



OPTIMUM PARKING MANAGEMENT

INTEGRATING DIGITAL
TECHNOLOGIES INTO DYNAMIC
PARKING MANAGEMENT

INDIGO

MAKING SPACE FOR THE FUTURE

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INTRODUCTION : THE NEW MOBILITY

As a symbol of freedom, mobility, and autonomy, the automobile has changed the shape of our cities and suburbs, yet in the past century, it has evolved beyond our expectations.

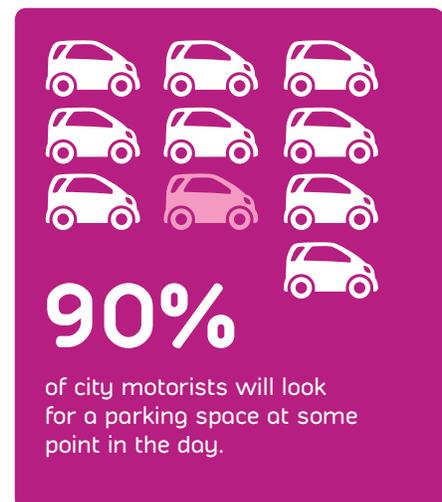
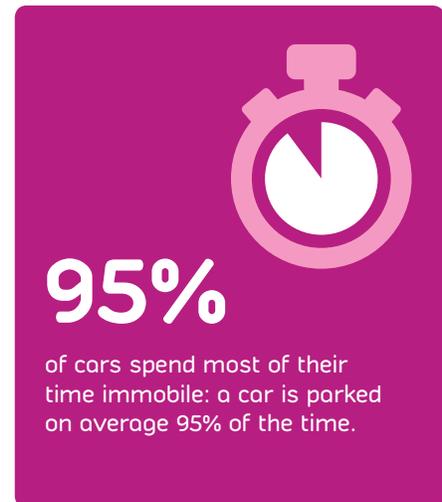
Cars now come equipped with advanced hardware that can avoid collisions, they can be self-driving, and yet the great paradox is that a typical car spends most of its time immobile⁹: a car is parked on average 95% of the time, when it is not stuck in a traffic jam.

The digital revolution, a major upheaval caused by technological advances, primarily computers and the Internet, has placed us in an era of accelerating change.

In industrialized countries, this change has shaken several sectors of the economy. While cars become sophisticated enough to be self-driving, and as automakers become mobility providers, cities become smarter by using and integrating new technologies to meet the challenges of the modern city: transportation, governance, and citizen services, to name a few.

Traffic congestion ranks high on the list of evils that afflict urban areas. It increases greenhouse gas emissions and is largely responsible for the smog in big cities. The search for available parking is, in part, largely responsible for congestion: 90% of city motorists lose up to 20 minutes a day looking for a parking space, by slowly circulating, or by immobilizing traffic to parallel park¹.

With the emergence of «smart» parking, solutions such as nested technologies in the roadway and parking areas, and connections to new mobile tools are being put in place.



The technological solutions to make parking more fluid, by eliminating traffic obstacles, and customizing and facilitating the driver's experience - exist.

But the growing digital revolution has seen the emergence of a large number of contenders for the next «unicorn,» technological start-ups that disrupt sectors of the economy and whose market values have reached over one billion dollars in record time.

Both public and private sector parking managers must adapt quickly to technological change - an essential component of the new urban economy - by separating fact from fiction before making important decisions. Above all, all parties involved in the management of transportation and parking must work together to achieve global solutions that will ensure the flow of traffic.

CHANGE WELL UNDER WAY

THE AUTOMOBILE IS BECOMING A SOPHISTICATED COMPUTER ON WHEELS

In 2015, 1,898,485 cars, light trucks and new commercial vehicles were sold in Canada, an all time new sales record and the third in three consecutive years ⁱⁱ.

According to industry analysts, this can be attributed to lower interest rates and gasoline prices, but also to the arrival of new models brimming with state of the art technological innovations.

With computerized vehicles, a manufacturer can now fix a problem in one of its models remotely. A car can house between 50 and 100 computers that regularly generate millions of lines of code. This level of computerization has taken motor control to the point where cars can be self-driving, such as the Google driverless car ⁱⁱⁱ.

The car, now transformed into a sophisticated computer on wheels, is ready to enter into the third evolution of the Internet: the Internet of Things (IoT), an era where devices and real world objects share information and data thanks to the Web.

ON MOBILITY

This paper refers to two different but related concepts of mobility. Depending on the context, the term refers to sustainable mobility or mobile information technology. To avoid confusion:

Sustainable Mobility



In an urban context, sustainable mobility is defined as the ability for people of all walks of life to move safely

through a wide variety of fluid networks, efficiently and comfortably with minimal environmental impact.

Mobile IT



Designates the uses and users of wireless electronic and computer technologies that allow access to digital media and digital information. Mobile IT allows users to modify information, communicate by mobile phone or the Internet, and to work online or off-line regardless of where they are.

CAR MANUFACTURERS TRANSFORM INTO FULL-SERVICE MOBILITY COMPANIES

The car has been rapidly developing but so has the way we view it due to harmful effects, such as highway congestion, and the increase in greenhouse gases. Digital technologies have given us new services that bring together users and drivers through mobile applications, disrupting the taxi industry worldwide.

Sensing this shift, several automakers have already begun preparing to change their mission from vehicle builders to sustainable transportation providers.^{iv}

For example, BMW now offers everyone – not only BMW owners – BMWi mobility services^v. The point is to encourage urban mobility whether you own a vehicle or not. The applications developed with the support of BMW include DriveNow, a car-sharing service; and ParkNOW, which filters parking spaces by rate, proximity, and services such as reserved parking. During the 2016 Auto Show in Detroit, Ford made an impressive display by launching FordPass mobility services, which will come standard with their new models. FordPass, offered to both customers and the general public, proposes shared ownership of a vehicle, reserved parking spaces, as well as scheduling of intermodal transportation.

MAJOR URBAN CENTRES BECOME SMART CITIES

New technologies have also pushed major urban centers towards the transformation to smart cities, cities that use and integrate new information and communication technologies by reconciling their housing, mobility, and economic functions, while at the same time reducing their global footprint.

According to a UN report, 54% of the world population was living in urban areas in 2014, and this proportion is expected to climb to 66% by 2050 with an addition of 2.5 billion new citizens.

In this context, cities are key to the sustainability of the planet and smart cities constitute a fundamental element. To accommodate the ever-increasing human population, cities must turn into more efficient, equitable and healthy living environments, and most importantly be respectful of the ecological fabric of our time.

SMART PARKING

THE ESSENTIAL COMPONENTS OF A SMART CITY

Every day, people crisscross their city to reach a variety of destinations: workplace, personal residence, spaces dedicated to culture entertainment, education and trade etc. Mobility is a key element of a city's quality of life and its economic prosperity.

Experts estimate that only a small share of urban congestion is caused by people passing through the city. The vast majority of vehicles in circulation want to reach a destination within the city, and one can conclude that these vehicles will, by necessity, have to park at some time.

A motorist can lose up to 20 minutes looking for a parking space. If each day 90% of vehicles traveling spend time circulating ^{vi} - and stopping to park on the street – the logical conclusion is that parking contributes significantly to urban congestion and increasing levels of pollution.

OVERVIEW

Cities aspire to become smart to ensure their viability and the well being of their citizens. Automakers are becoming smarter (unlike humans, they can avoid collisions and road rage!). It is therefore logical that parking must also become smart, and no longer pose a problem, but instead be part of the solution.

The term «smart parking» refers to the use of remote sensing devices that monitor the occupation of spaces. These devices can be cameras, air sonars, parking entrance gates, or sensors embedded in the roads.

The most efficient remote sensing systems not only provide information about available spaces, but also specify whether a coveted free space is large enough to park a given vehicle. They also analyze and transmit this information to mobile and web applications and dynamic signage^{vii}. This is called Dynamic Digital Signage.

Smart parking also uses mobile computing tools, specifically the smart phone whose use is increasingly widespread in the population. In 2014, 66% of Canadians owned a smartphone, compared to 62% in 2013^{viii}.

The development of smart parking solutions is an emerging industry. Across the globe, large urban areas are currently testing these solutions, along with airports, public transit agencies, and other organizations that manage large parking lots such as universities and hospitals.

Smart parking is based on technological solutions related to mobile devices and applications, but more importantly it allows a city to:

- Simplify and synchronize diverse parking management practices, both in the public and private sectors;
- Adapt the supply of parking according to the use of available spaces in real time;
- Optimize downtown parking in and on commercial streets to promote commercial vitality;
- Modify pricing according to vehicle size. The smaller the car, the cheaper the price of parking.

SAN FRANCISCO: 30% DECREASE IN TRAFFIC

The city of San Francisco has managed to reduce traffic in the city center by 30% in two years. The change: a visionary parking policy, which reduced the thousands of motorists circling through the city streets thanks to SF Park's strategy. The city installed a computer display system (and a mobile application) that indicates in real time where available spaces are located, plus a rate that fluctuates according to traffic during the day, with an option to extend parking beyond the traditional two hours.

Source : Le stationnement intelligent avant le béton. Et si la solution résidait dans l'affichage en temps réel des places disponibles ? Le Devoir, March 2015

SMART SOLUTIONS

Several smart parking solutions are currently established or being tested worldwide. Among those:

- ***Pay and Display Technologies, Pay by Space, Pay by License Plate***

These well-established technologies can replace several parking meters with a terminal for users to note the number of their parking space, and pay either with coins or a credit card, or with a mobile application. *Pay by Space*, and specifically, *Pay by License Plate* also automate security and management tools.

The number of street parking meters will gradually decrease and parking equipment will become multiservice. Moreover, we will see the arrival of multiservice terminals that will work in tandem with smart phones for all parking needs, plus combine several other municipal services: city and public services information, traffic updates through telemetering, and other commercial services in order to encourage the local economy.

For now, the first generation terminals consume a significant amount of energy due to the high number of features offered (color screen, keyboard, card reader, optical drive, etc.), which hinders their widespread implementation. But many technological advances are already reducing their energy consumption.

Eventually, parking meters will disappear: the connected car will communicate directly with the infrastructure responsible for parking management.

- **Reserved Parking Spaces**

Many companies offer remote booking tools - and advance payment - for parking spaces. To gain traction these tools must strengthen their platform, software, and data integration. Already their use has been successful in major airports such as London Heathrow, where much of the parking revenue comes from reserved parking.

- **Dynamic Pricing: the US**

Since 2011 the city of San Francisco has transformed its parking policy - the biggest reform for on-street parking since the invention of the parking meter in 1935 - pricing based on demand. Parking rates on and off street vary by location and time of day^{ix}.

Developed with mobile remote sensing technologies, pricing based on demand, or dynamic pricing, is designed to optimize the use of parking spaces. Other price varying criteria can be considered, for example, the implementation of a tiered pricing depending on the parking time, or free short periods on sections of commercial streets to encourage buying local.

In San Francisco, the policy is still at the pilot project stage^x. Further implementation in other cities face the obstacle of municipal regulations poorly adapted to this new approach.

- **Dynamic Pricing with an ecological component: Madrid, Spain**

In late 2014, the city of Madrid reformed its parking policy. Extremely innovative, and based on one of the most revolutionary algorithms, the program takes into account the ecological footprint of all vehicles according to their engine and their size. Pricing varies hourly and base prices may fluctuate by 20%. In addition, smog variables were introduced, allowing for an additional 10% increase if smog levels reached alarming levels.

Mobile and online tools have entered the parking industry in force, and have begun to revolutionize business models. For example, they allow parking managers to monitor violations and to issue tickets, or to monitor and repair equipment remotely. They facilitate the virtual management of private parking customers, and permit for variable rates to maximize potential: customers by the hour, monthly, VIP, events, exceptions, etc.

Software can track a driver's route and their interactions with various elements in the city: parking meters, gates, parking, streets, even the city as a whole. Some motorists are already able to choose a parking destination through a mobile application: you drive to your destination, the parking operator can track your position en route, an attendant greets you on your arrival, your place is guaranteed and has been booked and paid for.

Thanks to these technologies, all the features and applications enabled during a driver's route can be centralized: transactions, gate less parking, regular customer management, vehicle location, monitoring traffic, the issuing of parking tickets, availability signals. Bicycle parking can also be supported by this system. For example, the company NOW! Innovations has developed a digital platform to facilitate citizens' mobility ^{xi}. The system shares the parking network, it indicates charging spots for electric vehicles, self-service bicycle locking and parking, and other related services. This technology is capable of millions of transactions (research, billing and payment) in 8 countries and 3 continents.

When parking becomes fully integrated in smart transport systems, it will become central to the range of online services offered to citizens and visitors of smart cities.

CHALLENGES FOR A "SMART" FUTURE

To become smart, cities must by necessity integrate parking in their planning. It is imperative they have in place a global and long-term vision: if established in isolation, a dose of optimism will have very little impact.

To be truly effective and comprehensive, this planning must involve all stakeholders in transport management: public parking managers, but also institutional parking managers (hospitals, universities) along with private, municipal and provincial authorities, the managers of the freight, transit, building owners, merchants associations, chambers of commerce, and citizens associations.

This planning should also consider the many challenges ahead. Among others:.

- The challenge of data access: recognizing the importance and value of data and its use, agreement on the sharing and transparency of information
- The challenge of systems Interoperability: standardization and uniformity of the collection and presentation of data, to ensure their quality, ergonomics and their dynamic nature
- The challenge of conflicting agendas among the many players, partners in the public and private sectors, competing industries, thinkers and practitioners of management transport and parking.

To these challenges must be added the emergence of a “smart” marketplace, chaotic, propelled by digital technologies, and the overuse of the word «smart» invoked as a panacea.

There are countless IT companies offering solutions called «smart city», «smart infrastructure». Also on the market, any number of start-ups promising to solve all parking problems with their applications, but without any on-the-ground knowledge of the many parameters needed for management, monitoring and accounting in this specialized field.

A final but significant challenge, smart city planners must consider the costs of renovation and renewal of urban infrastructure, in a context where the public finances are fragile. The sums to invest will invariably come from different sources besides the public domain. They must learn the benefits and potentials of co-creating with their citizens, but also with private companies, public institutions and universities. They have every interest in inviting them to find and test all concrete solutions. Combined with the use of open data, the combination of the expertise of stakeholders from public and private spheres will be beneficial.

PUBLIC-PRIVATE PARTNERSHIPS AND PARKING

At Indianapolis, the public parking system was modernized in 2011 through a public-private partnership. According to the city, this agreement allowed it to increase its revenues and reinvest more than \$12 million in improving its infrastructure.

Source : Xerox and Indianapolis
<http://www.parking-net.com/parking-news/xerox-parking/indianapolis-public-private-partnership>

CONCLUSION

Smart meter

- Parking transactions
- Tariff plans
- Personalised and dynamic pricing.

Gate

- Parking enforcement
- Access control

ANPR / IRF*

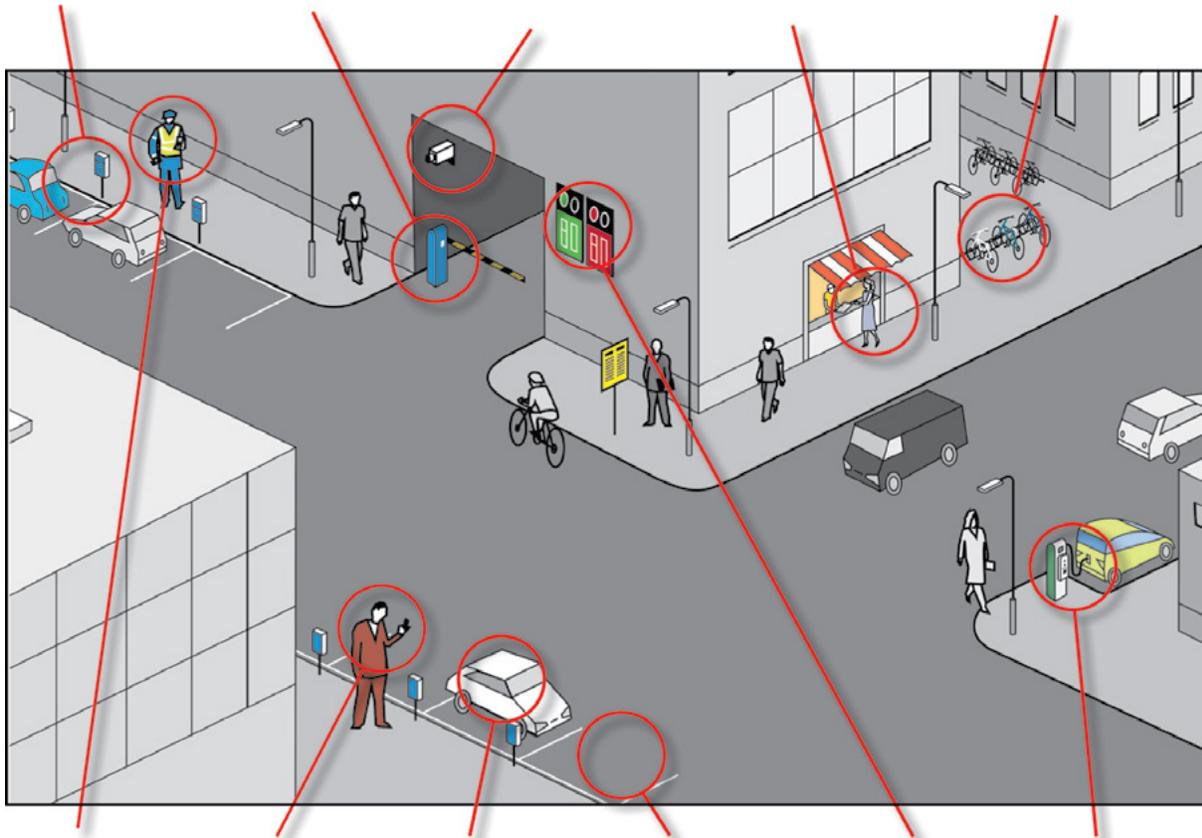
- Loyal customer access
- Automated payments and enforcement.

Point of sales

- Pre-paid and RFID cards
- Parking and citations payments.

Bicycle Parking

- Safe bike locks
- Customer access via app.



Enforcement

- Manual and automated parking enforcement
- On-the-spot citations

Customer

- Customer, parking and location data
- Hardware malfunction detection

Connected car

- Automated and seamless parking experience via M2M integration

Parking Sensor

- Parking space occupancy
- Parking lot usage
- Traffic and congestion monitoring

Info Panel

- Parking availability
- Traffic information

EV Charger

- Charging status
- Parking transactions

*ANPR : Automatic number plate recognition
RFID: Radio Frequency IDentification

Source : Now! Innovations ^{XI}

THE FUTURE IS NOW

By 2050 two thirds of the world population will live in cities. This is an increase of 2.5 billion people that cities will have to seamlessly integrate into their infrastructure. Such an increase in displacement must be anticipated and managed today so as not to disturb the environment. At stake is the very quality of urban life.

The technologies needed to ensure a well-balanced development exist and are improving year by year. With advanced smart parking, urban fluidity can be increased, and the effects of congestion and pollution can be reduce considerably. Soon our cars will drive themselves, park themselves, and come pick us up. Parking fees will be paid automatically through our e-wallet and displayed on the dashboard.

Is this utopia? Already an individual's daily trajectory could be interspersed with smart technologies that automate all the peripheral functions for parking, for example: the search for available spaces, payment, opening gates, signage for available spaces. All functions necessary for traffic management and mobility of individuals can also be automated: monitoring traffic and congestion, manual and automated monitoring of the use of parking lots (ticketing on the spot), controlling service use, user access control, detection of equipment failures.

Computer components, software and mobile applications and platforms exist. What remains is to connect the multiple stakeholders – public and private actors, industries, regulations - to make this scenario possible. Let us hope that in 2050 all these functions are integrated into a centralized system that will manage smart cities and contribute to the sustainability of the planet.

Several cities have followed suit and success is already on the horizon.

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BIOS

ÉRIC SASSET - BUSINESS DEVELOPMENT – MONTREAL AREA & MUNICIPAL MARKETS

Eric Sasset joined the Indigo Business Development team in November 2015. His experience with the company extends over 25 years, and thanks to his passion for parking, during this time he has acquired a highly specialized expertise in automation and the use of advanced technologies for outside and on street parking. He has initiated several major automation projects that have been established in Canada. As the Business Development Manager at Indigo, he specialises in the greater Montreal area and is active in the development of the Canadian Municipal Market.

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DANIEL GERMAIN - OPERATIONS VICE-PRESIDENT

Daniel Germain is Operations Vice-President at Indigo and has over 25 years experience in progressive management of the parking industry. He holds a degree in electronics from Hertzling Institute in Montreal. Mr. Germain joined Gestiparc as a shareholder in 1998. As Operations Manager, he participated in the development of Gestiparc in Montreal and Ottawa, and in 2004 launched operations in Toronto. After VINCI Park SA purchased a majority of shares of Gestiparc in 2004, Mr. Germain was promoted to Operations Vice-President in 2005. He is member of the Board of Administrator of the Canadian Parking Association.

Mr. Germain was directly involved in the transition of both the Toronto Pearson International Airport and Montreal's Pierre Elliot Trudeau International Airport and remains involved in the operations of both of these airport operations.

PIERRE BARRÉ - VICE-PRESIDENT OF BUSINESS DEVELOPMENT - MONTREAL AREA & MUNICIPAL MARKETS

Pierre Barré joined the Indigo team in December 2014, as a consultant. Established in the parking industry for over 28 years his expertise quickly proved in line with the company's strategy, and he became Vice President of Business Development - Montreal and Municipal Markets in 2016.

Mr. Barre has extensive experience in several areas of the parking profession, either as an owner of materials and equipment, or as an executive of a multinational company active in the field of parking. He brings a deep knowledge of European leading edge practices in the field of parking to his role in the implementation of major public street parking facilities in North America. Since his appointment as Vice-President, Mr. Barré heads the Business Development team for Montreal, currently working on the development of innovative turn key solutions (public-private partnerships, concessions, etc.) and tools for business intelligent technology.

Special collaboration of

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Danielle Desjardins provides research, analysis and writing services, for reports, studies and white papers, through her company La Fabrique de sens. Before that she worked for many years for a large organization in the communication sector, where she oversaw strategic planning, among other things. She is particularly interested by the impact digital technologies have on society.

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