City analytics

Ten ways data can improve your city planning, traffic flow, public transportation and parking efficiency

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You've got a tough job to do

As an urban transport professional, you're on a three-fold mission of optimization:

You want to improve service to the public.
You want to make travel better for everyone. So you're working hard on people-friendliness: fewer missed connections, quicker journeys, and overall better travel experiences.

You need to do it efficiently.
You're accountable for your decisions – and you certainly don't have any budget to waste. To hit your targets, you need to make sure you get the most out of your resources, run your operations profitably, and bring in revenue.

You need to do it responsibly.
Your job requires social and environmental responsibility, too. People expect your solutions to deliver less pollution, increased safety, and more sustainable, livable cities.

In short, your city needs your talent, energy and ideas now more than ever.

Talent

Ideas

Energy
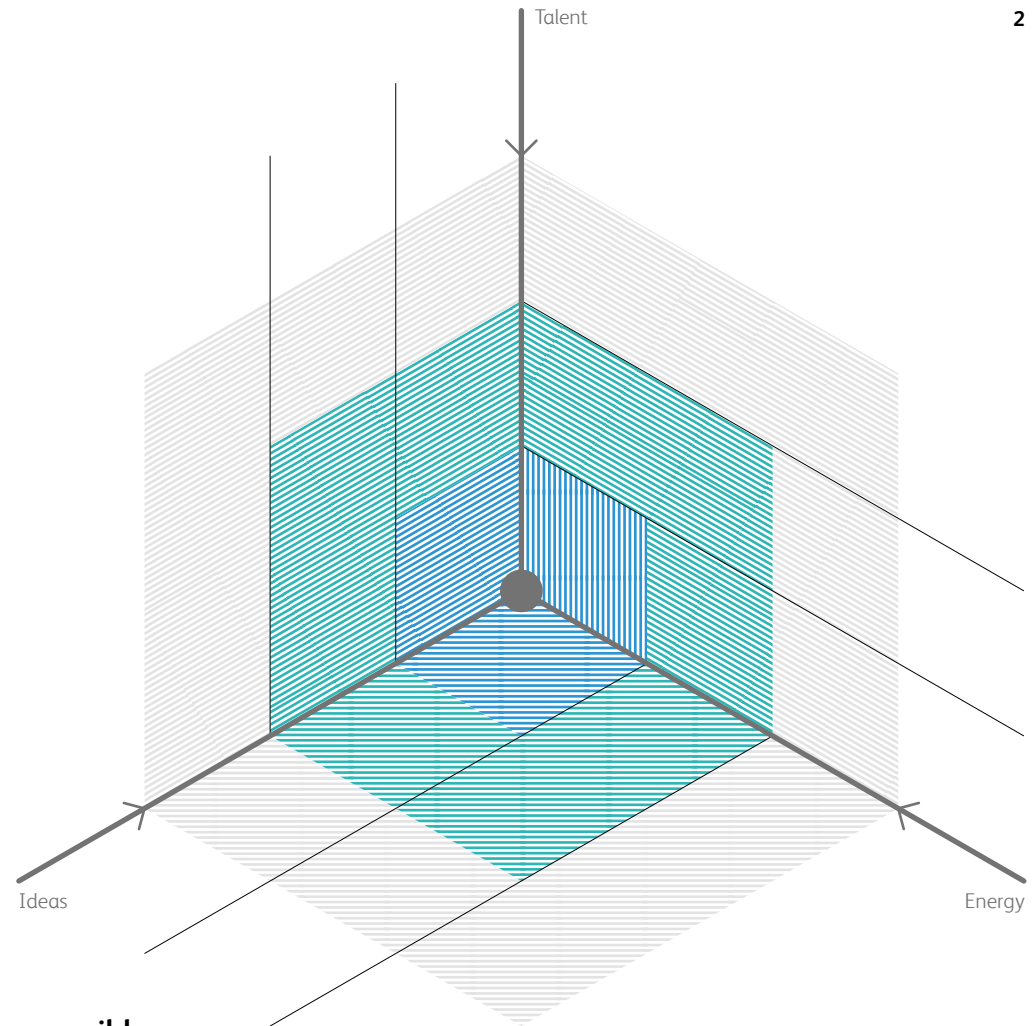
Your new job description sounds even tougher

You're doing this tough job in an age where customer expectations are high, and cities are running out of space and money. It's getting even harder for you to make an impact.

The good news: it's also the age of data, which provides insights into patterns that have never before been available to transportation professionals on this scale.

And that means your new job description includes an essential new skillset: understanding the value of good data, collecting and studying it, and applying its lessons to achieve your goals.

That's what this eBook is all about.

Basic principles of data analytics

In our personal and professional lives, we're awash in data.

The same is true in transportation. But there's more than meets the eye – smartphone location data, weather data, social media and more.

Embrace the data. Learn what's available and how to use it.

Then, learn to integrate it – the whole idea is to recognize patterns so you need to normalize, clean and connect data. Once you get a system in place, you'll be able to maximize the time analysts are working with data to understand patterns and trends.

Data

Integrate
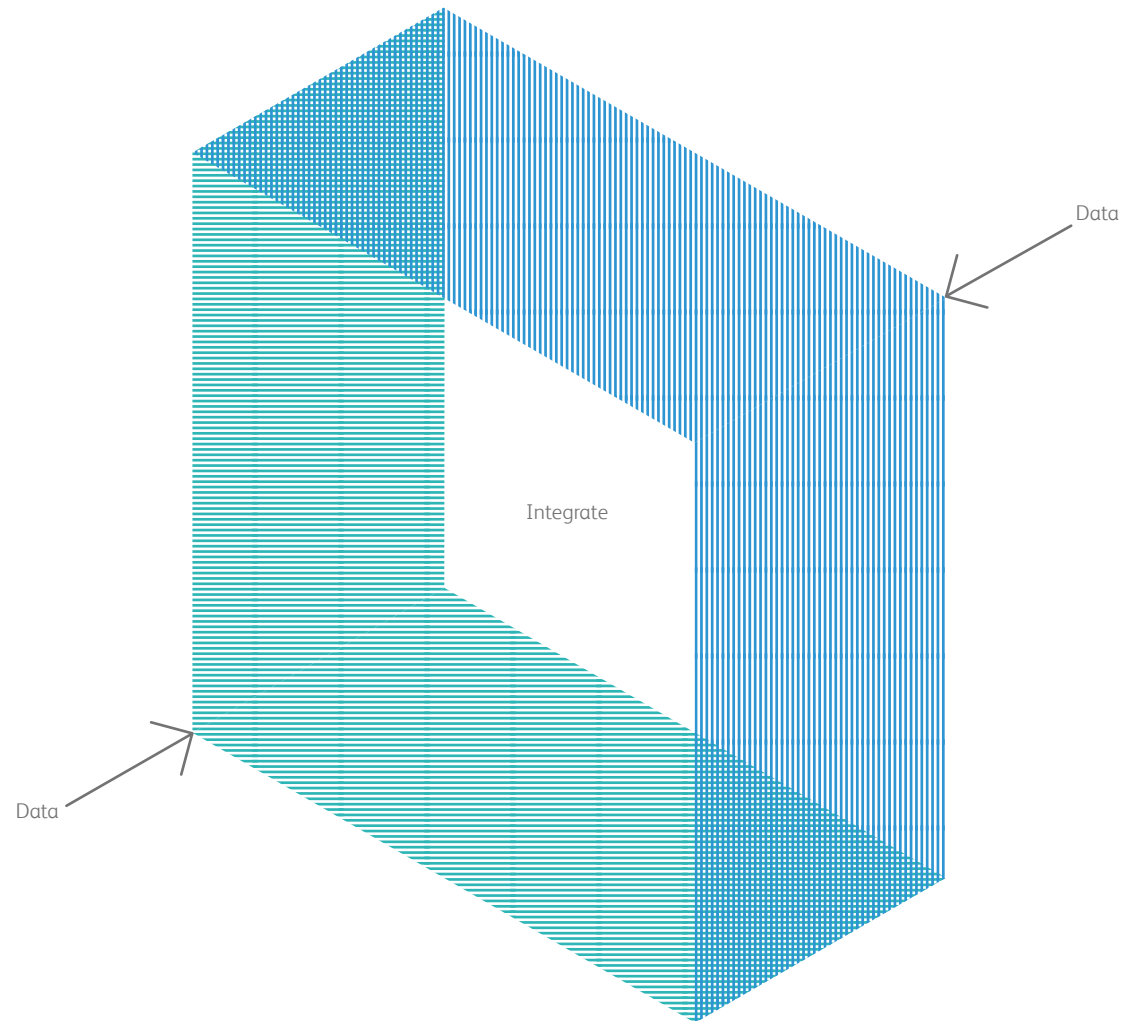
Data

Here are ten ways city planners, parking authorities and highway agencies are using data to help cities work better.

One

Two

Three

1.
Track your travellers

Smartcards and open payment systems have revolutionized our understanding of rider behavior by making data collection easier. For the first time, you can get granular detail on individual journeys that have actually been taken by real people – not based on unreliable estimates, random sampling, or surveys.

This gives you insight never before available:

- When people are travelling
- Where they're travelling to and from
- What modes of transport they're using and in which combinations
- Where they're changing
- How long it takes

...And you can get this data every day, every hour, every minute.

That gives you a truly accurate picture of the travellers and how they're using transport services (and, for example, see where the system is inefficient, and which neighborhoods might be over- or under-served).

In addition, integrated ticketing and fleet tracking systems make use of available passenger data to help transit operators track and manage their vehicle fleets.
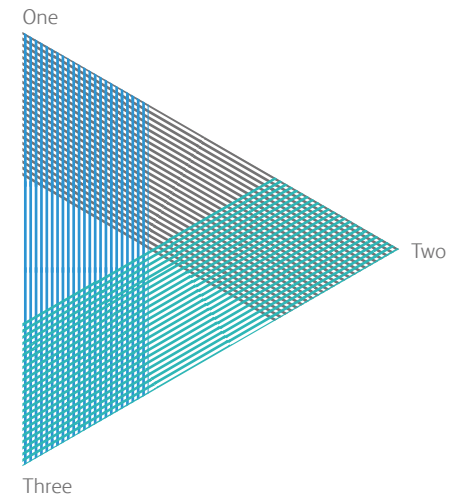
Think in threes
In many cities, metro stations used to only sell one-way and return tickets. Using analytics, one station manager discovered that 20 percent of the station's riders were actually travelling in a triangular pattern – an insight that led to the introduction of a three-way ticket.

2.
Identify and predict demand

Historical analytics help you build models that forecast traffic and traveler flows for very specific periods,
such as Tuesday evenings in July, on days before bank holidays, etc. – and plan for exceptional situations accordingly.

And real-time data can give you a complete view of current usage and demand.

Onwards and upwards

Since its introduction in 2007, 'Vélib', the Parisian bike share program, has become extremely popular with commuters and tourists alike. But there was one aspect the planners hadn't considered: a large number of people were cycling only one way, to go downhill. On the return journey, they'd use another mode of transport. That left the uphill pods chronically empty, and the ones at the bottom constantly filled.

Using advanced analytics, the program managers identified where the bicycles were and where they needed to be – in near real time. And they started dispatching electric vehicles to redistribute the bikes to the various locations, based on that day's use.

3.
Provide tactical fixes for city jams

When accidents or erratic driver behavior cause congestion in a city, it can have far-reaching ripple effects that cause congestion across large areas. Traffic data in combination with road-signaling technology can help alleviate such acute traffic problems by providing tactical responses, such as:

Variable speed limits: when traffic builds up, or when rain or snow hit suddenly, a dynamically adjustable speed limit can make a massive difference to accident rates. By analyzing traffic density and slowing vehicles down in a controlled manner, these systems keep traffic moving and avoid the dreaded stop-and-go.

Adaptive traffic lights: tactical traffic signaling can relieve congestion by optimizing vehicle flow for the current traffic density, and create a 'dynamic green wave.' In one such wave, a whole platoon of vehicles moves across several intersections without stopping, which reduces congestion, fuel waste, and delays.
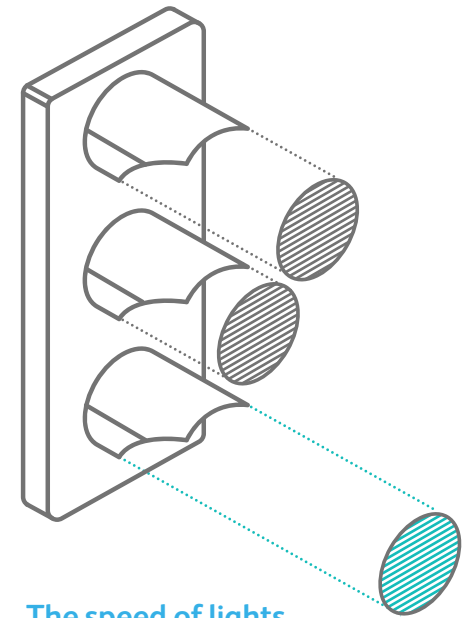
The speed of lights
In 2008, the city of San Antonio, Texas, upgraded its traffic signal system. Using real-time data, signals on major roadways can now automatically retime and coordinate themselves to the most efficient interval for the current traffic density. The results:

- A reduction in delay of up to 40 percent and increased throughput of up to 60 percent
- An average travel time saving of 54 seconds per corridor
- A total annual delay saving of 8.6 million motorist hours in traffic

Source: Texas A&M Transport Institute

4.
Respond to highway bottlenecks in almost real-time

Every city has notorious bottlenecks, where traffic regularly builds up. Predictive analytics help transport officials monitor traffic around these areas and counteract road congestion – before it happens.

Working with highway authorities to attack choke-points is an important part of keeping the city flowing.

Decongestant
Several highway agencies in the United States are using vehicle density data to avoid traffic jams successfully. When traffic is building up and congestion is imminent, they open the lanes reserved for high occupancy vehicles (HOV lanes) to other vehicles – at a charge. Drivers willing to pay the charge, which can be adjusted dynamically, can then reduce their travel time – and in turn, reduce the traffic density across all lanes.

5. Optimize resources

If you base your service capacities and frequency on experience and historical practice, there is a good chance you're either wasting resources or underserving travelers at any given time.

When you don't know what the exact rider behavior, the current demand and usage of your public transport capabilities look like, it's close to impossible to allocate resources efficiently – and run profitable operations. Data analytics help transport officials dynamically adjust resources and 'right-size' them, improving both service levels and efficiency.

Get efficient
Data analytics give transit operators an accurate picture of how people are using mass transit – and why. This knowledge helps planners optimize their use of infrastructure and adjust routes, service frequency, and stop locations. For example, instead of three partially full busses running back-to-back, maybe one bus could handle the route.
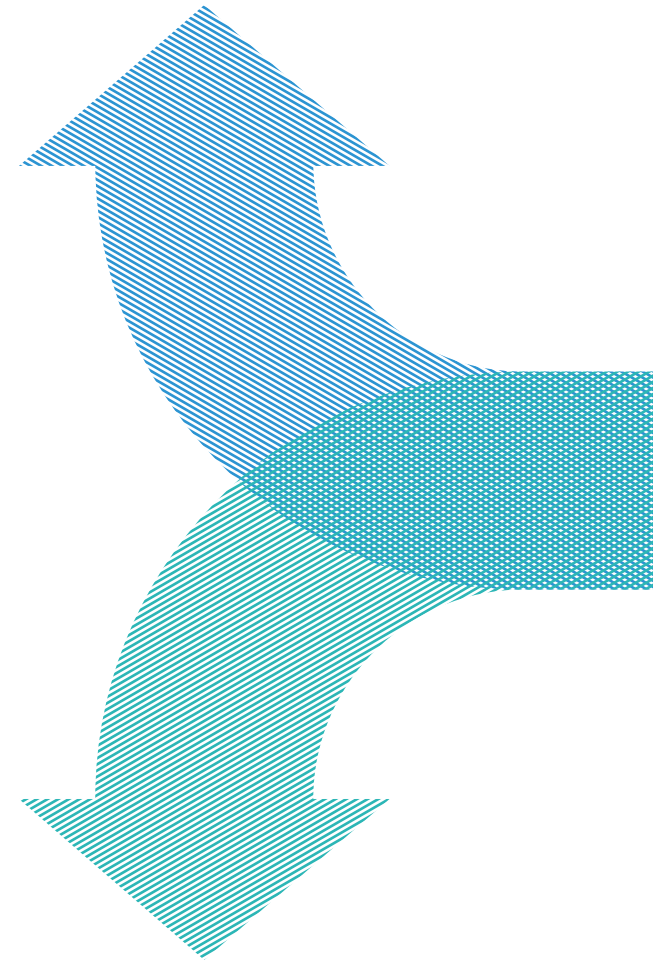
6.
Make your city greener

Two of the biggest traffic problems in our growing cities are congestion and air pollution. One of the causes: people looking for parking spots.

Up to 30 percent of traffic in cities these days can be people cruising for on-street parking, making it a leading cause of congestion, pollution, noise, and fuel waste.

Data analytics, combined with intelligent parking management systems, can help drastically reduce the number of cars cruising for parking and direct them to empty spots more quickly. The data also help officials get parking meter pricing right — by monitoring usage and optimizing prices for ideal occupancy rates.

Spot spotters
New technology, which combines cameras and geo-tracking with analytics, can 'see' whether a particular spot is occupied or not, and transmit that information to a device within the car such as the GPS or driver's mobile phone to guide the driver to the closest available space. The knowledge also helps commuters plan their trips better, so the data insights have a cascading impact.

7.
Protect your revenue

Automated fare and toll collection systems have made evasions harder for users. In addition, advanced technology can ensure that drivers and riders always pay the correct fare.

It works the other way, too: with new digital payment tools, authorities can automatically reimburse travelers if they've been over-charged, or if a service has been delayed for more than a given time.

And big data also brings a big benefit to parking enforcement authorities.

In many cities, enforcement beats, times and patrol shifts are outdated. And that means revenue from citations is a lot lower than it could be.

Analytics-driven enforcement can help you revisit enforcement practices, identify areas

and times when violations are most likely to occur and dispatch staff accordingly. And that can make a tremendous difference to compliance and to your revenue.

Clever cameras
Caltrans, the California agency that manages Californian highways, has long operated high occupancy vehicle (HOV) and high occupancy tolling (HOT) lanes to keep traffic moving.

Recently, they piloted an innovative compliance monitoring system that's based on advanced video analytics: the system (cameras, illuminator, trigger and image processor) was 'trained' to recognize what multi-passenger and single-passenger cars look like. With a 95 percent accuracy rate, the system outperformed roadside observers by far (36 percent accuracy) and detected an average 15 percent of violations on the HOT/HOV lanes.

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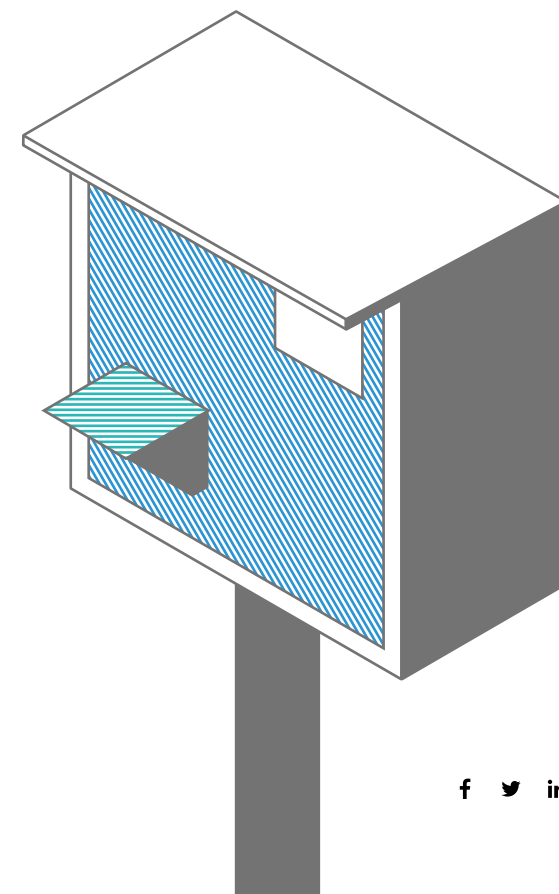
8.
Communicate more effectively

A recent study showed that travellers value reliable travel times even more than shorter travel times. And there are a number of factors that make people feel that public transport is unreliable:

– Buses showing up late
– Subways that are too crowded
– Unreliable transfers between stops

Communication plays an extremely important role in this: when services are delayed, passengers want to know what's happening – and why.

Real-time data on electronic message signs and traveler apps help communicate issues that cause delays – and ultimately improve passenger satisfaction by keeping riders informed and advising them on alternative travel options.

At the same time, agencies can tap into social media data to improve services: sentiment analyses from Twitter feeds, for example, to show how riders perceive service – and give officials the opportunity to get in touch with customers directly. And they might even learn about blockages or failures on social media first.

Riders are ready to pay for better tech
Travellers value easy ticketing, reduced delays and better communication from transport authorities. A study reported on Wired.com showed that a majority of U.S. riders say they'd be willing to pay more for completely paperless journeys, smartphone ticketing, and daily updates on prices and delays.

ParkIndy, the Indianapolis parking management system, has a strong presence on social media. The Twitter account @parkindy informs drivers of exceptions, blockages, events and travelling tips in real-time.

9.
Encourage environment-friendly behavior

Many transport authorities are making a point of increasing ridership among so-called 'choice riders' – people who own a car or have other travel options available to them, but opt for public transport due to convenience, cost, or other reasons.

Smartcards have been crucial in these campaigns: making public transport faster and easier to use.

Transit planners can also use the rider data to provide personalized incentives that make public transport clearly the better choice over driving.

Omni-modal
Octopus, the smartcard travelers use in Hong Kong, works across all modes of transport, and can even be used to pay for parking. This allows traffic planners to see, for example, when one traveler makes the same journey five times a week, using public transport on three of those days, and their private car on the others. And it lets them offer personalized travel recommendations, or even a customized discount to encourage more environment-friendly or congestion-reducing travel.
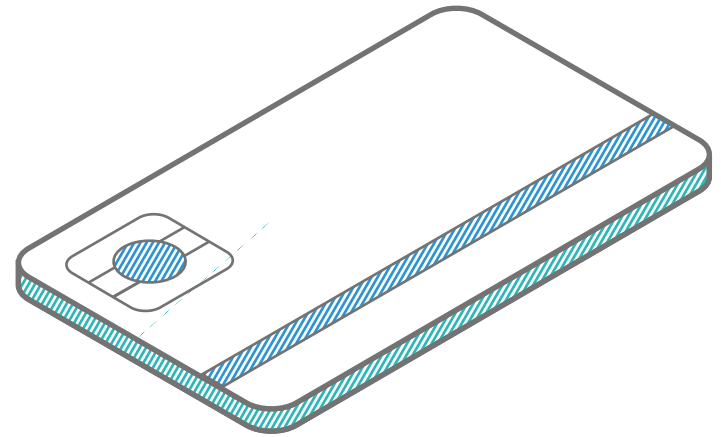
10.
Get a complete overview

Imagine you had a heat map that combined all your data feeds and showed you what was going on anywhere in your transit network, right now:

– The number of riders on your metro system going south
– The traffic density on your three main bridges
– The occupancy rate of on-street parking spaces downtown
– The number of 16-wheelers that are coming in from the turnpike
– Bicycle counts in the Western suburbs (and how many of them are bike-sharing vs. privately owned)
– All the Tweets using a certain hashtag that refers to a notorious bottleneck in your city

Very few cities around the world are bringing all their data flows together yet, but it's entirely possible. Once you overcome the silos and get all your data in one place, you can build a visual dashboard that illustrates traffic flows.

That gives you an amazing superpower: the ability to make corrective decisions, improve service and optimize resources – within a mode of transport and across the entire system.

And once you've been doing this for a while, you'll have a treasure trove of accurate historical traffic data that helps you forecast like never before.
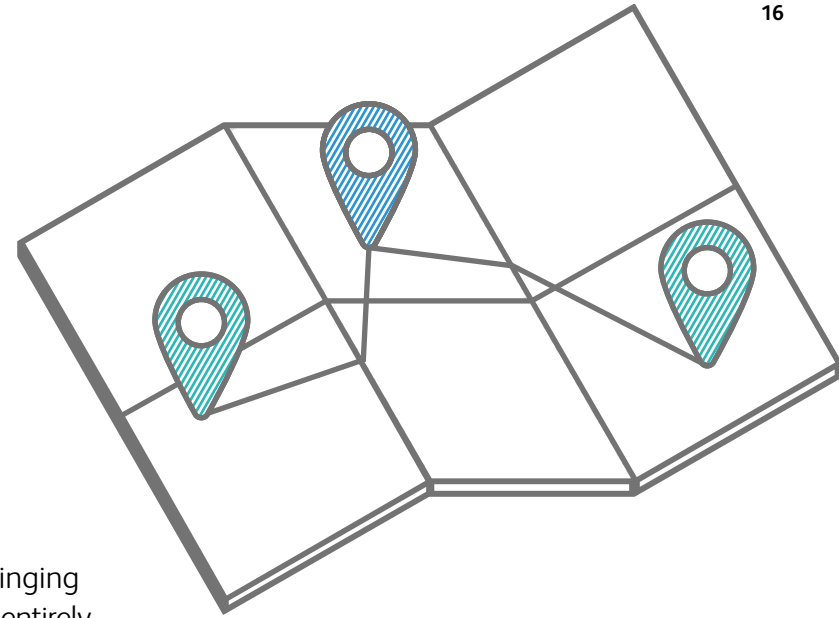
Data is here to stay

Make the data work for you

This is the age of the consumerization of technology. Your travellers and all their devices are already incredibly well-connected to all the data sources available to them.

They're expecting the same from you as a service provider. Even with budget constraints, you really can't afford to ignore the data and the enormous potential for optimization that comes with it.

So start getting systematic about data and leverage all the valuable information that's available all around you.

Use data to turn your traffic flows into a well-choreographed ballet that handles rehearsed performances just as well as improvisations.

You'll never want to go back.

Further reading

If you liked this eBook, you might enjoy reading some of our other ones:

Make your city flow
Seven ways cities are fighting congestion.

Sharing the city
Seven cities that are redefining mobility – and what you can learn from them.

Make your city flow

How seven cities are attacking their congestion problems

Download >

Sharing the city

How seven cities are re-inventing mobility for everyone

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We're Xerox and we're transportation data geeks.

There's nothing our transportation experts love more than an analytics-driven traffic flow. And we're not talking about reports or dashboards. Our parking, tolling and public transport solutions help cities across the world integrate and consolidate their disparate data sources, seize new opportunities and:

- Gain valuable, actionable insight into their transportation performance
- Collect data that leads to better strategic decisions
- Improve the quality of life for their citizens

And that helps them make an enormous difference to the financial and environmental bottom line.

We can do the same for you.

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