Activating a Seamless Integrated Mobility System (SIMSystem): Insights into Leading Global Practices

In collaboration with Deloitte

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The future of cities has captured the global imagination for centuries, and some of those earlier thinkers were prescient. A UK Ministry of Transport report in 1963 warned of the effects of traffic and motorcar ownership and recommended getting cars off the road and repurposing street space – a familiar refrain in today's mobility conversation. A half-century before, in 1911, French architect Eugène Hénard envisaged the first version of a seamless integrated mobility system: *a central tower to coordinate the various mobility modes and facets of a hypothetical modern city.*

It is no secret that a fundamental transformation is taking place in the way people and goods move about. Just as individuals have drastically changed the way they communicate over the past few decades, moving from postal mail to real-time social media, so, too, are we beginning to see a shift away from single-occupant, single-mode trips towards multimodal journeys employing innovations created in our rapidly evolving digital economy. This shift is enabled by a plethora of new mobility solutions that support more flexible and customized means of transportation, from drone-enabled shipping to the most remote parts of the world and self-driving vehicles to on-demand public and private transport options and integrated trip planning and payment systems. These disparate services and technologies, operating in isolation, risk exacerbating the strains on traditional mobility infrastructure, already taxed by population growth, urbanization, insufficient funding and growing volumes of people and goods.

The Seamless Integrated Mobility System (SIMSystem) Project proposes a solution much like Hénard's: to integrate disparate mobility modes in a single digital mobility platform to optimize the management and orchestration of the movement of goods and people and relieve pressure on today's overcrowded streets. The potential for impact is likely to be profound. With a bird's eye view of the deployment of mobility solutions across urban centres – and the ability to respond dynamically – city leaders can adjust schedules, stops, vehicle types and routing to benefit citizens, while optimizing efficiency. Such a system opens new opportunities for funding and financing infrastructure, not least because it enables a more comprehensive and nuanced view of the value that infrastructure creates. Shared, electric and autonomous mobility solutions, important for reducing carbon emissions, could be launched and scaled in a strategic and targeted manner.

Nevertheless, the journey towards the activation of a seamless integrated mobility system is fraught with challenges and questions: How can competitors be convinced to share data with one another and with the city? How can cities equip themselves with the human and technical capacity to handle this large technological effort? How can consumer privacy be respected while introducing more AI-driven technologies to track movement? How can this system ensure service to the underserved, while reaching critical mass?

To explore these questions and more, the World Economic Forum partnered with Deloitte Consulting to examine ten cities' journeys towards the activation of their own seamless integrated mobility systems. The aim is to combine insights from these case studies, viewed through the lens of vital strategic design choices, to offer important findings and considerations for other cities and stakeholders embarking on their own mobility system transformation.

This report is designed to aid policy-makers, businesses and practitioners, highlighting focal-point policies and identifying new opportunities for public-private collaboration. Further, it is meant to spark conversation, so we would like to take this opportunity to ask for your feedback: how does this resonate with the realities in your own city? What strategic choices have you faced through your own involvement in the transformation of mobility systems?

Last but certainly not least, we would like to thank Megha P. Bansal, Manager at Deloitte Consulting and Secondee at the World Economic Forum, for her contribution to this research and report. We would also like to recognize Mouchka Heller, Lead in the World Economic Forum's Platform for Shaping the Future of Mobility for her leadership in the SIMSystem project, on the ground and beyond.

The challenges of urban mobility

Mobility is increasingly a priority for cities as they seek to move greater numbers of people and larger volumes of goods. Driven by population growth, urbanization and constrained capital investment for infrastructure and transportation upgrades, cities are grappling with congestion, air pollution, accessibility and affordability.[1] Approximately 4 billion people live in urban areas today and by 2050 that number is expected to approach 6 billion, or two-thirds of the world's population.[2] Five hundred cities are home to at least 1 million people, and by 2030 there

could be 41 "megacities", each with more than 10 million people. The shortfall in global infrastructure investment already tops $1 trillion, and as urban populations grow, the strain placed on existing infrastructure and transit systems will only be exacerbated.[3]

These challenges threaten the economic prosperity, health and quality of life of city dwellers. Congestion in the United States alone could cost $2.8 trillion by 2030.[4] In 2018, the World Health Organization estimated that there were

1.35 million road traffic deaths globally each year – most of which occur in low- or middle-income countries.[5] An additional 4.2 million deaths annually are linked to outdoor air pollution, in large part due to vehicle emissions.[6] Access to affordable, reliable and safe transportation is often a significant challenge for low-income populations and can have an important impact on economic outcomes. New research using geolocation "big data" finds that clusters of physical interaction in cities – enabled by mobility – are strongly associated with economic growth and opportunity.[7]

A proliferation of new transportation technologies and services, from ride-hailing and trip planning to micro-mobility and micro-transit and beyond, have helped to tackle some of these urban mobility challenges. However, these offerings are often narrowly focused on a single mode or a single journey, and consist of disparate networks managed separately. *Addressing system-wide challenges in urban transportation requires a seamless integrated mobility system to coordinate different modes and better orchestrate the mobility landscape's complex web of stakeholders.*

The promise of seamless integrated mobility systems

In 2017, the World Economic Forum and Deloitte Consulting set out to define how such a seamless integrated mobility system might function and help address pressing mobility challenges. After a year-long exploratory effort collaborating with a diverse group of individuals representing start-ups, established companies, governments, academia and non-profits, the Forum published *Designing a Seamless Integrated Mobility System (SIMSystem) – A Manifesto for Transforming Passenger and Goods Mobility*, a white paper that makes the case for cities' need to accelerate the adoption of such a system.[8]

The SIMSystem Manifesto defines a seamless integrated mobility system as a "system of systems" that moves people and goods more efficiently by establishing: the interoperability of physical assets such as cars and buses; digital technologies including dynamic pricing and shared data exchanges; and the governance structures, standards and rules by which they operate. The manifesto highlights a set of principles to guide collaboration across the public and private sectors in the design of a SIMSystem:

The manifesto served as a starting point for turning principles into action. Following the 2018 Annual Meeting, the World Economic Forum invited cities to submit proposals detailing why they could showcase the journey towards a SIMSystem. Thirteen applications were received from cities, regions and countries, and ultimately Detroit and Ann Arbor in Michigan, United States, and Windsor over the border in Ontario, Canada, were selected as SIMSystem geographic partners. The region was selected because of its unique cross-border characteristics: the diversity of challenges posed by Detroit's urban renewal, the growing needs of an important university town such as Ann Arbor and the presence of the largest point of entry for goods entering the United States from Canada in Windsor. This confluence offered the opportunity to investigate how a SIMSystem could effect change in the movement of goods and people. Each city is investing in significant ways to advance affordability, economic growth, efficiency, innovation and sustainability in its mobility environment. For example, Detroit is expanding the reach of its public transit by increasing routes and service times; Ann Arbor is promoting what could be the world's largest testing environment for the deployment of connected vehicles and infrastructure; and Windsor is developing an active transportation master plan with a focus on multimodal transport. Over the course of this engagement, the Detroit/Ann Arbor/Windsor team developed a number of high-impact use cases to form the basis of a common data platform architecture, which could eventually serve as the backbone for a regionally integrated, interoperable mobility system.

Manifesto principles

Principle 1

User-centred: A SIMSystem is designed and operated based on the collective and individual needs of all the users it serves.

Principle 2

Designed to be adaptable: A SIMSystem is designed to be adaptable to the capabilities and operating conditions of the geographic area where it is deployed, the behaviours and needs of its users and improvements in technologies.

Principle 3

Open standards and protocols: The private sector will need to play a leading role in establishing open standards and protocols for the creation and use of mobility-related shared data exchanges and application programming interfaces.

Principle 4

Public-private collaboration: Governments will need to act as conveners to increase collaboration within and between the public and private sectors to enable a SIMSystem to operate across modes, geographies and functionalities.

Principle 5

Participation and value: Maintaining the private sector's ability to derive value from offering its products, services and intellectual property is essential to encourage broad-based participation and the full realization of a SIMSystem.

Principle 6

Agile governance: Government should actively undertake efforts to reduce institutional complexity and create more focused governance models to facilitate agile coordination and collaboration with the private sector and other governments.

Principle 7

Funding and financing: Governments will need to create innovative funding instruments and business models that enable multiple private-sector actors to underwrite the cost of a SIMSystem and share in the potential monetary benefits.

Principle 8

Performanace measurement: Standardized performance indicators should be established to measure the impact of a SIMSystem on accessibility, affordability, sustainability, safety, efficiency and integration.

Principle 9

Learning and improvement: An international public-private coalition should be formed and tasked with the frequent sharing of knowledge and best practices across geographical areas.

Principle 10

Scaling and growth: A public-private working group of leaders should be established to define and address fundamental framing decisions and enable a series of SIMSystem pilots in various geographical areas.

Opening the aperture on what it takes to activate seamless integrated mobility

The work of the pilot region and the experiences of numerous other cities made it clear that there is no "right" answer or single prescriptive approach to establishing seamless integrated mobility. Even as cities around the world are facing similar issues concerning mobility and a consensus on the need for change develops, there is also a debate about how to manage the transition to a new seamless intermodal mobility environment.

Nearly every city is instituting a wide range of pilots to explore this space, but many of these initiatives are too disparate and small-scale to deliver meaningful impact. Yet cities continue to replicate what is being done by others and, unsurprisingly, see largely similar results. Civic leaders in different communities are wrestling with many of the same considerations in terms of goals, opportunities for improvement, constraints and how best to engage the essential players needed in the mobility environment.

To accelerate the adoption of seamless integrated mobility systems, a common understanding of the issues and leading practices is needed, which would help speed the process of discovery and the realization of outcomes. This study aims to provide that understanding. To do this, several cities around the world were selected for deeper study because of their interesting and novel approaches

to advancing a seamlessly integrated multimodal mobility system. This research unearthed numerous "strategic choices" that cities must address – where cities need to align themselves between two seemingly contrasting approaches – and focuses on four choices that seemed most pressing and widely shared, discussed in more detail below.

This study covers 10 cities across three continents, with perspectives from more than 100 leaders from the public, private and non-governmental sectors, encompassing mayors and top transportation officials, corporate executives, start-up founders, non-profit leaders and academics. These perspectives offer wide-ranging lessons on tactics and strategies in transforming mobility systems – too many for a single report. This global collection is not exclusive, and the World Economic Forum recognizes the leadership of many cities not mentioned in this study, such as Helsinki and Amsterdam, among many others. Unsurprisingly, in a domain as complex and dynamic as mobility there is also no single answer – and what is "right" for any particular city may shift over time as the environment changes. Yet the hope of this study is to develop a common, global view of leading practices to increase the potential for replicability and accelerate the adoption of seamless integrated mobility around the globe.

Essential findings and common themes across cities

In many respects, the focal cities of this study and how they are working towards the future of mobility could not be more different. But there was also a surprising degree of consensus – indeed, near unanimity – on some of the approaches they have adopted and the challenges they face:

- **Political will determines everything.**
  Committed leaders willing to champion new approaches and drive change are nearly a *sine qua non* for achieving tangible progress – but they must have the authority to act on their vision. Cities need leaders who are tireless advocates for adopting a "boundaryless" approach and can convene the various players (public and private).

- **Having a clear vision necessitates making hard trade-offs.**
  It requires a "system of systems" approach. The trade-offs associated with prioritizing different outcomes (cost versus sustainability, for example) make it important to match mobility transformation efforts to specific goals and objectives, placed in the context and history of the region. Simply copying the playbook of another city is unlikely to work well.

- **Governance structures matter.**
  It can powerfully shape how and with what success a city advances its mobility agenda. A more centralized governance model with strong, integrated institutions, for example, might enable a city or region to push a more holistic approach, while more diffuse forms of governance could provide a more nuanced view of local needs and norms. Globally, we see few if any examples in which multiple entities and jurisdictions have achieved meaningful, system-wide impacts without some coordinating mechanism. The ones that have made progress have created an empowered mobility management function within city government that has the authority and responsibility to drive initiatives forward and create alignment across all modes of transportation.

- **Successful cities have found a source of leverage.**
  They help attract partnerships, funding and talent to shape their mobility environment. Large cities have a natural advantage given the size of their markets, but governments and other stakeholders should think about other assets – whether that is affordability, an open innovation environment or even favourable weather. Even the most constrained city often has policy and regulatory tools available to shape the participation of private-sector providers.

- **Pilots are not always the answer; seamless mobility requires system-wide thinking.**
  Focus on specific and intended outcomes, not just the process. Doing one-off pilots rarely constitutes time and effort well spent. And consider the interdependencies between mobility and other domains, such as housing and land use.

- **Data is necessary but not sufficient; avoid reinventing the wheel.**
  Understanding what data exists, where it is housed and the rules that govern sharing and exchange is critical to success. That said, resist the temptation of the idea that "more data is always better". In many cases, data can be functionally worthless to cities (and the private sector) and merely creates additional costs, capacity constraints and privacy and security concerns. Many cities have developed innovative approaches to sharing, managing and using data that can be looked to as examples.

Strategic choices on the journey to activation
– and how to manage for success

Beyond these commonalities, the research uncovered four primary strategic choices every city needs to address in activating seamless integrated mobility systems. These are not binary options, but rather represent a continuum along which cities and other stakeholders will need to navigate. Arguably, in a perfect world, a city might aim to achieve both ends of this continuum. For many today, however, this is a bridge too far and choices will likely have to be made about how a city approaches a particular pillar of its SIMSystem.

Strategic choice:
Individual journeys vs. system-wide optimization

The pace of innovation in today's mobility environment is creating a vast array of options for individual journeys. Dynamic shuttle buses, on-demand ride-hailing, car sharing, e-scooters and a host of mapping and mobility-as-a-service applications have brought new levels of choice and customization to consumers. Many of these efforts focus on optimizing an individual's journey, with limited regard for how those individual choices affect the overall system – potentially resulting in a collectively suboptimal outcome when millions of individual journeys are aggregated. Paradoxically, these innovations in mobility might exacerbate the system-wide challenges of congestion, sustainability and access. Avoiding these negative system-wide impacts will require more active management and the influencing of consumption choices. Doing so requires designing mobility policies that reflect the city's social aims. Ultimately, cities must decide what they are optimizing: an individual's ability to choose his or her preferred trip, or the efficiency and throughput of the overall system.

Whether a city tends towards individual-journey or system-wide optimization requires thoughtful understanding of goals, capabilities and citizens' needs. In the case of London, the organizing structure of Transport for London (TfL) integrates disparate transport options in a single user interface and prioritizes customer service to create system-wide efficiencies. In Detroit, Ann Arbor and Windsor, individual use cases are helping to create an understanding of how seamless integrated mobility could meet broader regional goals. The most successful cities understand their overall mobility transformation aims and what is going to be effective in meeting them, rather than pursuing one-off pilots or discrete strategies.

Singapore stands out thanks to the way it focuses on system-wide optimization, driven by a cohesive, top-down governance model while still encouraging private-sector competition. The city – and state, as they overlap – is investing heavily in introducing new modes of transport and continuing to build a robust and attractive public transit system. Driving these activities is the goal of enabling all citizens to access public transit within 10 minutes of where they live and to commute to the city centre within 30 minutes. The government has capped the number of personal cars allowed and instituted congestion pricing. This has contributed to roughly 80% of journeys being made by public transport.[9]

Considerations to guide the choice

– **Identify specific "human-centred" use cases** to make sure the design of systems and programmes is tied to the real needs of citizens. Mobility choices tend to be well established and habitual. Changing them is not easy. It requires thinking holistically about the human experience and how new modalities and different routes, prices and other factors affect daily routines, such as commuting to work or taking children to school. It takes more than a one-off trial to change entrenched patterns. New approaches can work and yield greater adoption, but they need additional enhancements that designers may have failed to understand in the pilot design. A sustained, outcome-oriented approach can also help align partners towards a common goal.

– **Develop a holistic strategy** to understand how mobility innovation fits into broader city programmes. Cities must plan for how a successful pilot might scale into something that can be adopted city-wide or beyond, or expand to include additional modes of transport. This can be challenging if mobility is managed in a dispersed manner across multiple agencies.

– **Engage regularly with citizens** to determine how mobility needs shift over time. Mobility innovation is dynamic, and adapting to shifting preferences and needs is essential. Feedback loops between citizens, all levels of government and mobility providers (both public and private) can help tailor options and deployment strategies in ways more consistent with city-wide mobility goals.

– **Assess the systemic impacts (e.g. second- and third-order effects) of mobility innovation.** Mobility is a complex, interconnected "system of systems"; changes to one component can result in unintended consequences that ripple through the entire network. Understanding these linkages early in the process is important.

Strategic choice:
Public-sector leadership vs. private-sector leadership

Cities have a critically important voice in determining the role played by the public and private sectors and how to balance competing priorities, incentives and capabilities. While government will always have a role – as a strategist, catalyst/convener, regulator, operator and more[10] – there is a wide spectrum of activities they can opt to lead on or allow private-sector players to drive. Even in the public sector, there is tension in terms of where within government mobility initiatives should be led. City or even neighbourhood-level entities may have a greater understanding of local needs and conditions, but may have limited visibility of regional movement patterns (as people commute across jurisdictions) or the budget and capacity to fund and execute on specific initiatives. How to balance the multidimensional role of the public sector while effectively engaging different parts of the private sector is an open question.

Every case study suggested that both the public and private sectors had a role in designing the establishment of a seamless integrated mobility system, but that the leading role depended on the city context. In Singapore, top-down governance drives many initiatives, while in Tel Aviv the mobility environment is shaped and strengthened through a vibrant mobility start-up community. The most successful cities have understood the relative strengths, challenges and offerings each sector can provide. It is critical to understand how the pieces of the puzzle fit together and structure roles accordingly, rather than relying on blanket phrases such as "public-private collaboration", which are meaningless without specificity.

San Diego stands out for its emphasis on a regional governance model, predicated on bringing 18 municipalities together under one organizing body and designing and funding projects and infrastructure through a single municipal planning organization. This emphasis on regional governance and working in partnership with the local municipalities enhances alignment across borders and helps support a collaborative culture on decision-making for regional priorities.

Considerations to guide the choice

– **Objectively assess the city's willingness and capacity** to manage mobility innovation. Governments can play many roles in a new mobility environment (e.g. strategist, catalyst/convener, regulator or operator): Determine which role is a strength of the city. Furthermore, identify which areas are going to be essential for success (e.g. engineering, technology, data analytics, systems integration, large-scale programme management) and map those against current capabilities to better understand what might be a potential weakness.

– **Determine to what extent the city is prepared to build capacity and skill sets** within the public sector or needs to engage the private sector to take the lead. Value for the city comes from creating greater accessibility, inclusivity, equity and sustainability in the way people and goods move. Value for the private sector lies in monetizing consumer data, systems and services-oriented business models built around mobility management, operating systems and the in-transit experience. Cities that appear to be making the most progress have struck a balance across sectors that seem to create value for both parties.

– **Consider the complexities in funding** to ensure long-term sustainability of projects. If city resources are constrained, evaluate whether offering opportunities for the private sector to lead might yield faster progress and results.

Strategic choice:
Data openness and transparency vs. privacy and security

Data is at the heart of creating a seamless integrated mobility system, requiring the private and public sectors to align on standards, legal frameworks and financial terms for secure, robust data exchange. At the same time, concerns about personal privacy and cybersecurity are growing and remain a priority for both governments and businesses. For many mobility services, data is a vital driver of value and a source of competitive differentiation, while governments need data to effectively plan and operate the overall transportation system and meet residents' needs. Many cities are not equipped to effectively process massive amounts of data and dynamically enact "on-the-ground" change to optimize transportation. This raises the question of who creates value and who captures it. Cities are increasingly confronted with fundamental issues concerning how data should be collected, shared, governed, protected and used. Often, data collection precedes data strategy. This can create paralysis in an area that is so critical to success.

Led by the city Department of Transportation (LADOT), Los Angeles stands out as a pioneer in public sector-led initiatives on open data exchanges. LADOT developed the Mobility Data Specification (MDS), designed to support a common approach across cities for collecting and sharing mobility data. The recently established Open Mobility Foundation seeks to manage the MDS's continued development and deployment, and to share best methodology across 50 cities in the US as well as dozens internationally. Highlighting the tensions about data-sharing, privacy and value creation, the MDS has also prompted strong opposition from some private-sector mobility providers.

Considerations to guide the choice

– **Systematically inventory current data assets and create a catalogue** to understand what data exists and how and by whom it is being used. Many cities need to share base-level data with multiple providers and a catalogue is a useful tool to do this efficiently. Lisbon has designed an advanced architecture and approach for such a catalogue, as has Transport for London.

– **Collect data with purpose.** More is not always better; data should be collected only with a specific use in mind. Determine the specific purpose and which data is essential, then create a road map for how the city will gather, store, secure, analyse and act upon the insights.

– **Determine core capabilities and build complementarities.** In some cases, it may make sense to build skills within government. In others, engaging the private sector may be a more viable (and affordable) option, especially for smaller cities with limited resources that may not be able to build capabilities in-house.

– **Look to existing standards** instead of reinventing the wheel. Many cities around the world are facing similar challenges. By using existing standards and common languages, cities can simplify the path to adoption and ease the burden on private-sector providers. MDS is one example; further standards and principles have been offered by the New Urban Mobility Alliance,[11] the National Association of City Transportation Officials,[12] the World Business Council for Sustainable Development[13] and others.

Strategic choice:
City-regulated vs. market-led innovation

New mobility services and technologies have often outpaced regulation. As cities come to grips with this more dynamic transportation environment, they must choose whether to proactively create policy, legislation and regulations that set guidelines within which the private sector must act, or whether to allow a more open, market-based approach to drive the pace of innovation and let regulation follow. Regulation and policy can help set necessary standards, promote knowledge-sharing and mitigate negative externalities or misalignment with city goals and strategic plans. This requires a more active role from government and a willingness to get private-sector players to comply. On the other hand, emerging mobility innovations such as dockless bicycles and scooters have arguably created significant value for users that might not have been realized so quickly or at all if more stringent rules had been in place. Cities must decide how to create incentives for all players to have a stake in the system while creating a receptive environment for innovation and meeting city goals.

The question of which comes first is not easy to answer – and in many cities, it will depend on existing governance models and structures. However, understanding how to work with new mobility service providers and incorporate them smoothly into the mobility environment can help head off potential downsides. In most successful cities, public-sector regulators and private-sector providers co-design the path towards the future. There are varied approaches to managing innovation and regulation, and cities should expect their stance to shift over time as new services and technologies emerge and mature. In Lisbon, city officials have welcomed innovators in micro-mobility introducing their services. They have taken the position that they will regulate as needed once these services become established. In effect, they have designed a regulatory approach based on the type of innovation they see: soft regulation for "green-field" opportunities and harder, rules-based regulation for "brown-field" opportunities.

Considerations to guide the choice

– **Calibrate tolerance for risk.** Be sure the regulatory approach is matched by a similar willingness to accept risk; market-led innovation suggests a more risk-accepting stance, by both government and the private sector. The political environment, popular attitudes and even the degree of litigiousness can have an important impact on what stakeholders are willing to tolerate. At the core of the issue is a philosophical question about how best to promote innovation for the public good. The answer will be different in different places.

– **Develop a process to evaluate pilots** in the context of broader city goals, including setting targets and metrics at the outset and creating contingencies, regulatory or otherwise, should those targets fail to be met. Working with private-sector providers to co-develop appropriate and feasible goals, while still being supportive of the broader system-wide objective, can ensure everyone is aligned at the outset.

– **Develop flexible, outcomes-based regulation** that can help manage new technologies and services that emerge. Scenario planning can help to identify a variety of outcomes and enable cities to better manage uncertainty. Rule-making should not be a one-off exercise but should be revisited and revised frequently.

Ultimately, all cities will have situational, political and economic factors that guide their response to these design questions. But within those constraints, cities have a range of choices under their control, and many cities have made interesting, nuanced and differentiated selections regarding their path to mobility transformation. While no two paths will look the same, their journeys offer important insights for others looking to achieve a truly seamless, integrated mobility system.

Journeys to seamless integrated mobility: Case studies from around the globe

To put the findings into context, the study explores how several cities charted their course in developing a SIMSystem, looking at what choices they made and why, and how they addressed some of the strategic choices discussed earlier.

Los Angeles, United States
– pioneering on data-sharing, with a city-forward approach

POPULATION:
13,300,000
(2016)

POPULATION DENSITY:
2,958/km^2

GDP:
$928 billion
(2017)

KEY MOBILITY STATISTICS

Public transport options:
Metro, light rail, bus

Monthly public transport pass:
US$84

Principal transport authorities:
Los Angeles Department of Transportation (LADOT),Los Angeles County Metropolitan Transportation Authority, Long Beach Transit

JOURNEY MODAL SPLIT   Other: 1%

Private car: **89%**   Public transit: **6%**

Walking: **3%**   Bicycle: **1%**

FURTHER READING:
Deloitte City Mobility Index (Los Angeles)

The second most populous city in the United States, Los Angeles (LA) has 3.8 million residents in its city centre and 13.3 million in the greater metropolitan area; it has 12,000 kilometres of streets and covers nearly 1,300 square kilometres, making it no stranger to the effects of massive flows of people and goods across the region.[14] Congestion and equitable access are two of the biggest challenges with which it is grappling.

A car-based culture, coupled with geography, legacy urban planning policy and housing shortages have driven reliance on single-occupancy vehicles. Nearly 90% of all trips are taken in private cars.[15] Urban planning policy in the 1930s, 1940s and 1950s centred on road infrastructure, leading to an urban environment that was built around the car and creating "a city of villages".[16] Urban sprawl and uneven levels of service across the city have led to low-income areas becoming reliant on public transit, with acute first-mile/last-mile issues. These two challenges have also affected the city's environmental footprint, with poor air quality[17] and state-wide mandates on greenhouse gas emissions in turn necessitating a change to the existing mobility system. In 2015, the LA City Council approved the Mobility Plan 2035 to reconfigure LA streets and city centres to focus on creating "complete streets" that are safe for all users, including pedestrians, bicycles and other forms of micro-mobility. Coupled with the state's sustainability plan and Vision Zero approach (an effort to reduce or eliminate transportation-related fatalities), the city and mayor are committed to transitioning from a car-based system to one that is more inclusive, sustainable and efficient.

Through the LA Department of Transportation, the city has paved the way with regard to data-sharing and governance models, specifically with its creation of the Mobility Data Specification (MDS) in September 2018.[18] MDS was created to enable greater visibility of the operations of private mobility providers using the public right of way, and aims to standardize data-sharing to improve the city's capacity to make data-driven decisions. MDS was designed in the midst of the growth of dockless bicycles and scooters, and specifies data collection on the status of available vehicles; unavailable vehicles due to rebalancing, maintenance or low battery; and historical trip data including starts, ends and GPS routes. MDS was designed with dual application programming interfaces (APIs) – a Provider API to enable mobility providers to send information directly to cities and an Agency API to provide a feedback loop from cities to mobility companies (e.g. crashes, illegal parking). MDS is

noteworthy because it gives governments access to near real-time data that can drive policy-making and decision-making. By creating common standards and API feeds, it also reduces the burden on cities to collect, cleanse and respond to disparate city data requests. MDS has since moved beyond LA; currently more than 50 cities in the United States and dozens internationally employ the specification, guided by a public sector-led non-profit organization, the Open Mobility Foundation.[19]

Even as MDS has found more adherents in city agencies, it has faced opposition from private-sector companies that question why government needs the breadth, granularity and latency the MDS requires, and whether cities have sufficient protocols to securely house sensitive citizen data. Critics contend that, even without associating names with individual journeys, trip-level data can easily be used to pinpoint a user's identity. They have also questioned what policies exist with regard to sharing data with law enforcement and immigration agencies. The stakes are high; in LA, disagreements over the MDS have led to threats of legal action, state-level preemption and suspended operating licences for some micro-mobility providers.[20]

This strong stance concerning open data and sharing is itself a product of how the city thinks about innovation and the emergence of new mobility services. Rather than reacting in an ad hoc fashion to every new "shiny object" mobility service,[21] the city wants to create a common and replicable framework for how new entrants can operate in LA, with the ultimate aim of better meeting the city's transportation goals on equity, access, safety and sustainability. The City of Los Angeles believes that the digital systems required to orchestrate seamless integrated mobility must be built *by* cities and *for* cities on an open platform to encourage broad adoption and usage and ensure city-wide goals are met. To that end, the city also announced the creation of urban mobility labs to embrace new innovations and position LA as a sandbox for research, development and testing in new transportation solutions.[22]

LA's story is centred on strong public-sector vision and leadership, focused on driving open data platforms and APIs, greater transparency and strong regulatory authority to ensure that private-sector mobility providers comply with the city's rules.

San Diego, United States
– regional coordination to achieve a new mobility vision

POPULATION:
3,191,338
(2016)

POPULATION
DENSITY:
1,681/km²

GDP:
US$231 billion
(2017) (San Diego
metropolitan area)

KEY MOBILITY STATISTICS

Public transport options:
Bus, light rail, commuter train, tram

Monthly public transport pass:
US$72

Principal transport authorities:
Metropolitan Transit System (MTS), North
County Transit District (NCTD), San Diego
Association of Governments (SANDAG)

JOURNEY MODAL SPLIT   Other: 2%

Private car: **91%**   Public transit: **3%**

Walking: **3%**   Bicycle: **1%**

FURTHER READING:
Deloitte City Mobility Index (San Diego)

San Diego has a penchant for innovation in mobility – in the 1980s, it was the first city in modern times to create a light-rail system to better serve riders and create connections across the metropolitan area. Today, the city is experiencing challenges in transitioning from a car-based system to one that harnesses new modes in a more sustainable and efficient way. To get there, it has charted a series of significant shifts to the overall transportation network under the auspices of a particularly strong regional coordinating body that is uncommon in the United States.

The city is geographically bounded, with an ocean to the west, large military installations to the north, an international border to the south, and mountains to the east. Despite a confined geography, the city is also experiencing significant growth in population and a rise in tourism. The region faces a reverse-commute phenomenon – many of the area's employment centres and universities are north of downtown. The 18 municipalities in the region vary greatly in demographics, density, affordability and transportation patterns.

The San Diego Association of Governments (SANDAG), the region's metropolitan planning organization (MPO), has a unique role in guiding transportation in the region. MPOs are federally mandated and funded transportation planning organizations, but their capabilities, resources and oversight vary significantly across the country. With powers over land use and transportation planning jurisdiction for San Diego and the neighbouring 17 cities, SANDAG is arguably more robust than most, controlling the allocation of significant funding and maintaining capacity to build and operate its own infrastructure. With voting representation on its board from each of the cities (plus representation from the county and other agencies) and an annual $1.3 billion budget,[23] SANDAG plans, designs and builds much of the region's infrastructure, from public transit to highways. Many long-range projects are funded by a half-cent sales tax dedicated to transportation called Transnet, which has been in place since 1987.[24] Additional funding is a challenge due to lagging sales tax revenue and rising construction costs that have contributed to a $10 billion shortfall.[25]

Still, having a regional governance model that also controls significant funding offers advantages relative to many other cities, in which policy-setting is more fragmented across agencies and jurisdictions. SANDAG's holistic view of regional challenges, political complexities and the movement of people and goods across the entire area – and its remit to be involved in both planning and operations – enables it to push for farther-reaching changes in the transportation system.

Spurred in part by state law requiring a 19% per head reduction in greenhouse gas emissions by 2035 (using 2005 emissions as a baseline),[26] SANDAG's current leadership has been pushing for a comprehensive overhaul of the region's transportation system to focus more on sustainability, accessibility, affordability and reducing reliance on single-occupancy vehicles. The MPO recently announced "Five Big Moves" to fundamentally transform the mobility landscape.[27] An important component – central to achieving system-wide optimization – is "Next OS". Aspiring to be "the brain of the entire transportation system", Next OS is an integrated platform that can orchestrate the more efficient movement of people and goods. This digital platform is intended to facilitate seamless intermodal mobility by turning integrated data into action-oriented insights that can help planners better manage transportation systems and, in its fully realized state, create a "mobility marketplace" to nudge behaviour and create better real-time balance of supply and demand.[28]

San Diego's story is focused on efforts to manage a large and diverse area entailing many jurisdictions through a federated governance model that centralizes some decision-making and funding, ultimately driving a more holistic vision for mobility. While debates over the appropriate way to invest in new forms of mobility continue, SANDAG is actively exploring new solutions to entrenched transportation challenges, while acknowledging that, just as it took decades to build today's car-based system, it will likely take as long or longer to remake that system.

Lisbon, Portugal
– inviting innovation to shape the mobility system

POPULATION:
2,886,662
(2014)

POPULATION
DENSITY:
957/km²

GDP:
$98.71 billion
(OECD reported, 2013)

KEY MOBILITY STATISTICS

Public transport options:
Metro, bus, tram

Monthly public transport pass:
US$80

Principal transport authorities:
Metropolitano de Lisboa,Carris,
Transtejo-Soflusa (other transit agencies:
Aerobus,MTS, TST, Fertagus)

JOURNEY MODAL SPLIT   Other: 1%

Private car: **54%**   Public transit: **29%**

Walking: **15%**   Bicycle: **1%**

FURTHER READING:
Deloitte City Mobility Index (Lisbon)

The second-oldest capital city in Europe, Lisbon was decimated in 1755 by a major earthquake and has been rebuilt from the ground up. Nicknamed the City of Seven Hills, Lisbon is known for its steep ups and downs, narrow, winding streets and beautiful coastal neighbours such as Cascais. Lisbon is home to 500,000 people in the city proper and close to 3 million in the greater metropolitan area. Two-thirds of people who work in Lisbon do not live in the city, placing pressure on the transportation system to accommodate commuters. The city has been named the 2018 European Mobility Week winner[29] and the winner of the 2020 European Green Capital Award.[30]

Congestion and pollution, largely due to single-occupant personal cars, are important challenges, despite the relatively robust use of public transit. Micro-mobility options have increased recently, especially in tourist-heavy areas such as Barrio Alto and Chiado; their broader impact on the mobility environment remains unclear. Legacy housing and land-use policies have encouraged personal car usage, as has the broader trend throughout Europe of offering cars as an employee perk.

The importance of strong, visionary public leadership is perhaps nowhere more evident than in Lisbon. The current Prime Minister of Portugal was previously the Mayor of Lisbon; the Minister of Environment and Climate Action has prioritized mobility as an essential issue for the nation; the Mayor of Lisbon has worked to align neighbouring municipalities on common goals for mobility; and the city has a forward-thinking Deputy Mayor for Mobility, Economy and Innovation pushing an ambitious transportation agenda. In its integrated mobility vision, the city seeks to create access to at least two different sustainable, efficient, comfortable, safe and inclusive modes of transport (alternative to private cars) within less than 500 meters of every home.[31] Lisbon leadership is reimagining public spaces for people, not just cars, and reinvesting in public transportation as the preferred mode, with a goal of reducing the share of trips in private cars from one-half to one-third. The city is looking to shift fundamentally from the role of "infrastructure manager" to become a "mobility manager", which necessitates examining all modes and use cases to create an integrated picture for the future.

To enable seamless mobility, the city deploys a common card (Viva Viagem) to access multiple modes of transport across the region; this can be paid for with a single monthly fee. Future plans include linkages with bank systems to facilitate payments and the integration of new modes of transportation. To discourage car usage and to address socioeconomic inclusion, the Lisbon region significantly reduced monthly public transit fares – from, for example, €150 ($165) for a

monthly pass to €30 ($33) within the Lisbon municipality, €40 ($44) for the greater metropolitan area, and capped at €80 (around $90) per family, with further reductions for children and senior citizens.[32] The result has been a surge in use of public transportation, to the point at which capacity is now struggling to keep pace with demand.

Data-sharing is critical to making seamless ticketing a reality, especially across multiple and new modes of transportation. Lisbon has embraced open data and is currently focused on creating a mobility catalogue – a database of essential mobility infrastructure information that can be pushed out via APIs to service providers, giving them one source of accurate, up-to-date information. The city wants this catalogue to extend beyond what is currently supplied on the General Transit Feed Specification to include planned transport supply, real-time events, infrastructure information, topography and elevation and mobility rules (e.g. on tariffs, parking, and road closures).[33] The hope is to provide needed information to third-party app developers, journey-planners and other mobility start-ups to create the solutions customers need.

The city calibrates its approach to regulation based on what type of service is emerging. For "green-field" innovation where outcomes are unclear but where there is potential upside, the city focuses more on "soft" regulation and guidance. For "brown-field" innovation pertaining to established modes or where the risks are greater or better

known, the city may adopt "harder" regulation. While the lines between green-field and brown-field are admittedly blurry, Lisbon's evolving approach to e-scooters provides an illustrative example. Initially the city took a hands-off approach. Nine companies entered the city within one year, and Lisbon began to experience similar challenges to other cities grappling with micro-mobility: abandoned vehicles, safety concerns and cluttering of public rights of way. As a response, the city instituted fines for companies whose scooters were found on sidewalks and in public spaces.[34] Now the city is thinking about adopting the Mobility Data Specification as scooters have taken a firmer foothold in Lisbon. Engaging through informal meetings with operators and micro-mobility providers is one way in which the city creates the feedback loop needed on regulation. As part of its stance on public-private collaboration, the city also announced the first ever corporate mobility pact in collaboration with the World Business Council for Sustainable Development and several private-sector partners to accelerate sustainable urban mobility transformation.[35]

Lisbon's story is focused on demonstrating the possibilities of innovation while making sure the necessary regulatory measures mitigate increased congestion, preserve tourism and reduce negative externalities. Leadership is generally aligned on a vision for integrating mobility across the greater city area and on the uptake of new digital technologies. It is focused on creating an environment in which innovation can thrive and new market entrants can prosper.

London, United Kingdom
– creating a world-class customer experience

POPULATION:
8,787,892
(2016)

POPULATION
DENSITY:
5,601/km²

GDP:
$831 billion
(CityLab, 2018)

KEY MOBILITY STATISTICS

Public transport options:
Tube, tram, bus, rail

Monthly public transport pass:
US$159

Principal transport authorities:
Transport for London (TfL)

JOURNEY MODAL SPLIT

Other: **2%**

Private car: **37%**

Public transit: **29%**

Walking: **29%**

Bicycle: **3%**

FURTHER READING:
Deloitte City Mobility Index (London)

A global capital and the economic engine of the UK, London has experienced significant population growth over the past decade, growing from 8.2 million residents in 2011 to more than 8.8 million residents in 2016 and a projected 9.3 million in 2021.[36] By 2041, the population could reach nearly 11 million, generating perhaps an additional 6 million trips each day.[37]

To address the challenge, London has established itself as a leader in innovation. It was among the first cities in the world to implement congestion pricing – a charge required to enter the central part of the city. That scheme resulted in a significant reduction in the number of vehicles in the zone, and while congestion has climbed since then due to a variety of factors, the reduction in traffic has enabled Transport for London (TfL) to repurpose roads for other uses, such as bus and bike lanes. More recently, the city has implemented an "ultra-low emission zone" in the same areas as the congestion charging zone to address air quality and emissions issues by charging non-compliant vehicles to enter. It plans to greatly expand the covered area in 2021.[38,39]

TfL is responsible for running London's mobility system, and one of its priorities is creating a seamless customer experience as the city looks to alleviate challenges concerning congestion, access, payments and throughput. Created in 2000, TfL is responsible for meeting the Mayor's strategy and commitments on transport in London. The organization runs the day-to-day operation of the capital's public transport network and manages London's main roads. Its broad portfolio includes the rail/metro networks such as the London Underground, London Overground and the Docklands Light Railway, as well as trams, buses, taxis, cycling and river fleet services for the city. TfL is credited with creating one of the safest and most efficient public transit systems in the world, and is often cited as a role model for an integrated transport authority.

TfL is also among the leading examples of a government body that balances the provision of public transport with effectively regulating private sector-led partnerships that seek to provide additional services, all in the name of broader system-wide goals. Transit service is offered via a mix of wholly owned TfL services (e.g. the "Tube"), franchises (e.g. some rail services, trams and buses) and licensees (e.g. buses, taxis and river services). Some policy is set by central government, but mobility and transportation fall under the purview of London's directly elected mayor, and TfL is directed by the vision and goals set forth in the mayor's transport strategy.[40]

London is a leader in integrated mobility, especially across the various modes of public transport (including those not operated by TfL, such as the privately owned train-operating companies).[41] It was among the first to offer smart ticketing with the introduction of the Oyster Card in 2003, followed by contactless payment systems in 2014. The Oyster Card is now nearly as iconic a symbol of London transportation as the ubiquitous red double-decker bus. TfL is continuing to refine and improve its operations, and is considering options such as integrating a wider range of mobility providers (e.g. ride-sharing, taxis, docked and dockless bicycles) into the Oyster system.

Open data is a critical part of that integration and TfL's largely collaborative relationship with the private sector. TfL's policy has been to make available data such as timetables, service status and disruption information, resulting in more than 80 data feeds available through a unified API. This in turn has nurtured a system of 13,000 app developers who have developed more than 600 new products used by more than 40% of the population.[42] Recent research by Deloitte suggests that providing this free and open data has boosted the London economy by up to £130 million a year through improved journeys, time savings, job creation and new innovations.[43]

London's mobility story is focused on a coordinated strategy across physical and digital domains through continuous system-wide improvements to the city's transportation landscape, including ambitious goals on lower emissions and air-quality improvements, and encouraging even greater use of public transit and active modes of transport (e.g. walking and cycling). It looks to cultivate mutually beneficial relationships with private-sector providers, while also making hard regulatory choices to achieve the city-wide objectives set out in the mayor's transport strategy.

Singapore
– optimizing the mobility system through top-down governance

POPULATION:
5,612,253
(2016)

POPULATION
DENSITY:
7,796/km²

GDP:
$311 billion
(estimated as
of 2016)

KEY MOBILITY STATISTICS

Public transport options:
Metro, tram, bus

Monthly public transport pass:
US$88

Principal transport authorities:
Land Transport Authority (LTA)

JOURNEY MODAL SPLIT   Other: 4%

Private car: **29%**   Public transit: **44%**

Walking: **22%**   Bicycle: **1%**

FURTHER READING:
Deloitte City Mobility Index (Singapore)

Located at the southern tip of the Malay Peninsula in South-East Asia, the Republic of Singapore is an island country of 5.7 million people. Singapore is a city state, where the national government and city government are synonymous, greatly simplifying policy-making structures and limiting the jurisdictional complexities that can cripple many cities' transportation plans. Its unique geography and political structure have enabled it to become a world leader in integrated mobility.

A central mobility challenge, but also one that helps explain why Singapore has been successful in encouraging multimodal travel, is simply lack of space. Public roads cover roughly 3,500 kilometres,[44] occupying 12–15%[45] of Singapore's total land area. Building more roads comes at the immediate expense of other uses, such as housing. As a result, the focus has been on creating more efficient modes of transport that cater to a wide range of people while discouraging private car use by implementing congestion charging and placing quotas on the number of car licences available.

In practical terms, three ministries collaborate to oversee transportation: the Ministry of Transport, the Ministry of National Development and the Ministry of Trade and Industry. The Land Transport Authority (LTA) is the main transport authority within the Ministry of Transport, while the Urban Redevelopment Authority (URA) is responsible for overall urban planning in the city. Effective collaboration between ministries and government functions is essential in achieving mobility goals in Singapore. Within the government, all agencies are able to access the same data to better coordinate and work towards common objectives.

Perhaps in part because of this close government alignment, Singapore also stands out for the range and comprehensiveness of its mobility strategy. There are two important plans for urban development prepared by the government: the Concept Plan (CP) and the Master Plan (MP). The CP is a strategic land-use and transportation plan covering the next 40–50 years,[46] and the MP is medium term and translates the CP into detailed plans for land use over the next 10–15 years.[47] The country has committed to a single Smart Mobility 2030 vision, driven by the LTA. Among the top priorities in this vision are dynamic, interconnected data usage and common standards; integrated systems; public safety and service improvements; and green and sustainable transport. In May 2019, the LTA released the Land Transport Master Plan (LTMP) 2040 report, which encapsulates the LTA's long-term plans to build a convenient, well-connected, inclusive and fast transportation system that will meet the needs and aspirations of Singaporeans over the next two

decades and beyond. One of their three vital themes is "45-minute city with 20-minute towns", capturing their goal of creating an environment in which residents spend no more than 20 minutes getting from their home to the nearest neighbourhood centre, and 45 minutes or less to complete most peak-period journeys from home to workplace. To do that, LTMP 2040 focuses on providing autonomous and on-demand services as well as building more integrated transport hubs in the city.

Singapore's story is focused on system-wide optimization driven by a cohesively organized top-down governance model that enables alignment across the public sector, centralized planning and financing of mobility initiatives and strong private-sector competition enabled by the city's willingness to deploy regulatory sandboxes. The country is committed to investing in new modes of transport (e.g. e-scooters and on-demand autonomous buses), while also pushing active transportation options (e.g. green-space pathways) to support a growing population, as well as capping the number of cars on the island.

Tokyo
– engaging the private sector to solve public-sector challenges

POPULATION:
13,725,778
(2017)

POPULATION
DENSITY:
6,267/km²

GDP:
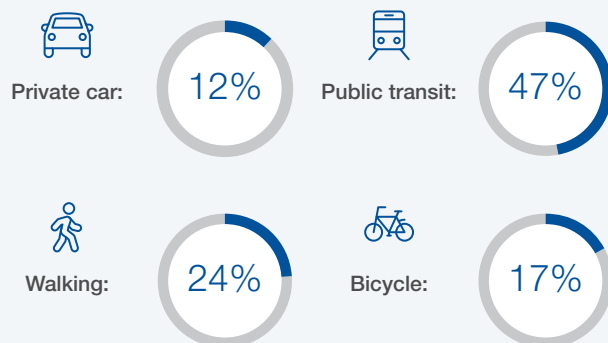**US$1.6 trillion**
(2017)

KEY MOBILITY STATISTICS

Public transport options:
Metro, bus, ferry, light rail, commuter rail

Monthly public transport pass:
US$73

Principal transport authorities:
Tokyo Metropolitan Bureau of Transportation,
Tokyo Metro

JOURNEY MODAL SPLIT   Other: –

Private car: **12%**   Public transit: **47%**

Walking: **24%**   Bicycle: **17%**

FURTHER READING:
Deloitte City Mobility Index (Tokyo)

The greater Tokyo area has more than 38 million residents, making it the world's largest megalopolis. With 23 special wards, 26 cities, five towns and eight villages, Tokyo has grown rapidly in the past decade, even as the country as a whole has experienced depopulation. The city will host the 2020 Olympic and Paralympic Games, and is looking to those events to spur changes in its mobility system.

The public transportation system in the Greater Tokyo area is one of the busiest and most sophisticated in the world. The system is in some ways a victim of its own success, with packed trains and a complex rail network. First- and last-mile mobility is a critical issue in most parts of the city. There are more than 30 private companies operating above-ground trains, creating a complex management challenge.[48] In the western part of Tokyo and the rural areas in the greater region, residents still rely on private cars because public transportation is less robust, which can put a particular strain on Tokyo's ageing population.

Tokyo was among the first cities to implement an integrated transit smart card system. The SUICA card (Super Urban Intelligent Card) was introduced in 2001 and is today one of the more iconic symbols of Tokyo's transportation system; PASMO is another commonly used option. These smart cards are prepaid, rechargeable and contactless, and can be used to pay fares on almost all public transportation, including train, subway, buses and taxis. The cards can also be used in vending machines, convenience stores and restaurants.

The Tokyo Metropolitan Government (TMG) Bureau of Transportation serves as the principal transportation authority in the region and coordinates with national government bodies, including the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and the Ministry of Economy, Trade and Industry (METI). By subsidizing the private sector, Tokyo has pursued a variety of mobility-related pilot projects, especially on mobility-as-a-service (MaaS). In its 2019 fiscal year, the TMG is supporting three efforts led by private-sector consortia, including providing route-finding assistance to travellers using real-time operation data for buses and trains.[49] In 2018, the national government introduced its first regulatory sandbox with the purpose of developing an environment in which businesses are able to conduct demonstrations and pilots for new technologies that are not anticipated under existing regulations; on-demand mobility using buses and cars was among the first to take advantage of this testbed.[50]

Tokyo's mobility story is based on a strong private sector-led vision and leadership enabled by government support and a flexible regulatory environment. Pilot projects have helped introduce new technologies, and the city has supported collaboration with the private sector to create public-private consortia that can help drive more affordable and user-friendly schemes.

Tel Aviv
– building a thriving start-up mobility environment

POPULATION:
1,388,400
(2017)

POPULATION
DENSITY:
7,866/km²

GDP:
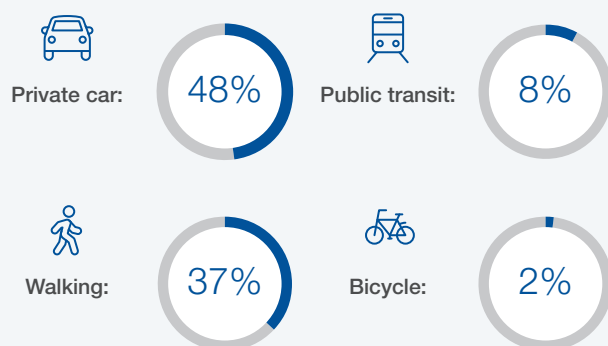**US$77 billion**
(2016 estimates)

KEY MOBILITY STATISTICS

Public transport options:
Bus, commuter rail, bicycle, shared taxi

Monthly public transport pass:
US$68

Principal transport authorities:
Israel Ministry of Transport and Road Safety,
Tel Aviv-Yafo Municipality

JOURNEY MODAL SPLIT

Other: 5%

Private car: **48%**

Public transit: **8%**

Walking: **37%**

Bicycle: **2%**

FURTHER READING:
Deloitte City Mobility Index (Tel Aviv)

Tel Aviv[51] is known for its strong start-up culture and innovation environment. In the mobility sphere, it is home to several transportation analytics firms, autonomous vehicle hardware and software developers, and numerous smart mobility start-ups, making it a hub for knowledge exchange and pilots. This start-up community could play a catalytic role as the city makes changes to its smart mobility and transportation projects and seeks to meet the environmental goal of reducing country-wide oil consumption by 60% by 2025 (a goal set by the Fuel Choices and Smart Mobility Initiative). The Israel Ministry of Transport and Road Safety is the principal transport authority in the region, and the Prime Minister's Office set up the Fuel Choices and Smart Mobility Initiative in 2011 as a joint governmental effort to focus on alternative fuels and means of transportation.[52]

Due to population growth, Tel Aviv is an increasingly dense metropolitan centre, with a growing number of commuters from neighbouring municipalities. While only about half of trips use private cars, congestion has nonetheless increased, prompting a search for new solutions in micro-mobility and public transit. Buses are frequently used, adding to the traffic challenge. Public transit also shuts down every Friday at sundown for the Jewish Sabbath and does not reopen until nightfall on Saturday. The Tel Aviv Municipality recently announced that it will begin operating a free public transportation system on weekends, across the city and its surrounding areas, by the end of 2019.[53] This could mark a new era for non-observant Jews or non-Jewish residents, who have struggled with a gap in service, particularly given that taxis are relatively expensive and the cost of car ownership is relatively high.[54]

Tel Aviv has long been at the forefront of micro-mobility. In 2011, the city established "Tel-O-Fun", a bicycle-sharing service[55] that aimed to reduce motor vehicle traffic and shift infrastructure investments towards bike paths in the urban centre. The municipality is currently re-examining this service's development and future.[56] More recently, Tel Aviv has been an attractive market for scooter companies, who find the landscape, weather and demographics ideal for deployment. As in many cities, rapid and unregulated deployment created challenges, prompting a firmer stance from the Tel Aviv municipality. In August 2019, it instituted new licensing requirements for providers of shared mobility vehicles (e.g. e-scooters and bicycle companies), fines for inappropriate usage, designated parking areas and limits on total fleet numbers.[57] It also requested that companies look into minimum user ages as well as limiting riders to one per scooter and other safety measures. The city has sought to strike a balance between stipulating how micro-mobility providers can operate and encouraging the development of a thriving start-up landscape.

The reaction to micro-mobility is symptomatic of the city's general focus on enhancing the individual journey. Complex governance in the region makes system-wide optimization a challenge, as rules, politics and culture often change by jurisdiction in the small country of Israel. Distributed authority between the national and local governments makes cohesive planning and execution a challenge. Nonetheless, the city aims to create a light rail system with more than 130 kilometres of underground lines and more than 100 stations across municipalities.[58] Despite delays and shifting plans, it could provide the backbone for a seamless integrated mobility system that would alleviate congestion and complement the city's robust micro-mobility options.

Harnessing its innovation environment is part of Tel Aviv's challenge and opportunity. It has made strides recently in establishing sister sites or partnerships across borders. For example, PlanetM, a mobility and economic development-focused organization based in Michigan, US, launched a partnership with the Michigan Israel Business Accelerator and the Israel Innovation Authority to roll out the Israel Michigan Autonomous Technologies Collaboration, creating better linkages between the two mobility innovation hubs.[59] That said, how the city can best use its local mobility talent to create meaningful impact for residents remains an open question.

Tel Aviv has worked to manage the complexities associated with distributed authority between the national and local governments. The municipality's small size relative to many global metropolises, its robust start-up community, agreeable topography and climate make it ideal for many new mobility providers. Yet the city is still learning how to manage an energetic but fragmented innovation environment. The Israel Ministry of Transport and Road Safety recently published a national Future of Mobility policy paper[60] in which it articulates six core areas for innovation. How the Tel Aviv municipality will align with that national policy remains to be seen.

Detroit, Ann Arbor, Windsor
– solving for mobility use cases to address regional needs

POPULATION:
4,393,090
(2016)

POPULATION
DENSITY:
897/km²

GDP:
$294 billion
(2016, total)

KEY MOBILITY STATISTICS

Public transport options:
Bus, light rail, commuter train, trams (streetcar)

Monthly public transport pass:
US$50

Principal transport authorities:
Detroit Department of Transportation, Detroit Transportation Corporation, Suburban Mobility Authority for Regional Transportation (SMART), Ann Arbor Area Transportation Authority (TheRide), Transit Windsor

JOURNEY MODAL SPLIT

Other: 1%

Private car: **91%**

Public transit: **3%**

Walking: **4%**

Bicycle: **1%**

FURTHER READING:
Deloitte City Mobility Index (Detroit, Ann Arbor, Windsor)

The region of Detroit and Ann Arbor, Michigan, and Windsor in Ontario, Canada, is home to many original equipment manufacturers (OEMs) in the automotive industry and a vibrant public-private community of mobility partners. Over the years, the region has suffered from economic decline as a result of the Great Recession (2007–2009) and a corresponding transformation of industry centres to address stagnant growth. While the area does not suffer from significant congestion, unlike other major urban areas, it does face a number of structural mobility challenges that have traditionally impeded the region's ability to attract top talent and business. For example, more than 90% of trips are taken by private car due to insufficient public transit infrastructure,[61] putting the onus of commuting on individuals in the region. Detroit also has the highest cost of insurance in the United States – with the average cost of premiums being more than double the state average and nearly four times the national average[62] – adding to the burden of private car ownership, particularly for lower-income families who may not have alternatives. The significant sprawl and affordability concerns exacerbate this challenge, as commuting times can vary significantly across the region. For example, in Detroit 70% of residents work outside the city limits; in Ann Arbor, there are 80,000 employment trips per day (in a city of 120,000 residents); and in Windsor, more than 6,700 cross-border commuters work in the Detroit/southeast Michigan area. The region is deeply connected and interdependent, even across an international border, sharing economic and social resources. Windsor is a 20-minute drive from Detroit under ideal conditions, but the commute can take hours. Ann Arbor is a college town, full of students who might not be able to afford a car, but potential employers are challenging to reach because of limited public transit options. In such a context, setting a transregional vision and collective leadership was a critical first step on the seamless integrated mobility journey.

As the members of the SIMSystem pilot region, the cities of Detroit, Ann Arbor and Windsor have forged a strong cross-border partnership, and have each committed human and financial resources to align on vision, strategy and objectives for collaboration. Over the course of discovery, the pilot region placed more of its focus on individual journey optimization to create greater affordability and transportation availability rather than a single system-wide goal. To do this, the region identified three workstreams for a seamless integrated mobility system that would help address specific challenges:

– First, and fundamental to their transformative journey, the three geographies are building a common data platform architecture and blueprint for the eventual creation of a regionally integrated, interoperable mobility operating system

– The second workstream defines, identifies and maps mobility deserts to address the central policy issue of inclusive economic growth

– Finally, the pilot region launched a use case facilitating the movement of thousands of healthcare practitioners who commute daily across the border from Windsor to Detroit.

To activate this use case, the city of Windsor examined system-wide partnerships to sponsor additional transit to augment the options available in the city, reduce employee use of single-occupancy vehicles and on-site parking, and improve quality of life for employees. For its work on inclusivity, the city of Ann Arbor has partnered with the Regional Transit Authority (RTA) and the Southeast Michigan Council on Governments (SEMCOG) to explore how mapping mobility deserts and feeding that data into a SIMSystem could help the city reach parts of the population not adequately served by reliable, flexible and affordable transport. As for the ongoing regional work towards an integrated digital platform, the pilot region, led by the City of Detroit, has partnered with industry and academic leaders such as Ford Mobility and the University of Michigan to establish the necessary human and technical requirements.

While the region has focused on individual journey optimization, it has also taken significant strides towards enabling the sharing of data and knowledge that is necessary to make such an integrated mobility platform a reality. Regional authorities, for example, the Detroit Department of Transportation (DDOT) and the Suburban Mobility Authority for Regional Transport (SMART), have taken steps to simplify travel and eliminate transfer fees, streamline the number of passes from 25 to six and introduce a new mobile payment app.[63] While some of these projects are still in preliminary phases, the push towards simplifying mobility modules across the region indicates how the cities are

prioritizing mobility as a means of economic transformation. Some of these smaller projects are pilot efforts of a thriving mobility environment, as one might expect in the home of the US automotive industry. The Detroit, Ann Arbor and Windsor hub has crafted a strong next-generation focus on mobility innovation through, for example, organizations such as the Techstars Mobility Hub, Detroit Mobility Lab, PlanetM, Ann Arbor's Mcity (with a focus on autonomous vehicles) and the American Center for Mobility, which focuses on testing and product development.

Being able to take advantage of this robust set of players is a unique opportunity for the region. For example, Windsor recently received funding to install a virtual reality centre for testing connected and autonomous vehicle (CAV) technologies. As a result of the partnerships they have built across the region, the Windsor-Essex Economic Development Corporation is working collaboratively with the University of Michigan to identify opportunities for cross-marketing of testing facilities for CAVs from the physical test site at Mcity in Ann Arbor to its digital twin at the Institute for Border Logistics and Security in Windsor. This kind of regional partnership model for specific use cases is a testament to the commitment of the city's leaders to solving mobility challenges in a collaborative public-private manner.

Detroit, Ann Arbor and Windsor face a complex challenge in managing a non-integrated region with distinct mobility challenges to support a cross-border workforce and underserved areas. The complexities concerning data – sharing, legal frameworks for exchange, even where to house an integrated platform – are made more challenging by the US-Canada border. Despite this, the region has strengthened its efforts to improve individual journey optimization and examine how an integrated system could support socioeconomic development and has renewed its commitment to taking its mobility system into the future.

Realizing the promise of seamless integrated mobility

The aim of this study is to help cities bring about large-scale change in mobility faster and with greater impact. A fully functioning SIMSystem enables cities to move people and goods more efficiently by creating interoperability across physical assets such as cars and buses; digital technologies like dynamic pricing and shared data exchanges; and the governance structures, standards and rules by which they operate. Through the application of big data, cognitive science and behavioural economics, cities can begin to shape, mould and influence citizens' transportation choices towards those that are more sustainable, cheaper and faster – and that create benefits system-wide.

Urban transportation, like politics, is local. As the stories of the cities featured in this report illustrate, there is no single path towards achieving seamless integrated mobility, and every journey is fraught with pitfalls and hurdles. But by gleaning lessons from some of the leading cities across the globe, the hope is that government officials, private-sector leaders and other stakeholders can make better-informed, clear-eyed choices along these many dimensions.

There is a need to continue and extend this exploration and dialogue with an even broader global community. More outreach is needed to give greater attention to rural communities and cities in developing countries. The movement of goods and its impact on the broader mobility system remain underexplored. And as nascent SIMSystems mature, it will grow increasingly imperative to develop vital metrics that allow the global community to track progress towards an improved mobility system. Understanding what works, as well as what does not work and why, will continue to be critically important for all engaged in trying to transform their cities, improve their quality of life and achieve further social progress. The World Economic Forum's Shaping the Future of Mobility Platform and Centre for the Fourth Industrial Revolution aim to continue serving as catalysts, sharing insights and accelerating progress for innovation and transformation as cities work towards a more advanced and innovative mobility system – one that can be more inclusive, accessible and equitable for all citizens.

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