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McKinsey on Government

Perspectives: Managing the city of the future

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Introduction

Urban life is on the rise around the world as every year tens of millions of people move from country to city. Yet this vast improvement in the quality of life that urbanization promises comes with its own set of managerial challenges. In this issue of McKinsey Perspectives, we focus on the nuts and bolts of delivering on the urban promise today and in the future.

Mobility is a governing theme for any city leadership as they struggle to cope with the universal realities of tight budgets, fixed infrastructure, and growing demand. Stefan Knupfer and Swarna Ramanathan explain how cities can move towards a seamless mobility model. Autonomous vehicles, electric vehicles, ridesharing, smart traffic systems, and predictive maintenance can all work together but require new models for public and private collaboration.

Autonomous vehicles are one of the most talked-about trends in city mobility. Tyler Duvall and colleagues define the different approaches cities are taking to this disruptive technology and make a case for how to develop shared autonomous mobility (SAM) as an alternative to continued gridlock. Cities that want to avoid the potential 25 percent increase in traffic that autonomous vehicles could bring will be changing everything from sidewalks to parking fees. Seoul consistently ranks high in its use of technology to meet the needs of its residents. Mayor Park Won-soon discusses why he has named 2019 the Year of Seoul's Future Transportation and the initiatives that Seoul is rolling out, including IoT, smart crosswalks, and connected-car technology.

Public–private partnerships are the subject of a discussion between Jonathan Law, Rit Aggarwala, and Ester Fuchs, each of whom provides insights on what it takes to create a productive partnership. Partnerships can be equally important in addressing the urban housing challenges of housing, particularly in large cities where around the world many residents are rent-burdened. Kate Anthony, Kunal Modi, Kausik Rajgopal, and Gordon Yu discuss the origin of San Francisco's homelessness epidemic and what will be needed to address it.

No matter what challenge city leaders face, one constant is the need for more funding. The good news here is that there are many options that city leaders may not be using including land monetization, collections, and new service models. Loay AlMujadidi and colleagues lay out how every city can generate an additional 50 percent of revenues.

Our cities are where we live, work, eat, and play and they need management just like every other part of our economy. We hope these perspectives provide new ideas for city leaders and residents alike as we work toward a better and more inclusive city for all.

Sincerely,

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Getting beyond gridlock in cities

With more than half the world's population living in cities, congestion and pollution are worsening. Technology may hold the solution—but only if city governments and companies collaborate.

by Stefan Knupfer, Swarna Ramanathan, and Simon London

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In this episode of the *McKinsey Podcast,* Simon London speaks with McKinsey senior partner Stefan Knupfer and associate partner Swarna Ramanathan about what seamless mobility in cities really means, what it will take to get there, and the massive benefit it could bring to people, government, and business alike.

Podcast transcript

Simon London: *Hello, and welcome to this episode of the McKinsey Podcast with me, Simon London. If you listen to this podcast, you probably live or work in a city. And if you live or work in a city, you know that getting from A to B is often difficult and time consuming. Extra point if you're listening to this episode while stuck in traffic. But it doesn't have to be this way. As we'll hear, a number of technologies are converging in a way that could make getting around in cities a whole lot easier. Autonomous vehicles, electric vehicles, ridesharing, smart traffic systems, predictive maintenance. Each of these is interesting in its own right, but put them all together in the right way and we could end up with cities that are a lot cleaner, more efficient, and more livable. To discuss the issues, I spoke with McKinsey senior partner Stefan Knupfer and associate partner Swarna Ramanathan. You can read more about their research in the article, "The road to seamless urban mobility." Stefan and Swarna, welcome to the podcast.*

Stefan Knupfer: Simon, delighted to be here.

Swarna Ramanathan: Thank you, very happy to be here, Simon.

Simon London: *Stefan, we're going to be talking about urban mobility, moving around in cities. At the risk of a terrible pun, that, in some ways, sounds like a very pedestrian topic. Why should we be talking about this now? Why does this matter as a topic?*

Stefan Knupfer: Because cities have more than 50 percent of the population worldwide, and that figure will grow to 60 percent by 2030. Cities are seeing a significant increase in congestion, so it's more and more difficult for people to move around in cities. For example, we have increased

congestion in London, Paris, New York, and if you think about New York and LA, I think the congestion increased over the past six years by approximately 30 percent. This is significant.

Then cities need to be healthier, however it will get more congested, it will get more polluted, and I think that's a significant issue. So far, we have not found a solution. It just takes you longer to get around, it's getting more expensive, and it's more unhealthy to live in cities.

Simon London: *So things are getting worse, not better? More people are living in cities, there's more congestion, more pollution, and yet, we think there is hope in sight. Swarna, why should we be optimistic and hopeful?*

Swarna Ramanathan: We can be optimistic and hopeful because there are lots of technologies in place. If we think about autonomous vehicles, it's not just self-driving cars, but also self-driving trains, buses, shuttles [Exhibit 1]. For example, in December 2018, Waymo announced the launch of a commercial autonomous-vehicle taxi service in Phoenix, Arizona.

Connectivity is another one. Again, it's not just connected cars, but looking at connected intersections, traffic signals, crosswalks, using the Internet of Things, et cetera. How do you get a cohesive ecosystem of connected technologies help you relieve traffic and hence relieve pollution and make people go from point A to point B in a more seamless way?

Another one is electrification. Most OEMs have announced launches of electric vehicles in the next couple of years. It's not just cars again. It's buses, bikes, scooters, commercial vehicles as well. We shouldn't underestimate the congestion and pollution costs by commercial vehicles in the cities. So electric vehicles in all those arenas and spaces.

Stefan Knupfer: One addition to what Swarna just said: the interesting thing is, why cities? Because all those technologies, honestly, by themselves, have a significant trend. And if you combine them in a city which is happening, you have a revolution. So I think the speeds that everything is changing

Exhibit 1

By 2030, in the seamless-mobility scenario, private cars will be used less, and autonomous shuttles could account for a quarter of passenger-kilometers.

Passenger-kilometers traveled per year, index: current demand = 100, %

	Baseline (2018)	Business-as-usual urbanization	Unconstrained autonomy	Seamless mobility

on the mobility side right now comes through the combination.

Simon London: *So it's not just electric vehicles on their own. It's not just autonomous vehicles on their own, or connected cars, or traffic systems, or ridesharing, it's not any of those individually, it's the confluence of all of that. If you put it all together, then potentially, you've got something revolutionary, is that the gist?*

Stefan Knupfer: I think that's exactly the gist. And I think you're also describing it in a perfect way, Simon, because all of this needs to come together. That's exactly why we call it seamless mobility.

Simon London: *Bring that to life for us a little bit. If I'm an urban dweller, trying to get around within a city, what is the seamless-mobility future like for me?*

Stefan Knupfer: It is interesting, because you will actually use very similar means of transportation that you are used to. The difference is only today, all of them are not connected, they are pretty much independent systems, they do not communicate with each other. The moment you make it seamless, you're using all those different modes of transportation in a seamless way. Which means the moment I say, in a city I want to go from a point A to a point B, I go online and I will know exactly what's the safest, what's the most affordable, what's the fastest way to go from point A to B. If I'm by myself, if I need to transport something, if I will have friends with me, it will offer me different ways of doing this.

Swarna Ramanathan: For example, you might share an autonomous shuttle to get to the railway station, and then take a train into the city center. And then maybe use an electric scooter or robo-

taxi, to go on to your destination from the city-center train station. So that makes your transit more seamless, and point to point. It's door to door using multiple modes of transport. That's what the consumers would see, but behind the scenes, they expect connectivity, and intelligent traffic systems, advanced train signaling, and predictive maintenance that would keep these trains and the remainder of the connected transportation systems running more smoothly with fewer delays and breakdowns, as compared to today.

Stefan Knupfer: The combination is very often, I think, the most difficult part when you are trying to use public transportation to get to the station. If you can find a way that you get to the station, again, in a safe way, in a convenient way, the usage of public transportation becomes much more convenient. But again, that means that every transportation means needs to be connected, and therefore needs to do so online. That is the only way that you can connect it.

Simon London: *We are not imagining a future state in which, for example, trains go away, and we're all buzzing around the city in autonomous flying whatevers. Our future with seamless mobility certainly has a big component of things that we are all familiar with.*

Stefan Knupfer: I must admit, Simon, I don't want to forecast how cities are going to look in 50 years. Because if you'd asked me 15, 20 years ago, if what we're talking about right now is even close to reality, I would have said no. Because the technology development is so significant. That's also why we're talking about 2030, 2040. I recently served a client who is in the area of flying around. They had significantly more advanced ideas that I would not even imagine, so I'd be very, very careful. We might fly around in cities much faster than we believe.

Simon London: *What do we think, if we could get to a world of seamless mobility, what's the upside?*

Stefan Knupfer: If you succeed, and also based on modeling, if the seamless mobility in the city actually works, we will have an increased transportation capacity of about 30 percent. That means about 30 percent more passenger miles that we can travel. We're doing this by cutting down on travel times by about 30 percent.

The cost will also go down significantly. So therefore, every time the costs go down, demand goes up, more people want to go. But the nice thing is we have the opportunity that more people can move around. And we still move them around in significantly shorter time.

The most important piece is that the greenhouse-gas emissions will go down significantly. We have numbers that are significant because we talk about emissions going down by 80 percent. That obviously requires that we are fully electrified in the vehicles. So as long as you have combustion engines in the cities, it's not going to happen. But the moment you have electric vehicles, even if the energy generation is not perfectly clean, at least you keep it outside of the city.

Simon London: *Presumably, there are also big societal benefits here, as well. So just talk a little bit beyond the economics and beyond the sort of saved minutes and more miles.*

Stefan Knupfer: So we already talked about greenhouse gas. The autonomous method is primarily going to be safer. Because if you think about it, 95 percent of deadly accidents are driving errors. Out of this, 30 percent is actually drunk driving. About 30 percent is that people are just not being aware of what's going on on the street. A machine doesn't do this. If I make a driving mistake, I hopefully learn from it. Hopefully. The machine, actually the entire system is going to learn from it. So therefore, the system learning in this case is going to be—just from a probability standpoint—it will be safer.

People actually like autonomous driving, even today. Not when it's in the city, because in the city, there is no fun driving. You have stop and go all the time. The only thing is, you're busy driving, and you can't do anything else.

There's a lot of people who like their cars, and like the driving experience, and the [turning]. This is

something you still can do in the countryside. So as long as you have a steering wheel in your car, you can actually do both. You can do autonomous and you can do your own thing. The last point that I'd like to raise here, as a benefit, is also it has an economic benefit. And I think that's important in our report, that everything that we propose makes economic sense. Just to give you an example, those new transportation services could be about 40 percent of transportation revenue in 2030.

That means for a city like London, our beautiful city, about $10 billion of additional revenue on the transportation side. And if you multiply this by all big cities in the world, you realize how big this industry will be.

Simon London: *And that's things like ridesharing, robo-taxis, bike-sharing schemes. If you add all those up, we think 40 percent of the transportation-related revenues, could be this new stuff?*

Stefan Knupfer: That's exactly right.

Simon London: *So this all sounds fantastic. We've got a cleaner, safer, more efficient transportation system within cities, a world of seamless mobility. What's the catch?*

Swarna Ramanathan: The catch is that seamless mobility will not happen without a close public and private cooperation. This will not be solved by either of them alone. For example, cities should be encouraging the use of shared autonomous vehicles but also controlling the number of autonomous vehicles that come onto the street.

You really need innovation from the private sector, but also a little bit of controlling force from the public sector and the policies. Our research shows that if robo-taxis and autonomous shuttles become widely available in an unconstrained way, congestion would only get worse and not better. While there could be many benefits—more point-to-point trips, potential lower greenhouse-gas emissions—like Stefan was mentioning, you're going to open up travel to a completely new segment of people who are not traveling today. But we wouldn't

be maximizing the potential of technology if there's no good private–public partnership.

Stefan Knupfer: Building on Swarna's point, if you do it in an unconstrained way, and you're not using all the technologies that we mentioned in a seamless interaction, you might get some disadvantages, at least in the short term.

For example, in New York, the more Uber cars you have, and the more people like them and use them, what you get is people using less public transportation. We strongly believe that you need to have public transportation, and you need to expand capacities there. So it's the combination of it; it shouldn't take away. The second is if you have more driving on the street, and you do this combustion engine, you obviously make the pollution worse, you make the congestion worse. The congestion obviously leads to more pollution, all those different things.

Therefore, in the transition, it's not going to be easy, and that's exactly why you have to have a strategy and know where you want to get to. And then to Swarna's point, you have to be very organized between public and private. If we just let it go, it's going to take us probably ten years longer and much more hardship and much more money.

And the cities can't wait, because the point is that you have those congestion-pollution problems today, and what cities do at this point right now, they ban vehicles, they ban cars out of the city. Which is nice to walk, but on the other side, it takes you significantly longer.

Simon London: *You've mentioned the word robo-taxis, and we've talked about autonomous vehicles, even autonomous shuttles as something that was probably part of the solution set [see Exhibit 2 for details on the opportunities for autonomous vehicles in the United States]. Realistically, when do we think some of those things are going to be hitting the streets, at any kind of scale?*
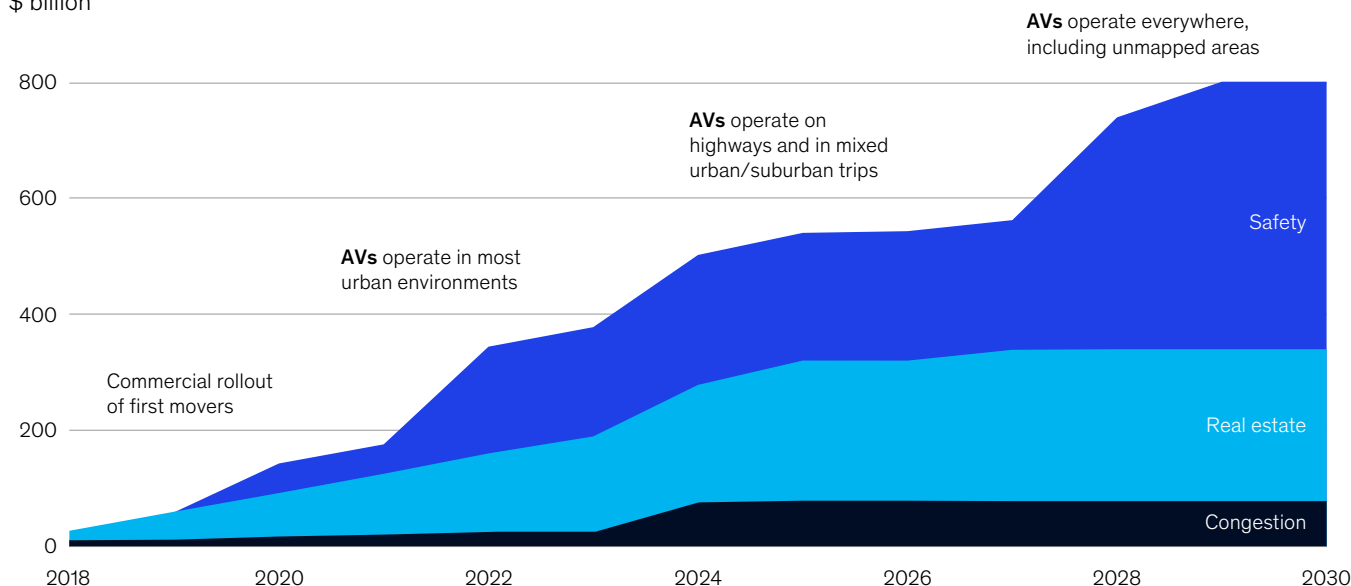
Swarna Ramanathan: It really depends on which part of the world you're talking about. You already see Waymo is doing different pilots and trying to

Exhibit 2

In the United States alone, if autonomous vehicles were fully adopted, the benefit to the public would exceed $800 billion a year in 2030.

Estimated public benefits[1] of autonomous vehicles (AVs),
$ billion

AVs operate everywhere,
including unmapped areas

AVs operate on
highways and in mixed
urban/suburban trips

AVs operate in most
urban environments

Commercial rollout
of first movers

Safety

Real estate

Congestion

800

600

400

200

0

2018   2020   2022   2024   2026   2028   2030

[1] Environmental benefits are proportionately small (<$4 billion) and barely visible in the chart.
Source: US Federal Highway Administration; McKinsey analysis

bring it to a commercial sense in Arizona. But it might not be the same case if you think about India or China as an example.

There are different models in terms of infrastructure and regulation. There needs to be careful coordination and synchronization. It's not a straightforward answer to say, yes, robo-taxis are going to come in 2020.

Stefan Knupfer: If you're in a more Western, developed city, and you live in a safer city, it's easier to go to autonomous. So therefore, you see the modern Western cities, and then a lot of the smaller European cities, leading. So Helsinki, Oslo. They're smaller cities in Europe, but obviously, they're very modern cities. So they're actually well organized, so they go very quickly in those things.

On the other side, I believe cities that will be kind of newly built, a lot of the Chinese cities, have all the opportunities to leapfrog.

Then you have cities like Mumbai or Mexico City. They're big cities, but the infrastructure's not necessarily there. They have absolutely the need from congestion and pollution standpoints to do something significant. On the other side, their starting point is relatively difficult in some of those areas. You will see some of them advancing significantly. But they're not necessarily the ones that are going to lead us in the next ten years. I think the other thing is, when you talk about timing, you have to understand what kind of autonomy.

For example, I don't want to get too technical, but as described from a level of one to a level of five, level five means everywhere, anywhere in the world,

driving is autonomous, nobody has a steering wheel anymore.

Now think about driving through the desert in Arizona, or you drive through the jungles somewhere in Africa, or something like this. There are a lot of roads out there that are probably better suited to autonomous driving.

So, level four, where you have something organized, and you can actually have a relatively simple infrastructure. Think about highways, think about New York City, you're driving east or west, you're driving north and south, and you're driving from traffic to traffic. It's relatively organized, and it's relatively simple to build an infrastructure that allows you to coordinate there. That's what you call level four.

It's a little bit restrained. If you go there, people talk about they can do this within the next ten years very easily. The technology is there, and therefore people talk about being able to do it within the next three to five years.

Simon London: *So we would argue that—it's a big generalization—but a lot of infrastructure spend should really be on the smart infrastructure at this point. It's the connectivity, and the intelligence, and existing infrastructure that probably will get you more bang for your buck.*

Stefan Knupfer: There's a big budget in every city and state, and probably also the federal government, for building additional roads. Now, building additional roads is not helpful. More roads means that more people will drive. It's not going to solve our problem.

Just think about autonomous vehicles, they're not doing stop and go. They all have the same distance, because they don't have a reaction time, they can drive much faster, they can drive much closer.

All of a sudden, you're using significantly more of the road capacity. Right now, we're using an average of about 10 percent of road capacity that we built. Now, building more roads probably means more people

will drive, but it's not going to solve our problem. And therefore, changing budgets, and that's a little bit difficult, I believe, because if somebody has money allocated to a specific area, it's very difficult to say, Do you know what? I'll take a radical cut here and move it completely to the other side.

Usually, we do some small cuts. But small cuts don't lead to revolutions. I think the quality of the roads needs to improve, but I don't think we need to see significantly more roads.

Simon London: *Put yourselves in the shoes for a minute of a mayor or a city planner. How do I approach this? I understand that there's a lot of change coming, and there's potentially a big role for me to coordinate and bring parties together, to get to rational solutions here. Where do I begin?*

Stefan Knupfer: That's a terrific question. And to be quite honest, we are in the very fortunate situation that we are allowed to talk to a lot of mayors at this point. Interestingly enough, not only about mobility but also about smart cities. We work with an organization called C40 that connects about I think 93 or 96 large major cities right now. More than 25 percent of world GDP, 500 million to 600 million people. Therefore, through this, we have the opportunity to talk to mayors. We know this is a positive development.

On the other side, it can be pretty messy on the way there, so therefore, we recommend pretty much to every mayor, you have to develop a mobility strategy that is ten, 15, 20 years out for your city. But it gives you a very clear indication not only for the people who live in your city, and vote for you, and need to understand why you're spending all the money, but also to the private sector—that the private sector is ready to invest, but if you don't know if you're allowed to invest, or even if it makes sense in a city, you're sitting there and saying, The city has to do something. Now, the city doesn't have the experience, the city doesn't necessarily have the money. The money and new technologies are in the private sector. They both actually have to come together in a significantly better way. I do believe the starting point needs to be a city saying, I'm willing to take this on.

The second thing is, we talked on the mobility side about 40 ideas, 40 major things that you can come up with. Again, we don't think that every city needs 40 of them. Because a lot of them are already in place. So you could get it down to ten or 15, that's a number that you can manage. That's very, very important. Don't try to follow every lead, don't try to follow every technology. Try to be very clear what you want to do, and then lay out exactly those ten, 15 things that you need to do. The moment you have ten, 15, you can also put the money next to it, you can put the management attention next to it.

This focus, that you understand what is important in the short term, what are the next steps, what are the technologies I can implement right now— I think that's important, but you have to have the big picture, because otherwise, as I said before, you start banning vehicles out of a city. That's a solution, but honestly, that doesn't make you move around faster, it doesn't help you with your delivery. You have to find better ways that those vehicles move around. I think that's the better solution.

Simon London: *You've mentioned that there are 40 or so levers or tools that are at the disposal of cities and city governments. Just explain those a little bit, without going through all 40, what are some of the tools that I've got?*

Swarna Ramanathan: At the highest level, there are three ways for cities to get to a seamless mobility according to our research. One is optimizing supply. Another one is optimizing the demand for transport. And the third one is improving sustainability.

If I had to pick a couple of them, very tactically, intelligent traffic systems, which include lights that send traffic and communicate with each other, to minimize the times that you and I would spend in traffic jams and really maximize movement. They all would also allow for dynamic lane allocation, which shifts lanes to the direction with more traffic. Smart parking is a technology that connects vehicles to infrastructure, or even vehicles to vehicles, to inform you where parking is available. They both are proven technologies.

Intelligent traffic systems have reduced commuting time in Buenos Aires by about 20 percent. Smart parking has reduced searching time for parking by about five minutes on average, in Johannesburg and in San Francisco.

These have significant impact on normal commuters' lives by saving time. But they are also pretty simple solutions that any city could think of, because they're existing technologies, available in most cities.

Stefan Knupfer: I like a lot where Swarna is going, because I think there are a few no-regret moves. There are one or two that I would like to add. Night delivery. Why do we deliver during the day? The only reason is because if a vehicle is not autonomous, it makes noise. Noise is primarily the trucks that obviously are diesel trucks, and they go backwards and make noise, and all of this is not going to happen in the future. You have electric vehicles, you don't need to make noise, because you know your surroundings.

So deliver at night, which means that you take the trucks and the delivery away from the day. If you go to a city these days, you see right and left trucks going to retail stores. Everybody is slaloming through the streets. Delivering at night opens up the whole street. And it's also easier for the delivery trucks to deliver at night because during the day, they can't park.

The other thing is, why is it that every delivery truck that goes long distance ending up in New York needs to go over the George Washington Bridge and then deliver somewhere in Manhattan?

Why aren't we using urban consolidation centers, which means they go to New Jersey, in an urban consolidation center and they repackage from the big trucks into smaller ones. And the smaller ones are all electric, and they only go to a specific zip code. All of a sudden, it looks very different in a city.

Simon London: *But again, it's a big coordination issue, isn't it? Because there are all these private-sector players, and they're all doing what's*

rational for them, and what minimizes the cost for them currently. They're used to having their trucks coming into the city, but getting to a more rational solution for the city as a whole takes an enormous amount of coordination and a lot of different parties.

Swarna Ramanathan: Yes, it takes a tremendous amount of coordination, but it's not impossible, Simon. Cities like Barcelona are piloting this night-delivery system that Stefan was just explaining. They have seen very good results. Travel times have been reduced by five minutes during the day, because they were able to move a lot of deliveries to be done during the night. So it's possible, it's not impossible.

Simon London: *And what about the private-sector side? If I'm a CEO here, what are the opportunities for me? Why should I be excited about this?*

Stefan Knupfer: You should be excited because there are significant business opportunities in the first place. Where there is new technology and new business opportunities, I hope that would excite CEOs to invest. Now again, as we said, I would only invest if I know that there is a city that I can work with. That's exactly why we said the public and the private sectors need to interact.

We thought about four layers that you could think through, as a city, but also obviously as a business: infrastructure layer, a rolling-stock layer, a digital-analytics layer, and a user-interface layer. The infrastructure layer is literally the very basic hard assets. For example, roads, rail lines, but also, for example, charging infrastructure for electric vehicles.

Rolling stock is another one. Very simple, we talk about trains, we talk about buses, but we also talk about robo-taxis, we talk about minibuses and minishuttles. We talk about electric bicycles and scooters. These are all the different kinds of vehicles that are moving around on the surface.

The next one, it becomes pretty clear, because the moment, as we talked about, if you want to go from point A to B, and you change different modes, you need to understand all the different steps that you go through in your mobility. This means you're talking about analytical and digital layers, such as ticketing, payments, mapping, vehicle vouching, or congestion pricing. We talked about the intelligent traffic lights that all need to be connected. Preferred lanes.

Then the most interesting one, and people like to forget about it, but think about it, we all like our smartphones. It's going to be, probably, the device we'll use to manage mobility going forward. But on it, you need navigation maps, you need payment integration, you need to find a very simple interface. People actually say, "I want to go from A to B, I want to be safe, I want to be fast, I'm not paying a lot of money, I want to do it with friends, I have luggage that I have to take."

With this little information, it should give you very simple instructions, and say, Here's your vehicle, this is what you're going to do first, second, third. And then very hopefully, very simply, you're going to get from A to B, and you're going to enjoy it.

Simon London: *It reminds me a little bit of the way information-technology people like to talk about the stack. And it sounds like there's a mobility*

If you want to go from point A to B, and you change different modes, you need to understand all the different steps that you go through.

stack here, all the way from the hard infrastructure at bottom, right up to a user-interface layer at the very top. And the trick for a CEO is to think about, well, Where do we want to play? Where do we play there, on which of the bits of that stack do we want to be in?

Stefan Knupfer: I think that's exactly right. Also you have to understand the interfaces. Even if you play in one, you need to find a way that you actually add value to the entire system. That's exactly, I believe, why we need a strategy, and we need to have the different players coming together.

What you see right now, most of the players, at this point, they offer a product or a service, but they're not offering solutions. We need them working together to offer solutions. That's the way to get to seamless mobility.

Simon London: *OK. So I think that's all we have time for. But Swarna and Stefan, thanks so much for joining.*

Stefan Knupfer: Simon, thank you so much. It was a lot of fun.

Swarna Ramanathan: Thank you.

Simon London: *And thanks as always to you, our listeners, for tuning in. To read more about our research and work on the future of mobility, please visit McKinsey.com.*

Stefan Knupfer is a senior partner in McKinsey's Stamford office, and **Swarna Ramanathan** is an associate partner in the London office. **Simon London**, a member of McKinsey Publishing, is based in the Silicon Valley office.

A new look at autonomous-vehicle infrastructure

What infrastructure improvements will promote the growth of autonomous vehicles while simultaneously encouraging shared ridership?

by Tyler Duvall, Eric Hannon, Jared Katseff, Ben Safran, and Tyler Wallace

Imagine a future in which fleets of autonomous buses and shuttles effortlessly navigate through city streets to their designated stops. Ridesharing services dispatch shared autonomous vehicles (AVs) to pick up multiple passengers traveling along similar routes. Robo-taxis drop off passengers at subway stops for the next legs of their trips. Some traditional car owners decide that they no longer need personal vehicles because shared-mobility AVs fulfill their needs. Road congestion drops because there are fewer vehicles.

Now imagine an alternative future in which everyone who once owned a traditional car instead has an AV. Many people without licenses also purchase AVs for their personal use, even though they haven't had a car for years or never owned one. Passenger-miles traveled increase by 25 percent.[1] AVs circle while waiting for their owners to finish shopping or running errands if no parking spaces are available, or else they run a variety of errands, ranging from delivering groceries to picking up dry cleaning, themselves. City streets become even more gridlocked.

Which scenario will emerge around the world? The answer will depend, in part, on whether public and private stakeholders invest in the infrastructure required to enable shared autonomous mobility (SAM). But this issue gets relatively little attention now, since companies, investors, inventors, and policy makers are rightfully focusing on issues, such as safety, related to the AVs themselves. Stakeholders will soon begin discussing AV-infrastructure requirements in more detail, however, as they undertake capital planning. Some of the decisions they make now could determine whether SAM gains traction.

To help transportation officials consider the road ahead, we have identified a potential path forward for AV infrastructure that enables SAM. It includes plans for basic structural and roadway alterations that can promote AV growth, as well as improvements specifically geared at encouraging shared mobility. Transportation leaders could think about a phased approach as they consider these improvements—first implementing some infrastructure changes during AV pilots, then making additional accommodations to suit mixed traffic (AVs and traditional cars), and finally creating infrastructure that supports a complete transition to AVs.

Autonomous-vehicle infrastructure at a crossroads

With the right infrastructure to enable shared mobility, multipassenger robo-taxis could account for 500 billion miles traveled on US roads—about 9 percent of the total—by 2030. By 2040, they could account for 50 percent of all miles traveled. In addition to less traffic congestion, vehicle emissions could plunge. With more AVs in use that make fewer errors than human drivers, transportation fatalities could decline. Real estate previously dedicated to parking could be repurposed into commercial or residential properties. These improvements, in combination, could produce economic benefits totaling $850 billion annually.

To get the enabling infrastructure ready for this future state, public officials could determine whether potential transportation improvements promote SAM—both for current AVs and later models that will be fully autonomous. If they design structures with SAM in mind now, they will not have to make costly modifications later. Other related issues to consider include road pricing, zoning, licensing, and insurance.

As the public sector considers potential infra-structure upgrades, it will be important to monitor changes in AV technology. Recently, there has been increasing debate about how much stakeholders should invest in vehicle-to-infrastructure (V2I) systems, such as sensors in roads or street signs that send signals to AVs, helping them navigate city streets. There has also been much industry debate about which V2I technology is most appropriate,

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[1] Eric Hannon, Colin McKerracher, Itamar Orlandi, and Surya Ramkumar, "An integrated perspective on the future of mobility," October 2016, McKinsey.com.

with opinion divided about the competing merits of dedicated short-range communications (DSRC) and cellular vehicle-to-everything (C-V2X) systems. Although evaluating specific V2I technologies is beyond the scope of this article, it is important to note the rapid growth of the V2I ecosystem (and that's true even though automotive OEMs are piloting AVs equipped with in-car sensors and dynamic maps that allow them to operate independently). If public-sector leaders keep these potential technology changes in mind, they will make informed decisions about infrastructure.

Basic upgrades: Keeping infrastructure assets in good repair

Only 41 percent of US roads meet the requirements for a "good ride," as scored according to the International Roughness Index. Potholes, poor striping, and other maintenance issues not only create safety problems but also present challenges to AVs. If governments consider adopting faster, more efficient approaches to improving basic infrastructure, they could reduce these problems. In addition to improving safety and reducing costs related to vehicle wear and tear, their infrastructure investments would enable AV pilot testing. For example, maintenance teams could restripe poorly marked streets with six-inch-wide, highly retroreflective lines to help prevent cars from wandering off the road. These lines bounce light back to the original source, resulting in greater visibility than reflective lines.

Even after initial repairs are made, road maintenance will be a major and ongoing concern. Deteriorating roads aren't only a nuisance for human drivers: they are major impediments for AVs. To promote higher levels of autonomy, mapping software must be highly accurate—for difficult intersections, for instance, it will need to record dimensions down to the inch. If roads are deteriorating and road markers are fading, the physical structure of the intersection will constantly change. Even minute alterations could thus impede the growth of AVs.

To avoid problems as AVs become more common, transportation officials could consider

making more systematic repairs than they have traditionally done. Officials might also think about forming partnerships with mapping companies to ensure that high-definition AV maps are quickly updated, in a cost-effective manner, when essential repairs are made.

In some cases, public officials could use AV growth as an opportunity to improve capital planning for streets. They might eliminate some costly repairs by devoting more funds to predictive maintenance. Such efforts might include sending out drones or AVs to spot potential problems before they escalate. Officials could also consider forming partnerships with various stakeholders, such as utility companies, transportation departments, and cable companies, to ensure coordinated and cost-effective street repairs. For instance, they could agree to conduct repairs and install new utility infrastructure on the same stretch of road simultaneously, or do so in quick succession, eliminating the need for multiple road closures.

Shared mobility: Shaping the future of transit

SAM may not be an immediate concern for public officials who are busy juggling priorities and dealing with tight budgets. But investing in SAM now could produce some immediate improvements in congestion and transportation, even though traditional vehicles far outnumber AVs. Acting now on a forecasted need is also less costly than acting later on an existing or emerging need.

Structures and accommodations that may be needed to support SAM include the following (exhibit):

— *Support facilities.* Autonomous fleets will need large support facilities to service and charge AVs. If cities allow private companies to operate vehicle fleets, officials might only need to regulate support facilities; their private partners would bear all infrastructure expenses. But if officials want to create public fleets, they should consider planning for the development of support facilities, much as they do when creating or enhancing today's bus systems. In some cases, they could repurpose existing

There are several infrastructure options transit leaders could consider to promote shared ridership.

Smart applications, such as an advanced traffic-management system, to provide routing and pricing information

Autonomous-vehicle maintenance, storage, and charging facilities

Reinvention of curb by rezoning on-street parking into flexible spaces for pickup or drop-off and transit stops during rush hour, commercial use in the evening, and freight use overnight

Mobility hubs to bring together multiple modes of transportation

Smart parking meters or market-priced parking permits for remaining on-street parking

facilities that are no longer essential, such as parking garages that are no longer seeing high demand. For most support facilities, the major costs will involve rent (unless the public sector owns the structure), labor, and creation of charging infrastructure for electric vehicles (EVs). Transportation officials must be thoughtful about the placement of these facilities to avoid disrupting the urban environment and damaging health, traffic, and civic life.

— *Staging areas.* To avoid congestion, AV fleets and ridesharing services need locations where they can idle when picking up or discharging passengers. One solution might involve

converting existing parking spots into staging areas accessible to multiple fleet operators.

— *Curb modifications.* In most cities, the curb predominantly serves as a space for parking. Transportation leaders could consider pricing this resource more dynamically, taking market demand into account, to free up spaces. They could also designate it for specific purposes at different times (designated with signs or beacons that send signals to AVs). During rush hour, the curb might be a pickup site for AV shuttles that are part of the public transportation system. Later, it could provide parking for food trucks during lunch and a site for freight delivery at

night. Transforming the curb may encourage SAM because travelers could share costs related to drop-off, especially during times when the price increases. Dynamically pricing curb space could also reduce congestion and cut down on vehicles circling—current problems that will extend into the AV world of the future. It has been estimated, for example, that nearly one-third of traffic in New York City consists of vehicles circling the block, looking for underpriced street parking. Pricing this scarce resource consistent with demand would also provide delivery trucks and ridesharing services with more options for conducting drop-offs and pickups, since more spaces would be available. One substantial benefit of this shift: less double-parking.

— *Mobility hubs.* For SAM to flourish, travelers must be able to transfer seamlessly between different modes. A commuter might take a robo-taxi from home to the nearest train station then grab an electric scooter to get the final mile from the train stop to the office. If this process is too difficult, passengers might opt to take a private AV from point to point—a trend that would increase delays and unreliability. To avoid this situation, officials could consider investing in more mobility hubs where travelers going in the same direction can access shared transportation, including AVs. These facilities could include micromobility-pickup locations (places where people could get scooters or bikes) next to subway stops, or large transit facilities that also contain dining and shopping options at critical nodes.

Long-term planning: Preparing for a completely autonomous world

Within cities, at least, a fully autonomous world awaits. Even though this world may be many years down the road, public officials should understand the changes ahead and consider the modifications needed to accommodate such systems. Right now, stoplights and street signs are geared to human drivers. In the future, cities may replace much of this signage with a digital transportation-management system that feeds key information, such as speed limits and turning restrictions, directly to vehicles. Roadways themselves will also need to evolve as AVs become the dominant form of transportation. For instance, officials might consider the extent to which safety enhancements, such as raised curbs or guardrails, are beneficial. While a distracted human driver might accidentally veer over the curb or into another lane, the probability of such accidents are expected to be lower with AVs. On low-traffic urban streets, it might be possible to expand walkable space without banning all vehicles entirely. Many streets could be narrowed, since AVs will be designed to operate in close proximity to other vehicles with very low risk of collision. AVs will also be smaller if they are fully capable of self-driving—for instance, mirrors would no longer be necessary, and bumpers would be less bulky, in keeping with a different crash-risk profile (fewer collisions overall, and higher proportion of accidents with minor damage).

Funding autonomous-vehicle-infrastructure upgrades: possible approaches

Federal, state, and local governments are already struggling with budget deficits, and transportation is underresourced. According to the American Society of Civil Engineers, the United States has an $836 billion backlog of highway- and bridge-capital needs.[2] Adding to the problem, the growth of AVs and EVs could exacerbate the current funding gap by 22 percent—about $80 billion—by 2040. (Given that most AVs will be electric, fuel-tax revenues may fall by more than half). And without the need to license and register drivers or personal cars, various fees could also fall substantially. These shifts will likely present a daunting financial challenge for the public sector.

Public officials could mitigate the funding gap by finding new revenue streams. When considering their options, it would be helpful if they investigate whether new revenue streams would reward or

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[2] "Roads," *2017 infrastructure report card*, American Society of Civil Engineers, 2017, infrastructurereportcard.org.

discourage more cost-efficient SAM. In many cases, these streams may come from public–private partnerships (PPPs), which are becoming more common with large transportation projects.

PPPs provide means for encouraging the diverse mix of capital investments that may be needed to support the growth of AVs and SAM. (No single public or private organization has the resources needed to make all required infrastructure upgrades.) With all PPPs, careful consideration must be given to ownership issues, contract terms, and the potential value of the future revenue streams. Prime mobility-related PPPs that encourage SAM might focus on the following activities:

— developing the infrastructure necessary to price the curb dynamically and collect revenues (for instance, by installing smart meters that display current prices, accept payments, and notify servers if they are occupied)

— bundling a variety of small capital improvements across a broad geography to capture economies of scale and attract the most efficient and sophisticated private-sector companies (for instance, by repairing multiple bridges simultaneously)

— setting up and operating mobility services, such as AV fleets, on behalf of a city, following the model that some have implemented for bikeshare programs

— constructing infrastructure to collect user fees on shared-AV-only lanes

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The greater use of shared AVs won't just change transportation systems—it could also breathe new life into cities. If transportation officials begin looking into SAM issues now, before AVs become widespread, they can create a future in which traffic flows smoothly and predictably, public transportation operates efficiently, and overall emissions drop. Residents could have more parks, restaurants, and businesses to enjoy in their own neighborhoods, giving them a greater connection to the local community. Risks to bicyclists and pedestrians, which have been growing in recent years, could also fall. The benefits that such changes could bring to society and the environment could be beyond price.

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The year of future transportation: An interview with Seoul Mayor Park Wonsoon

As Seoul's mayor seeks to bring transportation improvements to the city, he must carefully consider how to implement sustainable infrastructure and new technologies to best meet citizens' needs.

Mobility of the future aims to enhance the convenience, reliability, and sustainability of transportation by harnessing new technologies such as the Internet of Things (IoT), automation, and artificial intelligence. But for such transformations to be successful, involved government leaders must identify both the needs of citizens and the vast potential of the ever-evolving technologies.

Seoul Mayor Park Wonsoon is familiar with this undertaking. Wonsoon, who has introduced several future mobility initiatives over the past eight years, named 2019 the Year of Seoul's Future Transportation. He spoke with McKinsey about his current and planned efforts to innovate the way citizens of Seoul move, including harnessing mobility technologies such as autonomous and connected cars.

McKinsey: *What do you see as the biggest transportation challenges that Seoul needs to resolve in the next ten years?*

Park Wonsoon: In January 2013, I vowed to transition Seoul from a car-centric city into a people-centric city.

The starting point for transforming Seoul into a people-centric city is improving areas closest to the day-to-day lives of citizens. I view our mandate for the next decade as twofold: first, meeting the complementary goals of creating a walkable community and enhancing the public interest in pedestrian space; second, tackling climate change issues, such as fine dust particles, while preserving the city's nature, history, and culture.

I have worked to make Seoul a city that respects the walking rights of all citizens by creating spaces such as Sinchon's pedestrian- and bike-only street, an exclusive zone of the street Yonsei-ro solely for public transportation, the child-friendly A.Ma.Zone safe street, the Seoul Trail and urban walking trails, and the Seoullo 7017 pedestrian path.

To combat fine dust particles surging to emergency levels, we are planning to limit old diesel vehicles on the roads and switch to green cars, including hydrobuses and electric vehicles.

We also designated the area contained by Seoul's 700-year-old Fortress Wall as a Green Transport Promotion Zone—an area that prioritizes sustainable transport such as walking, biking, and electric vehicles. Higher-emission vehicles, such as old diesel cars, are barred from entering the zone. And we are establishing electric buses, pedestrian zones, and public transport facilities (such as a bicycle rental center) to encourage cleaner modes of transport.

McKinsey: *What are Seoul's primary key performance indicators for urban mobility?*

Park Wonsoon: Our approach to mobility is based on the rights of citizens and sustainability. Citizens want convenient, reliable, and diverse personal mobility choices, including bicycling, and they consider pedestrian right-of-way as a basic part of human dignity. Seoul is considering how to improve citizens' quality of life in these ways and create a city that empowers people and respects their safety and civic convenience.

For example, we are currently carrying out the Special Smart City Zones project in two autonomous districts in Seoul: Seongdong-gu and Yangcheon-gu.[1] In Seongdong-gu, smart crosswalks have sensors for detecting movement that trigger flickering lights along the crosswalk to help draw pedestrians' attention to the safety line and traffic signals. And drivers will see the lighted crosswalk from a distance, giving them more time to slow down. In Yangcheon-gu, IoT services—such as one service that uses artificial intelligence to reserve parking spaces for people with disabilities—have been launched to bring on-the-ground services directly to where people actually need them.

Our subindicators thus include the number of traffic fatalities, public bicycles, car-free streets, and secured parking lots in residential areas; public transit user satisfaction; and air quality.

McKinsey: *How are Seoul's leaders using technology to manage and improve urban mobility?*

Park Wonsoon: Technology has been a priority in Seoul's government since the 1960s; thus, it

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1 "Seongdong and Yangcheon to become the first Special Smart City Zones in Seoul," Seoul Metropolitan Government, January 31, 2019, english. seoul.go.kr.

isn't surprising that city leaders are committed to creating smart transportation.

As part of our transportation initiative, we are installing 50,000 IoT sensors across the entire city. This initiative includes a parking system where parking availability can be checked in real time through IoT technology, and a taxi service that connects the driver and the passenger by predicting real-time taxi demand through artificial intelligence. We are also building an integrated control center for processing administrative services such as toll collection, payment, and management. By harnessing smart security cameras and deep learning, we will automate simple tasks that previously relied on the human eye, thus increasing service efficiency.

On another note, Seoul is using technology to transition to an environmentally friendly and sustainable transport system. For example, the city is making efforts to manage transport demand and improve air quality by managing the total traffic volume and using information and communications technology to restrict high-emission vehicles.

The city will enhance the level of services by applying connected-car technology. We are also planning to launch a connected-car pilot on 1,600 city buses this October and develop the world's first all-in-one platform to create a safer transportation culture. The all-in-one platform integrates the individual devices that had been installed on buses for operation management, electronic traffic cards, driving history records, 5G capability, vehicle-to-everything (V2X) connectivity,[2] and advanced driver-assistance systems. The platform provides data about unexpected events on the road, including jaywalkers, improperly passing cars, and accidents related to traffic signals and crosswalks.

McKinsey: *What concrete preparations are Seoul's leaders making in line with the deployment of autonomous cars?*

Park Wonsoon: The biggest change in urban life for the future smart city is probably going to be autonomous driving. Autonomous driving will be a trigger point and a catalyst in transforming not only the physical landscape of the city but how people, technology, and capital are connected.

This month, we will complete the world's first test bed for 5G convergence with autonomous driving at Sangam Digital Media City. It is the only test site in the world that supports autonomous driving with 5G and V2X technology on public roads. We will run 5G network–based driverless buses, and various startups will test their technologies here.

We have applied to register this area as a "specialized complex for automotive driving and 5G smart city" with South Korea's Ministry of Land, Infrastructure and Transport, and we plan to apply for regulatory exemptions that will dedicate this area for testing autonomous driving. We expect the site to improve the competitiveness of domestic companies involved in autonomous driving, and we believe that public–private partnerships from the testing stage are important for advancing user-centric public services.

McKinsey: *How are Seoul's leaders encouraging citizens to participate in improving urban mobility?*

Park Wonsoon: To develop information and communications technology–based services, we have launched the "public–private partnership for a smart city" project where various players—including citizens, businesses, and experts—can collaborate. This project harnesses an open platform to allow these players to brainstorm innovative ideas and solutions, from business development to implementation.

Ultimately, innovation in urban mobility must address the changes to citizens' lives that will come in the future. For the past eight years, the Seoul Metropolitan Government has come up with new, exciting solutions through experiments together with its citizens in urban centers and on the streets. Now, at this turning point, Seoul will once again seek solutions together with its citizens, promoting cooperation not only with other districts but with cities around the world.

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[2] Vehicle-to-everything (V2X) technology wirelessly enables a vehicle to exchange data with its surroundings, including infrastructure and other vehicles.

How can the private and public sectors work together to create smart cities?

Smart-city experts share examples of successful public—private partnerships from around the world.

by Jonathan K. Law, Rit Aggarwala, and Ester Fuchs

How does a city transform itself into a smart city?

One strategy involves bringing the private sector into the fold, to provide funding, technical know-how, and innovation that complements public-sector efforts. But bringing these two different elements together can also prove challenging in practice.

At a recent smart-cities event in New York, convened by the McKinsey Global Institute, Kathryn Wylde, president and CEO of the not-for-profit Partnership for New York City, asked smart-city experts for examples of successful public–private partnerships. Rit Aggarwala, head of urban systems at Sidewalk Labs and adjunct professor of international and public affairs at Columbia University; Ester Fuchs, professor of international and public affairs and political science, and director of the urban and social policy program at Columbia University; and McKinsey partner Jonathan Law shared the following thoughts.

Jonathan Law: When you've seen one public–private partnership, you've seen one public–private partnership. A lot of people are exploring and trying different things and trying to be thoughtful about it.

To give a couple of examples, in Copenhagen they're working with Hitachi on how to monetize data sets to be used for creating applications and other solutions for residents.

Another example is how Abu Dhabi has partnered with a Swiss company on telemedicine, determining how to provide solutions, do so equitably, and ensure that there's a good flow of funds.

Another one is Mexico City, which is working with a nonprofit on earthquake detection. It's not just about for-profit companies; it's also about think tanks and nonprofits who are working in this space and thinking about bringing them into this ecosystem.

A different model here is what Singapore is doing with its smart-nation initiative. The country is trying to incubate a number of different solutions on the governmental side. The hope is that they spin off so that they do have some longer-term, more sustainable revenue stream against them. But at least at that beginning stage, where it's a little riskier, they can bring incubation and that risk capital.

Rit Aggarwala: One example that I always think about with great admiration is Amsterdam— and the story of Amsterdam Smart City—which effectively has the same relationship with the city government that New York's EDC [New York City Economic Development Corporation] has: it's a kind of captive nonprofit.

But interestingly, it started as an entrepreneurial nonprofit outside of city government. It was started with an EU grant independent of the city, and then it grew, and then the founder became the CTO [chief technology officer] of Amsterdam. And so, these two things converged, but it retains that entrepreneurial feel.

And at a time when the city was uninterested, it allowed a set of entrepreneurs to identify urban problems where there are technological solutions and set up a bunch of demos, pilots, and things

One strategy involves bringing the private sector into the fold, to provide funding, technical know-how, and innovation.

that got the public's imagination. That became something that government took very seriously and now is embraced fully.

Ester Fuchs: University partnerships are one type of partnership that has been critical in the smaller and middle-size cities, in fact, and even in New York as well.

Columbia University recently secured a grant from the National Science Foundation and is in the process, we hope, of getting a second grant, which uses Harlem as a test bed. The first grant, COSMOS, provides funding to wire a part of Harlem to have the kind of capacity to compete economically and provide for the community.

The interesting part of these models is how much of them are bottom-up rather than top-down. There are community partners who will be engaging in the process of figuring out what we want to use this data for. Part of it is creating the technology to collect the data, but also engaging the community to determine how this data will be used to solve problems at what we're calling the streetscape level, which I think is very innovative and extremely promising.

Jonathan K. Law is a partner in McKinsey's New York office; **Rit Aggarwala** is the head of urban systems at Sidewalk Labs and adjunct professor of international and public affairs at Columbia University; **Ester Fuchs** is a professor of international and public affairs and political science and the director of the urban and social-policy program at Columbia University.

Homelessness in the San Francisco Bay Area: The crisis and a path forward

Homelessness in and around the San Francisco Bay Area continues to rise. Coordinated efforts among governments, nonprofits, and the private sector could stem the crisis and spark progress.

by Kate Anthony, Kunal Modi, Kausik Rajgopal, and Gordon Yu

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Homelessness in the San Francisco Bay Area has reached crisis proportions. The region has the third-largest population of people experiencing homelessness in the United States, behind only New York City and Los Angeles. Two-thirds of the Bay Area's homeless residents are living on the street, in their cars, or in encampments, while the remainder live with daily uncertainty over whether their bed at night will be a relative's couch or a temporary shelter cot. Tent encampments are becoming a visible feature of the region's streetscape, and the crisis is placing an undue burden on auxiliary support systems, such as healthcare, criminal justice, and behavioral health. Despite concerted effort by public officials and substantial investment in housing and related supports and services, the number of homeless people is growing, as inflows continue to outpace outflows.

Addressing this issue will likely require a regional, multi-stakeholder approach that holistically supports homeless families across the full journey, from housing insecure to homeless to housed, and integrates resources across the government, nonprofit, and private sectors.
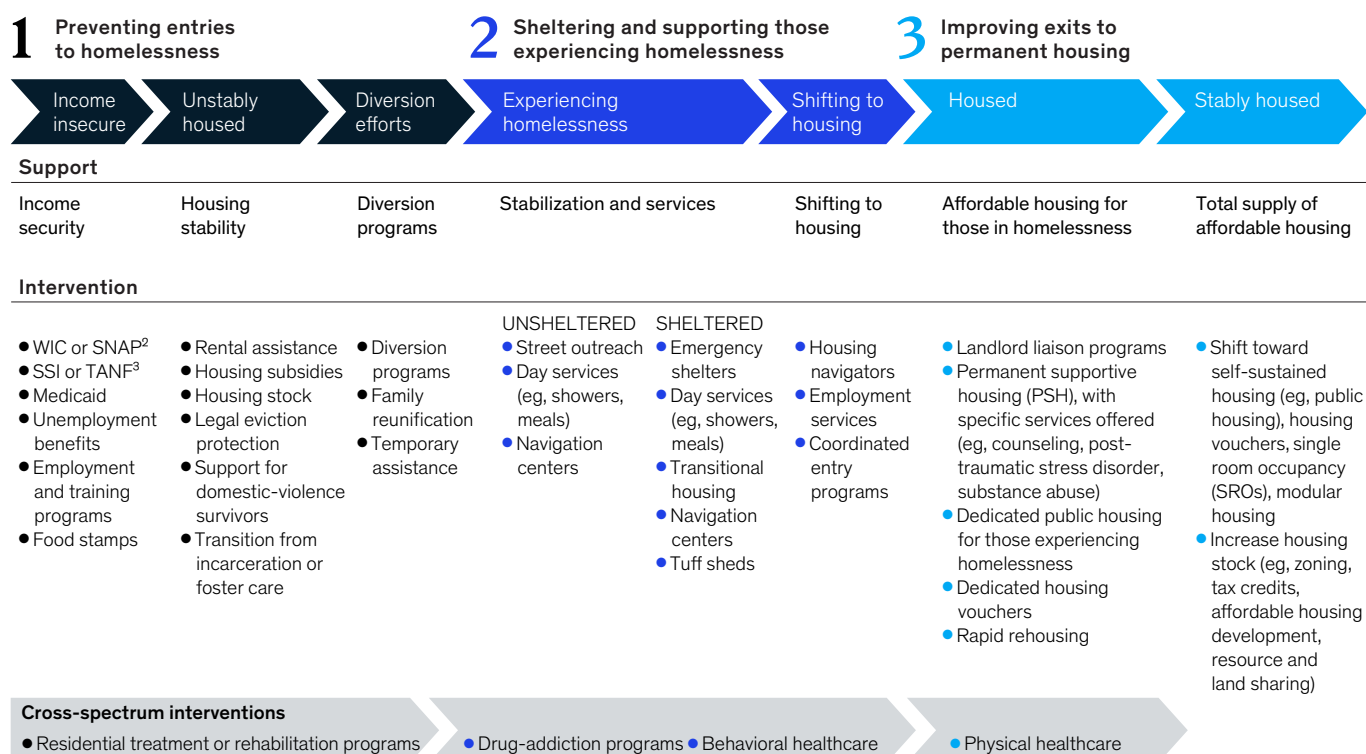
The journey from housing insecure to homeless to housed

While most of the public thinks about homelessness as "unsheltered" homelessness, or street homelessness, the reality is a broader journey as individuals enter, experience, and transition out of homelessness, with myriad possible interventions along the spectrum (Exhibit 1). Complicating the crisis further are the facts that an individual's or family's path into and out of homelessness is often not straightforward and that the support system

Exhibit 1

Understanding how people experience homelessness can help in identifying appropriate interventions.

Stages of homelessness[1]

1 Preventing entries to homelessness

2 Sheltering and supporting those experiencing homelessness

3 Improving exits to permanent housing

Income insecure	Unstably housed	Diversion efforts	Experiencing homelessness	Shifting to housing	Housed	Stably housed

Support

Income security	Housing stability	Diversion programs	Stabilization and services	Shifting to housing	Affordable housing for those in homelessness	Total supply of affordable housing

Intervention

			UNSHELTERED	SHELTERED			
• WIC or SNAP[2] • SSI or TANF[3] • Medicaid • Unemployment benefits • Employment and training programs • Food stamps	• Rental assistance • Housing subsidies • Housing stock • Legal eviction protection • Support for domestic-violence survivors • Transition from incarceration or foster care	• Diversion programs • Family reunification • Temporary assistance	• Street outreach • Day services (eg, showers, meals) • Navigation centers	• Emergency shelters • Day services (eg, showers, meals) • Transitional housing • Navigation centers • Tuff sheds	• Housing navigators • Employment services • Coordinated entry programs	• Landlord liaison programs • Permanent supportive housing (PSH), with specific services offered (eg, counseling, post-traumatic stress disorder, substance abuse) • Dedicated public housing for those experiencing homelessness • Dedicated housing vouchers • Rapid rehousing	• Shift toward self-sustained housing (eg, public housing), housing vouchers, single room occupancy (SROs), modular housing • Increase housing stock (eg, zoning, tax credits, affordable housing development, resource and land sharing)

Cross-spectrum interventions

• Residential treatment or rehabilitation programs   • Drug-addiction programs • Behavioral healthcare   • Physical healthcare

[1] Individual journeys are nonlinear; those experiencing homelessness may cycle between some stages repeatedly and skip others altogether.
[2] Special Supplemental Nutrition Program for Women, Infants, and Children or Supplemental Nutrition Assistance Program.
[3] Supplemental Security Income or Temporary Assistance for Needy Families.

itself is fragmented, with limited communication and data sharing between service providers and across regions. Efforts to improve the crisis response system will benefit from an end-to-end strategy to stem the instances of entry into homelessness, increase exit opportunities, and better coordinate care across the support spectrum to ensure people don't get "stuck."

The state of the crisis in the Bay Area

Based on a 2017 point-in-time (PIT) count, 28,200 people were estimated to be homeless in the Bay Area, with 70 percent of these living in Santa Clara, San Francisco, and Alameda Counties (Exhibit 2).[1]

Preliminary PIT counts released in 2019 indicate an increase of 17 percent in San Francisco, 31 percent in Santa Clara, and 43 percent in Alameda Counties from 2017 to 2019. The total number experiencing homelessness in a given year is likely substantially higher: PIT counts may underestimate persons experiencing homelessness on an annual basis by at least two to three times.[2]

Contrary to popular myth, the majority of homeless persons in the Bay Area are not coming from other regions: 89 percent of people experiencing homelessness in 2017 reported living in their county for one or more years.[3] However, practitioners
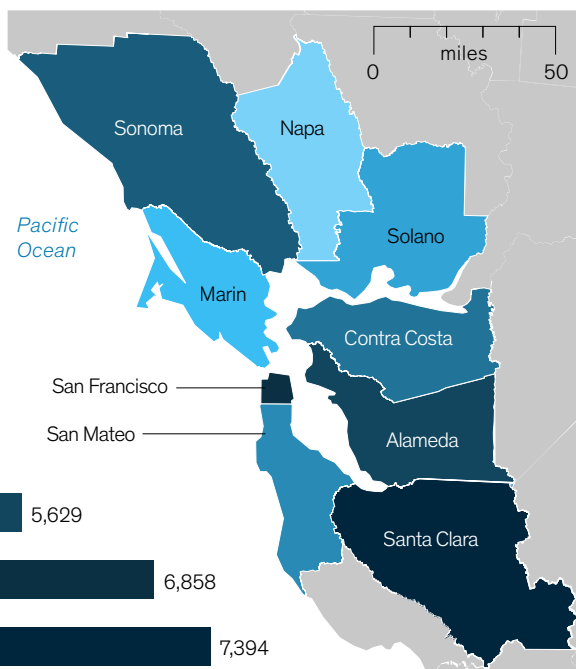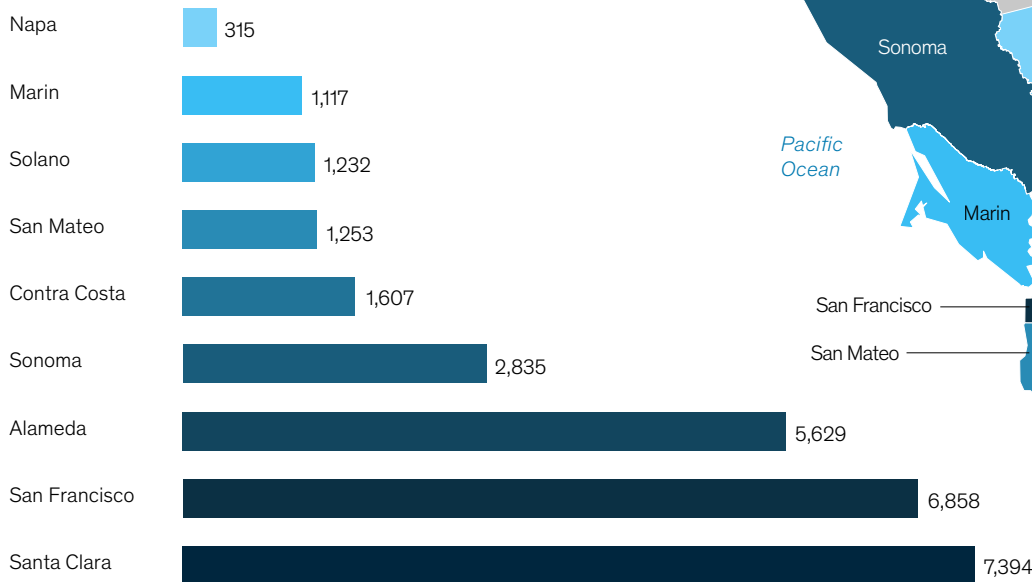
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[1] The primary national source of data on homelessness is the US Department of Housing and Urban Development PIT count: an unduplicated count of sheltered (annual) and unsheltered (biennial) homeless persons conducted by volunteers on a single night in January.
[2] Meghan Henry et al., *2017 Annual Homeless Assessment Report (AHAR) to Congress*, US Department of Housing and Urban Development, October 2018, hudexchange.info. The 2017 AHAR documented more than 550,000 persons experiencing homelessness in the United States, according to the January PIT count, but estimated that more than 1.4 million experienced homelessness over the course of the year.

Exhibit 2

In a 2017 count, around 28,000 people were estimated to be homeless in the San Francisco Bay Area.

Persons experiencing homelessness by Bay Area county in 2017, number

County	Number
Napa	315
Marin	1,117
Solano	1,232
San Mateo	1,253
Contra Costa	1,607
Sonoma	2,835
Alameda	5,629
San Francisco	6,858
Santa Clara	7,394

Source: 2017 US Department of Housing and Urban Development point-in-time-count data, by Continuum of Care, 2017 US census estimates

report high rates of interregional mobility, with persons experiencing homelessness crossing county lines regularly, many separated only by a short bus or metro trip.[4]

A large portion of the Bay Area homeless population is unsheltered: 67 percent in 2017, second only to Los Angeles. Relative to other metropolitan areas, the Bay Area also has high rates of chronic and youth homelessness (Exhibit 3).[5]

How we got here
The combination of a long-standing housing-affordability crisis, insufficient inventory, and a lack of system-level and regional coordination means the Bay Area has failed to sufficiently stem inflows, increase exits, and effectively navigate those experiencing homelessness to lasting solutions.

Housing affordability
Long-standing housing-affordability challenges affect every stage of the Bay Area's homelessness cycle. From 1999 to 2014, the Bay Area permitted construction of 61,000 fewer very-low-income affordable-housing units[6] than recommended by the state and lost a substantial portion of existing housing inventory to market pressures—in San Francisco, for every two affordable housing units created, the city lost more than one from its existing inventory because of units being permanently withdrawn from the protection of rent control.[7]

The result is a severe housing shortage: according to the National Low Income Housing Coalition, as of 2017, in the San Francisco–Oakland–Hayward and San Jose–Sunnyvale–Santa Clara metropolitan areas alone, there was a supply gap of more

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[3] 2017 self-reported data from 94 percent of Bay Area population of persons experiencing homelessness (in San Francisco, Santa Clara, Solano, Sonoma, Contra Costa, Marin, and Alameda Counties).

[4] Figures based on 2017 San Francisco Continuum of Care program data on place of origin of persons experiencing homelessness. Finding supported by interviews with other counties.

[5] This is similar to other West Coast metropolitan areas. East Coast metropolitan areas tend to have higher rates of family homelessness.
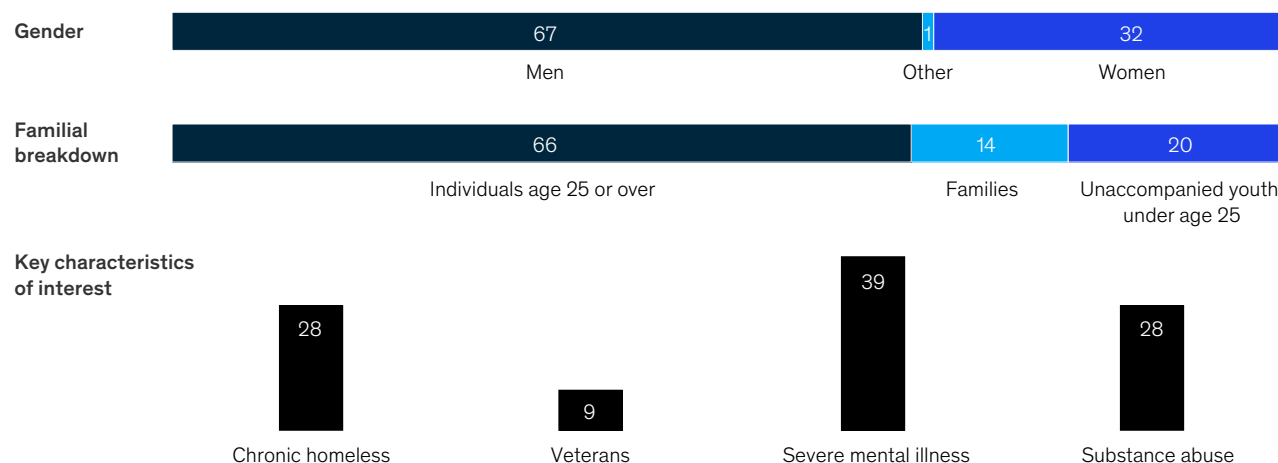
[6] US Department of Housing and Urban Development defines "affordable" units as those units for which monthly rent and basic utilities does not exceed 30 percent of monthly income for a given income bracket. "Very-low-income affordable" units are defined as units affordable to families making less than 30 percent of the area median income.

[7] *Housing balance report no. 7*, San Francisco Planning Department, September 2018, sfplanning.org.

Exhibit 3

The Bay Area sees high rates of chronic, youth, and individual homelessness.

Demographics of people experiencing homelessness in Bay Area, % of 2017 count

Gender			
67	1	32	
Men	Other	Women	

Familial breakdown		
66	14	20
Individuals age 25 or over	Families	Unaccompanied youth under age 25

Key characteristics of interest

Chronic homeless	Veterans	Severe mental illness	Substance abuse
28	9	39	28

than 157,500 affordable and available units for extremely low-income households. Two-thirds of extremely low-income households lived in rental accommodations they struggled to afford, leaving them one unexpected expense away from entering homelessness (Exhibit 4).

Insufficient inventory
Insufficient inventory across the homelessness spectrum further limits exit opportunities and leaves many waiting on permanent solutions without a temporary home. In keeping with the national push

for Housing First,[8] the Bay Area has doubled down on increasing permanent-supportive-housing[9] and rapid-rehousing[10] options. However, in light of the affordability challenges previously discussed, current inventory is not nearly enough to meet demand. Accounting for permanent-supportive-housing and rapid-rehousing supports, the current Bay Area crisis-response system currently shelters 30,000 homeless individuals. Assuming current bed-count utilization is at 100 percent, more than 28,000 additional individuals require permanent housing, with more than 18,000 of those in need

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[8] According to the US Department of Housing and Urban Development (HUD), Housing First is a HUD-supported method of intervention for people experiencing homelessness that uses housing itself as the intervention—providing permanent housing first in order to then provide services (such as behavioral healthcare and medical treatment) that help to build stability. In contrast, a "housing-readiness" approach makes people experiencing homelessness clear certain criteria before being eligible for housing.
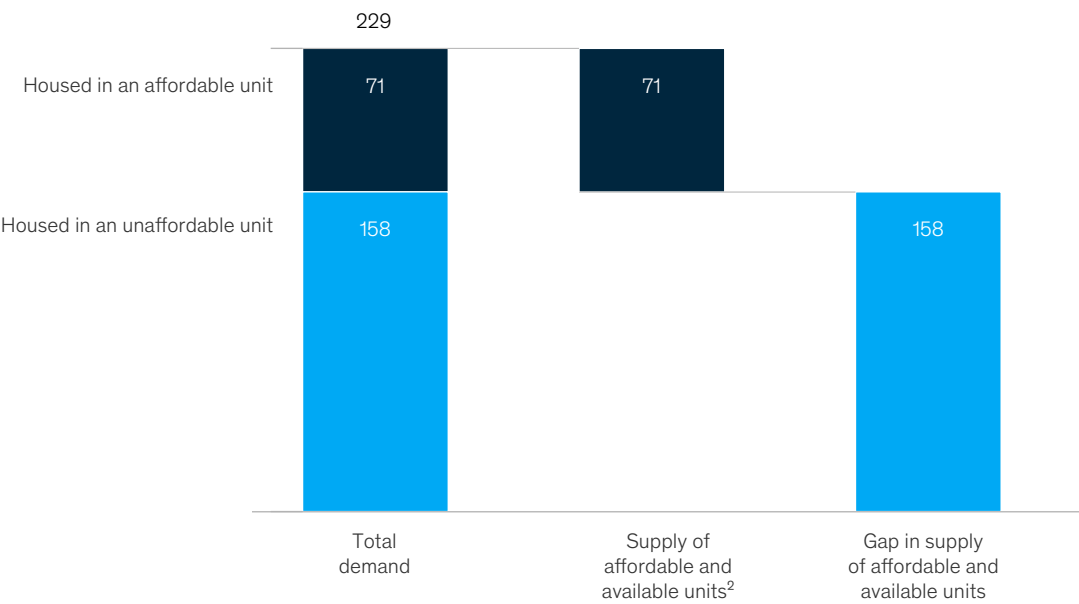[9] Permanent supportive housing is housing with indefinite leasing or rental assistance paired with supportive services to assist homeless persons or families with a disability in achieving housing stability.
[10] Rapid rehousing emphasizes housing-search and relocation services and short- and medium-term rental assistance to move homeless persons and families (with or without a disability) as rapidly as possible into permanent housing.

Exhibit 4

Two-thirds of low-income households were in rentals they struggled to afford.

Supply vs demand of affordable rental units for extremely low-income households in San Francisco–Oakland–Hayward and San Jose–Sunnyvale–Santa Clara,[1] thousand

[1] National Low Income Housing Coalition 2017 gap analysis. <30% area median income defined as extremely low income.
[2] Affordable unit defined as one where monthly rent and utilities do not exceed 30% of monthly household income. Analysis for rental units/households only. Affordable and available unit defined as unit that is either vacant or currently occupied by a household at defined income threshold or below.
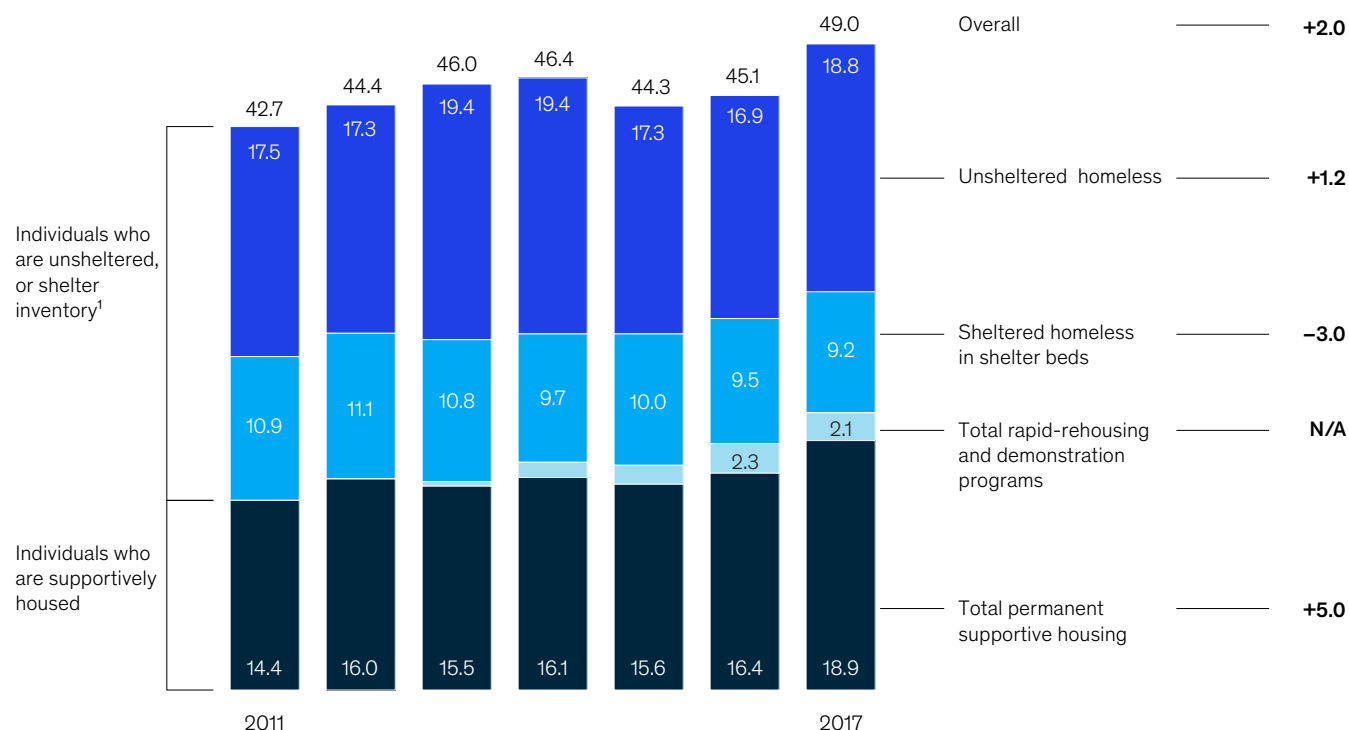
Source: National Low Income Housing Coalition; US Department of Housing and Urban Development

Exhibit 5

The number of persons requiring support from the crisis-response system continues to increase, with more than 18,000 of those in need of immediate shelter.

Individuals currently needing support from Bay Area crisis-response system, thousand

Compound annual growth rate in need and support, 2011–17, %

Overall		**+2.0**
Unsheltered homeless		**+1.2**
Sheltered homeless in shelter beds		**−3.0**
Total rapid-rehousing and demonstration programs		**N/A**
Total permanent supportive housing		**+5.0**

Note: Figures may not sum, because of rounding.
[1] Assumes that shelter beds are 100% utilized and that bed count serves as an approximation for the sheltered-homeless population.

Source: US Department of Housing and Urban Development point-in-time-count and housing-inventory-count data

of immediate shelter (Exhibit 5). Ultimately, an "all of the above" strategy is required: the right mix of affordable housing, permanent supportive housing, and temporary shelters to meet the full accommodation need.

Lack of coordination

The Bay Area's crisis-response system is highly fragmented, with limited communication and data sharing between service providers and across regions. Each county operates its own Continuum of Care: submitting its own strategic plan, collecting its own data on its homelessness population and system performance, and receiving its own funding from the US Department of Housing and Urban Development (HUD). Given the substantial interregional mobility of the Bay Area's

homeless population, this approach impedes understanding of current service needs and gaps; it also hampers much-needed collaboration to determine the most effective strategies to meet growing need.

Pillars of the solution

Practitioners across the system agree: there is no silver bullet. Progress on the issue will likely require regionally coordinated efforts by governments, philanthropists, and the private sector across three key spheres.

1. Meet the accommodation need

At its core, the solution to homelessness is a home. The Bay Area must expand the housing supply available to extremely low-income households

to keep people in their homes and increase exit opportunities into permanent housing solutions. Efforts will need to target both families and individuals able to benefit from rapid rehousing services, as well as the Bay Area's large chronically homeless population, who, in most cases, require housing with wraparound services in order to successfully transition out of homelessness and remain housed long term.[11] These solutions aren't free, but neither is the status quo: a 2015 study in Santa Clara County estimated that indirect costs of homelessness on the healthcare, criminal justice, and social services systems amounted to more than $520 million annually.

Meeting the affordable-housing gap will likely not be possible under the status quo: convoluted permitting, high construction costs, and long timelines fraught with administrative bottlenecks impede meaningful progress. Renewed efforts by stakeholders in the public and private spheres could reduce the time and cost needed to build new units, encourage housing production for lower-income brackets, and test and scale innovative models to meet accommodation needs and provide the necessary support services.

2. Drive greater state and regional collaboration

The fragmented solution landscape and intraregional mobility of the Bay Area's homeless population point to the importance of a cohesive strategic approach to homelessness that integrates funding, data collection, and advocacy efforts between service providers and across regions. Creation of a regional Bay Area Homeless Management Information System could help to build a more accurate map of inflows, exits, available services, gaps, and costs to serve. Establishing a regional homelessness-management plan—like the regional emergency-management systems that have been set up in the wake of disasters—could enhance service delivery, reduce redundancies, increase accountability, and enhance the region's power to advocate at the state and national levels.

3. Engage private and philanthropic capital to enhance services and pilot innovative solutions

Private and philanthropic dollars can be deployed in innovative ways to expand and improve services for current homelessness populations. Public–private partnerships and innovative models, such as pay for success,[12] could mobilize much-needed capital to rapidly test and scale highly effective interventions. Fast-growth employers expanding in the Bay Area can add housing as they expand or invest in efforts to preserve affordability, such as the recent Partnership for the Bay's Future, supported by Facebook, Genentech, Kaiser Permanente, and several local foundations. Innovative technologies can enhance outreach efforts, reduce costs, and simplify complexities in the current service system.

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Unprecedented growth in the Bay Area has brought unprecedented challenges. The region has long been an engine of growth and prosperity, but it has also increasingly become marked by unaffordability and inexcusable conditions for our most vulnerable. The problem is not intractable: the Bay Area has the intellect and resources to turn the tide, but doing so will likely require additional resources and a more cohesive, coordinated, and substantial approach than the status quo.

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[11] The Bay Area's large youth population also often require additional services in order to ensure successful exit and retention in permanent housing.
[12] Pay for success is an innovative financing model that ties financing for interventions to the achievement of measurable outcomes.

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Unlocking the full potential of city revenues

A disciplined approach to revenue development has been shown to increase potential additional revenues by 50 percent.

by Loay AlMujadidi, Christian Azoury, Dirk Schmautzer, and Jonathan Woetzel

The rapid urbanization of the world's population is well under way. By 2050, 68 percent of the global population will live in urban areas.[1] Emerging countries and regions will see the greatest increase in their urban populations, and China, India, and Nigeria represent slightly more than a third of the projected growth in that time frame.[2] As city populations swell, municipal governments face increasing pressure from citizens and businesses to improve service delivery performance. Furthermore, the funding that municipalities receive from other government entities is decreasing. From 2010 to 2016, for example, central government funding as the share of total municipal revenue fell by approximately 12 percent, on average, across all countries in the Organization for Economic Co-operation and Development (OECD)[3] (Exhibit 1).

As a result of these twin trends, a majority of the municipalities around the world are struggling to increase revenues while facing structural budget shortfalls that threaten service delivery and quality. Beyond central government funding, the primary revenue streams for municipal governments are service fees, fines, taxes, and assets such as buildings and properties. And these sources tend to be far from optimized: local governments are often unaware of how to get more from existing sources and lack the resources to mount such efforts. In addition, elected officials must strike a tricky balance between raising taxes and fees and maintaining public support.

To meet rising expectations for service delivery amid tight budgets, municipal governments must increase revenues from existing sources as well as create new revenue streams. Elected officials have four primary revenue sources, each containing multiple levers. The challenge is identifying and prioritizing the opportunities that will have the greatest impact

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[1] "68% of the world population projected to live in urban areas by 2050, says UN," United Nations Department of Economic and Social Affairs, May 16, 2018, un.org.
[2] "68% of the world population projected to live in urban areas," un.org.
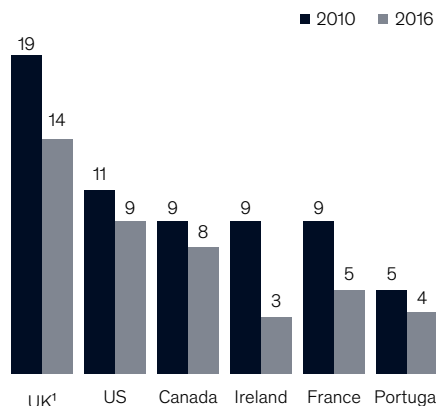[3] OECD fiscal decentralization database (object name Table 12: 1970 – 2016), OECD, accessed April 15, 2019, oecd.org.

Exhibit 1

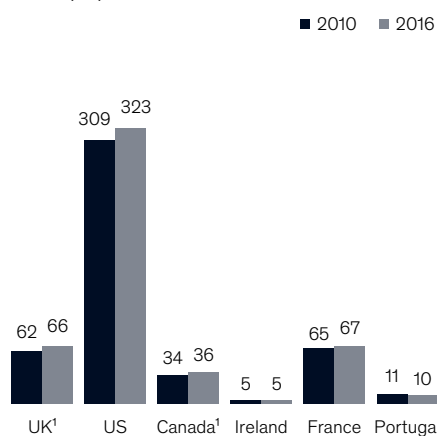## The funding municipalities receive from government entities is decreasing.

Central government funding for municipalities is decreasing

Central government funding as the share of total municipal revenue,[1] %

■ 2010 ■ 2016

+

Population growth is adding a cost burden to municipalities

Total population, millions

■ 2010 ■ 2016

=

Municipalities need to become more financially sustainable

Two ways for municipalities to establish financial stability

■ Focus of this article

| 1 | Revenue maximization |
| 2 | Cost optimization |

[1] Based on a report from the Organisation for Economic Co-operation and Development on intergovernmental transfers; internally consolidated between the central and social-security sectors only.
Source: Organisation for Economic Co-operation and Development; World Bank

and are relatively feasible. In our experience, governments that pursue a practical approach to revenue generation can capture up to 50 percent of incremental revenues. This can be accomplished through moves that won't adversely affect public opinion or a city's competitiveness in attracting businesses and economic development.

Understanding municipal revenue streams

Before cities can begin to optimize their revenues, they must first compile an inventory of existing revenue streams. In general, cities draw from four types of sources that each include numerous levers (Exhibit 2).

Service fees. Municipalities raise revenues by charging for services such as public parking, toll roads, waste management, and building permits, among others.

Fines. Cities use fines as both a deterrent for behavior at odds with the public good—for example, the accumulation and nondisposal of garbage or building construction without a temporary fence—and a revenue source.

Charges and taxes. Municipalities often levy charges and taxes on property owners as well as on income, sales, and other transactions. These activities, such as hospitality charges and taxes on plastic bottles and bags, carbon from vehicles, and vacant land, do not involve the delivery of services from the government.

City assets and investments. Through leases, joint ventures, and joint development agreements, municipalities can generate additional income. Assets can include land monetization (such as land used by telcos for cell towers), appreciating land values, and commercial advertisements in public spaces, public markets, and shopping centers.

Exhibit 2

Cities generally draw revenues from four types of sources.

Non-exhaustive

	Service fees	Fines for violations	Charges or taxes	Asset monetization
Revenue levers	• Toll roads • Business licenses • Construction permits • Development permits • Land registration • Excavation • Telco towers • Waste • Public parking • Public toilets • Public Wi-Fi • Funerals • Pet licenses • Universal municipal services • Utilities	• Building licenses • Gardens and public parks • Public health • Residential units and real estate • Roads and infrastructure	• Congestion • Property (municipal) • Land transfer • Vacant land • Betterment levies • Advertisements • Hotel occupancy • Municipal sales • Recycling (eg, bottled water) • Municipal vehicle or carbon • Other excise taxes	• Naming rights • Billboards and signs • Land monetization • Municipal data • Parks • Beaches • Mountain resorts • Housing units • Commercial units • Public markets • Returns from equity and bond investments • Land-value appreciation

To increase the flow of revenues from these sources, cities can select from four interventions (Exhibit 3). Some are widely practiced, while others represent emerging and innovative options for city governments to pursue. Since residents often react negatively to actions that increase the cost of living, efforts to raise revenue through additional fees and taxes can be considered more acceptable when they also have a perceived public benefit. For instance, some cities have implemented a refundable deposit for beverage containers to encourage recycling or sought to enhance public safety by issuing speeding tickets to motorists.

1. Charge more
Perhaps the simplest and most straightforward approach across each of the four revenue streams would be to charge more. Municipalities could increase service fees (such as those on parking and construction permits) as well as fines, taxes, and the cost of accessing city assets (such as beaches). To guide price hikes, cities could use benchmarks to determine the acceptable range. This intervention is typically most applicable to

service fees—specifically, utility services such as water, sewage, or electricity. As an alternative to benchmarking, cities could also determine the cost of services and then establish a cost-plus pricing model to generate additional revenues.

Cities could also revise their pricing models by using differentiating factors specific to each revenue lever. These factors often include volume of activity, location, and period of validity. In Finland, for example, fines for speeding are broadly linked to the income of violators and how far over the speed limit they were traveling when caught. This approach has the potential to not only fairly penalize offenders and reduce instances of speeding but also to generate more revenue. A 2016 study conducted by the Australia Institute concluded that the Finnish model would yield a 12 percent increase on average in the value of fines issued by five states in Australia.[4]

Last, municipalities could increase revenues by implementing higher fees for faster processing times or better service. This intervention is typically applicable to any paper-based transactions or

[4] Cameron Amos and Jesper Lindqvist, *Finland's fine example*, The Australia Institute, January 2016, tai.org.au.

Exhibit 3

Four interventions can help cities increase revenues.

Interventions		Revenue streams			
		Service fees	Fines	Charges	Assets or investments
Charge more	Market prices	Increase pricing based on benchmarks or associated cost to serve wherever is applicable			
	Differentiated levels	Revise price-model leveraging differentiating factors specific to each revenue lever category • Examples of differentiating factors: size, location, validity period			
	Fees for convenience	Increase pricing by providing faster processing time or higher-quality service			
Increase number of transactions		Increase quantity of service offerings or asset monetization Increase surveillance or inspection for selected fine sources to maximize detection of violations			
Improve collection		Optimize collection and audit process to increase collection rate and minimize leakage			
Introduce new revenue levers		Introduce new types of service fees, fines, and charges			

services, such as business license fees, construction permit fees, or land registration fees. In Los Angeles, for instance, developers can obtain an expedited engineering permit for a surcharge of 40 percent of the permit's cost.[5]

2. Increase number of transactions

Cities can also raise revenues by increasing the number of transactions through various approaches. This intervention includes expanding the sheer quantity of service offerings and assets, extending charges to a larger user base, or increasing the frequency of surveillance and inspection for selected fine sources to maximize detection of violations. Furthermore, technological advancements can aid increased surveillance. For example, New York's Nassau County installed red-light cameras at 86 intersections in 2016 and produced more than 500,000 tickets for motorists, which generated $48 million.[6] These cameras are controversial, which is one reason why many municipalities haven't taken this approach.

3. Improve collections

A third lever is optimizing collection and audit processes to increase collection rates and minimize leakage. One strategy that cities have followed is introducing an amnesty program for delinquent parking tickets that waives penalties and additional fines as an incentive for motorists to pay up. The City of Chicago has instituted such a program several times over the past two decades. Each time, the city brought in $7 million to $9 million in revenue.[7] Other strategies, such as payment plans, can also reduce leakage and increase collections.

4. Create new revenue streams

Finally, cities could introduce new types of service fees, fines, and charges—and in so doing, create new sources of revenue. In general, this intervention represents the horizon for innovation across all revenue streams. For example, cities could institute new charges for the disposal of food waste. These fines would promote environmentally responsible behavior as well as create a viable revenue stream for the city. In 2013, Seoul introduced a volume-based food waste disposal charge that succeeded in reducing its daily food waste significantly.[8] Similarly, London has instituted a congestion charge that drivers must pay when traveling within the city center. This charge generates more than $100 million in revenue each year.[9]

Optimizing land monetization has the potential to double baseline revenue from income-generating assets. For existing land lease contracts, cities could maximize value through renegotiation or cancellation and retender based on tenant response. When renegotiating existing leases, several levers can be utilized, such as increasing allowable floor-to-area ratio (FAR), collecting penalties for violations, amending contract duration and payment terms, and modifying plot use. Cities could also increase value from unused land plots through monetizing them either as lease contracts or through other more innovative public–private partnership structures, such as joint development agreements or joint ventures (Exhibit 4).

How to design a city revenue optimization strategy

Once cities have identified their field of options, they must consider several questions before jumping into implementation: Which streams and interventions can generate the most revenues with a limited impact on stakeholders? What is the size of the opportunity? And what is feasible to achieve? There is no one route that cities can or should take to boost revenues. Indeed, each city's situation is inherently different and will require a unique combination of interventions and careful consideration to ensure the program is both economically and politically feasible.

The following steps provide a structured process for cities to determine a tailored and effective solution,

[5] *City of Los Angeles Department of Public Works, Bureau of Engineering standard fee list*, July 1, 2018, eng2.lacity.org.
[6] Candice Ferrette and Robert Brodsky, "Red-light camera revenues jump in Nassau County," *Newsday*, June 10, 2018, newsday.com.
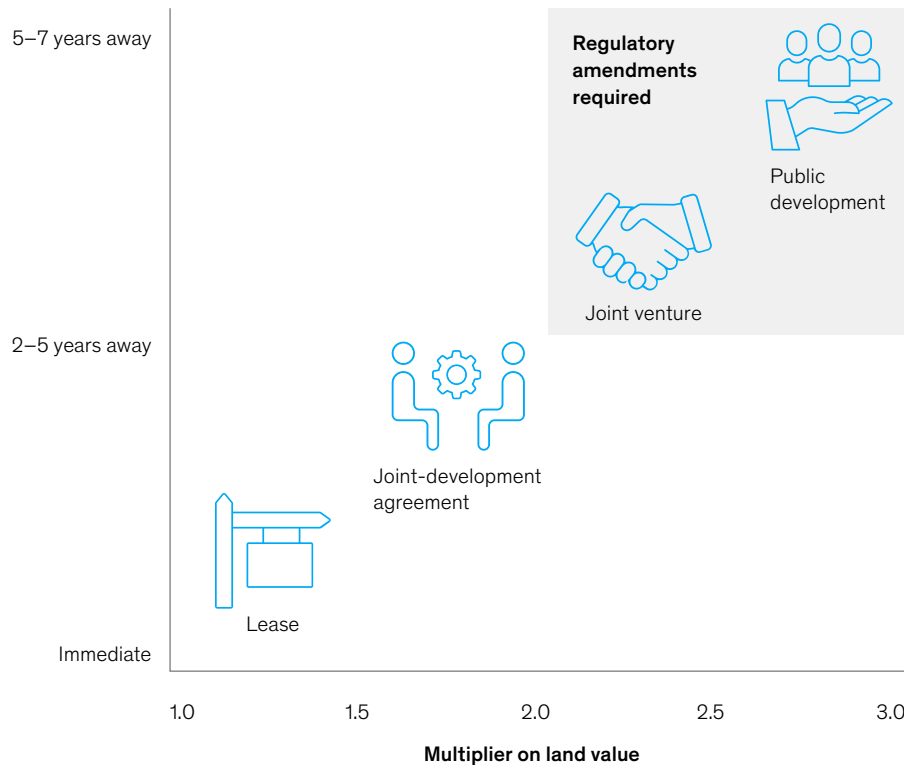[7] Sarah Jindra, "Chicago's ticket amnesty program begins today," WGN9, November 10, 2015, wgntv.com.
[8] *Two Decades in Effect: Volume-Based Waste Fee System in South Korea*, Ministry of Environment, South Korea, January 2016.
[9] Nicole Badstuber, "London congestion charge has been a huge success. It's time to change it," *CityMetric*, March 12, 2018, citymetric.com.

Exhibit 4

Optimized land monetization through public–private partnerships could double baseline revenue from income-generating assets.

taking into account the distinctive characteristics of each city. First, to identify the relevant revenue streams and which interventions to apply, cities should determine the relevant data and revenue baselines. This preparatory work generally consists of collecting the relevant data and developing the current revenue baseline. In addition, to help gauge the likelihood and tenor of social acceptance prior to forging ahead with implementation, cities could consider conducting a citizen sentiment survey to understand how receptive residents might be to specific changes in fee structures and charges.

Next, cities should perform a thorough gap analysis to define the potential revenue impact for any given stream. This exercise involves analyzing the city's revenue baseline to determine current revenue generation across all streams and then comparing revenue streams against benchmarks for peer cities to identify any gaps. With initial adjustments for relevance and size of potential revenue impact,

cities can select the most promising streams as revenue generators.

Following the clear identification of interventions and opportunities, cities can set priorities based on social acceptance, economic impact, and ease of implementation. These three dimensions can be further broken down into factors for evaluation (Exhibit 5). Cities should then establish a revenue committee that adopts a strategic perspective to assess the impact of revenue levers and understand the interlocking factors.

Social acceptance. How receptive citizens and businesses are to a given intervention in a revenue stream can have significant impact on the intervention's long-term viability. Therefore, the following three areas should be examined:

— *Visibility*—the significance of the changes and their impact on citizens and businesses. Are

Exhibit 5

Cities can assess a revenue-optimization strategy and set priorities based on three dimensions.

Dimensions	Factors	Assessment questions
1 **Social acceptance**	**Visibility**	Is the magnitude of change significant, hence is it visible for citizens and businesses?
	Potential public benefit	Does the revenue layer induce positive behavior or does it have a clear public benefit?
	Price against benchmarks	Is the level of fees, fines, or charges higher or lower compared with regional benchmarks?
2 **Economic impact**	**Impact on GDP**	What will be the impact of the lever on GDP?
	Impact on inflation	What will be the impact of the lever on inflation?
	Impact on competitiveness	How does the lever affect the position of city on various competitiveness indexes?
3 **Ease of implementation**	**Technical readiness**	Is the municipality technically ready to introduce the selected lever?
	Resource requirements	What kind of additional resources does the lever require?
	Alignment with government agenda	Is the lever in line with the government agenda or road map for the corresponding area?

Source: McKinsey & Company

changes concentrated within a specific group or area of the city or are they highly visible and applied to the entire population?

— *Potential public benefit*—the positive impact of the chosen revenue lever. Does the lever provide clear public benefit while inducing positive behavior? Are these interventions applied fairly to various socioeconomic segments?

— *Price against benchmarks*—a comparison of current prices for government services against data from comparable cities that have similar levels of competitiveness. Is the level of fees, fines, or charges higher or lower than the regional average?

In addition, the city should refer back to the results of the citizen sentiment survey conducted during the preparatory stage to help inform the assessment of social acceptance.

Impact on economy. Of course, feasibility depends in part on the impact of an action on the city and its residents. Areas to be assessed may include the following metrics:

— *GDP*—whether the lever impacts the economic sectors and activity in the city.

— *Inflation*—whether the lever increases the cost of living for residents.

— *Competitiveness*—the city's position on various competitiveness indexes and how certain factors, such as government services and safety, compare with other urban centers.

Ease of implementation. An effective assessment will analyze a given intervention's technical feasibility and implementation. Cities should consider the following areas:

— *Technical readiness*—the familiarity of the municipality with the technical requirements behind the suggested revenue lever and its implementation.

— *Resource requirements*—the resources needed to implement the selected lever.

— *Alignment with government agenda*—the relevance and fit of the suggested revenue lever when mapped across the government plan.

Collectively, these assessments will help cities to produce a prioritized list of levers for implementation.

Guiding principles for implementing revenue optimization programs

Fix the home. This category involves enhancing internal effectiveness of city teams to generate more revenues without visible impact to the public. In our experience, governments can capture significant value—up to 50 percent of potential additional revenues—by implementing measures linked to effectiveness such as enhancing collections and audit processes or better asset monetization.

Cover cost to serve where possible. Governments should ensure that fee levels cover the costs of services being provided in the majority of cases. This applies to administrative services as well as other city services such as utility provision.

Introduce innovative fees and charges. Cities that want to implement new charges will be more likely to build public support if such measures both induce positive behavior and have a clear, equitable, and risk-averse public benefit. A new tax on plastic would raise revenues and also benefit the environment. VIP services can also be offered where increased fee levels guarantee higher quality.

Los Angeles, for example, charges higher fees for expedited permitting and licensing processes.[10]

Bundle charges. A limited number of charges and taxes ensures higher social acceptance and minimal collection leakage. Dubai instituted a knowledge dirham, a flat charge that applies to all government services.[11]

How to implement the program

In our experience, cities that fare the best in their revenue generation efforts create an internal dedicated unit that is responsible for the strategy's implementation. These cities typically adopt one of two archetypes: an independent revenue monetization department that focuses on commercial aspects and acts as a strategic unit for generating revenues, or a commercial unit integrated into the finance department that is responsible for tracking progress of revenue targets.

To establish this dedicated unit, cities could create a cross-functional workforce with representatives from different departments, including finance, planning, property, legislation, and key municipalities. This unit has several responsibilities. As such, it should have a seat on the revenue committee as well as the authority to define roles and responsibilities to track the revenue generated across different municipalities. It should also prepare reports on the performance of various initiatives and their respective owners or entities and update revenues studies based on changing market conditions. In Saudi Arabia, the Ministry of Municipal and Rural Affairs has a control unit that monitors the performance of regions and the regional government authorities that oversee municipalities. We have found that this effort has led to a year-over-year increase in municipal revenues of 30 percent.

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10 *City of Los Angeles Department of Public Works, Bureau of Engineering standard fee list.*
11 "Dubai introduces innovation fees for government transactions," *Khaleej Times*, January 30, 2018, khaleejtimes.com.

To instill a culture of performance, organizations should set targets for net revenues and select key performance indicators (KPIs). For example, revenue KPIs could include the annual increase in revenue per lever, while nonrevenue KPIs could define targets for each lever and its corresponding interventions, such as the annual increase in the number of violations detected.

Performance meetings should be scheduled on a weekly basis to track revenue generation and build ownership. These meetings serve as a way to monitor progress and enable proper implementation. The involvement of leadership as well as all relevant departments and municipalities would help to ensure proper implementation across all levels.

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Most cities have yet to unlock the full potential of their existing revenue sources, let alone tap into new streams. Despite the numerous options available to generate more funding for city operations, elected officials must proceed carefully. Maintaining public support is critical to the longer-term viability of such efforts, and cities must create an attractive business climate. Cities that successfully cultivate a mixture of actions can dramatically improve their fiscal health and improve services for their residents.

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