

# SMART CITIES

## Implementing a Smart Parking Eco-System

Presented to  
The Standing Committee on Transport, Infrastructure and Communities  
Parliament of Canada  
February 21<sup>st</sup>, 2016

## Table of Contents

INTRODUCTION .....	3
BACKGROUND .....	3
PARKING INDUSTRY .....	4
PARKING AND THE SMART CITY .....	4
THE PATH TO THE SMART PARKING ECO-SYSTEM .....	5
INTEGRATION AND INTEROPERABILITY.....	9
STANDARDS AND OVER-SIGHT .....	9
PROMOTE CANADIAN SOLUTIONS.....	9
ABOUT THE AUTHOR.....	10

## INTRODUCTION

Urban areas or visions for urban environments that leverage multiple secure Information and Communication Technology (ICT) in order to connect and manage city infrastructure and assets is a Smart City. Smart City technology can span multiple sectors of this urban environment to provide secure, real-time information to decision makers at all levels in an effort to assist in the formation of intelligent or 'smart' decisions. Affected city sub systems include Electric, Water, Waste, Health Care, Schools, Libraries, City Maintenance, Urban Planning as well as Transportation and Parking.

As subject matter experts in the Parking Industry, J.J. MacKay Canada Limited, with this submission, will address elements of a Smart City directly related to Smart Parking Infrastructure. This submission will focus at a high level on the current state (PARKING AND THE SMART CITY) of parking equipment technology and highlight key elements a Smart City needs to consider as they move towards implementing a smart parking infrastructure solution (THE PATH TO THE SMART PARKING ECO-SYSTEM).

## BACKGROUND

J.J. MacKay Canada Limited (MacKay Meters) is a Canadian based, owned and operated, world leader in the design, manufacturing, and deployment of parking technology solutions. Incorporated in 1960, MacKay has gained global recognition providing its customers with innovative products that are on the leading edge of technology. J.J. MacKay Canada Limited achievements include:

- 1985 – introduced the parking industry's first fully electronic parking meter
- 1990 - Smart Chip Card technology implemented in its parking equipment
- 1998 - Wireless Technology implemented in its parking equipment
- 2003 - Credit Card acceptance implemented in its parking equipment
- 2011 - introduced first Industry Canada (IC) Certified Parking Meter
- 2011 - introduced first Federal Communications Commission (FCC) Certified Parking Meter
- 2011 - introduced first PCS Type Certification Review Board (PTCRB) Certified parking meter
- 2011 - introduced first EMV Compliant parking meter
- 2016 - introduced first parking meter to carry the recyclable emblem
- 2016 - introduced the first energy neutral parking meter

Headquartered in New Glasgow, NS, J.J. MacKay Canada Limited parking technology can be found globally and includes such cities as San Francisco, New York, London (England), Hong Kong, Kuala Lumpur, Jinan China, Vancouver, Edmonton, Regina, Thunder Bay, Yellowknife, Montreal, Moncton, Charlottetown, Halifax, St. Johns and many others.

MacKay manages sales and service offices in New Glasgow NS, Montreal PQ, Scarborough ON, Vancouver, BC, Patterson New Jersey, Sunrise Florida, Buenos Aires Argentina and Hong Kong. MacKay hosts data for over 300 of its customers across multiple data centers that in turn manage in excess of 75,000 wireless/credit card enabled smart parking spaces. Integration points include City Systems, Pay By Cell Payment Providers, Guided Enforcement and Guided Parking service providers among others.

J.J. MacKay Canada Limited manages an extensive portfolio of patents related to parking technologies including Contactless payment, coin recognition and parking meter technology.

## PARKING INDUSTRY

Estimates of size and scope of the parking industry are imprecise but it is a generally held belief that three non-residential parking spaces exist for each registered vehicle. With over 250 million registered vehicles in the US alone it is estimated that there are upwards of 800 million parking spaces in existence with approximately 20 million being paid/metered spaces. As of 2005, estimates contend that the industry in the US employs upwards of 143,000 people <sup>1</sup> and generates 25 billion dollars annually.<sup>2</sup> In Canada, Statistics Canada reports (2015) that there are 33,168,805 registered vehicles which in turn account for close to 100 million non-residential parking spaces.

## PARKING AND THE SMART CITY

Latest indices available from Statistics Canada note that as of 2017 81% of the countries population resides in an urban environment. As the country's population continues to urbanize, increased demand on city infrastructure will cause an increased demand for 'smart' responsive parking infrastructure solutions. Key components of smart parking infrastructure include: real-time communications, real-time and convenient access to data, convenient and multiple forms of payment and reliable equipment that is capable of managing change to the parking Eco-system in a real and sustainable way.

Smart parking equipment provides a plethora of data that contributes to the formation of intelligent decisions surrounding maintenance, collection, rate adjustments, street level environmental/ atmospheric conditions and parking guidance. Access to this plethora of data enables urban planners, city administrators, maintenance personnel and many others to accurately forecast growth, traffic flow and expenditures.

Real-time notification of required collection and maintenance provides staff the opportunity to be more responsive to the metering solution and the end parking consumer. A prompt response to maintenance issues ensures product downtime is minimized which in turn minimizes inconvenience to the end parking consumer while maximizing the opportunity for revenue generation. Reporting of required cash collection real-time provides staff the ability to strategically collect as required as opposed to predefined set schedules. Efficient smart collections promotes efficient staff utilization, minimizes unnecessary expenditure and reduces green house gas emissions by minimizing unnecessary scheduled collections.

Access to both current and historical occupancy reporting allows for dynamic rate adjustments. Smart Cities that understand occupancy can intelligently manage it through real-time/dynamic rate adjustments with parking session limits to ensure business, and other, districts that require on-street/ curbside parking have it available for consumption. Additionally, Smart Cities that dynamically manage event parking can reduce parking congestion by strategically setting parking rates in and around event venues and their outlying areas. Dynamically setting premiums on parking spaces close/closer to event venues encourages parking in outlying areas at a reduced rate as well as encouraging the use of alternative forms of transportation.

Sharing of real-time information across sub-system equipment and service providers promotes efficiency as well. Providing parking session information to Guided Parking service providers allows end consumers to make informed and efficient decisions concerning available parking spaces. Additionally, with the sharing of parking session information Guided Enforcement service providers are able to intelligently direct enforcement personnel to high occupancy areas with an inordinate percent of expired spaces. Increased efficiency, through intelligent

---

<sup>1</sup> Parking Industry Study Demonstrates Size and Scope of Industry and Significant U.S. Employment, May 31<sup>st</sup>, 2011, National Parking Association

<sup>2</sup> Smart Parking and the Connected Consumer, Opportunities for Facility Operators and Municipalities, December 2012

decisions reduces traffic congestion, maximizes personnel efficiency while reducing green house emissions.

Inclusion of environmental monitoring technology in parking equipment provides important information concerning street level temperature and air quality. Providing this environmental information to the end consumer on site at parking equipment displays or through other informational outlets (both traditional and social forms of media) provide valuable information to not only the parking consumer but all citizenry. It is also important information for city and urban planners. Smart parking equipment allows for directed end consumer notification. Strategic marketing/advertising as well as Emergency Alert Notifications. Be it air-quality concerns or amber alerts due to missing children or other forms of concern, real time communications promotes another avenue to intelligently inform citizenry of important and necessary information.

While elements of the smart parking Eco-system as described above exist today, often these elements are disconnected from the larger Smart Parking and Smart City Eco-system.

### **THE PATH TO THE SMART PARKING ECO-SYSTEM**

Intelligent decisions along the path to a smart parking Eco-system will be a primary factor in determining success. The parking Eco-system of today is not the parking Eco-system it will be in 5, 10 or 15 years from now. However, the decisions made today will directly affect a cities ability to move effectively to what the future parking Eco-system will become. Significant decisions can be made today that will allow a city to evolve its parking infrastructure into a smart parking Eco-system with out limiting the Cities ability to adapt to changes in technology as it occurs.

Smart Cities should leverage existing infrastructure, introduce change as appropriate and integrate the parking Eco-system elements to allow for a 'smart' integrated solution from which intelligent decisions can be made. Lay the basis for success with a robust network that may include cellular, Wi-fi, radio and other modes of communication. Upgrade existing parking infrastructure when able by taking traditional 'unconnected' parking equipment and upgrading to 'network enabled' devices capable of accepting multiple forms of payment including credit card, mobile payments and cash. Establish interoperability standards and ensure the resulting data is shared.

#### **Leverage Existing Infrastructure**

##### **The Network**

In Canada today, cellular technology provides data access across most urbanized areas. In many instances Wi-fi canopies and other forms of networked technologies exist to provide additional network coverage. Leverage what is available, when moving to smart metering equipment. Select vendors that provide access to available networks and provide flexibility in the network selection. Ensure that the smart metering equipment has flexibility to evolve as the network technologies change and new technologies are introduced.

Network flexibility is a key component in selecting smart parking meter suppliers. Access to the network needs to be considered an important but modular component of the overall metering equipment. Flexibility to move from one network supplier to another should require no change to the end metering equipment. Flexibility to move from one network technology to another should require minimal impact on the parking equipment, and at most the replacement/upgrade of the network module.

Smart Cities need to intelligently select a parking equipment supplier that has planned for the future

advancements of network technologies and have provided a clear upgrade path to take advantage of those advances as they occur. The answer should not be replacement of equipment, the answer should be an upgrade path to advancements in network technologies for the smart metering equipment they are purchasing today.

### Parking Infrastructure

The traditional parking meter blankets the downtown city core across most Canadian Cities. As Cities, make the decision to move to a smart infrastructure they can leverage existing infrastructure and upgrade from the traditional to a smart parking meter intelligently. For instance, smart parking meters are retrofitted on existing parking equipment (pole and coin vault). By simply removing the existing traditional meter mechanism and installing a new smart meter mechanism you can introduce intelligence to your parking infrastructure. No change to the city landscape, no change in behavior patterns of the end parking consumer required, however a new connected meter is introduced that provides real-time communications with the convenience of additional forms of payment including credit card and mobile payment. Additionally, in many instances city infrastructure can be reduced by collapsing two traditional meters to one smart meter. Intelligent smart meter suppliers offer smart management of two spaces through one piece of equipment. A Dual bay meter will manage two spaces from a single smart meter, while reducing infrastructure, the cost of deployment and monthly service fees.



Figure 1: Traditional Single Space meter



Figure 2: Smart Parking Meter (mkBeaconTM)



Figure 3: Traditional Dual Head Parking Meter (Serving 2 spaces)



Figure 3: Smart Parking Meter (mkBeaconTM Duo)

### Introduce Change Intelligently

#### Mobile Payment

By the end of 2016 it is estimated that there will be 4.8 billion mobile phone subscribers, with 20% of these users having made at least one mobile payment. This number is expected to reach 90% by 2020. <sup>3</sup>

In North America, urban areas that offer mobile payment have approximately 13% of all parking transactions generated by mobile devices. This number increases based on city demographics: age of population, access to and comfort using smart phones for payment as well as proliferation of other point of sale devices offering mobile payment. Parking rates, as well as access to larger denominations of coin are a factor to consider as it relates to mobile payment usage in parking. In Canada, the \$1 & \$2 Coin is the predominant form of payment with certain Canadian cities see as much as 87% of parking transactions as the result of coin payment.

As the proliferation of smart phones ushered in the demise of the phone booth so too will the adoption of mobile payment usher in significant change to the parking industry. Cities will evolve, demographics will change, and smart metering equipment needs to be positioned to respond to meet today's and tomorrows reality. Intelligent smart parking equipment providers manage all forms of payment effectively and support:

- coin acceptance
- credit card acceptance
- Contactless payment
- mobile payment

Smart Cities should introduce a mobile payment program that is integrated with the smart parking equipment as part of its intelligent change program.

### **Guided Parking Solutions**

It is estimated that up to 28% to 30% of traffic congestion is due to drivers searching for available parking and/or comparing available rates at or near their destination.<sup>4</sup> The end consumer in its quest for affordable and available parking will adopt in-vehicle and smart phone guided parking solutions. Guided parking solutions will be integrated tightly with smart parking equipment to understand parking rates and availability. Guidance will be based on an analysis of parking sessions generated at the smart parking equipment and via mobile payment (remotely).

The analysis will guide the end parking consumer to available parking spaces at or near their selected destination efficiently with a real benefit of reducing traffic congestion and lowering CO2 emissions.

### **In-Vehicle Communications**

As noted above, guided parking solutions are assisting drivers locate affordable available parking today either through smart phone applications or through in-vehicle information systems. As vehicle information systems evolve, these systems will understand where available parking is located, which parking spot is selected, and current rate structures and other behavioral settings of the parking equipment (ie TOW Away periods, max stays etc.,). These intelligent vehicles are capable of purchasing parking and will either communicate directly with the parking equipment to update the parking session of the parking equipment or do so through a back-office integration point. While in its infancy today, Smart Cities should select smart parking equipment capable of supporting this functionality.

### **The Electric Vehicle**

---

<sup>3</sup> How Mobile Payments Will Grow in 2016, Fortune (Tech) on-line, Sarah Silbert, October 29<sup>th</sup>, 2015

<sup>4</sup> Volume 20, Number 6, Parking Today, John Van Horn, Donald Shoupp, March 13, 2013 Parking Is Hell Podcast.

Today, the Electric Vehicle (EV) Industry is experiencing a 20% increase annually. 2014 Sales figures indicate 118,773 EV units were sold with that number expected to increase to 740,000 EVs per year by 2024. It is further anticipated that by 2040 35% of the automotive sales will be of Electric Vehicles.<sup>5</sup>

As the electric vehicle industry moves to 2040 and beyond demand will be placed on smart city infrastructure to support vehicle charging. Demand for both on and off-street charging of these vehicles will occur and intelligent smart parking equipment suppliers will need to respond. Support for EV Charging at the parking equipment will be required and integrated into the larger parking Eco-system and Smart City infrastructure.



## Introduce Change Responsibly

### Solar Harvesting Technology

Solar Harvesting Technology is an important element of Smart Parking Equipment. The ability to cost effectively harvest solar energy to charge parking equipment batteries is a reality that needs to be apart of any smart parking equipment solution. Harvesting the solar energy in a real way can see battery life extend to three to five years from a mere six to twelve months under normal operating conditions.

It is important that as Smart Cities become intelligent about parking they understand the harvesting capabilities of the potential parking equipment suppliers. Ensure that the harvesting capabilities are real and make an impact-full difference in extending the lifetime of a battery pack and go beyond a superficial inclusion in the product. Today's solar harvesting and battery technologies allow smart parking equipment providers to implement a net zero energy usage solution under normal operating conditions.

### Recyclable Material

Responsible corporate citizens must be aware of the impact they and their products have on the environment. Smart Cities, by extension, have a duty to ensure that the corporate citizens they engage are responsible and respectful of the environment. Smart Cities must take reasonable steps to ensure that smart parking equipment suppliers take measures to ensure they are minimizing their carbon footprint through innovative design and manufacturing processes.

Smart Cities must engage clean manufacturers of smart parking equipment. Clean manufacturers are manufacturers engaged in producing products that reduce the carbon footprint by minimizing the use of natural resources, promote the utilization of recyclable material, engage in solar harvesting and use recyclable batteries as part of their 'clean' products.

These clean manufacturers exist and are excitedly involved in the manufacturing process. They understand their corporate responsibility to protect the environment and fully understand the benefit they can provide to Smart Cities and its citizenry. These clean manufacturers protect the environment through innovative design, processes and material selection. They understand being a clean environmentally conscious manufacturer can result in a significant improvement to the quality of the product and reduction in the cost to produce.

---

<sup>5</sup> The Rise of Electric Vehicles: By The Numbers, March 21, 2016 Prableen Bajpai NASDAQ



**Reuse of existing infrastructure**

As noted above a key and relatively unobtrusive way to implement smart parking equipment is through leveraging existing parking infrastructure. Upgrading the traditional parking meter also benefits the environment in a meaningful way through the reuse of existing poles, coin vaults, coin cans, locks etc.,

**INTEGRATION AND INTEROPERABILITY**

Smart Cities and smart decisions require real-time access to data from all relevant data sources. Smart City parking equipment suppliers must understand they are part of a parking Eco-system and offer equipment data to the larger Eco-system.

**Interoperability Standards**

As Smart Cities emerge, they must emerge with an interoperability standard. This interoperability standard must become the de-facto standard that all suppliers of smart parking equipment providers adhere too and it must define the data exchange among the various smart city sub-systems in an effort to support the business processes of the Smart City.

**Publish Data**

As Smart Cities evolve and standards are developed and implemented, Smart Cities position themselves in a unique way as it relates to data. Offering data for general consumption through open data portals should be seen as a natural evolution of the Smart City Initiative. Publishing data encourages innovation and growth in information technology through software development and information management.

**STANDARDS AND OVER-SIGHT**

In many aspects regulations exist to monitor and enforce the safe, reliable and secure production of Smart Parking Equipment. As Smart Cities engage Parking Equipment Providers they take on the responsibility of ensuring that these suppliers meet the relevant standards which include:

- Industry Canada (IC) – Standards and Certification of Radio Apparatus and Electronic Equipment Used in Canada
- Payment Card Industry (PCI) Security Standards for the safety of cardholder data.
- International Standards (ISO) Certified Quality Control Processes

**PROMOTE CANADIAN SOLUTIONS**

Canadian Smart Cities have a unique ability to foster and support Canadian based innovation and Canadian based solution providers. Canadian based solutions should be sought out and encouraged. In so doing, Smart Cities will discover it is not a compromise to select Canadian products, but rather a selection of quality at a competitive cost. World class Canadian parking equipment suppliers exist and compete on the world stage each and every day. Canadian Smart Cities through the expenditure of Canadian tax dollars should have an initiative to promote Canadian Smart Solutions.

Adrian O'Neil

Chief Technology Officer  
J.J. MacKay Canada Limited

### **ABOUT THE AUTHOR**

Mr. O'Neil is an experienced software and services director, with over twenty years of managerial and hands-on technical expertise delivering software and hardware products and services to the marketplace. Mr. O'Neil has been intricately involved in the product design and development life-cycle from both a hardware and software perspective and holds or has held senior positions within the Parking, Electric Smart Grid and Wireless Industries including: Chief Technology Officer, Vice President Engineering and Director of Software Development. Additionally, Mr. O'Neil holds several patents related to Parking, Water Heater Demand Side Management, Smart Metering, Utility Automation and Data Management.

Mr. O'Neil is a graduate of St. Francis Xavier University, Algonquin College of Applied Arts and Technology and the Information Technology Institute.