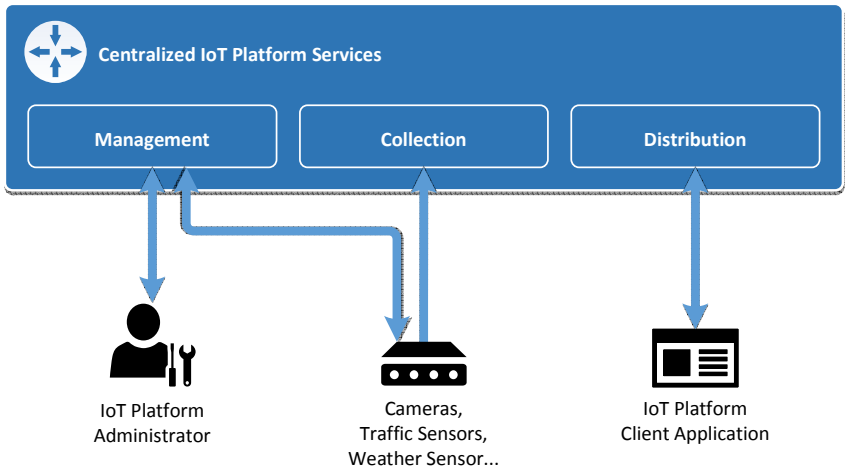



**Figure 1: IoT Platform Services**

Additional benefits of implementing an IoT platform include:

- Secure, highly-available, and scalable camera & sensor system platform;
- Operational efficiencies for sensor systems through consolidation of common services into a shared IoT Platform;
- Rapid deployment of new sensor systems as a result of not having to re-implement common sensor system services that already exist within the IoT Platform;
- Improved field device program governance, including co-location of the City's sensor data;
- Improved data validation and data quality monitoring processes to increase sensor data reliability, and correspondingly, user confidence in the sensor data;
- Consistent enforcement of evolving information management policies for all sensor systems deployed to the IoT Platform, from a single location;
- Enable rapid innovation of new sensor data applications, by linking the City and entrepreneurs with sensor networks through central, easily-consumable services;
- Better issue resolution processes supported by effective reporting and notifications practices; and
- Efficient IT development methodology leveraging Open-Source Software (OSS).

The IoT Platform represents a progressive-approach toward sensor system management, and lays the foundation for a system that will enable the City and residents to leverage vast amounts of data generated by current and future applications. With the introduction of the IoT Platform, a common framework for deploying sensor systems can then be established, which is expected to result in significant operational efficiencies that can be realized by any department that is currently operating, or looking to operate a sensor system.

At a high-level, the major services of the IoT Platform are summarized as follows (refer to Figure 2):

- **Device Management:** System administrators will use management services within the IoT Platform to provision "devices" using consistent security and access control policies. Through centralized management of devices, it becomes possible to track sensor assets from one location, regardless of device type, and monitor device usage to drive investment decisions for expanding camera & sensor networks.
- **Data Collection:** Sensor data collected through the IoT Platform's single ingestion point goes through a corresponding data processing pipeline. Data processing pipelines are composable, so that as little or as much data processing as is required may be completed before loading the data into an appropriate data store.
- **Data Distribution:** Sensor data stored in the IoT Platform is made available to consumers (users or application services), through a common, secure portal for all data distribution services (i.e. Application Programming Interface [API] Gateway). With a single API Gateway for the entire IoT Platform, it becomes possible to leverage multiple types of camera & sensor data through a single endpoint on the web, while ensuring security and access control policies are more consistently applied.

Therefore, in simplest terms, the IoT Platform connects device sensor networks that produce data, with consumers looking to derive value from the collected information, as illustrated in Figure 2 below.

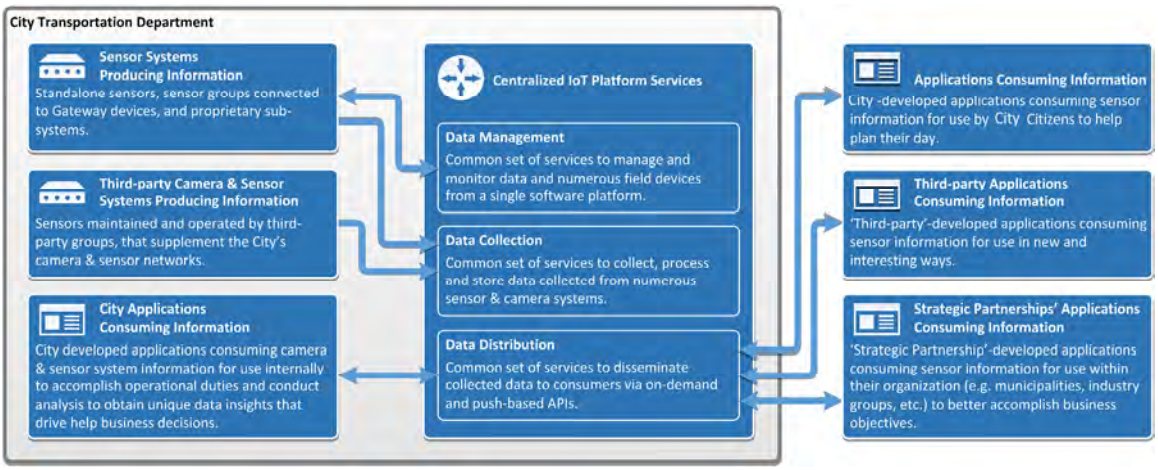



**Figure 2: IoT Platform Services**

The interconnection of the major functional components is illustrated at a high-level in Figure 3 below.

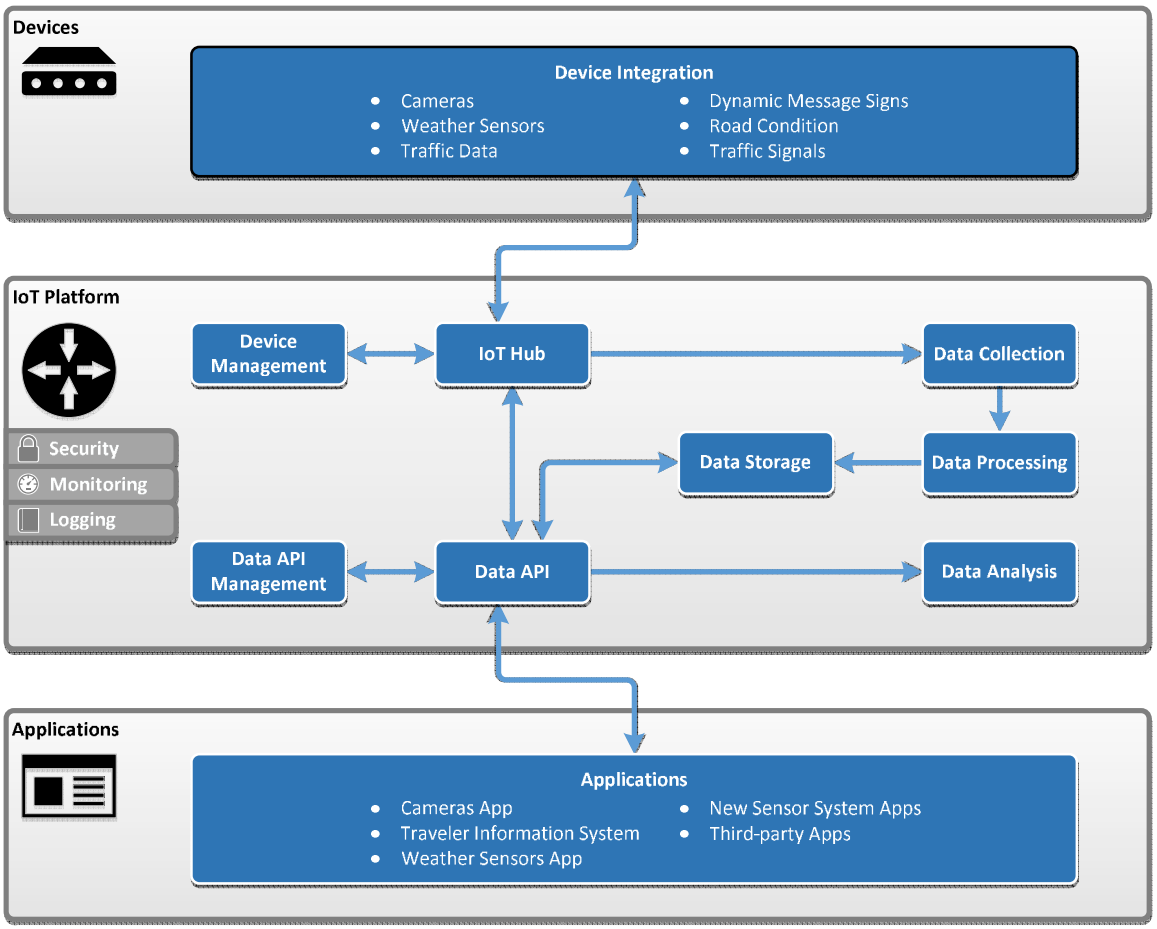



**Figure 3: IoT Platform Functional Architecture Diagram**

### 1.4.2 Device Integration

The IoT Platform will collect data from many different types of sensors (similarly, devices). While some sensors will have sufficient computing resources to communicate directly with the IoT Platform to exchange information, others may feature only low-power wireless communications and/or limited computing resources. In this case the IoT Platform will be configured with a "IoT Gateway field device" in order to communicate indirectly with remote field devices with sporadic and often interrupted communication links. Remote devices with store-and-forward capabilities can be integrated with the IoT platform using data burst features.

Some sensors may feature proprietary methods of information exchange that are supported only by correspondingly proprietary head-end software. It will be necessary to integrate such proprietary sensor sub-systems as needed, by incorporating a software service that interfaces with the proprietary head-end software and publishes all associated sensor data to the IoT Platform – therefore, functioning in a manner similar to an IoT Gateway field device.

Therefore, the two major device integration scenarios to be supported are summarized as follows:

- Sensor ↔ IoT Platform
- Sensor ↔ IoT Gateway Field Device ↔ IoT Platform

### 1.4.3 Device Management & Monitoring

To manage the many devices integrated into the IoT Platform, device management & monitoring services will be provided. The device management & monitoring services will include the following functionality:

- Device Core Management & Monitoring
- Device-Specific Management & Monitoring
- Device Security Management
- Device Maintenance Management

The IoT Platform will maintain a global registry of all devices added to the IoT Platform – the Device Registry. Core details pertaining to each device's identity will include: unique device ID, device type, geographic location, status (enabled or disabled), basic diagnostics (e.g. last active time), maintenance details, security settings, and messaging policy settings. Core Management & Monitoring services will be supplemented with Device-Specific Management & Monitoring services as required to meet unique integration requirements for a particular sensor type.

A Device Maintenance Management area within the management services will enable maintenance-related information to be associated with the device, including:

- Maintenance Agency Name
- Maintenance Agency Contact Information
- Email Distribution List for Device Issues
- Maintenance Log

### 1.4.4 IoT Hub

At the interface between the IoT Devices and the IoT Platform is the IoT Hub that provides reliable, bi-directional communication necessary to enable the following data flows:

- Publishing sensor data and events from devices to subscribed IoT Platform services, and,
- Publishing of sensor requests from IoT Platform services to subscribed devices.

The IoT Hub will implement Security Middleware to enforce device authentication and message exchange policies set through the device management services. The security middleware will reject connections from any devices that present invalid or insufficient security credentials.

### 1.4.5 Data Collection

Sensor data for the IoT Platform will primarily be ingested through the IoT Hub and placed onto a data processing queue. There are three major data collection modes through which sensor data could be placed onto the data processing queue:

- In-band Data Collection: Field devices initiate communications and send data to the IoT Hub.
- Out-of-band Data Collection: The IoT Hub initiates communications and polls field devices for new data.
- Third-party Data Collection: Methods developed to collect data from devices maintained and operated by third-parties.

Sensor data for the IoT Platform would be processed, then loaded into data storage processes services in real-time (as network connections allow). The data processing services then applies one or more of the following operations:

- **Data Transformation:** The data transformation logic consists of mapping sensor data from its native format to a normalized data structure, which may include conversion of data from one unit of measurement to another (e.g. inches to millimeters).
- **Data Validation:** Ensures a basic level of data quality. Validation logic defines acceptable ranges of values in which the data may exist, and detects failed communications.
- **Data Loading:** Loading data into one or more data stores that are best suited for later querying and reporting of the sensor data.
- **Real-time Data Analytics:** Additional information from sensor data can be extrapolated by comparing it with other sources of sensor data, or performing some other compound processing operations.

### 1.4.6 Data Storage

Central to the IoT Platform are the data storage facilities through which the significant amounts of sensor data will be stored. The appropriate type of data store for a given type of sensor data depends upon its type and structure. The following types of sensor data, for example, can be ingested into the IoT Platform:

- Cameras: Images, video and events
- Travel times: route travel times and congestion metrics
- Traffic Data: volume, speed, vehicle classification

- Weather Sensors: Weather observations such as temperature, humidity, precipitation, wind speed, etc.

In addition to sensor data, the data storage facilities of the IoT Platform will store system-wide configuration data, analytics, and logs.

Data Quality Services will regularly monitor recently loaded sensor data for any obvious data inconsistencies or abnormalities, to ensure data quality.

Data Downsampling and Retention Services will be required to manage the significant amounts of data generated by the IoT Platform. In particular, services to downsample data as it ages and permanently delete other data after specified periods of time, will assist in regulating growth of the underlying database, and ensure data storage is being used efficiently.

#### *1.4.7 Data Analysis*

Data Analysis facilities would be a feature of the IoT Platform, which would allow users the ability to realize basic data visualizations, and conduct deeper analysis of sensor data to identify trends and unique insights using Business Intelligence (BI) tools. The BI tools enables users to view and explore sensor data in new and interesting ways, in order to unlock additional data insights that can be used to drive and support business decisions.

Although sensor data will primarily be exposed through the consumer-facing Data API, the additional Data Querying & Reporting APIs will provide finer-grained access to sensor data, and better enable loading and exploration of bulk datasets from one or more of the storage services, for detailed analysis by privileged consumers.

## *1.5 Next Steps*

The proposed strategy for implementing a Data Management system is forward-looking, in that it will leverage new and emerging technologies as the City develops and implements ITS programs and services. The core deliverable for this system is the IoT Platform upon which sensor systems for transportation will be deployed. IoT is an emerging field that continues to evolve, and is expected to grow significantly over the next several years as more and more sensors become capable of network communications. Data and information are important aspects of government services. By advancing City-wide strategic initiatives in data collection and management, the City can better manage programs, current and future, and make decisions effectively.

While the development and implementation of an IoT Platform is a significant undertaking, it can be implemented in phases. In the short term and in the context of the overall ITS Plan, it is more important to expend capital budgets on deploying infrastructure rather than developing integration platforms. To maximize the effectiveness of new ITS infrastructure (particularly, the data available from it), there are lower cost interim services that could be implemented to provide improved value to motorists. A good example of such an interim service is a traveler information website. The robust and feature-rich user services for motorists now offered by many transportation agencies often had very humble beginnings. Examples could include adding travel time % deviation metrics to the StATRACKER Performance Dashboard page on the City's website. Another example could be a Road Conditions page with traveler information that includes image captures from webcams, travel time heat maps (from Bluetooth detectors), and current DMS messages (when deployed). Once the devices are implemented, developing and deploying the Road Conditions page is a relatively straightforward endeavor – one that can provide immediate value and generate use and further interest in more data and services. Such a page could be implemented using the existing government Road Conditions website framework.

In the short to medium term, another potential incremental step is to deploy a Commercial Off The Shelf (COTS) Advanced Transportation Management System (ATMS) to use as an interim integration platform. There are a number of providers of such systems, with varying degrees of sophistication. ATMSs generally provide data collection and reporting, device control, and information dissemination functions, similar in principle to the proposed working modules of the IoT platform. It is understood that the City currently uses the CENTRACS signal management system. While Centracs does have some of these features, there are other solutions that may be worth considering. The key difference between an ATMS and the proposed IoT platform is the open nature of the module development, APIs, and other functions. It is expected that IoT platforms will benefit substantially from the vast network of web developers and open source components.

A particular medium term consideration is the opportunity for lessons learned from other jurisdictions. While the IoT Platform may seem a long way off, other jurisdictions are in the process of implementing similar platforms right now. It is therefore likely that meaningful best practices that can help inform and guide the implementation will be available in the foreseeable future.

As noted, in the short term, deploying ITS technologies to support better monitoring and management of transportation infrastructure will provide immediate and long term benefits. Regardless of the data management strategy that is eventually implemented, data sources and field devices will be required. Therefore, increasing the ITS footprint within the City should be a high priority.

In the interim, planning for a long term integration platform can commence. Steps towards the implementation of a comprehensive data management strategy are outlined below.

1. Definition of information flows and data structures as part of the planning phase for all new technology deployments.
2. Development of functional requirements for the implementation of a traveler information web page that can be developed and deployed in the near term to provide increased value to motorists and generate additional interest in ITS data. The deployment of the site should be timed with the deployment of other early winner projects, who's data or functionality can be showcased. Consideration should be given to making this web page a prominent and accessible feature on the City website.
3. Development of functional requirements for the new platform. Articulate the business drivers and functional and technical requirements of the new system.

4. Development of a migration strategy. Develop a phased migration strategy that maps current processes, devices, and people to the needs of the new platform.

Please contact me if you have any questions or require any further information regarding this technical memo.



Regards,

**Ian Steele P. Eng.** Principal
Senior Systems Engineer

PBX Engineering Ltd.

300-131 Water Street
Vancouver, BC, V6B 4M3
T + 604.408.7222
F + 604.408.7224

201-2612 Bridge Street
Victoria, BC, V8T 4S9
T + 250.388.7222
F + 778.433.9130

www.pbxeng.com

# Technical Memo

**Associated Engineering Ltd.**
Suite 300 – 4940 Canada Way
Burnaby, BC
V5G 4M5

March 02, 2018

**Attn: Keenan Kitasaka P.Eng.**

**Subject: City of St. Albert ITS Strategic Plan – Technical Memo: Telecommunications**

Keenan,

Intelligent Transportation Systems (ITS) offer the potential for significant value for transportation agencies through improved monitoring and traffic management. ITS infrastructure, by its nature, relies on the deployment of technology to realize this value. Telecommunications infrastructure needs to be implemented in parallel to ITS field device deployments and is therefore a core component of an effective ITS strategy.

This technical memo provides a high level overview of options for developing a sufficiently robust network to interconnect ITS infrastructure, as well as an overview of other related considerations, such as field device bandwidth, data transmission, and security. Recommended next steps are provided at the end to guide subsequent activities.

## *1.1 Overview*

A robust telecommunications network that supports transmission of field data to a central hub, as well as inter-agency data exchange, is essential to the operation of ITS. Network technology is a constantly changing field whose evolution is often guided by infrastructure designers and administrators as well as the end user. From gigabit Wi-Fi networking to 40Gbps and 100Gbps network backbones, IPv6 adoption, 5G LTE, Radio Frequency Identification (RFID)/tolling/Dedicated Short Range Communications (DSRC) for vehicles and transportation infrastructures, virtualization and storage technologies, video encoding schemes, to explosive growth of network video traffic as well as the use of social media, the technology landscape as a whole has changed dramatically. While these changes drive increased end user expectation from today's and tomorrow's transportation systems, they also enable innovative services and collaboration models to be delivered. Investments in regional telecommunications infrastructure is costly and must support several lifecycles of rapidly evolving end point devices, systems, and applications. Considered network architectures must account for this fact and focus on optimal realistic models while meeting operational needs and acknowledging a City's jurisdictional and financial constraints.

The key objective of this telecommunications discussion is to improve the scope and reliability of the network, so that current and future sensor capacity and functionality requirements can be satisfied with confidence.

In addition to being an important supporting sub-system for ITS devices, telecommunications infrastructure directly supports a number of the Proposed Actions identified in the St. Albert Smart City Master Plan[1], including:

- C.1.1 Expedite the development and implementation of an intelligent transportation system strategy for St. Albert.
- C.1.2 Work with regional neighbours to coordinate intersection timing on key transportation corridors and actively share transportation data.
- C.2.1 Provide transportation data and digital trip information, directly and indirectly, to travellers considering all modes of mobility.

## *1.2 ITS Field Devices*

This section provides an overview of the types of devices typically deployed by transportation agencies and their respective considerations. These field devices will provide the principal input into the requirements for the supporting network infrastructure.

### *1.2.1 Field Device Bandwidth*

The bandwidth required to support field device data transmission will affect the transmission medium selected. The current and planned ITS devices represent a broad spectrum of bandwidth and protocol requirements. The following table summarizes generally expected bandwidths and protocols for various ITS devices.

| Type | Description | Approximate Required Bandwidth | Protocols Supported |
|---|---|---|---|
| Advanced Traffic Controller (ATC) | Smart Switch controlling devices such as gates, traffic detectors, and signals. | <100kbps | Ethernet (10/100Base T) or RS232 |
| PTZ Camera | Controllable camera | 0.5-3Mbps | Ethernet (10/100Base T) H.264/.265, MPEG4, or MJPEG encoding |
| Fixed Camera | Fixed camera | 0.5-3Mbps | Ethernet (10/100Base T) H.264/.265, MPEG4, or MJPEG encoding |
| Web camera | Similar to either a fixed or PTZ camera, but typically limited to providing still images. | 128kbps | Ethernet (10/100Base T) MJPEG files |
| BlueTooth Detector | Route travel time information; Origin-Destination information. | <100kbps | Ethernet |
| Vehicle Detector Station | Traffic count station for collection of volume/speed/occupancy data. Can be remote, or connected to signal controller. | <250kbps | Ethernet, RS232 |

[1] City of St. Albert Smart City Master Plan, October 2016 [P59, 61, 62]

| Type | Description | Approximate Required Bandwidth | Protocols Supported |
|---|---|---|---|
| Commercial Vehicle Operations (CVO) | Range of technologies for vehicle and cargo management including Weigh-In-Motion (WIM), transponder, or RFID components. | <100kbps | Ethernet (10/100Base T) or RS232 |
| Dynamic/Changeable/Variable Message Sign (DMS/CMS/VMS) | Message sign capable of displaying programmable messages. | <100kbps (note: communication link typically has a very low demand factor> | Ethernet (10/100Base T) NTCIP-compliant protocol |
| Road Weather Information System (RWIS) | Various types of sensors (air temperature, pavement temperature, humidity, visibility, etc.). Generally integrated into a data logger. | <250kbps (Devices generally polled for data at regular intervals> | Ethernet (10/100Base T) Modbus or other similar protocol. |

Bandwidth requirements on a project or program level will be determined by the aggregate bandwidth of the various types of devices involved.

### *1.2.2 Device Standards*

Where possible, the use of standards-based devices and software should be employed. In particular, the National Transportation Communications for ITS Protocol (NTCIP) standards set is important to consider, particularly with devices such as DMS, where standards-based controllers greatly simplify installation and reduce costs. NTCIP is a family of open standards that define data communication protocols between transportation centres and transportation field devices (C2F) as well as between two or more transportation centres (C2C). Utilizing devices and software that are NTCIP compliant ensures that all devices speak the same "language" and are able to seamlessly share information with one another. The two main goals of NTCIP are to facilitate interoperability and interchangeability of roadside transportation electronic devices. Interoperability allows different types of devices to communicate on the same network, while interchangeability allows the same type of devices from different vendors to communicate. The benefits of NTCIP include:

- Supporting interagency coordination: C2C communication allows for the sharing of information between multiple agencies as long as they all utilize NTCIP compliant software and devices. If authorized, this could allow one agency to control devices operated by another agency regardless of the device vendor.
- Allowing for future system expansion and avoiding obsolescence: By utilizing NTCIP compliant management software, future system expansion is easily achieved because all NTCIP compliant devices can be more easily integrated.
- Competitive bidding and vendor choice: A computer that supports NTCIP is able to communicate with any device, regardless of vendor, that is also NTCIP compliant. As such, the number of options and vendors to choose from increases.

C2F communication refers to the transfer of data between management software on a remote computer and roadside devices such as dynamic message signs, traffic signals, vehicle detectors, or closed circuit television cameras (CCTV) among others. C2C communication refers to the peer-to-peer transfer of data between separate management software systems.

## *1.3 Fibre Optic Networks*

As a technology, fibre optic cable has been in use for decades. Increasingly, agencies are taking advantage of the benefit of fibre optics on a wider, regional basis to both increase the capabilities of their networks, as well as lower telecommunications costs. The advantages are particularly prevalent for cities and municipalities who have direct control over their own infrastructure, as they are better able to coordinate and control the installation of the necessary supporting components within roadways and Rights Of Way. The trend towards network infrastructure ownership has gained significant momentum, with almost every major city actively building out or planning to build communications capacity to support their own operation and administrative needs.

The increase in connected devices drives a commensurate increase in network bandwidth requirements. These bandwidth growth challenges are being experienced by cities and corporations all around the globe and that growth may not be linear. Cisco Systems, one of the world's leading providers of network equipment, has predicted that from 2015 to 2019 a compound annual growth rate of 20% will be experienced for government and business bandwidth requirements[2].

Fibre optics are considered the gold standard for telecommunications networks due to their high bandwidth capacity and overall reliability. Fibre optic technology is continually being improved. Single mode fibre, the type used for long distance paths such as those required for inter-building connections within a city, can support very high data throughputs. Currently, fibre optics are able to support data rates of more than 10Gbps, with commercially available equipment now able to support up to 40Gbps. Recently released newer technology has been proven to support up to 100Gbps.

It should also be noted that there are additional benefits to implementing a fibre optic network that are difficult to quantify, but are nonetheless important. These include:

- Improved ability to monitor, manage, and respond to network issues.
- Reduced reliance on 3rd parties for configuration changes and network improvements.
- Higher network reliability and resiliency.
- Increased stakeholder satisfaction through improved services.

Construction of a wide-area fibre optic network is feasible from a technical perspective. The technology, engineering skills, and resources are readily available and the construction model has been proven in numerous other jurisdictions. Long term maintenance of such a system is expected to require minimal additional effort.

[2] http://www.cisco.com/c/en/us/solutions/collateral/service-provider/ip-ngn-ip-next-generation-network/white_paper_c11-481360.html

For cities, such networks often support more than just ITS connectivity, with corporate data sharing the same cable, if not the same network segments. Networks that support important operational roles should be designed to be as resilient as possible, minimizing single points of failure. A single point of failure is any one network element that may disrupt a network service upon failure. To maintain network resiliency, the network topology should be designed with an adequate level of redundancy.

Network topology refers to the physical arrangement of the network. The topology has a significant bearing on the effectiveness, cost, and redundancy of a network. Ultimately, the topology of the network is determined by the requirement of the network architecture, network redundancy, and construction cost. The network topology is generally comprised of the following components:

- **Nodes:** A node is a defined connection point into the network, where a network switch is present. Examples of a node include a building, an intersection, or a discrete device connection point.
- **Segments:** A segment is a defined part of the path of the fibre optic cable, used to accurately describe and cost that portion of the path. A segment is generally described by physical boundaries, such as a section of roadway between two intersections, between a branch point and an intersection, or between a branch point and a building.
- **Links:** A link is a complete connection path between two different nodes. A link may be comprised of multiple individual segments.

Once these components are identified, they can be arranged to form an integrated network topology. Common fundamental network topologies include star, ring, and mesh as follows:

- **Star Network:** A star network topology (sometimes refers to as a Hub and Spoke topology) is created when all nodes connect directly to a central core. Generally, this topology is implemented because of its simplicity and low cost, where links to nodes are simply added as required. However, this topology offers limited redundancy.
- **Ring Network:** A ring network topology is formed when each node on the network is connected to each of the two adjacent nodes, providing an alternate physical (and logical) path between all nodes. This topology can provide high redundancy and is often the preferred approach, due to the balance of reliability and low fibre strand requirements.
- **Mesh Network:** A mesh network topology is established when all or most nodes are interconnected, providing high redundancy and preventing network failure. To implement this topology, many fibre cables are required per node. Typically, a fully meshed network is often deployed for critical infrastructure and in areas of geological locations more prone to natural disasters

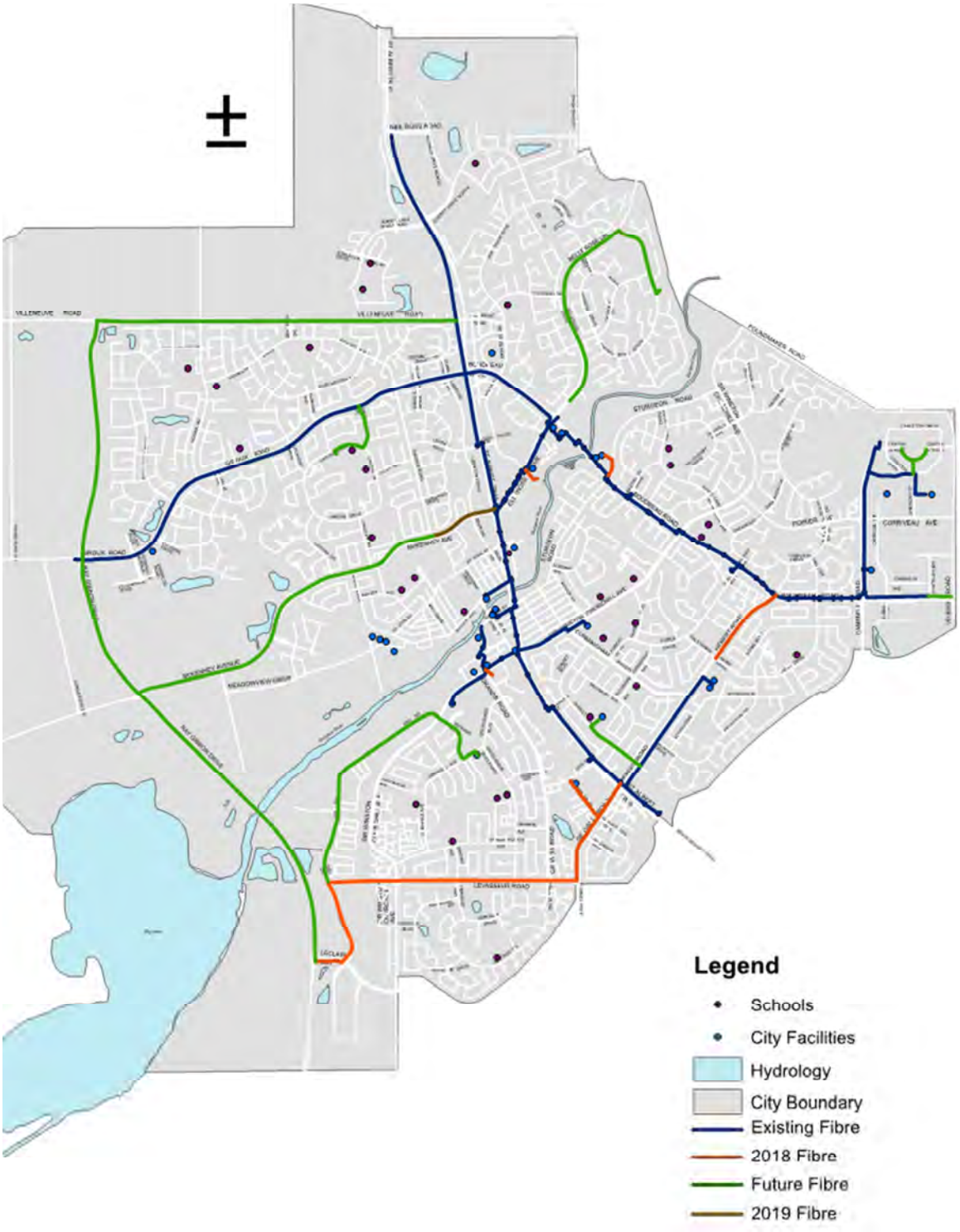
Collapsed (or folded) rings can also be created within each topology along a common physical path to create and improve logical (but not physical) redundancy. The primary drawback of the fibre optic network is the significant upfront capital cost necessary to undertake the implementation. However, once completed, this investment in telecommunications infrastructure would establish a foundation that would support the projected growth in service demand well into the future, while substantially reducing long term operational costs.

City infrastructure is continually evolving. Roads are upgraded and underground infrastructure is replaced, repaired, or expanded regularly. To accomplish these upgrades, the road surface must be exposed, trenched, and restored. Because the trenching, backfilling, and surface restoration is such a significant part of any underground communications duct installation, agencies can save considerable costs if communications ducting is installed in coordination with other municipal projects, such as water or sewer upgrades. This helps to facilitate future fibre optic cable expansion. As demand increases, network connectivity can be expanded to reach more facilities.

If an agency has a well-documented and well-circulated set of standards, it becomes much easier to plan for and gain acceptance for co-sharing of project scope.

### *1.3.1 Existing and Proposed Fibre Infrastructure*

From the information provided, it is clear that the City has already implemented fibre optic infrastructure and has plans to expand the network. The following figure shows the existing and planned fibre optic infrastructure footprint.




The existing fibre infrastructure is configured in a star topology with several main trunks originating near the centre of the City. These trunks connect many of the City's facilities to one another while also providing a backbone from which other branch fibre may eventually be deployed. Future phases will interconnect these existing trunks to create physically redundant paths.

## *1.4 Last Mile Connectivity*

As noted above, the deployment of fibre optic infrastructure is capital-intensive and tends to occur over long capital infrastructure investment cycles. As such, there is an interim need to establish network connectivity to realize near-term value from the deployment of ITS devices. This section explores several options for connecting field devices to existing fibre optic backhauls, or directly to the City's corporate network, for locations where direct connectivity to the corporate network (i.e. by fibre or copper) is not currently possible – this is often referred to as "Last Mile Connectivity".

### *1.4.1 Point to Point and Mesh Wireless*

There are many wireless connectivity options and architectures that can be implemented to support field to centre data communications.

To reduce installation costs associated with conduits and cables, wireless mesh technology can be utilized to provide localized or corridor-based network connectivity to ITS devices. A wireless mesh network consists of many radio nodes organized to create a mesh network. Like a mesh network connection, a wireless mesh requires less cabling and provides cost effective and dynamic high bandwidth networks over a specific region. A wireless mesh links anchored to the fibre optic backbone can provide up to 100Mbps of bandwidth with appropriate equipment and can be extended over large distances (up to 30km in ideal conditions).

While direct fibre connections are generally favoured where feasible, wireless mesh can be a cost effective alternative for device interconnection.

To create a mesh network, multiple network nodes are required. The nodes are tied together wirelessly and should be strategically placed to reduce signal loss and reduce the number of new poles required. Each node typically consists of:

- One transceiver
- One network switch
- ITS devices

The transceiver at each node provides the access points for other transceivers or the optical network. Obstructions such as trees, buildings, or power lines should be avoided within the path to prevent reduced throughput or connectivity issues. The strategic placement of each node can reduce the number of total nodes required to cover the region and reduce cost of the overall project. A wireless study should be conducted at each corridor to provide the necessary information about the specific region before implementing a wireless network.

A point-to-point connection can be configured to allow one device to directly connect to another device without passing through other nodes. This is the simplest topology which connects two end points; this connection presents the most robust connections since no other intermediate hardware is required. This topology also presents the fast transfer of data. The wireless mesh network can also be setup in such a way that point-to-point connections are possible. However, using this topology reduces the coverage distance if the transfer throughput is to be maintained at a specified threshold. Otherwise, the distance can increase by sacrificing transfer rates.

Point-to-multipoint connections can be implemented to leverage "collector" end points which may be strategically connected to fibre or copper infrastructure; such collector locations can effectively uplink devices from several different locations relative to the receiving node without additional radios being required.

Other wireless mesh connections involves cellular modems which utilize 4G gateways to connect wirelessly to other devices. The cellular modems can be used for remote access or an interim or high priority device installation, in advance of a more robust communication backbone.

### *1.4.2 Cellular*

In areas where coverage exists, cellular data is an excellent solution for field device communication. It is straightforward to implement and is used extensively by transportation agencies throughout North America. Most ITS devices (i.e. data collection sites) are easily supported by modern 4$^{th}$ Generation (4G) Long Term Evolution (LTE) cellular networks. Indeed, many will function satisfactorily over older 3G networks. 5G (100mbps) networks are now being deployed in urban centres across North America.

With the ongoing push towards smart cities, many agencies have begun integrating asset tracking into their existing networks. As a means of connecting these monitoring devices, the recently developed technology LTE-M1 is ideal for these wide area IoT applications. LTE-M1 is a highly efficient, low-bandwidth (100kbps) solution that is designed to operate on battery power without the need for supporting infrastructure. These LTE-M1 devices enter a "deep sleep" mode whenever they are not transmitting data which results in such low power consumption that these devices can go years on a single charge.

Due to the cost of traditional cellular radio, high quantities of remote sensing applications may be too costly to tie-in to the existing network. LTE-M1 is significantly cheaper as it utilizes such a small amount of bandwidth and can be deployed almost anywhere where coverage is available.

### *1.4.3 Wi-Fi*

Wi-Fi technology (IEEE 802.11 protocol) is widely used by municipalities due to its high data rates with relatively low implementation and operational costs. While the data transfer rates are capable of streaming things like HD video, Wi-Fi has significantly shorter range than other wireless technologies. Significant improvements have been made to the 802.11 protocol allowing municipalities to begin deploying citywide public Wi-Fi.

Protocol 802.11n is the most widely used for this application as it has significantly more range than previous protocol revisions while maintaining a high data transfer rate. 802.11n is capable of transferring up to 600mbps (closer to 300-400mbps in real life applications) with ranges up to 250m when deployed outdoors.

Protocol 802.11ac is a newer Wi-Fi protocol employing wider channels and more spatial streams for duplex communications. This protocol is fully backwards-compatible with 802.11n and is capable of throughput nearing 1300mbps.

As a means of increasing the overall range of the Wi-Fi network, municipalities have been deploying large-scale mesh networks comprised of various nodes. With enough nodes, a mesh Wireless Local Area Network (WLAN) can ensure near complete coverage along city corridors and urban areas. . Some cities deploy wireless point to point mesh networks to connect signals along corridors, then implement Wi-Fi nodes at each intersection to provide local data services for maintenance crews, or support other civic activities.

## 1.5 Network Design Considerations

### 1.5.1 Bandwidth and QoS

ITS network requirements are generally dominated by streaming video from digital cameras or encoders. The stream size from a given digital camera can range considerably depending on the encoding scheme, resolution, frame rate, level of compression, and number of streams being requested. Reasonably quality video can be as low as 1Mbps or as high as 5Mbps if multiple streams are being transmitted.

Therefore, any discussion on network connection bandwidth requirements will largely centre around the quantity of cameras that will be involved. Depending on the nature of other data being shared over the link, it may be necessary to establish Quality of Service (QoS) for certain packets in order to guarantee cohesive and timely delivery. For example, scheduled sharing of historical data used primarily for planning purposes would likely not require QoS. However, roadside vehicle detector data that is being used in near real time to determine roadway congestion levels may need QoS to ensure consistent and timely data is fed to the server.

### 1.5.2 Network Availability

Network availability is a measure of the achieved connectivity uptime of the links between nodes, aggregated across all fault conditions. Good network planning seeks to mitigate sources of downtime through sound engineering. Network downtime can be caused by a variety of fault conditions, with consequences varying from degradation to complete traffic loss. The following table lists several of the most common sources of downtime.

| Fault Condition and Impact | Mitigation Approach |
|---|---|
| Discontinuity of the physical media between network nodes (ex: damage to fibre cable). Results in loss of connectivity between the nodes. | Provide redundant physical paths, with automatic failover routing. |
| Facility power failure. Loss of connectivity to all devices connected to the switch. | UPS appropriately sized for necessary runtime, properly maintained and tested.<br>Redundant device power supplies plugged into independent sources. |
| Equipment failure. Failure of an optical interface would have the same effect as a damage to the fibre cable. Failure of a switch port will result in the loss of the connected device. Other types of equipment failure may produce loss of connectivity or degradation. | Redundant equipment with failover.<br>Alternate paths with automatic failover routing.<br>Network management tools to quickly detect and react to failures. |
| Configuration error. Many network outages are a result of unexpected consequences of a network change. | Best practices for change management.<br>Written procedures for change ticketing, rollback procedures, configuration audits. |

### 1.5.3 Scalability

ITS deployments within the region will continue to evolve. Deployed networks need to be sufficiently scalable to support the inevitable increase in devices and demand. New requirements will present themselves, requiring modifications or enhancements to the network.

Examples of potential change requirements could include:

- Addition of Ethernet access ports for new field devices
- Increase in bandwidth to accommodate new video streams
- Migration to utilize newly constructed fibre paths
- Addition of new devices
- Additions or changes to the data sharing agreements between agencies

When implementing future network connections, the following principles relating to scalability should be considered.

| Principle | Description |
|---|---|
| Create policies that explicitly state how and where new connections to the network can be made. | Includes relevant VLANs for hosts, standardized designs for additional nodes, and designated nodes for external connections. |
| Specify equipment that is inherently scalable without significant disruption to the WAN architecture. | Includes the ability to add ports, upgrade link speeds, and add logical segments within the logical framework. |

### *1.5.4 Manageability*

Complex networks require appropriate management and oversight. Implementing an appropriately capable Network Management System (NMS) is critical to the long term operation and maintenance of a network. These systems include appropriate tools necessary for service assurance, such as fault detection and reporting. They also include capabilities for automating routine tasks, such as performance and threshold monitoring, logging, and configuration backups.

The NMS should be implemented at the agency level and in most instances should be able to leverage the existing capabilities of a given agency's IT department. The exact approach for managing and maintain the ITS network will depend on the governance and internal responsibility structure that is established.

### *1.5.5 Security*

Cyber security is a critical and ever-evolving concern. Network disruptions from Denial of Service attacks, data theft or tampering, or device misappropriation are all real-world examples of the threats public agencies face in today's interconnected world. As the data management strategy develops and new device and communication infrastructure is brought on line, appropriate network security and data integrity policies will need to be planned and implemented to ensure complete integrity of data and continued safe and secure operations.

In regards to how best to secure the field devices, there are several methods that can be considered. Using hardware unique identifiers to ensure only authorized transmissions, VPN, encrypted messages, and handshake protocols are several standard methods. The ideal security method and architecture will provide the highest confidence without adding unreasonable cost to the project, or threaten the overall objectives and goals that the solution is to deliver on. Generally, using unique identifiers, either device generated or randomly generate (or both) with high levels of encryption should be reviewed as the first possible solution and can be implemented in the immediate term.

The concept of security extends beyond just direct access to the network. As the data collection footprint expands through the ITS program, there is a commensurate obligation to ensure that all aspects of the data collection, ownership, management, and dissemination are properly and securely managed. The Information Standards Organization standard ISO/IEC 27002 Information Technology-Security Techniques-Code of Practice[3] for Information Security Management is a good and comprehensive guide to this topic.

## *1.6 Next Steps*

The telecommunications network will support the increasing need for bandwidth by various ITS applications as they emerge and are subsequently deployed across the City. The network will also facilitate improved traffic management in the region through the widespread use of ITS technologies. Regardless of the data management strategy that is eventually implemented, data sources and field devices will be required – and network connectivity will be necessary to support those devices. It is important that the telecommunications network be designed and implemented in parallel with the ITS infrastructure.

In the interim, planning for a long term ITS telecommunications network strategy can commence. Steps towards this strategy are outlined below.

1. Development of network interconnection standards to define how field devices and other agencies may connect to the City's network to transmit or receive data.
2. Prepare a bandwidth analysis report to identify the network capacity requirements, coordinated with the ITS device implementation plan.
3. Prepare a detailed network architecture design, considering business resiliency needs, projected network expansion, and important design considerations such as cybersecurity.
4. Prepare a network deployment plan, building on the network architecture and coordinated with the with the ITS device implementation plan, taking into consideration available capital and City budget cycles.

Please contact me if you have any questions or require any further information regarding this technical memo.



Regards,

**Ian Steele P. Eng.** Principal
Senior Systems Engineer

[3] https://www.iso.org/standard/50297.html

# DISCUSSION PAPER

**City of St. Albert**
**ITS Strategic Plan Development**

**Discussion Paper – Regional Integration in St. Albert**

| | |
|---|---|
| ***Prepared by:*** | Jessica McLennan, EIT |
| ***Issued:*** | August 2018 |
| ***Previous Issue:*** | March 23, 2018 |

## 1 Introduction

No man is an island, and neither is St. Albert as the City is at or near the geographic centroid of the Region that includes the surrounding county and neighbouring cities. For St. Albert to flourish economically and socially, links between neighbouring communities require development, maintenance, and support. The transportation links between St. Albert, Edmonton, and Sturgeon County move people and goods, support the local economy, education, and well being of communities. Using Intelligent Transportation Systems (ITS) to support these links improves safety and efficiency for those who travel on them. For these benefits to be maximized, developing regional connectivity on cross-jurisdictional corridors and modes are imperative.

Intelligent Transportation Systems (ITS) use technology to improve the efficiency, safety, and sustainability of transportation. All modes of transportation can use ITS, including transit, cycling, walking, freight, rail, marine, in addition to private vehicles. ITS technology and systems can help cities achieve a variety of goals, including decreasing congestion, increasing transit ridership, improving walking conditions, efficiently de-icing roadways, increasing safety, and providing current travel conditions. Technologies can allow people to make more informed decisions regarding how, where, and if to travel.

The true benefits of ITS are realized when integrated regionally. Transportation doesn't stop at borders and regional integration ensures that benefits don't stop at borders either. Institutionally, regional integration is an arrangement for enhancing cooperation through rules and policies between neighbouring governments. Using ITS to support regional integration will provide increased benefits, both to St. Albert, and neighbouring communities. Technologically, regional integration requires seamless design, deployment and operation of systems to serve two or more communities. Achieving this objective requires cooperation on services, standards, data management, hardware and software.

As the region moves towards deployment, the City should be familiar with two terms that sound similar but are distinctly different. These terms are commonly used but often confused in practice. Firstly, "integration" is the ability of two systems to work together, either through software (common

applications, systems) or shared hardware (systems that cross boundaries). Secondly, "interoperability" is the ability of equipment or devices on two or more different systems to work seamlessly. Interoperability is achieved, for example, when a smart card on one transit system can be used for fare payment on another.

# 2 Benefits of Regional Integration

Imagine a future where St. Albert has invested in ITS to maximize the benefits, minimizing congestion, functioning safely, and increasing sustainability. St. Albert's neighbour, Edmonton, has also invested in ITS to improve their transportation network. Now imagine your own future: You work in southern Edmonton and your children are enrolled at the University of Alberta. On your way to work, you drop them at the Village Transit Station to take the bus to the university. Their phone shows the real-time location of the bus as "FOURMINUTES AWAY – they'll be on time for their class. As you drive onto Anthony Henday Drive to head to work in Edmonton, instead of congestion, a well functioning freeway is before you. Your in-vehicle navigation system informs you of an accident ahead but that's not a problem as you divert off the freeway. Somehow all the traffic lights in front of you seem to be synchronized and you fly through the intersections. The efficiency benefits of ITS continue throughout your trip through both jurisdictions. When arriving at work on time, you complain to your colleagues about the weather, but not the traffic, because you flowed seamlessly from one city to the next. It doesn't matter who owns the road you drive on, it just matters that it functions well.

The above scenario demonstrates regional integration which has been supported in the ITS programs of both Edmonton and St. Albert. This scenario is possible with technology today and is already in place around the world. Without the investment and commitment, a number of ITS benefits can't be realized, including:

- Avoiding duplication of efforts in jurisdictions;
- Sharing of information and data;
- Coordination of snow and ice removal;
- Improved incident management;
- Transit integration and priority;
- Corridor management;
- Freight management and freight routing;
- Reduced travel time variability

As with most transportation initiatives, success is not achieved through technology alone or through sheer engineering know-how. ITS cuts across geographic areas and modes as much or more than other transportation systems. The institutional elements that are brought in by the modal and geographic aspects of ITS are a critical factor to ITS success. The added need for both technical and policy-level officials to understand ITS amplifies the institutional concerns. If officials don't understand what ITS can do, regional integration will be difficult.

To successfully integrate ITS regionally, it must be an interagency, multimodal, and mobile environment. Some of the agencies that should ideally be involved include:

- The City of St. Albert
- The City of Edmonton
- Sturgeon County
- St. Albert Transit (StAT)
- Edmonton Transit Service (ETS)
- Alberta Ministry of Transportation

When developing a regional ITS system, agreements between regional partners are necessary, otherwise the system will be unable to share data, cooperate in carrying out a process or strategy, evolve with changing practices and technology, and optimize program development with funding opportunities. It could result in overlapping of tasks and redundant development of components in the system.

# 3 Degrees of Integration

Integration of ITS technology and information between regional agencies can be achieved in varying degrees based on the community needs, City and Provincial regulations, privacy legislation, and political environment of the integrating partners. In Alberta, for example, Provincial highway or transportation corridors that continue through City jurisdictions are typically operated by the local agency. Further, the types of ITS technology deployed by the jurisdictions can impact the degree to which regions can integrate.

Typically, degrees of integration can be between two extremes with everything in between. For example, two jurisdictions may choose to integrate their traffic control centres by only sharing information which would represent the lowest level of integration. They may be able to view real-time information from sensors, cameras, and traffic counters; however, they wouldn't be able to interact with the cameras to zoom, or change the view. Although this is a low degree of integration, having information from neighbouring jurisdictions may allow for better traffic planning, and incident management. An incident in one jurisdiction may cause congestion or delay in its neighbour. As well, there may be a required joint response when emergency services operate in both jurisdictions.

A higher degree of integration may involve one or more jurisdictions with permission to not only view information generated from sensors and cameras, but have some degree of control over the cameras, allowing them to pan, tilt and zoom as they wish. Control of the cameras may be shared between traffic control centres, allowing operators to not only collaborate but also focus on what is critical to them.

Total integration involves two or more jurisdictions being able to view, control, influence, and use the ITS deployments of other jurisdictions. Besides being able to move and operate the cameras, and

collect data, traffic control centres may be able to change what is displayed on variable message signs, allow transit priority for buses and emergency services from other jurisdictions, have unified transit payment schemes, change contra-flow directions, and more. This level of integration requires jurisdictions to develop a framework of agreements, and surrender some autonomy. Although such arrangements are rare, it occurs when one jurisdiction does not have the staff, infrastructure or technology to adequately handle all situations.

The primary benefits of regional integration (all degrees) include allowing seamless travel between jurisdictions on a variety of modes and having a backup of traffic control in case of emergencies. It can allow a region to function with only one traffic control centre, creating economic efficiencies.

Jurisdictions should examine the degree to which they will integrate with their neighbours. Integration may be undertaken for just some ITS deployments, and just to a certain degree. Although greater integration will lead to greater benefits, agreements to do so are required from both parties. Agreements to undertake a small degree of regional integration initially can demonstrate the benefits of integration and may lead to a deeper degree of integration in the future.

# 4 How to Regionally Integrate

To assist regional integration and guide deployment, an ITS architecture should be developed. An ITS architecture is a framework that documents the centres (traffic, transit, emergency services, etc.), roadside infrastructure, vehicles and mobile travellers using ITS as well as the data that flows between them. The framework guides agencies in developing standards and making deployment decisions that will result in efficiency, economies of scale, and inter-operability.

The regional architecture will help coordinate the development of regionally integrated ITS projects through a common vocabulary (data dictionary), identify technical and institutional issues, and, eventually, develop design and interconnection standards. Advanced transportation systems are gradually tied together and new ones are created. Regional architectures provide a starting point from which agencies can have a conversation within and between them about how everything will work across their jurisdictions.

Beyond the architecture, it is critical that the Regional agencies first establish dialog about potential projects. The ITS Strategic Plan includes a Project #12.1 that will establish a Regional ITS Committee which will develop a work plan of potential projects. Initiatives that are provincial often span multiple jurisdictions. Possible areas of interest include:

- Commercial vehicle enforcement in the region including dangerous goods
- Transit between St Albert and Edmonton
- Traffic signal systems that cross jurisdictions
- TMC integration
- Traveller information

- Electronic payment systems
- Connected and autonomous vehicles

Developing the work plan with a ranked list of regional projects is a first step, followed by a regional architecture. This is an excellent process towards regional integration. The cooperation and support of regional stakeholders are critical and required to ensure that ITS technology to be implemented is institutionally feasible for all parties.

# 5 Seamless Movement and Barriers at Boundaries

Regional integration removes barriers between jurisdictions and can be applied to all modes of transportation, including vehicular traffic, goods movement and transit to assist people through their journeys.

## 5.1 VEHICULAR TRAFFIC

Car passengers and drivers travelling through a multi-jurisdictional urban area don't normally recognize the owners of roadway segments. There are no visible boundaries or changes in road style to make it clear that drivers have entered a new jurisdiction, other than some signage. In addition, drivers don't necessarily care who owns the road but are concerned about their journey, travel time and safety.

To reduce delay for drivers, and improve seamless travel between jurisdictions the regional coordination of traffic lights can improve traffic progression through a corridor. Traffic lights that have not been coordinated between jurisdictions will create congestion and impede progression for drivers as they travel.

Sharing traffic data between the jurisdictions can improve a number of city services, including responding to incidents, snow and ice removal, traffic signal coordination and data sharing for planning purposes.

## 5.2 TRANSIT

St. Albert Transit (STAT) has several routes that begin or end in Edmonton, which make it a regional transit service provider, as their routes extend outside of their jurisdiction. The planned extension of the LRT into St. Albert will also make the Edmonton Transit Service (ETS) a regional transit service provider. Integrating transit schedules and information between the regional transit members will improve the transit passenger experience and remove barriers for transit use. Barriers exist when passengers must pay fares to multiple agencies, when information isn't available to travellers regarding schedules and real-time bus arrival information and when transit schedules aren't coordinated between regional partners, making transfers inefficient and time consuming.

Providing coordinated regional transit information gives passengers a greater feeling of surety and reduces uncertainty that their connections and transfers are as scheduled. Even if snow or traffic delays buses, knowing that a bus will be late and but will arrive reduces travel anxiety for transit users.

At signals within the City, installation of green extension technology at signals and GPS on buses can improve bus efficiency and transit schedule adherence. STAT buses that travel through multiple jurisdictions but not integrated with City of Edmonton traffic signals, will not experience the full benefit of investment in transit signal priority if regional integration is not used.

The extension of the LRT into St. Albert will require integrated signal timing with transit to allow the trains to progress through St. Albert safely and efficiently. A lack of regional integration of ITS in transit and LRT can severely hamper transit operation and customer experience.

# 6 Interoperability Concerns with Regional Integration

For services and functions that cross borders, such as transit, it is possible that buses with ITS technologies will communicate with and apply responses from two different system, say in St Albert and Edmonton. These systems may involve fare payment, “next bus” customer information, and transit signal priority. Thus, as regional partners deploy cross-jurisdictional projects, interoperability will become critical.

Systems that also can grow with greater coverage and services to support regional integration. Regional partners should consider agreeing to common standards that will allow current and future systems to be interoperable and reduce future roadblocks. Using a standard such as the National Transportation Communications for Intelligent Transportation Systems Protocol (NTCIP) reduces the risks of interoperability.

NTCIP is a family of standards designed for interoperability and interchangeability between computers and electronic traffic control equipment from different manufacturers. These standards facilitate communication between multiple traffic centres and between field devices and traffic centres. Historically each vender of devices and software adopted a different, proprietary deployment strategy for data communications. Most projects required a mix-and-match from different vendors, which required expensive interfaces to create connectivity amongst the systems and devices. These interfaces meet project specific needs but do not promote the interchangeability of equipment and enable sharing of communication infrastructure. The creation of NTCIP standards have reduced the complexity of interconnected ITS systems and components. The common language of NTCIP has allowed the creating of an ITS framework and subsequently, supported public agencies to better share their data.

# 7 Economies of Service Delivery

In addition to providing, seamless, efficient movement and exchange of information through regional integration, economies of service delivery are available. A regionally integrated traffic management centre can save the costs of having to operate two or more traffic management centers. An integrated transit service can improve customer service without increasing costs of transit provision. Installing technologies to undertake integrated corridor management as entire corridors, rather than as piecemeal chunks, will lead to greater benefits to the public. When integrating services through ITS, incremental increases in integration lead to either decreases in costs or improvements in customer services.

# 8 What Regional Integration Means to St. Albert

The travelling public does not notice when they cross the border from one jurisdiction to another and many journeys start or end in a differing jurisdiction. Consumers evaluate their journeys as a whole, rather than by jurisdictional segments. The St Albert ITS Strategic Plan addresses transportation issues internally within the City and as well, includes a longer term, regional initiative to examine cross-border opportunities. Ultimately, it is the customer and end users that will benefit by a regionally integrated network, through seamless cross-jurisdictional trips, better information and a more efficient and safer multi-modalwork, overall.

St. Albert has an objective of attracting jobs and growing economically; most businesses need to use the road network to move people and things. If the road network surrounding St. Albert is congested it may be difficult to attract businesses, even if the St. Albert road network operates well. St. Albert needs to present itself as a competitive place to do business. Regionally integrated and interoperable transportation systems support this goal and others within the City's Transportation Master Plan.

# DISCUSSION PAPER

**City of St. Albert**
**ITS Strategic Plan Development**

**Discussion Paper – City-Wide ITS Deployment**

| | |
|---|---|
| ***Prepared by:*** | Jessica McLennan, EIT |
| ***Issued:*** | August 2018 |
| ***Previous Issue:*** | March 22, 2018 |

## 1 Introduction

There are different nicknames, terms and images to describe the City of St Albert. Vibrant and thriving. Sustainable. Evolving as a "Smart City". The Botanical Arts City. Cultivating life. Many images of St Albert show green space and heritage buildings. All of these terms and images describe St Albert as a rapidly changing place that is desirable to live in and growing as a community. Yet, the City needs to strike a balance between growth and the "small town" qualities that attract residents. Cities like St Albert offer amenities and a high quality of life, which in turn attracts more residents and businesses, but creates urban challenges such as traffic congestion, accidents and pollution.

Typically, an urban area that supports commercial goods movement doesn't mix well with quiet neighbourhoods, with an active transportation system to move people. Pedestrians, cyclists and buses conflict often with heavy commercial trucks. Thus, supporting a thriving economy versus protecting the natural environment and community is a classic problem for many cities.

The transportation network is one key to both goals, an efficient and safe system that supports commercial goods movement, while transporting people in a sustainable manner. In St Albert, the challenge is that the road and highway networks are largely constrained whereas the population is forecast to nearly double over the next 25 years. Protecting the community and quality of life will require maximizing the existing transportation network but also diversifying the modal capacities to offer more choices.

## 2 Progress

The City of St Albert recognized these issues. The City started with the "Community Vision" in the St Albert 2015 Transportation Master Plan (TMP) which states:

***"A vibrant, innovative and thriving city that we all call home, that sustains and cherishes its unique identity and small town values. We are the Botanical Arts City."***

The TMP set the framework with the “five pillars” of social, economic, built environment, natural environment, and culture. Moving forward with this framework, the TMP identified many issues with transportation.

The primary north-south corridors are St Albert Trail and Ray Gibbon Drive. With Sturgeon County and Highway 2 to the north and the City of Edmonton to the south, it’s not surprising that St Albert Trail carries the vast majority of regional traffic. As a commuter route, St Albert Trail receives little benefit but much of the traffic problems. For example, St Albert Trail has 7 of the top 10 worst intersections in terms of accidents in the region. Further, the active transportation network (transit, pedestrians, and cyclists) isn’t developed enough to take significant pressure off St Albert Trail.

To achieve the vision of St Albert Trail as a user friendly main street, alternative routes need to be developed to the north end, primarily by expanding Ray Gibbon Drive and building Fowler Way. Transformation will be gradual but by providing a faster, safe alternate route, trucks and autos will be encouraged to shift over. Development will follow.

In the long term, 127th Street completes a “ring road” around the City but the segment is outside of municipal control and within Sturgeon County. Anthony Henday Drive provides east-west connectivity along the southern boundary of the City and between the primary corridors of Ray Gibbon Drive and St Albert Trail.

The TMP provided important recommendations on the future networks for roads, active transportation, public transit, goods movement and ITS.

# 3 The Key Working Level Plans

The TMP set the high-level framework and direction for the future of St Albert’s transportation network but at the working level, the City moved forward with two key plans:

***Smart City Master Plan***

The Smart City Master Plan has three key outcomes:

1. Greater Efficiency – support opportunities for improved operational efficiencies, employee productivity, and returns on investment.
2. Dynamic Economic Development – support economic development efforts to grow existing businesses and attract new investment.
3. Enhanced Service Delivery – identify innovations or technologies to improve asset management, sustainability and enhanced municipal service delivery.

In support, the St Albert Smart City Master Plan has six focus areas: People, Economy, Mobility, Environment, Living, and Governance/Operations.

This process resulted in recommendations for 22 strategies and proposed actions.

***St Albert Intelligent Transportation Systems (ITS) Strategic Plan***

The ITS Strategic Plan supports both the St Albert Transportation Master Plan and the Smart City Master Plan.

The ITS Plan is based on the needs of the communities and stakeholders. The Vision of the ITS Strategic Plan is:

***"Building better communities through transportation innovation"***

The ITS Strategic Plan has the following key objectives:

1. Improve the transportation network
2. Increase safety
3. Support livability and sustainability
4. Enhance economic prosperity and goods movement
5. Support regional transportation
6. Develop the active and transit transportation networks
7. Encourage innovation and technological excellence
8. Support and enhance data management.

The ITS Strategic Plan includes 14 strategies comprised of 41 distinct projects.

# 4 Common Elements and Challenges

The ITS and Smart City plans identified several common challenges and key recommendations. To achieve "City-wide" ITS deployment, it is important to recognize that creating new environments take time – hence, St Albert's key plans are phased over 10 years. However, it is equally critical that there is steady progress and these projects move forward within both plans:

### *1. Data Management*

Both the ITS and Smart City plans referred to a data management environment focused on the "Internet of Things" or "IoT", in which every device is connected, has an "IP" address and is online. The IoT data management structure is also the fundamental base for the Smart City applications.

The IoT vision is a data-rich environment that will quickly become overwhelming because of the growth of data types, volumes, speeds, and sources. To move forward with the ITS deployments, it is

important that the City proceed with development of the Data Management discussion paper's recommendations in Project 8.1.

Specifically, the development of the IoT platform and its data hub are critical to both the ITS and Smart City programs.

### *2. Telecommunications*

The transmission of data between the field devices and a central hub is important for both the ITS and Smart City applications and programs. Of particular importance is the completion of phase 2 of the St Albert fiber optic network in a hybrid star/ring topology. Currently, the fiber network is approximately 95% complete. "Last mile" connectivity, however, must be assessed for the ITS projects and field devices.

The focus should be on the primary corridors for the ITS projects, especially St Albert Trail and Ray Gibbon Drive.

### *3. Traffic Management Centre*

The central hub for any ITS network is the Traffic Management Centre (TMC). The Smart City program also envisioned the development of the TMC. It is important for both the ITS and Smart City programs that the City proceed with the development of the TMC as per Projects 10.1 to 10.4. While deployment is long term, it is imperative that, as projects are being designed in the short term, the planning work of the TMC proceeds in conjunction.

### *4. Short and Medium-Term Projects*

Support for the ITS and Smart City Plans depend on early demonstration of ITS technologies and benefits. The "Early Winner" projects are those in the short-term with high payback, low effort in the areas of:

- Data management
- Traveller information systems
- Active marketing of the success of the innovative pilots
- Development of the St Albert Trail improvements including adaptive signal control, traveller information and improved safety
- ATIS web site for the public
- Support for the elements of the Smart City program.

In the short-term, it is important to use the results of the pilot projects for new technologies and apply them to transportation corridors and issues. The short to medium-term periods (0 to 5 years) are foundational to the ITS program and will form the basis moving forward. It is important during this period that support of senior leadership and Council is achieved through delivering evidence-based projects with documented benefits.

As this period is critical to the success of St Albert's ITS and Smart City plans, as well as the TMP, it is recommended that the City consider preparing a detailed Implementation Strategy to support and guide development, moving forward.

### *5. St Albert in the Long-Term*

For both the ITS and Smart City Plans, it is important that St Albert embrace a leadership role in the region and indeed, Canada, as a centre of excellence for transportation technology and innovation. St Albert is already poised to assume this role, having achieved many of the goals initiated through pilot tests, research, and partnerships, as discussed in the ITS Strategic Plan. In the long-term, it is recommended that St Albert consider the following:

- Leadership requires proceeding with both plans' recommendations, particularly the common ones.
- Supporting roles for research in academic pilots like the University of Alberta's ACTIVE-AURORA test bed will differentiate St Albert from other cities and regions.
- Proceeding with preparations for the arrival of autonomous vehicles as per Project 11.3.
- Creation of an ITS and Innovation Committee that will embrace methods to integrate new technologies into the future of St Albert.

The ITS Strategic Plan provides a glimpse into the future of St Albert's transportation network. Seamless, safe, efficient, integrated, interoperable and sustainable are key terms that describe it. As well, the ITS plan guides St Albert through a "paradigm shift" in it's business processes and City services. The delivery of these services and how they are managed will become different.

As St Albert moves towards City-wide deployment of ITS, the City will change, before our eyes. The first step is followed by another, towards the vision.

# DISCUSSION PAPER

**City of St. Albert**
**ITS Strategic Plan Development**

**Discussion Paper – Imagine Autonomous Vehicles in St. Albert**

| | |
|---|---|
| ***Prepared by:*** | Jessica McLennan, EIT |
| ***Issued:*** | August 2018 |
| ***Previous Issue:*** | March 22, 2018 |

## 1 Introduction

A world of "Autonomous Vehicles" or "AV" conjures images of a totally driverless yet mobile society. It is perhaps the most futuristic vision from our past. The past is about to meet reality soon, as AV or so-called "driverless vehicles" are being tested on roads and highways.

Autonomous vehicles have evolved significantly over the years, starting as a research project by Stanford University, moving on as a Google self driving car project.

The autonomous vehicle uses a variety of sensors, lasers, radar, GPS, and cameras to "see" ahead, around and behind the vehicle in a 360-degree field of view. The AVs' software controls the systems and guides the vehicle.

Perhaps the most well-known developer of the driverless car is Google which led the initial research with a fleet of test vehicles. The Google self-driving car project is now called "Waymo" for "a new way forward in mobility". Waymo is a subsidiary of Google's parent company Alphabet Inc.

Today, every major auto manufacturer has a driverless prototype which has been tested.

## 2 What is an "Autonomous Vehicle"?

Autonomous Vehicles are defined as any vehicle in which some form of a critical driving task is done without the driver's actions such as steering or braking. There are various definitions of the levels of automation starting with the US DOT.

The US Department of Transportation's National Highway Traffic Safety Administration (NHTSA) released a policy on automated vehicles. The policy identified four levels of automation but has now adopted the five levels of automation as defined by the Society of Automotive Engineers (SAE):

***Level 0***: No automation in which the driver is in complete control of all driving functions such as steering, braking and acceleration, a level that exists today.

***Level 1***: An advanced driver assistance system (ADAS) where the vehicle assists the driver with one function (steering or braking/accelerating). This level is common in many cars today with some that assist in braking.

***Level 2***: An ADAS on the vehicle controls both steering and braking/accelerating for the driver. Adaptive cruise control combined with lane keeping is one example.

***Level 3***: Limited Self Driving Automation in which the driver releases full control of all functions in certain (limited) conditions such as traffic loads and congestion. The limitation occurs when the driver must be available to regain control from the car. An example of this type of vehicle is the Google experimental vehicle in which a driver is always present.

***Level 4***: An ADAS on the vehicle can do all the driving tasks, monitor the driving environment and performs all critical functions for the entire trip in "certain circumstances". These circumstances may be conditions in which autonomous driving is permitted by law.

***Level 5***: An ADAS on the vehicle does all the driving under all circumstances. The car could be empty or contain occupants who are never involved in driving functions.

### *Where are Autonomous Vehicles Permitted on Roads and Highways?*

In the US, 21 states have passed legislation related to AV. In Canada, the Province of Ontario launched an autonomous vehicle innovation network in Stratford, Ontario to encourage research into the use of AV with $80 million in funding. AV were also tested in Oct. 11th, 2017 in Kanata North Technology Park near Ottawa.

### *Why are Autonomous Vehicles being developed?*

Primarily, the US and other governments are interested in the safety benefits of AV. In the US, over 35,000 people perish annually on US highways and roads at a cost approaching $1 trillion.

It is expected that AV will reduce the deaths, property and personal injury costs of accidents.

### *What are the Potential Impacts of Autonomous Vehicles in St Albert?*

The introduction of AV in the City of St Albert will have some immediate to long term impacts. The following impacts should be considered as the City moves into the Smart City and ITS programs:

- Land use planning – as parking demand decreases with market penetration of AV, curbside space can be re-purposed for such uses as bike lanes, transit and HOV lanes, wider boulevards, commercial space, etc.

- Land development – if commuters can now work instead of drive, the trip to work will be productive time. It is expected that housing will expand in the suburbs, encouraging sprawl and development.
- Engineering standards – highway capacity and geometric design standards assume a certain headway between vehicles. AV will have more precise ability to follow others in a platoon so the capacity of a lane will be greater.
- Safety improvements – as the AV become more mainstream, it is expected that the accident rates will decrease. Similarly, incident response, emergency services and hospital capacity will all be affected by reduced demand.
- Parking off site – garages and parking lots may experience reduced demand and may be converted to office buildings or housing. While parking at some activity centres such as malls may see reduced demand, drop off zones at entrances may need greater space.
- Mobility for seniors, youth and disabled – it is likely that AV will provide mobility to those who have been constrained. It is reasonable therefore to expect that these new drivers will increase traffic.
- Trucking impacts – a shortage of future drivers will encourage carriers to explore driverless trucks which will have no restrictions of operating hours as human drivers do.
- Transit impact – one of the largest budget items in transit is for drivers. Transit agencies will explore driverless buses in the future.
- Fleet Operator impacts – mobility as a service (MaaS) such as Uber or Lyft are testing autonomous vehicles to reduce costs.
- Taxi service impacts – in a competitive environment, AV provides some options. On average, every vehicle in the US is parked for 22 hours per day. AV will create a fleet of rental vehicles that could be used during the day before returning to serve its owners.
- Car sharing impacts – with some AV, there may be opportunity to share a vehicle to combine, for example, work trips.
- Cyber security of AV will become an industry that may affect the job markets in St Albert.
- Data management in St Albert will be a recipient of “rich” AV data.

### *Timing – When Will AV Appear?*

The introduction of autonomous vehicles varies and is likely more restricted by the legislation and liability issues rather than technology. The most popular period of introduction is between 2019 to 2025. Fleets will require more time to turn over their vehicles.

The reality of the introduction and adoption of AV is not “if” but now “when” the AV world is coming. The use of AV will be one of the most “disruptive” technological events in human history which will change how we live.

The world is changing before us.

# Appendix C – Network Diagram

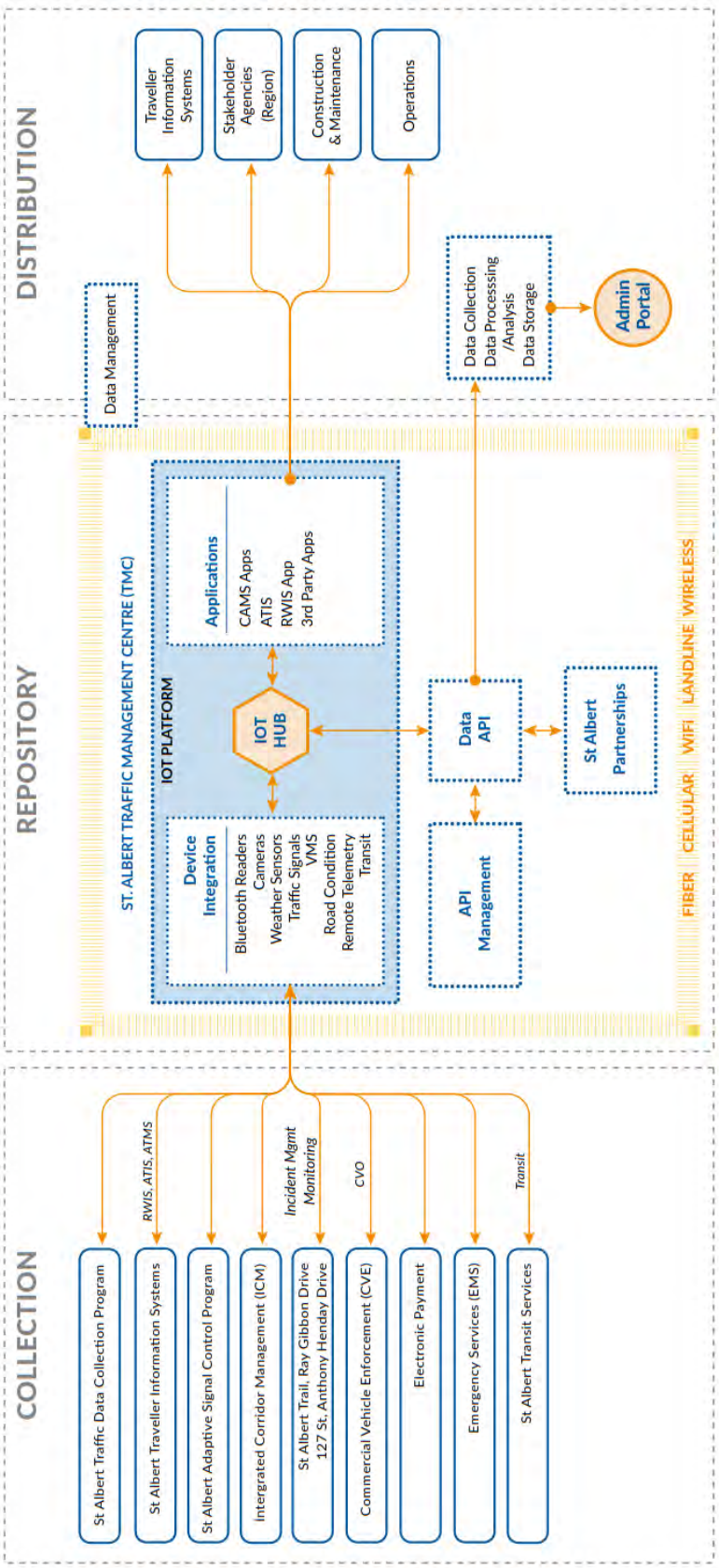



**Figure C-1**
**St. Albert ITS Network Diagram**