Parking by satellite

With the Skymeter GNSS device walking away with the overall Intertraffic Award for Innovation in 2010, its creator reveals how everyone – from authorities and operators to the parking public and the environment – could benefit from a shift in technology thinking

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A system with large efficiency benefits for parking authorities exposes much more than simple revenue opportunities – which alone are a sufficient motivator for any municipality strapped for operating funds

The term 'parking management' refers to the myriad ways of controlling how parked cars occupy public or private space owned by another party. It sometimes even refers to ways to manage how one is permitted to park on one's own property, for example whether you are permitted to park overnight in your driveway or how many spaces a developer must provide for a new development.

Traditionally, parking supply has been managed via a discordant patchwork of inconsistent regulations, or accidentally by competition for development space. Often it is not managed at all. More motorists wishing to park on-street compete for fewer spaces. More building means more garages are built. Garage parking bays cost four to seven times more than a street spot to build and maintain (ignoring the full value of scarce kerb space), hence pricing that reflects building costs rather than demand means that the demand for street space is ever upward, and urban parking congestion increases.

Having been in Jeju, Korea this past October, it was interesting to note that parking congestion there was the same as in Toronto or in Manhattan. Motorists circled for empty spaces. On the busy side streets, stuffed with shops, I saw no sidewalks.

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Slowly moving cars and pedestrians together wended through a clutter of vehicles parked on both sides.

Parking control mechanisms include local laws and regulations, signage, permits, short or long-term rental payments, or ticketing (citations for violations). At one extreme, wheel clamping may be used to ensure payment of fines or towing may be used if a vehicle is blocking traffic. At the other extreme, as noted in Jeju, motorists and pedestrians are left to sort things out for themselves. A few lines were painted on the street, many cars were parked where there were no lines, and people walked around them like water draining through vegetables in a sieve.

The notion of using payment to manage parking seems simple in theory. A privately owned vehicle is occupying public space, which is at an increasing premium in urban areas, and which denies the use of that space to any other – whether car, cyclist, or pedestrian. So a payment seems reasonable. On the other hand, each of the parked cars brought at least one person who may transact some business, which that local community might profit from, so we may not wish to discourage motorists by charging a fee to park – or so common thinking goes.

Do we have it wrong?

Well known among the small group of transportation economists that concern themselves with parking management, Professor Donald Shoup (Berkeley) took great pains in *The High Cost of Free Parking* to show that this problem is anything but simple and that we are making grievous and essentially thoughtless errors in the matter.

There are many sides to this. Merchants – whose business arrives on wheels – often demand free parking. Municipal traffic managers need to keep motorised traffic moving, both for cars and transit vehicles. Cyclists demanding safer bike lanes – and often with a voice too weak to affect change – compete with cars parked on-street. Some municipalities need the revenue.

Ironically, many cities such as Toronto have policies promoting low on-street parking fees to keep merchants and motorists happy, but levy parking fines very aggressively as a way to maximise revenue. Such a policy contributes greatly to congestion on downtown streets, and makes the parking experience an unnecessary nuisance. Rather than paying a market price and enjoying the visit, the motorist circles for a while, wrestles a parking meter, pays a cheap price, and occasionally gets ticketed. There are few financial transactions for a simple service that are as unpleasant as that for parking.

In the end, many motorists save a small amount of money, some are annoyed and overpay, the city retains less revenue, merchants are happy for the wrong reasons (the cheap spaces are taken by others so their customers may not be able to park at all), and politicians remain unaware that these policies harm almost everyone except those few motorists that win this ‘parking lottery’ and manage not to get ticketed.

Parking by satellite

In 2010, the 75th anniversary of the parking meter, a new kind of in-car parking meter became available. Based on very accurate positioning algorithms and a built-in database of parking locations, times, prices, and rules including exceptions (pricemap), parking by satellite offers touchless, private and anonymous parking management that addresses many of the problems that now plague parking payment.

How it works from the motorist’s perspective is that a vehicle is parked in any spot, lot or garage that is designated as accepting automatic payment via satellite metering, and receives a credit or debit invoice each month. Privacy is managed by not permitting time and location data out of the vehicle – only billing data is forwarded showing the amount of money owed and to whom. From there, fees are collected or debited and distributed to the appropriate parking operator.

From the parking operator’s perspective, this could simply be another form of payment collection. But that would be to miss the prize. A parking operator that manages a garage or lot competes with others. Such an operator can offer loyalty rewards – ‘Spend €60 with Super Car Parks and get free parking on Saturday’. A city can offer parking prices gauged to vehicle size, for

instance '25% parking discounts for cars less than three meters long'. A local group of retail merchants could offer an hour of free on-street parking to its customers – managed online and anonymously.

Lots of advantages

These satellite meters use a communications network to forward billing data. Likewise, the parking pricemap, which is electronic, can be updated, personalized and uploaded to the meter. A retailer can arrange for employees who park away from the entrance to pay a lower rate. Hospitals can let their staff park free. Cities can let emergency personnel pay a different rate during certain hours. Local residents can park on-street for free, while visitors would pay. A city resident could go online and purchase a one-week residential parking permit for a visitor, uploading a pricemap change to the visitor's satellite meter giving him guest parking for the week.

Intelligence can be used to better distribute cars in large lots: a massive park-and-ride lot can offer lower rates for those who park farther from the station entrance – an attractive option for students or other lower-income users. A retailer who closes at 18.00hrs can turn his 15-space parking lot into revenue after store hours.

As a bonus, the same meter can determine an accurate per-mile premium for pay-as-you-drive insurance. And it can pay the road tolls that are already set up for microwave or manual payment – all without slowing or stopping.

Graduated parking

The IPI Parking Professional of the Year (2010), David Hill, began trialling satellite parking technology late in 2009 while he was chief operating officer of the Winnipeg Parking Authority (WPA). Interested in bundling on- and off-street parking as a service improvement, Hill wrote, "I believe graduated parking rates would make us more successful in managing supply and demand, which in our industry is based around the [constrained] capabilities of our machinery."

Graduated parking pricing meant a vehicle would be permitted to stay for an extended period on the street, but each 15-minute increment would cost a bit more than the previous. This addresses three of his critical concerns.

First, it would reduce enforcement costs, allowing his team to enforce many more spots, as managed parking could be expanded to more streets. Not only would he reduce the expense of having a parking officer peer through every windshield, he would write fewer tickets, handle fewer complaints and have to deal with fewer collections. Instead, money will flow directly from the motorists' accounts into WPA's bank.

Second, it would signal to drivers to choose garage parking for all but relatively short stays. This reduces demand for on-street parking, which in turn reduces circling, congestion and emissions.

Judging by the response to a short TV news spot about his trial, it makes for happier motorists as well. Several people called WPA customer support, asking 'Where can I get one?'

Enforcement

Hill's third concern was enforcement. The meter that permits graduated parking separates the flagrant scofflaw from someone making the occasional error of returning a few minutes late, misreading a sign, or not having correct change. This is the most important advantage of graduated pricing managed by this self-metering technology.

Many social problems can be characterised by something statisticians call a 'power law' distribution – all the activity of interest is at one end rather than in the middle as it would be for a 'normal' distribution. Malcolm Gladwell described this in his February 2006 New Yorker essay, *Million-Dollar Murray*. He detailed how 80% of homeless cases are homeless only once and only for a few days, that 10% are 'episodic' and return to the street a few times over a few years, and that

Applying the '10-80-10' rule to parking, GNSS could allow enforcement to dedicate resources towards the 10% of motorists who go out of their way not to pay, making enforcement far more effective

> “Deploying such meters in a private and user-friendly manner would gradually reduce enforcement costs”

it is only the last 10% that remain intractably stuck in that condition. It is this final 10% that cause almost all of the expense, distress and legal issues of the homeless problem. Gladwell also showed that the power law applies to emission levels of vehicles: 80% are very clean, 10% have a problem that the owner addresses quickly, and 10% are performance vehicles or clunkers driven by chronic offenders with no intention of conforming.

When I first met Dave Hill, he described the parking enforcement problem as a ‘10-80-10’ rule – the same power law that describes a lot of human problem behaviours. Breaking this down, 10% of motorists are highly compliant with all parking rules, the people who may get only a couple parking tickets in a lifetime. They exist – I have a Toronto friend who drives daily and has had one parking ticket in 32 years. The 80% of motorists intend to comply but make the occasional sign-reading error or misjudging time. These people get one or two tickets annually. I am one of these. The last 10% go out of their way not to pay for parking. Although a few of these are egregious scofflaws, most simply try to underpay meters or park in unpriced areas, which generates ‘spillover’ problems. I once had a colleague who never paid for on-street parking and simply wrote a cheque each month to the city, claiming the money worked out the same while he saved considerable bother.

Hill’s 10-80-10 rule is vital for enforcement management. He predicts voluntary participants in a self-managing, privacy-assured, in-car parking system would come from the highly compliant 10% and the well intentioned 80% of parking’s power law equation. This would allow parking enforcement departments to focus on the last 10%, making enforcement far more effective – an additional and gratifying consequence for Hill, who dislikes writing tickets for the person who makes occasional errors and who would have been happy to pay had they returned in time or had correct change.

Widespread use of a GNSS-based parking device would not just allow cities to get rid of parking meters cluttering roadsides, but it would also allow them to offer drivers pricing incentives to influence their behaviour, such as a parking discount for eco-driving, for not driving during peak hours or for lower insurance premiums via PAYD insurance

Self-enforcement

Correctly operating meters can be self-checking and can relay status information to a mobile or handheld reader operated by a parking officer. They can call in a distress message to a central billing system if tampered with. The remedy for tampering is to flick on a red LED to signal a failed meter, forcing the driver to resort to a kerbside meter. External enforcement is still needed for vehicles without a working meter, but the cost of enforcement for vehicles with working meters is reduced to a fraction by comparison. Deploying such meters in a private and user-friendly manner would gradually reduce enforcement costs.

In fact, as meter use becomes pervasive it is possible to switch from beat enforcement to dispatch enforcement, as the system knows which spots are occupied by vehicles with correctly

operating meters (without knowing the identity of the owners of those vehicles).

Setting prices

Prices are decided centrally – hopefully based on demand. They are managed electronically and changes automatically downloaded to meters. Pricing can be more effectively planned and easily updated. As a graduated, commercial, on-street example, one could provide 20 minutes free, four cents a minute for the next 100 minutes and 20 cents a minute thereafter to encourage turnover. To manage residential permits, resident vehicles might be assessed at five cents an hour instead of their annual permit cost, while visitors might be assessed at one cent a minute until 23.00hrs and 10 cents per minute thereafter to fairly pay for – but not ban – overnight visitor parking.

Price changes might be infrequent (perhaps annual) and managed with zone-based signage, keeping rules as simple as necessary. Changes could be more adaptive – managed via in-car signage.

Self-audit

Motorists have several ways to audit bills. For normal private accounts charges and trip data can be reviewed online under password control. Loyalty points and rewards can be collected, expense reports compiled for reimbursement, and data can be deleted or even sold – aggregated and anonymised – to marketing companies or for O-D studies. For fully anonymous data management, data can be downloaded by Bluetooth and reviewed on a smartphone.

Demand management

Wide-area, managed parking pricing can be used to quell congestion. Parking could be free within 500m of a motorist's residence while priced everywhere else. Any vehicle that is stationary during peak congestion times could have its municipal parking account credited with a reward or discount. In any jurisdiction where road-use charges meet more resistance than parking charges, this provides transport authorities with an earlier control lever on congestion and sorely needed transport financing. Furthermore, parking charges can be shaped to local demand needs and are seen as more acceptable than road-use charges.

Near-zero transaction costs

Touchless, in-car parking metering and fee collection means fewer kerbside machines – only signage and mobile enforcement via non-intrusive reading of meter 'health' signals. License plate recognition (LPR) can be used for additional documentation and enforcement paid for by the citation collections. Hence, satellite-metering technology avoids new infrastructure costs and reduces transaction costs for converting untolled parking to tolled parking. If a municipality tolled its residential streets, motorists could choose from among in-car meter, quarterly or annual permit, or fines. Applying tolls everywhere and priced to address only marginal social costs is not only fair but can be used to manage spillover on streets and convenience parking at retail shops. None of this can be accomplished with kerbside machinery that requires a specific number of bays or sufficient demand to justify deployment expense.

How long will this take?

We will continue to see kerbside meters for some years, albeit many fewer. For now, they are critical for non-participants, as in-car meter use would be voluntary. But as new technology comes on-stream for the 'connected vehicle', more and more automotive applications for safety, traveller services, infotainment, congestion-based navigation, PAYD insurance, road tolling, emergency services and so on, the inclusion of automatic location-based parking is too good to ignore. The real question is, how long will it take us to understand the new paradigm? After all, satellite parking is not simply a replacement for current metering technology. It is a massive opportunity to bring centralised parking demand management and a measure of congestion management to our cities.

If privacy and fairness are guaranteed and perceived as trustworthy – and if early users are rewarded with convenience and discounts that more than pay for the in-car device – then nothing can stop this. ■