How real-time, stall-based, occupancy monitoring can help cities understand current and future parking requirements

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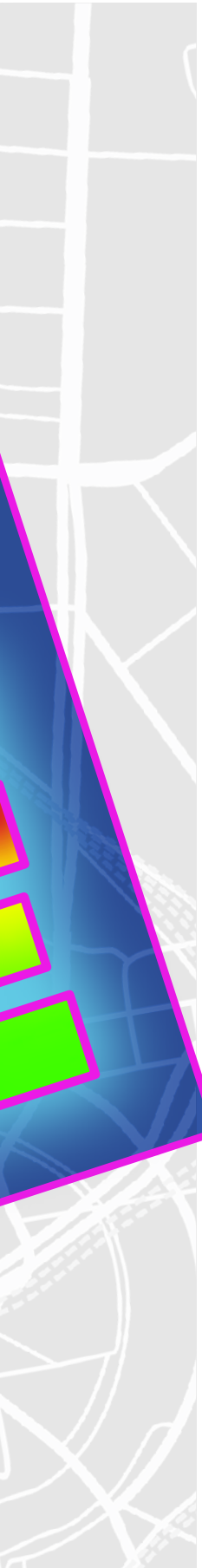


By Mark Hall and Domenic Sorbara

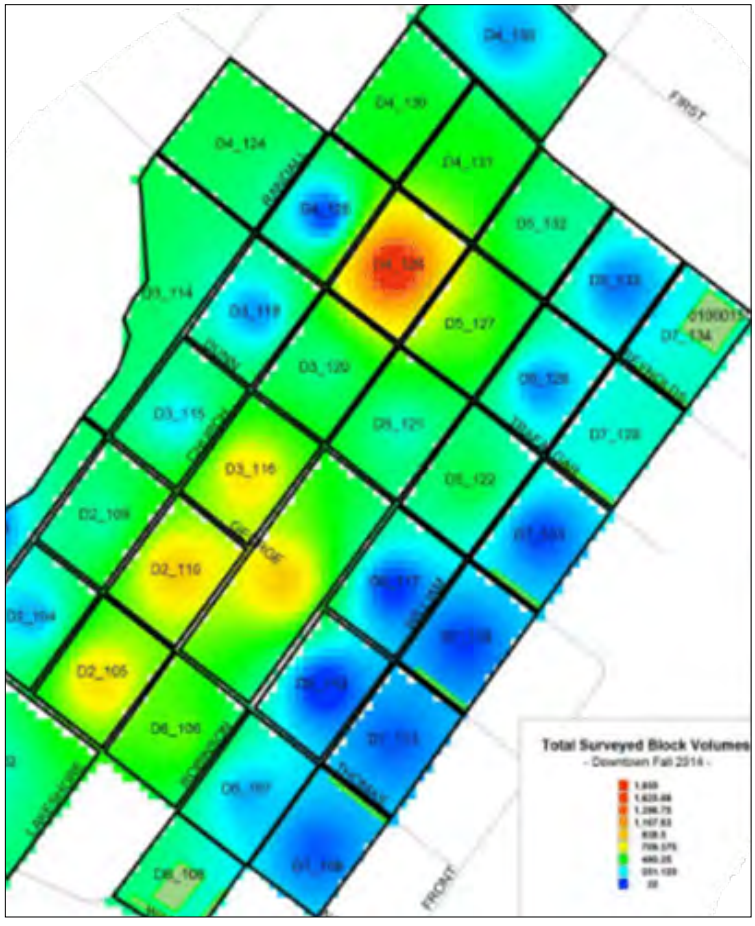
PARKING HAS QUICKLY BECOME A MAJOR AREA OF FOCUS (typically as a pain point) for cities and municipalities of all sizes. As urban municipalities grapple with the impacts of parking on budgets, land use, and customer/community experience, smart parking solutions and technology in general can provide parking organizations with the abilities and data to optimize usage and maximize resources.

When it comes to understanding their current parking supply situation, discussions with most cities reveal a negative overall experience due to a perceived lack of parking stall availability. However, the total number of stalls is not necessarily the issue. Quite often, the perception that parking supply is deficient relative to the expected or desired experience is often based on the time it takes a customer to locate a vacant parking space versus the duration of their expected stay. As such, finding an available space in a timely manner is really the defining metric for a positive parking experience.

Another factor to be considered is how the impact of the pandemic will affect their needs moving forward. When the COVID-19 pandemic hit, there were varying effects on the parking industry. In some areas across North America, demand reached an all-time low as employers mandated remote working and residents avoided unnecessary travel, opting to stay within their local communities. As an example, sensor data collected from the city of Stratford in Canada showed that from the beginning of March to the beginning of April, parking occupancy rates plummeted from approximately 75 percent to just over 10 percent.

Moving forward, those who were required to continue going into their workplaces or are now returning to them may no longer be comfortable carpooling with coworkers, using car-sharing programs, or riding public transit, meaning there may be more single-occupancy vehicles on the road. So, what does the future hold: A return to more single-occupancy cars on the road leading to an increased demand for parking, or a decrease in demand due to more professionals working from home than in pre-pandemic conditions?

While it is too early to accurately assess the true impact of the pandemic on the parking industry, one thing is certain: Municipalities will need accurate data to make informed decisions when it comes to their community parking needs.



Heat map representing Spatial Dimension of parking space occupancy derived from sensor-based stall occupancy data collection.

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On-street and Surface Lot Spaces

Currently, there are three main parking scenarios available within most municipalities: on-street parking, surface lot parking, and parking garages. While these options worked 30 years ago when there were fewer vehicles on the road, traffic volume has increased exponentially in large urban areas, creating serious challenges in terms of driver/customer experience. As is commonly reported, drivers can be left circling city blocks for upwards of 10 or 20 minutes before locating a parking spot, adding to an already congested road network. In turn, these issues affect a municipality's operations and efficiency.

Looking specifically at on-street and surface parking lot scenarios, a number of issues can affect the parking experience for both drivers and for municipalities (in terms of operations and revenues):

- A lack of entry/exit control.
- Continuous vehicular exposure to the elements.
- Poor wayfinding/signage.
- Obstructed sight lines.
- Lack of enforcement.
- Lack of data available for drivers to gauge availability of parking.

By gaining more access to real-time and historical data about parking usage and challenges, cities will be in a better position to enact more progressive and cost-effective parking strategies.

Technologies

The architecture of a smart parking program strategy should be designed around three major components: parking demand, supply, and market potential. When it comes to capturing consistent data to align with these components, cities should be striving for these high-level requirements with their data: high accuracy, high reliability, and real-time and historical data collection. As with most cities today, budget and resources are a major focus, so cost efficiency is also a requirement when looking into any smart parking technology or approach. There are a number of methodologies and technologies that offer the ability to provide various levels of data or clarification on stall status, ranging from manual counting to license plate readers, gates/loops, meters, and payment apps to sensor and video based solutions.

These techniques offer varying degrees of benefit and data availability but only a couple really offer the needed 24/7 coverage, high data accuracy, consistent reliability, real-time status and stall-level insight that cities need. The leading technologies would be sensors and cameras with image processing. And when

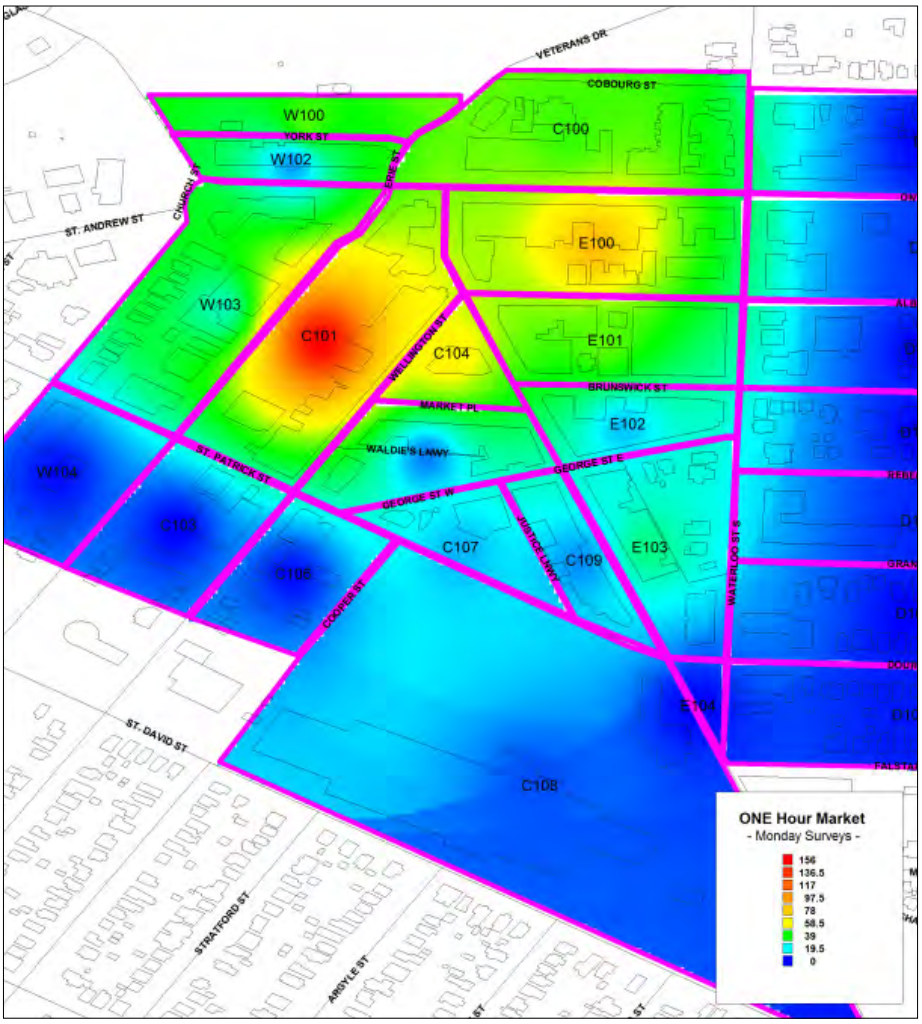
Surface-mount parking sensor

Inground parking sensor

it comes to surface lot and on-street monitoring applications, a combination of both technologies may provide the best solution to cover all the requirements.

For on-street parking, stall occupancy sensors may be the best choice. Sensor-based stall occupancy monitoring offers the key characteristics of high accuracy, high reliability, and both real-time and historical data availability with a lower cost-per-stall point than the other available technologies. Sensors can detect if that stall is in use or not, relaying that information in real-time while also offering historical usage data for each of the spaces. This allows cities to make informed decisions based on individual stall usage, as well as examining overall trends offering a comprehensive parking profile on the number and type of parking spaces needed, as well as potential requirements for the future.

For surface lot applications, a combination of stall occupancy sensors and video/camera monitoring is the best choice. Cameras provide a cost-effective way of monitoring the occupancy state for many of the stalls, augmented with individual stall sensors for specialty stalls and camera blind spots.



In both cases, the solution should also work alongside existing technologies that are deployed, such as payment systems and license plate recognition (LPR) to comprise a holistic smart parking solution.

Types of Data

Circling back to the key components of a smart parking program—parking demand, supply and the market potential—there are a number of data points that need to be accessible no matter what approach or technology a city may select. In some cases, a parking organization may simply look at their total number of spaces and count how many are occupied at various intervals to determine if demand is meeting supply. However, having access to a more extensive set of data will provide much more value.

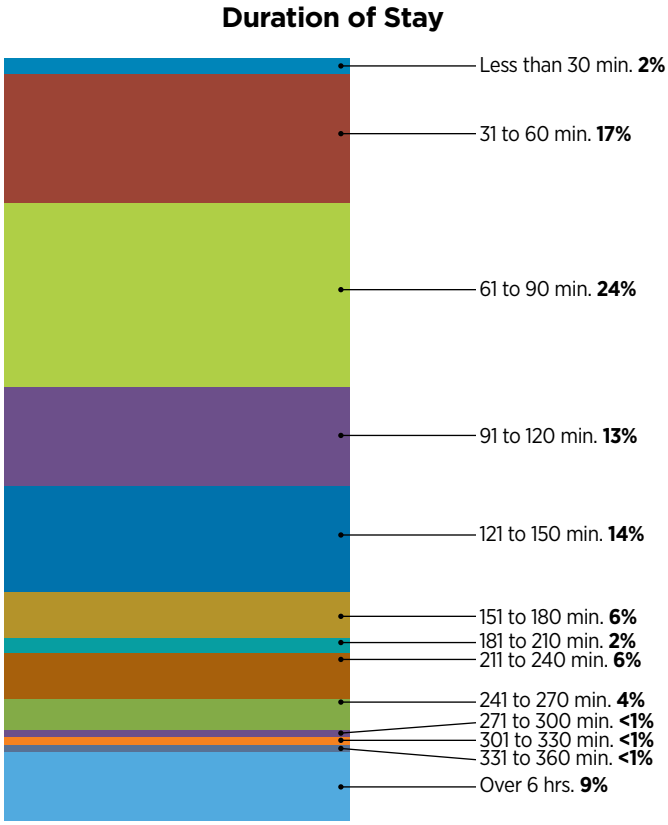
Parking demand includes both physical and experiential aspects such as the physical environment, attraction of parking supply, trip characteristics, parking operations, and customer experience. This is where the combination of real-time and historical data allows an organization to build out a comprehensive customer profile. Key characteristics are revealed through various metrics and actions, captured with real-time and historical data, and include an understanding of different volumes of traffic throughout the day. Tracking lengths of stay (short or long) and pick up/drop off points can also provide insights, as can understanding walking distances and the effects related to pricing.

What this profile development will reveal is the volume of vehicles visiting a particular area, how long they are staying and how much are willing to pay. This information then gets overlayed with data related to the businesses in each area to get a true understanding of why drivers/people are coming to certain areas of the city.

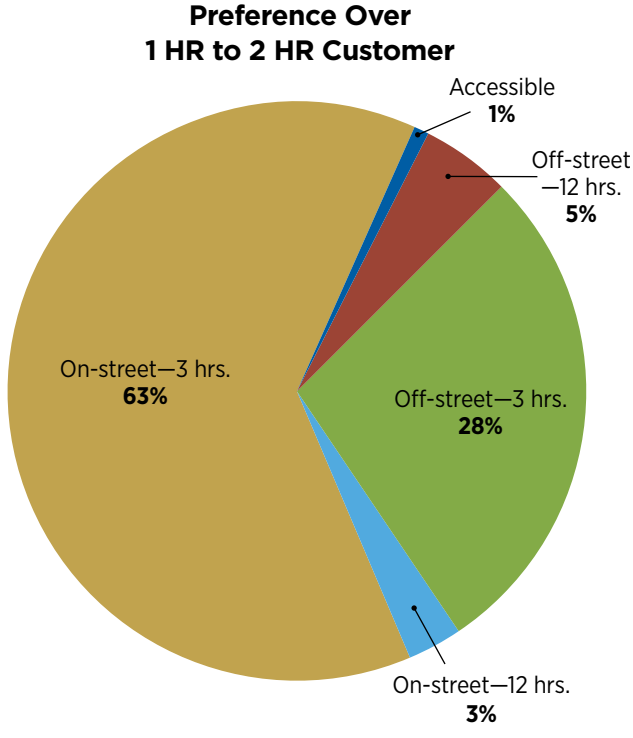
When it comes to digging deeper into data from a parking supply perspective, again there are three key supply metrics to understand if parking services are meeting demand: volume, occupancy or accumulation, and customer mix (based on duration of stay).

Volume is where real-time data really brings things into focus. There are four areas that comprise volume:

DURATION OF STAY DATA



Duration of stay data acquired from based stall-based occupancy monitoring



Duration of stay with focused time interval

- Turnover (which is basically total volume and duration of stay compared to the supply of space that many track).
- Effective turnover (which deals with peak number of spaces occupied).
- Pattern analysis.
- Spatial behavior.

Real-time monitoring offers the opportunity to measure the optimal performance of parking assets in association with understanding spatial factors of walking distances, price impacts, and demand along with land use that may affect volumes.

Occupancy is probably the easiest to understand but intensity, which stall-based monitoring offers, is much better from a strategy perspective. In terms of intensity, cities will want to monitor aspects such as type of spaces being occupied (short term, long term, accessible etc.). Spatial dimension will identify higher level geographic occupancy characteristics. This is where having data can help with defining requirements and helping with decision making on new assets such as parking garages. Stall-based data can also help with temporal variation or understanding how trends and performance have changed over time and what those change drivers may have been.

A key aspect of capturing real-time and historical data is the ability to look at and compare different timings at a stall level. Having the ability to look all those data points to understand trends and performances on an hourly, daily, weekly, and monthly basis is something that cities will find incredibly valuable for making evidence-based decisions on infrastructure requirements that could cost tens of millions of dollars.

This brings us to the final component in the supply section, market potential, or customer mix: Customer stay monitoring for patterns, demand over time, and turnover. The inclusion of real-time data facilitates understanding of those areas in high use. But to really understand the customer mix, data should also draw out those misfits, or areas of low use, while also helping to bring an understanding as to why those assets are under-performing.

Implementation and Use Scenarios

Sensor-based stall monitoring is not a new technology, though there have been several advancements since some of the early deployments. Big cities such as Los Angeles and San Francisco have experimented with stall-based occupancy monitoring in the past with

somewhat differing results. Both installed parking sensors to monitor utilization, with the goal of implementing a dynamic pricing system. In Los Angeles, parking owners saw immediate benefits with revenues increasing by approximately 35 percent per month. When decreased labor and enforcement costs were factored in, profits increased more than 50 percent.

In San Francisco, a stall-based occupancy monitoring pilot program and associated dynamic pricing model ran from 2011 to 2013, affecting 25 percent of the city's metered spaces and garages. According to city officials, average meter rates fell by 4 percent, while city-owned garage rates dropped 12 percent; net parking revenue actually increased.

The ability to collect the real-time occupancy state of parking stalls reliably, continuously, and with minimal maintenance is foundational to sustaining a parking system that consistently delivers on the key performance indicators. The right type of sensor technology can indeed provide all the necessary data capture requirements for a successful parking solution.

Parking assets are a large and important component of a city's budget and resource focus. As such, each city needs to understand their own requirements and utilization no matter what the scenario. By evaluating its parking strategies using real-time data monitoring and smart parking solutions, municipalities will find ways to generate additional revenue, whether that be through the realization of operational efficiencies, changes in land uses for underperforming lots or having the data that lets them know they don't need to spend tens of millions of dollars for infrastructure that isn't needed.

Having access to accurate, consistent data via stall-based occupancy monitoring will provide cities and municipalities the ability to analyze and assess a variety of options to best meet their needs, enabling them to properly evaluate their parking experience which directly impacts their community. Choose the right technology, or combination of technologies, to ensure maximized parking asset usage and compliance revenues, reduced traffic congestion (and air pollution) while keeping budgets and operations manageable and improving public safety. ◆

MARK HALL is head of marketing for eleven-x. He can be reached at mark.hall@eleven-x.com.

DOMENIC SORBARA is a parking consultant for Parking and Systems Consulting. He can be reached at dsorb@hotmail.com.