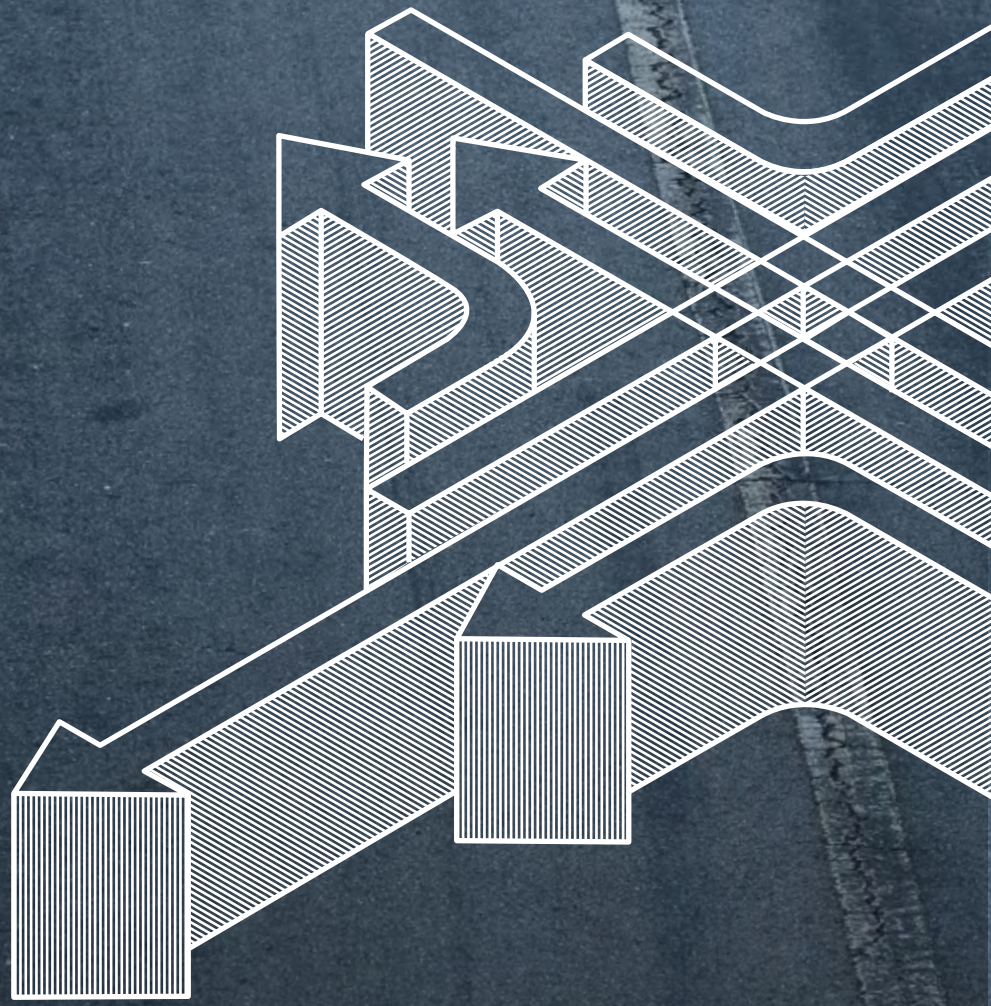
Make your city flow

Seven causes of congestion
and how cities are tackling them



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Commuting in congested traffic corridors isn't something most people actively enjoy

We don't want to be on the road to somewhere. We want to be there.

When we're in traffic – whether that's in a car, on a bicycle, by foot, or using public transport – we want it to flow. We want to keep moving, catch our connections, and not waste time.

When it works, travel times are predictable, and most people don't mind too much. When it doesn't, we're in for one of the biggest frustrations known to humanity.

Time spent stuck on public transport and in traffic jams is time lost, both to work and leisure:

Drivers in the ten most-congested cities in the United States sit around 42 hours in traffic jams every year, wasting more than $121 billion in time and fuel while doing so.[1] Internationally, the lines are also long: nine of the ten most congested cities in the world are outside the United States, led by Istanbul, Turkey, where delays add up on average to 110 hours per year, according to the Tom Tom Traffic Index.

Congestion also comes with a social cost. As author Robert Putnam claims in, "Bowling Alone", his book about the increasing disconnect between the individual and the community in American society: Every 10 minutes spent commuting means 10 percent fewer social connections – time spent with friends and family, pursuing a hobby, doing volunteer work.[2]

And none of that's even mentioning the unnecessary pollution and noise, the accidents and fatalities, the road rage.

It's a fact: jams reduce quality of life for everyone. And with 85 percent of the developed world predicted to be living in cities by 2050,[3] the problem isn't going away.

This eBook is about understanding the root causes of congestion – and learning how cities all over the world have tackled them.

Make your city flow

Seven causes of congestion

– and what cities all over the world have done about them

Cause #1
Road capacities are maxed out

The problem

The roads in most cities weren't engineered for today's traffic densities. They've reached the limit of what they can take. Throughout the 20th century, cities have tried to solve the issue by building more and wider roads.

Some argue that this only leads to more congestion as increased road capacity induces more and greater demand.

What to do about it

Make using buses, trains and other modes of mass transportation more attractive. One example:

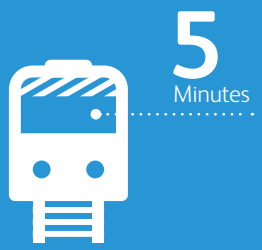
Singapore is one of the world leaders when it comes to innovating in public transport. The city state has introduced two approaches:

Investing in public transport: the government has made increased ridership a priority, and is providing highly developed services across several modes of transport (buses, rail lines, and water transport).

Discouraging car ownership and driving: Singapore has introduced high taxes for cars, as well as congestion pricing in the central business district and on a major expressways.

The result

Car ownership is down to 0.18 cars per capita, and the investment strategy is paying off, too: 48 percent of all journeys in Singapore rely on public transport.[4]



"Every year, we make improvements. For example, in the past, trains sometimes ran at intervals of six, maybe seven minutes during off-peak periods. Now, we require no more than five minutes."

Lui Tuck Yew
Minister of Transport, Singapore[5]

Cause #2
No real alternatives to driving

The problem

When people don't have public transport options in their city (or they're inadequate), they depend on private vehicles to get around. But surface area is limited for building roads and parking lots.

What to do about it

Encourage alternative modes of travel.

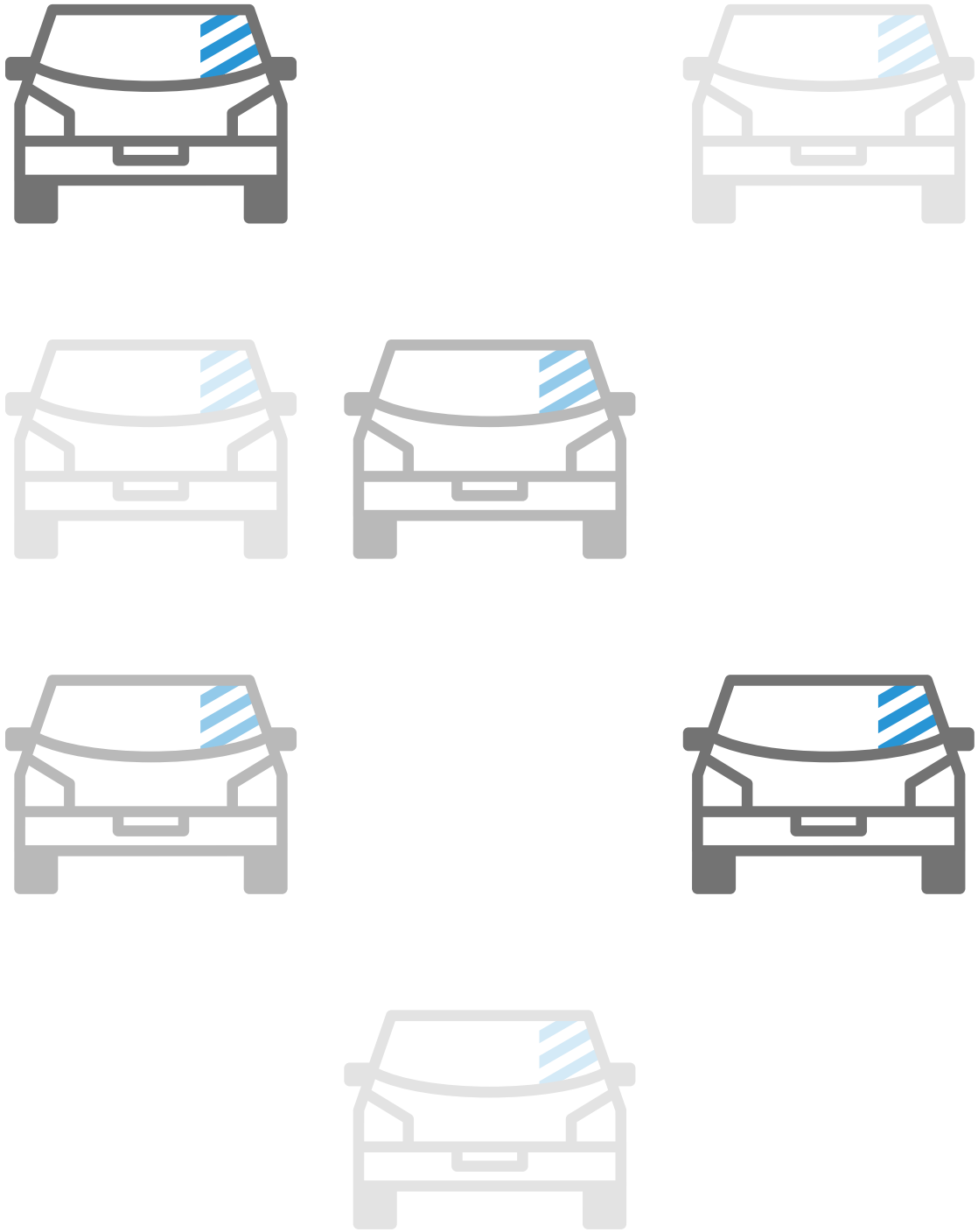
Several cities have created interesting initiatives:

Portland: from the early 1990s on, the city has invested in bicycle-friendliness through bike sharing schemes, bicycle boulevards, and bicycle parking facilities. As a result, more commuters bike to work in Portland than in any other major U.S. city.[6]

Vienna: the Austrian capital is pioneering a new transportation mindset, called 'Bike City', a housing project that focuses on the needs of its cycling inhabitants. The building has large elevators, safe bike storage, and a garage for repairs. And its planners have managed to do away with a regulatory standard: the compulsory one parking space per household. This saved space – which comes at a premium – and money, which was invested in facilities for better living (for example, saunas, green spaces, and relaxation rooms).

Paris: 'Vélib' is one of Europe's most popular bike-sharing schemes. Paris has followed it up with 'Autolib', a program that lets Parisians car-share 2,000 electric 'Bluecars'.

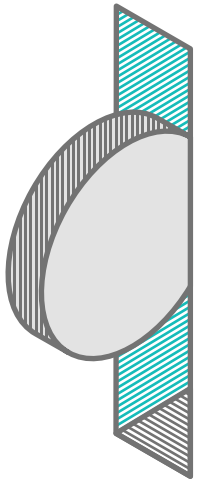
The result: an estimated reduction of 22,500 private cars, fewer traffic jams, less noise, and less pollution.



"It turns out the creative class of young people really like the idea of being able to bicycle to work. Younger people are driving a lot less than previous generations. Employers, when deciding where to locate in Portland, look at what employees are available here. We think this influx of creative, young, educated people… helps the economy."

Dan Keppler
City Club of Portland Research Committee [7]

Cause #3
Cash-based toll collection



The problem

Traffic builds up quickly when lots of cars travel into and out of cities at rush hour, and tolls are collected manually. Vehicles have to slow down or stop completely, which means longer travel times, and more emissions. (And collection costs can actually eat up to a third of revenue[8].)

What to do about it

Introduce all-electronic open road tolling so traffic can flow better.

Starting in the 1990s, several U.S. highway agencies implemented EZ-Pass, an electronic toll collection system that allows drivers to pay their tolls automatically from a prepaid account. A small transponder on the inside of their windscreens communicates with a reader as the driver passes through a toll lane, and automatically charges the account.

The result

No more need for cash, and no need to stop anymore. Electronic tolling has led to fewer traffic jams, fewer emissions, and significantly shorter travel times 9 many agencies today provide a hybrid service of both cash and automated lanes).

Today, 26 tolling agencies in 15 states, including the NY Port Authority, are members of EZ-Pass. And the system has evolved:

– It can now collect tolls at highway speed – so no more slowing down
– It has become interoperable, which has greatly increased convenience for people travelling across the U.S.

Keep rolling. It's greener.

A recent study shows that electronic toll collection at toll plazas saves 20 percent of CO_2 emissions compared to manual collection. And open-road collection can even save up to 70 percent in emissions[9].

Cause #4
Driver behavior

The problem

In dense traffic, congestion can happen for no obvious reason. Sometimes, all it takes is slightly erratic driver behavior, like sudden slowing down, for the notorious 'ripple effect' to occur. The slower speed creates a sustained traffic jam.

What to do about it

Smooth traffic flow by using speed controls.

Transport engineers have found that variable speed limits are an effective way to regulate traffic dynamically.

Sudden braking is bad for flow, but controlled slowing down can actually make traffic move faster, on the whole. Adaptive speed limits – i.e., adjusting speeds based on conditions – help in two ways:

- Drastically reducing accident rates[10]
- Improving traffic flow instead of jamming. When road capacity has been reached, even a lane change can have a big effect[11]

A study shows that variable speed limits have been successful all over the world, reducing the severity of shockwaves, and the occurrence of jams and standstills. In many cases, they have minimized the risk of accidents and also reduced pollution.[12,13]

A five-year trial of variable speed limits (VSL) in Sweden tested different use cases:

- Intersections with bus stops
- Road sections with vulnerable users
- Stretches of road with dense traffic
- Cases of adverse road conditions

The results

The results showed an overall success of the system: drivers reduced their speed by 5 to 15 km/h (3 mph to 9 mph) at intersections, with a smoother flow and less sudden braking.[14]

"The intuition is if you are more aggressive, you will get to your destination faster. Studies have shown that if you are less aggressive, you'll get there faster."[15]

Hesham Rakha
Professor of civil and environmental engineering at Virginia Tech

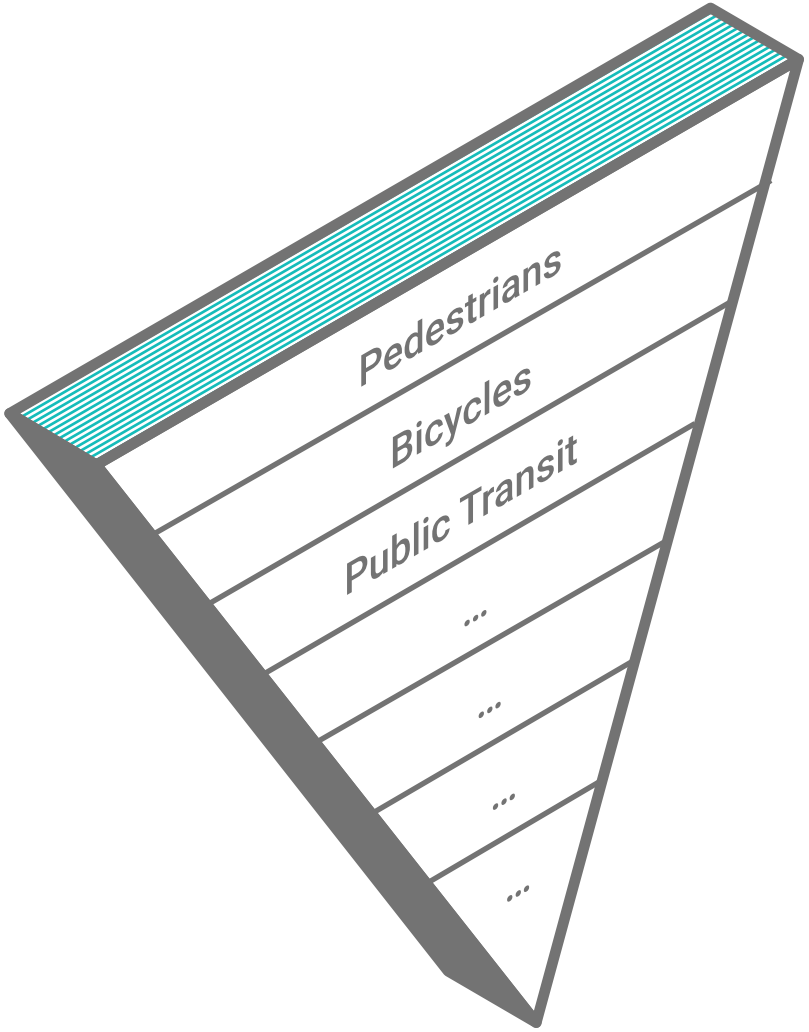
Cause #5
No priority for public transport

The problem
Many cities still give the same priority to cars as they do to public transport. This discourages the use of other modes of transportation and also creates a competition for space, as in Brussels,[16] where cars, trams, buses, and cyclists all have to share the same one-lane road.

The consequence
Travel times explode. A simple blockage (such as a badly parked car) can hold up dozens of cars, buses or trams.

What to do about it
Prioritize the modes of transport that work best in your city.

There is no golden rule as to what works best. While some people propose a hierarchy that puts pedestrians, bicycles and public transit before other modes of transportation, other objectives play a role in this decision (including land use, population growth and cost).



The Brazilian city of Curitiba is a model example for intelligent re-thinking of public transport, and has, in fact, been called 'the most innovative city in the world' by the U.N. Conference on Human Settlements.[18]

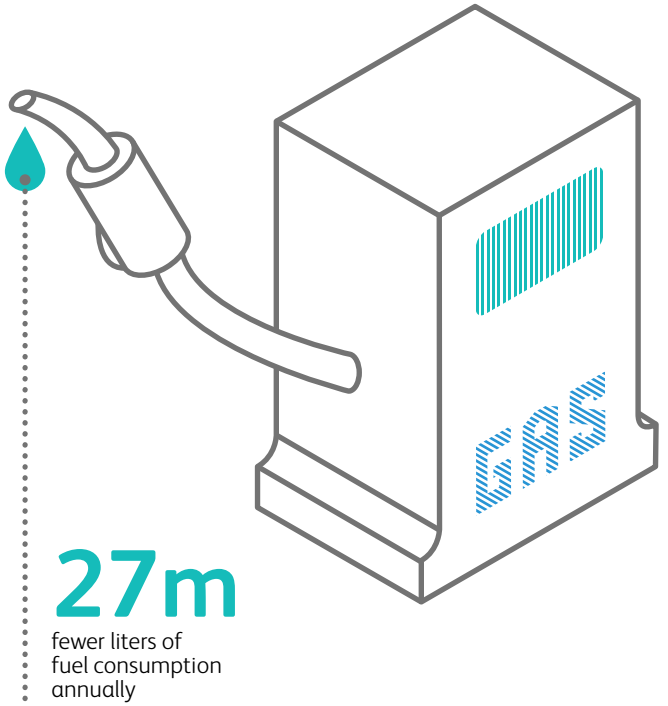
Starting in the 1960s, the city was experiencing rapid population growth of about four percent a year.[19] The big issue for city planners: a quick and affordable way to deliver urban transport to its inhabitants.

In 1974, Curitiba was one of the first cities in the world to implement a Bus Rapid Transit (BRT) system with:

- Lanes exclusively dedicated to buses
- Triple-section buses that carry around 2.3 million passengers a day (85 percent of all travelers use the BRT[20])
- A comprehensive network of express and 'feeder' lines (no-one lives more than 400 meters from a bus stop)
- Tube-shaped, elevated stops where passengers pre-pay their fare and board gap-free, at platform level, which reduces boarding times

The result

Compared to building an underground system with a similar capacity, the BRT is highly cost-effective, and has brought many benefits to Curitiba, including increased ridership, better travel times and, most importantly, 27 million fewer automobile trips and 27 million fewer liters of fuel consumed annually.[21]



“A bus with 80 passengers has a right to 80 times more road space than a car with one.”

Enrique Peñalosa
Mayor of Bogotá from 1998 until 2001[22]

Cause #6
Traffic signals aren't optimized

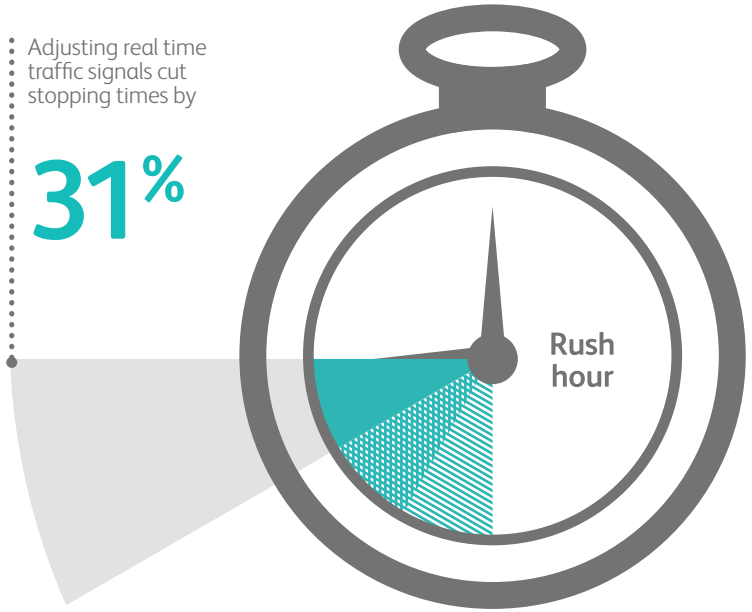
The problem

Traffic during rush hour is very different from other times. When traffic signals are timed for a different kind of flow, cars have to stop more often, journeys take longer, and traffic builds up.

What to do about it

Dynamically adjust your traffic signals.

The Los Angeles Department of Transportation has developed a system for adjusting signals in response to real-time traffic demands. As a result – at intersections, arterial roads, and downtown grid networks – the city was able to cut travel times by 13 percent, stopping by 31 percent and delays by 21 percent.[23]



Re-timing for other goals
Several cities have re-timed traffic signals to help with their transport priorities and environmental objectives:

Timed for bikes
On San Francisco's Valencia Street, adjusted signals make traffic flow better for the large number of cyclists along the route.

Timed for public transport
Amsterdam has recently timed signals to favor buses and trams. The result: travel time on trams has been cut by 1.5 minutes. Buses move 3 minutes faster, on average.

Timed for fuel savings
Portland has a traffic signal optimization project focused on fuel savings and emission reduction. It saves drivers over 1.75 million gallons of gas, and 15,460 tons of CO_2 each year.[24]

1.5
Tram times are 1.5 minutes faster

3
Buses move three minutes faster

Cause #7
Drivers looking for parking spaces

The problem

Up to 30 percent of traffic in cities is caused by drivers looking for parking, especially where on-street parking is free and off-street parking is available (or when there's a big difference in price between metered on-street parking spots and off-street parking).

What to do about it

Run analytics to feed intelligent parking systems and dynamic pricing.

Los Angeles parking management officials tested whether pricing could be used as a way to manage demand. The basic idea: optimize pricing to keep 10 percent to 30 percent of on-street parking available throughout the day.

The program has two key elements:

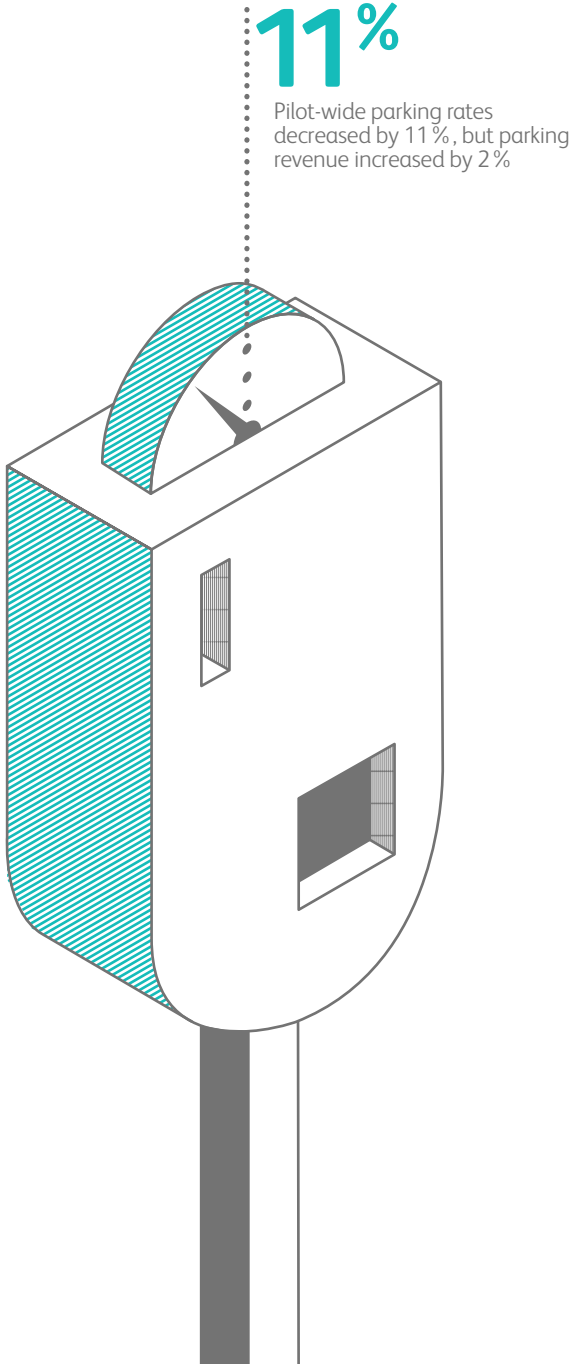
Dynamic pricing: the Department of Transportation installed systems with flexible payment that feed data into an integrated back-end system which continually compiles occupancy and payment patterns and determines the right market price.

Customer apps: the system pushes parking information out to drivers, and also helps enforcement officials: it detects unpaid, but occupied spaces in real-time.

The results

Even during the pilot-run, the results in Los Angeles were overwhelming:

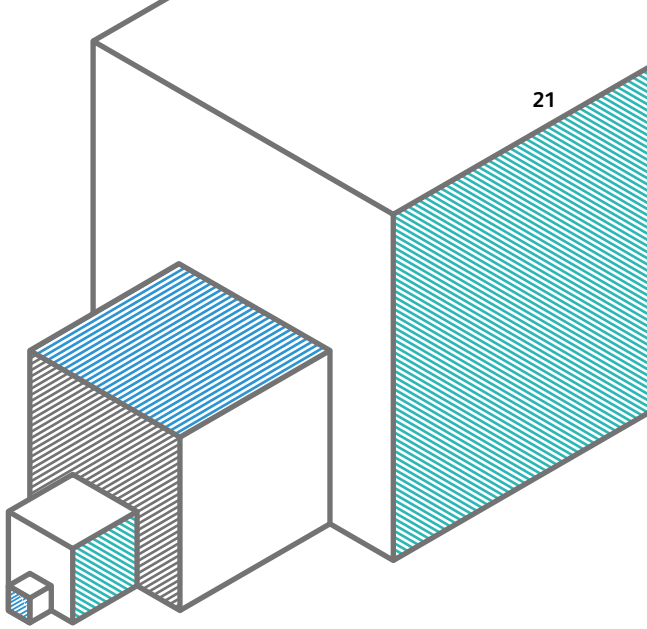
- The program cut parking congestion by 10 percent as spaces were easier to find
- Under-utilized parking spaces went down five percent as drivers were drawn by lower rates
- Parking rates decreased by 11 percent, but revenue increased by two percent
- 76 percent of drivers indicated that they would park in less expensive areas nearby



"We've gotten it all wrong, by providing free housing for cars and very expensive housing for people."

Donald Shoup
Distinguished Research Professor,
Department of Urban Planning, UCLA[25]

Cities are continuing to grow



Cities are continuing to grow

Mindsets and transportation options are changing. We don't know how we'll all get around in our cities in 10, 20, 30 years.

But we do know that sooner or later all cities will reach the limits to handle traffic as we know it today. These examples from around the world have shown that there's no shortage of innovative ideas for tackling congestion. All it takes is a willingness to:

- Re-think priorities
- Question how things are done
- Trust the data to understand patterns better
- Experiment with new technology

At Xerox, we're already hard at work shaping the next frontier of solutions in the battle against congestion and for greater mobility.

"A city is not a problem, it's a solution."

Jaime Lerner
Former mayor of Curitiba, Brazil

Further reading

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

City analytics

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

Download >

Sharing the city

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

Download >

We're Xerox.

We love flow.

Our solutions are helping cities all over the world re-engineer their transportation systems and traffic flows, and get people and goods where they need to be, quicker and with less hassle.

We help authorities around the world deliver policy objectives and meet business goals.

And we do it from our research centers to the delivery and execution of data analytics; from electronic tolling system to back-office platforms; and from proof of concept to parking meter operations.

There's nothing our engineers love more than solving a tough congestion problem.

What's yours?

Talk to us.

WORK CAN WORK BETTER

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