ARCADIS

CITIZENS IN *MOTION*

WHO'S DRIVING **YOUR FUTURE?**

_ WHAT IS CAV?

Connected and Autonomous Vehicles (CAV): Will have a disruptive influence on the mobility solutions within our cities.

They will most likely be Electric Vehicles (EV), and this itself poses a challenge around establishing the most appropriate charging infrastructure.

This report refers to Levels 4 and 5 of autonomy in EV, where vehicles communicate with each other and the environment around them without the need for a human driver to intervene.

The impact of digital disruption can be seen all around us, accelerating at pace and scale, changing the way we interact with each other and the world.

Every industry, from retail to leisure and health to banking, is being transformed, ultimately driving exponential growth for the tech-firms making it happen.

The emerging CAV revolution opens a new frontier of disruption in transportation and urban living, beyond existing examples such as Uber. For our cities, exclusively electric connected and autonomous vehicles present a huge opportunity to radically transform urban mobility.

Cities across the world are grappling with congestion, overcrowded transport, poor air quality and the need to drive greater prosperity, competitiveness and improve the citizen experience.

CAV have a role in driving success in all these areas. However, they could simultaneously threaten to make some problems worse, such as congestion, or jeopardize the viability of vital public transport services, affecting citizens' ability to travel or access employment and other critical services. The risk is that this could create a transport system with unequal access.

Nevertheless, the power of big-tech and automotive firms means that the march of CAV is an inevitability. What is not inevitable is the way that cities respond.

CHANGE IS COMING

To maximize opportunities and mitigate threats it is vital that cities are proactive in preparing for CAV disruption. CAV sit at an intersection where the physical meets the virtual and where digital connectivity creates unprecedented opportunities to reshape city transportation.

While creating complex challenges, this is also why it offers such potential for profound advancement.

From engaging local people, to forming regulatory policy, testing and licensing, cities have a lead part to play.

Connected and autonomous vehicles are coming. For cities that proactively shape CAV to meet their needs and ambitions, it offers a colossal opportunity to enhance mobility outcomes.

For those that do not, it threatens to disrupt the status quo in a way that is inconsistent with a city's aims and the interests of its citizens and visitors. In the long run this could damage a city's ability to compete globally.

What are you doing to seize the CAV opportunity to better meet your city's mobility objectives and improve quality of life? Are you driving the future of your city's mobility?

_ JOHN BATTEN
GLOBAL CITIES DIRECTOR

_ AN AUTONOMOUS FUTURE?

The proliferation of CAV is inevitable. However, exactly what form this disruption will take in our cities, from business and service models to the vehicle itself, is yet to be fully defined.

All cities share common fundamental attributes, but are ultimately different, with their own histories, cultures, topographies, infrastructures and aspirations. Because of this, a 'one size fits all' approach to CAV is unlikely to deliver the full extent of the opportunity available and will not ensure that the special character of a city is protected.

Cities around the world have different visions for CAV. Cities like Singapore and San Francisco put CAV at the heart of the future of mass transit. In contrast, others such as Paris and Hong Kong have more emergent ambitions to develop CAV as an enhanced personal transport solution. Meanwhile cities like Dubai, are seeking to push boundaries further altogether, experimenting with flying taxi drones, for example.

To show how technology will change the city, Dubai has established its Museum of the Future.

CITIZEN CONNECTION

User experience will be critical for the adoption of CAV, both from the perspective of service providers and considering city mobility objectives. The appetite among both citizens and visitors for advanced CAV is not yet fully understood, but it seems that some cities are already more receptive to the idea of autonomous mobility. For cities, CAV could affect the impact of other people-centered policies, such as London's Healthy Streets strategy. It is important to ensure CAV are inclusive and accessible to all.

GOVERNANCE PLATFORMS

National, regional and local government has a role to play in creating an environment where CAV can thrive as part of a balanced eco-system. Engagement with citizens, regulation and licensing, funding support, working with the private sector, testing and implementation of supporting systems and infrastructure are all critical.

Mobility networks need to be planned over long-periods, stretching forward to 2030 for Dubai and even 2056 in Sydney. The challenge is how to adjust to disruption and yet maintain agility to respond to new opportunities. The established mobility blend in any city represents huge investment from the private or public sector, but a disruption like CAV could threaten to deprive existing providers, like taxi or bus companies, of income. It is down to cities to engage with the private sector to find a solution that strengthens, not weakens, the whole network.

ENABLING INFRASTRUCTURE

Engagement with the private sector will be pivotal to success. In most parts of the world public budgets are under constant pressure. Not only will CAV cost significant sums of money to introduce, but many of the preluding systems and infrastructures will require funding and financing that will need to be borne by both the public and private sectors, as well as the citizen.

EV charging infrastructure, 5G communication networks and advanced traffic management systems will all need to be well-developed before CAV can be a major and successful part of a city's transportation network.

The coming of CAV is a significant and assured disruption.

History tells us that disruptions move quickly. From the way in which streaming services like Spotify have transformed the music industry to how internet algorithms have changed the shape of the online dating industry, consumer behavior has often shifted before incumbents have got to grips with the changing landscape.

CAV technology is no different. Cities everywhere have the opportunity to be on the front-foot, to shape behaviors and to respond positively so that CAV best meet their mobility objectives and enhance the citizen-experience.

Arcadis subscribes to the principles of Vlerick Business School's Four Digital Realities.

How will these realities reshape the market and play a key role in the proliferation of CAV?

_01

Customer experience is value.

Customer choice means the proposition has to be customer-centric. Customers are moving targets and so propositions need to be continually tested and improved.

_02

Data is a main asset.

Data is at the heart of improving the customer experience.

_03

Ecosystems co-create value.

No single organization owns all the data, skills or capabilities to compete for today's dynamic customer. An organization must strategically choose partners to grow together, evolve and move to the market faster.

_04

Digital platforms.

Digital platforms help connect people, organizations, and resources in an interactive, digital environment where value can be created and exchanged. Platform-based business models fundamentally change how companies can do business.

Mobility as a Service (MaaS): The integration of a variety of different transport modes into a single accessible-on-demand platform with a standardized payment and ticketing system.

AT YOUR SERVICE

The concept of MaaS goes hand-in-hand with the future growth of CAV. Understanding and enhancing the citizen experience sits at the heart of MaaS.

Data on how customers use mobility, from cars and buses to cycling and metros, allows a city to improve its transport mix. As a result, one of the real benefits of MaaS comes in helping to drive behavioral change. This can be designed to align with a city's vision and strategy for the benefit of all its citizens or, conversely, if left unchecked it could be to maximize a private company's revenue.

Success depends on aligning city vision with citizen experience, as is evident from the results of a recent MaaS pilot in Amsterdam. Over half of participating citizens confirmed they would give up their private vehicle in favor of MaaS, where ridesharing services play a central role. This gives confidence that permanent behavioral change is achievable given the right level of service, at the right price.

The success of unified smart charging systems highlights how customer-focused innovation will be adopted if the balance of incentives is right.

It seems likely that CAV will be a force that creates an environment for greater use of MaaS approaches, and vice versa. As MaaS grows, there will be increased opportunity for CAV to be a major part of the offering.

MaaS presents a route to less congestion, better air quality, more efficient travel, greater prosperity, better citizen-experience and, ultimately, improved quality of life. However, this depends on mobility options being integrated into a single system.

MaaS pilot in Amsterdam's Business District (Zuidas):
A joint agreement between large employers has tested the concept of a commercial MaaS solution to ensure employees can continue to travel to and from work through a 10-year period of major transport infrastructure development.

A LOOK AROUND THE WORLD

Across 14 global cities, the following profiles offer a snapshot of activity across three key elements: citizen connection, governance platforms and enabling infrastructure. These are considered within the context of the overall city's mobility objective.

AMSTERDAM

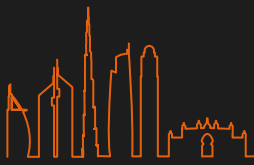
A city with CAV at the heart of MaaS innovation

BERLIN

A city focused on multi-modal mobility

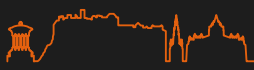
BRUSSELS

A city focused on improving air quality and reducing dependence on private cars



DUBAI

A city piloting CAV and looking to push the boundaries



EDINBURGH

A city aiming to outperform in decarbonization through mobility innovation

HONG KONG

A city where an efficient metro and nostalgic transport modes have strong influence on CAV adoption

LONDON

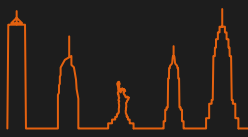
A city focused on healthy streets and emergent approach to taking advantage of CAV disruption

LOS ANGELES

A city aiming to increase public transport use through CAV

MELBOURNE

A city exploring CAV as an alternative to costly mass transport infrastructure



NEW YORK

A city looking to increase transit choices with CAV

PARIS

A city continuing large-scale public transport investments to drive innovation

SAN FRANCISCO

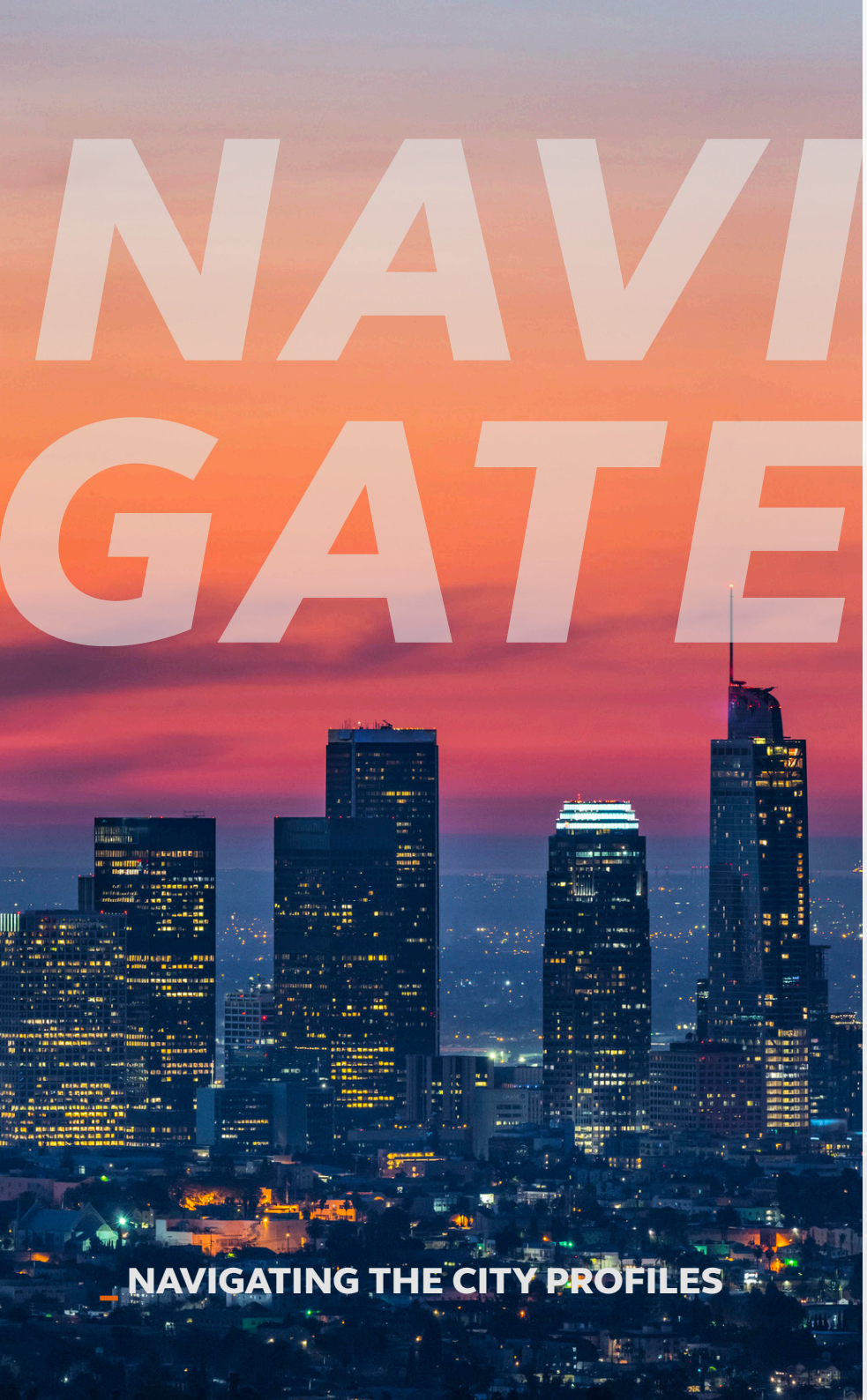
A city as a mass CAV lab in a car-orientated mobility market

SINGAPORE

A city leading in alternative modes of mobility, as part of its Smart Nation vision

SYDNEY

A city preparing for CAV



NAVIGATING THE CITY PROFILES

The 14 cities have been selected to provide a spread of cities around the world that have the opportunity to incorporate CAV as part of their mobility mix. Each of these cities has the potential to become more competitive and sustainable through smart outcomes focusing on mobility, resiliency and regeneration.

Recommendations for driving towards the mobility objective with a CAV focus

A look through the lenses of citizen connection, governance platforms and enabling infrastructure, identifying key points in respect to elements that may or may not support the development of CAV-based solutions as a means of achieving city mobility objectives

City mobility objective

AMSTERDAM

CITIZEN CONNECTION

- High levels of satisfaction with an effective, well-financed public transport system, although pressures on bicycle infrastructure exist.
- Citizen identity linked to walking and cycling as primary modes of transport.
- Broad acceptance of measures to reduce car access and parking in central city areas.
- Ridesharing pilots in Zuidas highlight readiness for transport innovation aligned to MaaS.

"Without human drivers, driverless vehicles are potentially a lot cheaper to operate, for example as a last mile solution. If that means more convenience for the same price, I'm sold."

_Citizen of Amsterdam

GOVERNANCE PLATFORMS

- Well-established national CAV program including on-road testing since 2015, remote-control from 2018 and 5G integration.
- Smart Mobility strategy 2016-2018 on four themes: internet of things, smart use of space, MaaS and CAV. Conventional cars are discouraged.
- Amsterdam smart city platform enables innovation in the city to accelerate the transition in mobility.

"Amsterdam stimulates autonomous (public and semi-public) transport to keep the city livable, sustainable, accessible and attractive."

_Ger Baron, Chief Technology Officer, City of Amsterdam

ENABLING INFRASTRUCTURE

- Intelligent road network provides strong foundation for CAV, including early investment in connected traffic signal interfaces.
- Dense EV charging network – 267,000 charging points in the Netherlands of which 4,000 in Amsterdam.
- National integrated public transport payment system; OV-Chipkaart.

"CAV can provide a huge opportunity to improve the mobility system and improve quality of life in Amsterdam."

_Carolien Gehrels, Arcadis City Executive, Amsterdam

A city with CAV at the heart of MaaS innovation.

The world's cycling capital – 45% of mobility is human-powered.

9% growth in city population and 15% growth in tourism places pressure on transport network.

Declaration of Amsterdam puts the city at the heart of EU initiatives to accelerate CAV adoption.

ARCADIS RECOMMENDATIONS

Focus CAV pilots on areas less well served by public transport in line with wider efforts to reduce car use.

Focus initiatives on areas of concern to citizens including social inclusion, congestion, parking and connectivity.

Identify how CAV can contribute to the development of integrated city-wide MaaS.

Integrate all knowledge on impact of CAV on the city systems into the integral city masterplan.

Embed CAV thinking in traffic and urban planning to create the optimal transportation network.

Identify and promote role that open data infrastructure will have in facilitating and accelerating CAV and MaaS.

CITY MOBILITY OBJECTIVES

Being smarter to keep Amsterdam a city where pedestrians, cyclists, and effective collective transport can coexist.

Carolien Gehrels
Arcadis
City Executive, Amsterdam

AMS

BERLIN

CITIZEN CONNECTION

- Berlin has hosted mobility service tests, making the citizens relatively early adopters.
- The digital sector drives 20% of economic growth and sustains 13% of jobs in the city.
- The preference of citizens and politicians is to support eco-mobility solutions.
- Evidence points to public scepticism towards level 4+ CAV with fears centered on potential loss of control.

"CAV is a future topic that will change our daily lives in terms of comfortable, safe and time efficient transport."

_Citizen of Berlin

GOVERNANCE PLATFORMS

- Berlin Mobility Act, the first of its kind in Germany, is focused on eco-mobility.
- The strategy for future mobility and Berlin as a smart city is in development, with the need for supporting legislation to be passed.
- Following 2017 legislation, driverless vehicles can be tested on roads provided a human remains at the wheel.

"A growing city means growing mobility requirements. This increases our responsibility and the challenges of reconciling mobility needs with climate and health."

_Ramona Pop, Senator of Economics, Energy & Public Enterpriseses, Berlin

ENABLING INFRASTRUCTURE

- Berlin has an EV-based mobility pilot.
- Momentum around increasing EV charging infrastructure is building.
- There is a national five step plan for 5G implementation.
- The DIGINET PS pilot is testing CAV in Berlin's city centre.
- VBB-fahrCard provides an integrated ticketing system for public transport.

"Located at the EUREF-campus, Arcadis is at the heart of Berlin's research and testing of intelligent mobility."

_Thorsten Schulte, Arcadis City Executive, Berlin

A city focused on multi-modal mobility.

Over 10m average daily trips.

50% of households are car-free.

75% of transport modes are shared or human-powered.

Over 600 EV charging stations.

Population is expected to grow by 15% by 2035.

ARCADIS RECOMMENDATIONS

Continue to implement CAV-testing projects to build citizen confidence and exposure to the technology.

Identify CAV opportunities aligned to shared and active mobility priorities.

Encourage continued public/private sector collaboration to develop solutions that align with city mobility objectives, including engaging citizens.

Lobby for legislation that will permit level 4+ CAV without the need for any human monitoring or intervention.

Develop a strategy for digital infrastructure to bring together an agile business community and political enabling framework.

Progress EV charging infrastructure development plan to accelerate electric mobility and deliver more sustainable outcomes.

CITY MOBILITY OBJECTIVES

Become safer, greener, and more mobile with a focus on sustainable transport modes.

Thorston Schulte,
Arcadis
City Executive,
Berlin

BER

BRUSSELS

CITIZEN CONNECTION

- Very strong culture of private vehicle commuting.
- Using incentives to change behaviour. On the smoggiest days, public transport and bikeshare services are free.
- The number of ride and bike-sharing start-ups increasing.
- Half of Belgians have concerns about potential safety of CAV.
- Trust in more traditional organizations, such as established car manufacturers, is twice as high as in technology companies.

"How will walking and cycling be organized in a city of CAV?"

_Citizen of Brussels

GOVERNANCE PLATFORMS

- No centralized authority - transport management devolved to 19 municipalities.
- Automated solutions to and from Brussels and the airport are being piloted.
- Staggered implementation of low emission zoning will incentivize EV adoption.
- Testing of CAV, including Level 5 enabled but still controlled by humans, now allowed on public roads, governed by a code of practice.
- Smart city and open data initiatives in place.

"We want to boost innovative projects that improve daily mobility. Digital applications can stimulate better integration of transport networks and contribute to a mental and modal shift."

_François Bellot, Federal Minister of Mobility

ENABLING INFRASTRUCTURE

- MOBIB smartcard supports integrated ticketing and payment across the metro, buses and trams.
- Brussels Smart City Initiative includes smart ticketing and real time transport data.
- Extensive investments to increase public transport capacity.
- Enabling technology for 5G being rolled-out from 2020 onwards.
- Ring road will be reconstructed.

A city focused on improving air quality and reducing dependence on private cars.

45% of journeys made using public transport and 6% are human-powered.

A car-centric city with 55% car ownership.

Population growth expected to be circa 0.5% per year to 2030.

ARCADIS RECOMMENDATIONS

Engage citizens to build trust in CAV.

Develop long-term plan for incentives to encourage wider adoption of shared transport modes.

Expand support for CAV testing to build an environment for early adoption.

Align low emissions zone initiatives with EV take-up as well as public transit uptake.

Integrate CAV solutions and electric mobility opportunities into future investments for road infrastructure.

Identify and plan how existing and future initiatives can work to develop a MaaS offer.

CITY MOBILITY OBJECTIVES

Move away from car-centric culture and move towards other mobility solutions.

Carl Verelst,
Arcadis City Executive, Brussels

BRU

DUBAI

A city piloting CAV and looking to push the boundaries.

Over 1.5m passenger trips daily.

55% of citizens own a motor vehicle.

The population is expected to grow by 10.7% per year to 2030.

Aim to transform 25% of total journeys to autonomous modes by 2030.

Public transport use increased from 6% of all journeys in 2006 to 17% in 2017. Goal to further increase to 20% by 2020, and to 30% by 2030.

CITIZEN CONNECTION

- Sharing services less developed than some cities, but public transport use is growing. 'First and last mile' of mobility are of particular concern, given the hot climate.
- High car dependence, but 70% of residents would favor CAV to increase productivity and eliminate the need to park and walk outside.
- CAV trials, such as a shuttle service in Downtown Dubai, have 91% approval ratings.
- A plethora of CAV initiatives, including autonomous police car fleet, mean citizens are exposed to the technology as it develops.

"Autonomous vehicles could remove the frustration of having to endure traffic congestion during peak hours and allow me to relax, plan my schedule and enjoy my daily commute more."

_Citizen of Dubai

GOVERNANCE PLATFORMS

- The Dubai Autonomous Transportation Strategy sets clear CAV targets linked to economic and environmental outcomes.
- The Dubai Future Foundation supports a Centre of Excellence for Autonomous Transportation Systems to build expertise.
- A range of initiatives, like hydrogen technology, Hyperloop and drone taxis, are being considered.
- Investment at national and city level. Open regulation, fast decision making and unified planning for transport, roads and traffic.
- EV Accelerator Initiative in place.

"If we want to become one of the smartest cities in the world, we definitely need to be at the forefront of cities, ready to accept autonomous vehicles."

_Ahmed Bahrozyan
CEO of the Licensing Agency, Roads & Transport Authority

ENABLING INFRASTRUCTURE

- 100+ EV charging stations and increasing.
- Advanced traffic management systems and roads suitable for CAV.
- Public transport integration is ongoing – metro integration with other modes of transport including trams, buses, taxis, park and rides, and walking.
- The Nol Smartcard provides an integrated ticketing system for public transport.
- 5G rollout commenced.

"Dubai's vision around smart mobility, including CAV, is world-leading. The opportunity now is around bringing this vision to life to help Dubai achieve its goal of becoming the world's smartest and happiest city."

_Rachad Nochahrli
Arcadis City Executive, Dubai

ARCADIS RECOMMENDATIONS

Identify steps and incentives that will make CAV as attractive as private car ownership for citizens.

Continue the move towards a MaaS offer for citizens that incorporates CAV.

Set appropriate milestones to ensure a phased roll-out strategy up to 2030.

Embed CAV targets into the current and future strategic transport masterplans of Dubai.

Continue to engage private sector in enhancing infrastructure that best supports innovative modes.

Deliver the 'first and last mile' mobility infrastructure needed for CAV to take off.

CITY MOBILITY OBJECTIVES

Mobility that is innovative, people-centric, sustainable and inclusive underpinned by autonomous and shared solutions by 2030.

Rachad Nochahrli,
Arcadis City Executive, Dubai

DUB

EDINBURGH

A city aiming to outperform in decarbonization through mobility innovation.

Population forecast to increase 20% by 2039 (to 595,000).

Congestion in the city estimated to cost £309m per year.

Edinburgh 2020 Vision sets out a reduction of carbon emissions by over 40% across the city.

Scotland pledged to phase out new petrol and diesel cars and vans by 2032, eight years ahead of the UK-wide target.

CITIZEN CONNECTION

- High modal share of bus use driven by satisfaction levels.
- Plans for a new cycle hire scheme in 2018 to increase use of bicycle journeys from 3% in 2015 to 15% in 2020.
- Edinburgh accounts for more than 23% (489) of all EV in Scotland.
- Population growth (12% between 2006-2016) puts pressure on network capacity.

"People will need to be given time to get used to them – safety is important."

_Citizen of Edinburgh

GOVERNANCE PLATFORMS

- UK Government wants driverless cars to be in commercial use by 2021.
- Around 12 different trials have been run in the UK over the past three years.
- No policies at the country and local levels to incentivize CAV.
- One of four Scottish cities implementing a Low Emission Zone (LEZ) by 2020.

"The Scottish Government has clear priorities for the sustainable growth of the country's economy. Transport, the environment and the digital sector feature highly in the strategies for meeting these goals."

_Transport Scotland

ENABLING INFRASTRUCTURE

- Fibre internet access to at least 95% of premises throughout Scotland.
- The City Electric Vehicle Action Plan sets out three strategic EV charging hubs.
- Aims to become the data capital of Europe.
- 21% of buses in Edinburgh are hybrid and low emission vehicles.

"CAV offers great potential and in Edinburgh it is crucial that the new technology is deployed in a complementary manner, reducing congestion and not adding to it."

_Graham Hill, Arcadis City Executive, Edinburgh

ARCADIS RECOMMENDATIONS

Facilitate joined-up multi-mode transport by developing MaaS as part of new City Mobility Planning.

Raise CAV acceptability among citizens by tailoring pilots to focus on customer experience and inclusion.

Adopt positive regulatory strategy that engages with providers.

Prioritize outcomes to deliver strategy planning and implementation e.g. EV charging infrastructure.

Pilot schemes for autonomous mass transit, demand-responsive buses and integrate with new operations center.

Integrate CAV solutions and electric mobility opportunities to improve customer experience.

CITY MOBILITY OBJECTIVES

Edinburgh will have a cleaner, safer, more inclusive and accessible transport system delivering a healthier, thriving and fairer capital city, and a higher quality of life for citizens.

Graham Hill,
Arcadis City Executive, Edinburgh

EDI

HONG KONG

CITIZEN CONNECTION

- Air pollution is amplified by emissions from commercial fleets which are mostly diesel-fuelled.
- Some perceptions that technology may inflict severe job losses.
- 90% of trips made by public transport. Some see CAV as the "problem of others" which could lead to reluctant adoption of some CAV forms.
- Ride sharing schemes have been well-received among the younger generations despite regulatory limitations in place.

"Hong Kong is long overdue embracing digital innovation in its transportation system."

_Citizen of Hong Kong

GOVERNANCE PLATFORMS

- Smart City blueprint mentions CAV but no legal framework or concrete plans yet. Data and smart traffic management systems are prioritized over CAV.
- HKD$50bn has been allocated to development of the city's technology and innovation industry generally.
- CAV currently being tested in West Kowloon Cultural District and will be tested in restricted areas of the airport and other suitable locations.
- Sharing schemes are legal, but the carriage of passengers for hire or reward without a permit outlaws many operations.

"Smart Mobility is an important element for Hong Kong's development into a smart city."

_Carrie Lam, Chief Executive of Hong Kong

ENABLING INFRASTRUCTURE

- Constrained road environment presents potential challenges for CAV.
- Extensive investments in advanced traffic systems, data collection and sensors.
- Significant adoption of EV and ambitious targets for 30% by 2020.
- Integrated public transport ticketing system with high pick-up of electronic payment methods.
- Electronic Road Pricing (ERP) Pilot Scheme with implementation strategy for the near future.

"CAV have the potential to address some of Hong Kong's urban challenges and improve the city's livability."

_Francis Au, Arcadis Head of Hong Kong & Macau

A city where an efficient metro and nostalgic transport modes have strong influence on CAV adoption.

Over 12.6m passenger trips daily.

Over 70% of registered vehicles are private cars.

Number of days when smog posed a high health risk doubled in 2017.

Population is expected to reach a peak of 8.22m in 2043.

EV charging infrastructure is in its infancy.

ARCADIS RECOMMENDATIONS

Further understand attitudes and appetite for CAV as part of future strategy development.

Building on existing success, look to extend technological developments to create MaaS offering.

Encourage further engagement with the private sector to accelerate innovation in mobility.

Give further consideration to legal framework that may, or may not, support development of CAV.

Consider research into CAV-technology to ensure adopted systems align with existing programs of investment.

Consider how existing initiatives can integrate to create MaaS offer that further enhances citizen mobility experience.

CITY MOBILITY OBJECTIVES

To accelerate advocacy for CAV adoption the city needs a framework that strikes a balance between the interest of transport operators, passengers and technology, with a focus on 'first and last mile' connection around metro stations.

Francis Au,
Arcadis Head of Hong Kong & Macau

HKG

LONDON

A city with a focus on healthy streets and emergent approach to taking advantage of CAV disruption.

27.1m passenger trips a day.

54% of households have at least one private motor vehicle.

Over 4m people regularly use ridesharing apps.

An EV charging infrastructure taskforce has been launched.

Greater London's population is expected to grow by 0.7% per year to 2046.

CITIZEN CONNECTION

- There is widespread support for the pursuit of healthier streets in London.
- Many citizens perceive mobility to be less affordable than in other cities.
- Sharing services continue to proliferate, with citizen engagement seeing year-on-year growth.
- Citizens have concerns around how CAV could adversely impact city life in relation to jobs and safety.
- Dockless bicycle-sharing schemes have been met with mixed reaction.

"I am really excited about the prospect of CAV helping to further improve air quality in London."

_Citizen of London

GOVERNANCE PLATFORMS

- The Centre for Connected and Autonomous Vehicles (CCAV) working to make the UK a premier development location, providing over £250m in funding.
- Legislation and codes of practice in place nationally for testing.
- Mayor of London and London Assembly Transport Committee have released Future Transport report on CAV.
- Transport for London are focused on connected citizens rather than just CAV.
- CAV being tested in Greenwich as part of a wider trial led by the Transport Research Laboratory and the Government.

"The shift away from the private use of cars will be vital in creating a future London that is not only home to more people, but is a better place for all those people to live in."

_Mayor's Transport Strategy

ENABLING INFRASTRUCTURE

- Program for EV charging infrastructure rollout but more scale required to support wider proliferation.
- The Oyster Smartcard provides an integrated ticketing system for public transport.
- Planning is decentralized.
- Advanced use of intelligent traffic systems.
- Congestion charging illustrates potential for road charging to manage demand.

"As London moves towards mega city status by 2040, mobility challenges will be ever present. How the city embraces CAV will be a key fork in the road, that will either enhance or frustrate city performance."

_Peter Hogg, Arcadis City Executive, London

ARCADIS RECOMMENDATIONS

Engage citizens to support the development of sharing services to improve customer experience and value.

Define, in partnership with citizens, what part CAV may or may not play in realising London's mobility objectives.

Broaden testing activities to inform the plan for how CAV may contribute to London's mobility mix.

Engage with private sector to deliver CAV solutions that deliver on London's objectives.

Identify CAV opportunities in connection to public transport and foster pilot schemes.

Consolidate infrastructure planning to streamline achievement of supporting aspects to the London Plan.

CITY MOBILITY OBJECTIVES

Transform London's streets, improve public transport and create opportunities for new homes and jobs through encouraging more people to walk, cycle and use public transport by 2041.

Peter Hogg,
Arcadis City Executive, London

LDN

LOS ANGELES

CITIZEN CONNECTION

- Widespread stigmatization of public transport networks partly as a result of poor connectivity and reliability.
- Weak ridesharing culture dominated by private vehicles rather than public transport.
- Increasing adoption of EV – 3.5% of new cars are electric.
- Citizens voted in favor of a sales tax solely for transportation projects, a testament to the investment wanted in mobility.

"I'm looking forward to seeing what the future of driverless cars will be for a disabled senior like me. Driving gives me a sense of independence and freedom. I'm hoping this technology becomes mainstream soon."

_Citizen of Los Angeles

GOVERNANCE PLATFORMS

- Complex transport network with many different authorities.
- Federal Automated Vehicles Policy driving a safety focused approach to CAV.
- Requirement for 'standby drivers' dropped in 2018 - vehicles can be operated remotely.
- The city is incentivizing adoption of EV and associated infrastructure.
- Urban Mobility Strategy is focused on data, MaaS and the idea that public infrastructure should be subject to pay-as-you-go fees.

"The scale of the city makes it difficult to realize the cumulative impacts of these innovations without a focused approach."

_LA Urban Mobility In a Digital Age City of Los Angeles Department of Transportation (LADOT)

ENABLING INFRASTRUCTURE

- Fragmented management of highly complex transport infrastructure.
- Roadmap in place to develop a CAV road network and convert the public transit fleet to full automation.
- Support for EV investment through the California Capital Access Program.
- Autonomous bus trial planned for 2020.
- Plans for fixed smart infrastructure.

"Cars are part of our culture - unfortunately, so is congestion. CAV could change the transport narrative. It's part of the solution to move people and goods more efficiently."

_Macaria Flores, Arcadis City Executive, Los Angeles

A city aiming to increase public transport use through CAV.

700 cars per 1,000 residents – cars account for 85% of the modal split.

71% of trips are in single occupancy vehicles.

100 vehicle accidents per day.

Growth in metro network – 116 stations by 2035.

ARCADIS RECOMMENDATIONS

Identify opportunities for CAV to align with the safety agenda and encourage wider adoption of different transit modes.

Develop CAV pilots which will raise shared transport efficiency and encourage citizens to switch away from single-car occupancy.

Identify opportunities for public/private mobility services in autonomous as well as electric mobility schemes.

Align future regulatory framework with proposed federal legislation for CAV.

Integrate CAV solutions and electric mobility opportunities to improve customer experience and program delivery.

Develop MaaS to integrate sharing schemes and public transport and incentivize switch away from private car ownership.

CITY MOBILITY OBJECTIVES

Infrastructure as a service and urban mobility in a digital age by 2035.

Macaria Flores,
Arcadis City Executive, Los Angeles

LA

MELBOURNE

A city exploring CAV as an alternative to costly mass transport infrastructure.

Over 1.5m passenger trips every day.

51% of households in Greater Melbourne have access to two or more motor vehicles.

Melbourne is a technology hub with more than half of the top 20 technology firms.

Population expected to grow by almost 1.7% annually to 2031.

CITIZEN CONNECTION

- High use of private cars but in the center of Melbourne, car ownership and use is declining.
- Satisfaction with public transport is improving.
- The number and use of ridesharing services has expanded significantly.
- Citizens have not shown large appetite for bikesharing and one operator has exited the market.

"Congestion is getting worse, so if CAV can be used to improve traffic, I'm all for it."

_Citizen of Melbourne

GOVERNANCE PLATFORMS

- Clear strategy aiming to tackle private car dependency by 2030.
- National policy incentivizing CAV is developing. Victoria Government has legislated support for testing and provided AUS$9m for expansion of trials.
- Government has emphasized potential safety benefits of CAV.
- Positive environment for public/private initiatives.
- Infrastructure Victoria has released a report outlining future scenarios for automated and zero emissions vehicles.

"Our 30-year infrastructure strategy identified autonomous vehicles as being one of the greatest uncertainties for the transport system. We are pleased to be able to build on our existing work to look more deeply into this transformative field."

_ Michel Masson, Chief Executive Officer, Infrastructure Victoria

ENABLING INFRASTRUCTURE

- Public transport is near full capacity.
- Infrastructure networks in need of investment and improvement but scale of the city region is a challenge to affordable development.
- The Myki Smartcard provides an integrated ticketing system for public transport.
- Limited infrastructure for EV charging.
- Advanced transport management systems are in place.
- 5G rollout is planned.

"Not only will CAV transform the way Melbourne's citizens get around, but it will have implications for how land is used, opening up new opportunities to further improving quality of life."

_Pru Sanderson, Arcadis City Executive, Melbourne

ARCADIS RECOMMENDATIONS

Engage with citizens to further build engagement with CAV.

Move faster with CAV trials to create an integrated MaaS offer for citizens that out-competes private car use.

Revisit transport strategy in relation to car-sharing and CAV-based models.

Continue to engage private sector to deliver on plan at pace and scale.

Identify pilot schemes in mass autonomous, demand-responsive buses to create opportunities for efficiency gains in public transport.

Review EV charging pricing structures as a prelude to CAV proliferation and decarbonization of private cars.

CITY MOBILITY OBJECTIVES

Prioritize and increase the use of public transport, walking and cycling and create mobility that is more competitive than the private car; with a focus on current and future land use to create a high quality public realm; by 2030.

Pru Sanderson, Arcadis City Executive, Melbourne

MEL

NEW YORK

CITIZEN CONNECTION

- An innovative city with a tech sector similar in scale to Silicon Valley.
- Has the lowest rate of vehicle ownership in U.S. cities.
- Bicycle and ridesharing schemes have seen huge growth.
- 6,000 miles of streets and 77% of space is occupied by cars, meaning CAV provides an opportunity to 'reclaim streets'.
- MaaS can act as a disruptor in a city which is fundamentally both a mass transport and walking city.

" New York is such a big and dense city that it's a great place to test mobility innovations."

_Citizen of New York

GOVERNANCE PLATFORMS

- Federal Automated Vehicles Policy driving a safety driven approach to CAV.
- 2018 city law will allow CAV testing on roads. New York has its own CAV testing registration scheme, running to 2019.
- CAV seen as potential tool in meeting "Vision Zero" goals to reduce crash related injuries.
- One of three CAV pilot deployment sites selected to demonstrate benefits.
- CAV acceleration aligned to policy objective to increase adoption of ride-sharing.
- Tax credits to incentivize installation of EV charging stations.

"By helping develop the infrastructure necessary for electric vehicles, we're going to make it easier than ever for New Yorkers to switch."

_Bill de Blasio, Mayor of New York City

ENABLING INFRASTRUCTURE

- Limited curb and road space emphasizes the need for high-occupancy vehicles.
- Management of infrastructure split across multiple agencies.
- On-going program to install rapid EV charger hubs in all boroughs by 2018.
- Broadband connectivity needs to improve. Governors' Island Connectivity Challenge driving 5G innovation.
- Advanced traffic management system being expanded.

"CAV potentially offers the opportunity to alleviate congestion and create development that is more inclusive and sustainable."

_Peter Glus, Arcadis City Executive, New York

A city looking to increase transit choices with CAV.

2.4bn passenger trips per year.

62% of journeys use sustainable modes.

33% of New Yorkers are using ridesharing services.

Taxi trips in decline but ridesharing services driving overall growth in shared mobility services.

Average travel speed across the city has been declining since 2012.

ARCADIS RECOMMENDATIONS

Encourage alignment of innovative MaaS propositions with existing travel behaviors.

Develop incentives to switch away from private car ownership to mitigate risk of increased congestion.

Extend AV testing regime beyond 2019 to provide greater clarity to investors.

Align future regulatory framework with proposed Federal Legislation for CAV.

Consider streamlining transport agencies that could be disrupted by CAV.

Accelerate the rate of investment in EV and 5G infrastructure aligned to the ridesharing market

CITY MOBILITY OBJECTIVES

Safe, green, smart and equitable solutions to improve safety, health and expand travel choices.

Peter Glus
Arcadis
City Executive, New York

NYC

PARIS

CITIZEN CONNECTION

- Effective public-funded mass transport satisfies most citizen needs, in the densest areas.
- Citizens show willingness to adopt new modes of transport, for example eBikes and CityScoot.
- Early publicly-backed models for bike and ridesharing are transitioning to new, improved business models.
- Air quality issues are a major driver of mobility policy – the European Commission has taken France to court over air quality in Paris.

"We aspire to a better environment and a better quality of life, but we also need to get from A to B. Will autonomous vehicles help us reconcile our needs and our aspirations?"

_Citizen of Paris

GOVERNANCE PLATFORMS

- Transport strategy is primarily focused on increasing use of public and human-powered modes of transport.
- Priority to reduce congestion and pollution with elimination of private diesel-fuelled vehicles by 2024 and all motor vehicles by 2030.
- National support and €100m plan by the Paris Region to prepare roads for CAV.
- Electric Mobility Program to deploy car-sharing EV fleet and move towards CAV.

"We need to reconsider our roads for CAV. A new service infrastructure could make Paris the city of new mobility."

_Jean-Louis Missika, Deputy Mayor of Paris

ENABLING INFRASTRUCTURE

- Grand Paris Express is a transformational investment for Paris and supports development of multimodal transport.
- Strong support for EV innovation from French businesses.
- A drive to expand EV charging network to 20,000 points.

"New forms of mobility offer tremendous opportunity for Paris, but their success depends on a strong and smart public policy framework."

_Nicolas Boffi, Arcadis City Executive, Paris

A city continuing large-scale public transport investments to drive innovation.

2.3bn journeys by public transport each year.

Over 65% of inner Paris residents don't own a car.

34% of journeys in Greater Paris are human-powered.

Early adopter of ridesharing.

City has the ability to ban vehicles on alternate days to reduce pollution.

ARCADIS RECOMMENDATIONS

Raise CAV acceptability among citizens by tailoring pilots to focus on customer experience.

Facilitate joined-up multi-mode transport by developing MaaS.

Capitalize on the early presence of CAV on roads to build the safety and sustainability case.

Reduce single-car dependency by enhancing public/ private Partnership ridesharing schemes with CAV capability.

Prioritize Big Data and the roll-out of 5G through the Smart Region Initiative.

Integrate CAV solutions and electric mobility opportunities into the Grand Paris Express and future investments for road infrastructure.

CITY MOBILITY OBJECTIVES

Sustainable balance between mobility, safety, quality of life and environment.

Nicolas Boffi, Arcadis City Executive, Paris

PAR

SAN FRANCISCO

A city as a mass CAV lab in a car-orientated mobility market.

1m car trips and 600,000 passenger trips per day.

15% of vehicle trips by ridehail and ridesharing services (12x the number of taxi trips).

Car use in the city core area will increase by 30% by 2040 without intervention.

50 businesses licensed in California to test CAV technology.

CITIZEN CONNECTION

- A car-orientated mobility market with access to mature and diverse ridesharing services.
- CAV are a common sight in the city. Remote driving under test conditions is acceptable.
- Dominant tech sector brings in a high appetite for new technologies.

"San Francisco is home to so many tech firms that it really is the obvious place to develop new mobility solutions."

_Citizen of San Francisco

GOVERNANCE PLATFORMS

- Federal Automated Vehicles Policy driving a proactive safety focused approach to CAV.
- Requirement for 'standby drivers' dropped in 2018. Ability to operate remotely required.
- Guiding principles for CAV adoption have been developed, focused on the needs of citizens.
- Transit-first policy aims to use CAV to fill gaps in existing transit networks.
- State government offers tax incentives to CAV organizations.

"Infrastructure is made in a way for humans to interact with. Now that's going to have to change. Infrastructure will interact with a machine."

_Elliot Katz, co-founder of Phantom Auto

ENABLING INFRASTRUCTURE

- Fragmented management of transport infrastructure under pressure from growth in the city.
- Support EV investment through the California Capital Access Program (CCAP).
- 5G roll-out planned for 2019-20.
- CAV pilot planned for Treasure Island based on driverless shuttles.

"A lot of the AV technology developments originate right here in Silicon Valley. I am excited about using the technology firsthand."

_Peter Wijsmann, Arcadis City Executive, San Francisco

ARCADIS RECOMMENDATIONS

Develop MaaS to integrate ridesharing schemes and public transport and incentivize switch away from private car ownership.

Maintain early mover advantage associated with field trials of mass CAV.

Capitalize on innovative approach to testing remotely-controlled CAV.

Align future regulatory framework with proposed federal legislation for CAV.

Integrate CAV solutions and electric mobility opportunities to improve customer experience and program delivery.

Consider streamlining of transport agencies that could be disrupted by CAV and prioritize outcomes.

CITY MOBILITY OBJECTIVES

Incorporate CAV in an expanded offering of shared mobility services in line with a transit-first policy for a sustainable and equitable outcome by 2024.

Peter Wijsman, Arcadis City Executive, San Francisco

SFO

SINGAPORE

A city leading in alternative modes of mobility as part of its Smart Nation vision.

Over 8m passenger trips a day.

Citizens spend almost 90 minutes every day on public transport.

In 2015, there were almost 1m motor vehicles; 50% private cars.

One of the world's most active CAV testing environments.

CITIZEN CONNECTION

- CAV concept broadly accepted by citizens of Singapore.
- Increasing acceptance of ridesharing schemes.
- High level of digital maturity boosted by a number of public/private joint initiatives.
- Focus on CAV for 'first and last mile' in regional transit.
- EV still lack popularity amongst individual car owners due to price considerations.

"As our population grows and the roads become more congested, CAV technology is the clear solution for future urban mobility challenges."

_Citizen of Singapore

GOVERNANCE PLATFORMS

- Committee on Autonomous Road Transport for Singapore (CARTS) coordinates all CAV initiatives.
- Active testing; center for CAV testing opened in 2016 and a MaaS Lab at NTU/Jurong.
- The Government plans to have self-driving buses and shuttles on public roads by 2022.
- Targeting a 10 fold increase of EV in ridesharing and taxis by 2020.

"CAV is especially promising for Singapore because it can help alleviate the tight land and manpower limits that currently constrain our land transport system."

_Mr. Khaw Boon Wan, Minister for Transport

ENABLING INFRASTRUCTURE

- Very high quality road and communications network.
- Open-data based analytics helped reduce overcrowding on buses by 92%, even with growing passenger numbers.
- Accelerating density of EV charging stations with 10 fold increase by 2020.
- Scarcity of land for development: 12% of land currently used for parking and roads.

"We are moving toward a future where the general public has an increasing acceptance of CAV. However, there is still a long way to go, such as addressing perceived safety concerns to enable integration with other modes of transport."

_Tim Risbridger, Arcadis Country Head, Singapore

ARCADIS RECOMMENDATIONS

Incentivize the switch away from private car ownership to sharing models of mass modes of transport.

Engage and educate the community to build awareness and gain wider acceptance of CAV.

Develop technologies required to deliver a reliable CAV system that can be safely incorporated into living environments.

Unify CAV regulation with other digitalization initiatives.

Urban planning required to ensure infrastructure and systems are future-proofed to accommodate and facilitate future CAV systems.

Continue to work with the private sector to enhance the availability of EV charging infrastructure.

CITY MOBILITY OBJECTIVES

Accelerate and leverage sustainable, cost-effective technologies to provide safe and reliable green transportation to achieve a car-light Singapore.

Tim Risbridger
Arcadis
Country Head, Singapore

SIN

SYDNEY

CITIZEN CONNECTION

- High levels of private car ownership and use – will citizens embrace a CAV-based sharing economy?
- Current evidence points to strong engagement, rollout and effectiveness of ridesharing services. 91% of users are satisfied or very satisfied with ridesharing services.
- Upcoming trials of CAV across Sydney will influence citizen views.
- New South Wales (NSW) has a well developed university research base in CAV-related fields.

"Improved road safety will be the greatest benefit of CAV, followed by unlocking the productivity of people who now spend time driving."

_Citizen of Sydney

GOVERNANCE PLATFORMS

- NSW Government has legislated support for CAV testing and provided AUS$10m to support expansion of trials.
- While the National and NSW Governments are taking positive steps towards CAV preparedness, the absence of a single regulatory authority or framework may require addressing.
- NSW has the Smart Innovation Center, Future Transport 2056 strategy and Minister for Innovation and Better Regulation.
- There is a positive environment for the curation of public/private initiatives. Transport for NSW is working with industry partners to deliver a two-year CAV trial.

"Australian governments are working together to make sure automated vehicles can be legally and safely used when they are available for purchase in Australia."

_Australian Government, Department of Infrastructure, Regional Development and Cities

ENABLING INFRASTRUCTURE

- A first for Australia, the metro in Sydney will be fully automated and driverless.
- There is limited EV charging infrastructure.
- The Opal Smartcard provides an integrated ticketing system for public transport.
- Planning is decentralized.
- An integrated transport management center responds to network demand across all current travel modes.
- Strategy in place for future 5G rollout.

"The critical first step is envisioning the autonomous future we want, so we can put the frameworks in place to deliver it."

_Stephen Taylor, Arcadis City Executive, Sydney

A city preparing for CAV.

Over 1.6m passenger trips on public modes every day.

High car ownership with 1.8 cars per household.

37% of citizens used a rideshare service in 2017.

Population expected to grow by almost 1.5% annually to 2036.

Uptake of EV slow and charging infrastructure lacking.

ARCADIS RECOMMENDATIONS

Build on the success of existing ridesharing services and citizen goodwill to consolidate support for CAV-based mobility.

Move at pace with CAV trials and combine with existing integrated ticketing schemes to create an integrated MaaS offer for citizens.

Identify the roadmap to deliver the intended outcomes of the transport strategy.

Continue to engage private sector to deliver the plan at pace and scale.

Review EV charging pricing structures as a prelude to CAV proliferation and decarbonization of private cars.

Consider centralizing planning for CAV-enabling infrastructure.

CITY MOBILITY OBJECTIVES

Create a successful city with a strong economy and customer focused, safe, accessible and sustainable mobility by 2056.

Stephen Taylor, Arcadis City Executive, Sydney

SYD

DRIVE
_DRIVING YOUR FUTURE

Although the 14 cities are very different, it is possible to identify some common themes.

Around the world, cities are aiming for mobility functions that deliver many of the following outcomes:

Healthy and safe.

Reducing the potential for harm to pedestrians and passengers, and promoting health and wellbeing of the population.

Citizen-centric.

Focusing on the needs of citizens and consistently delivering an exceptional passenger experience.

Green and sustainable.

Minimizing adverse impacts on the environment, improving air quality and being sustainable to operate for the long term.

Accessible.

Improving social and economic equality, and being available to all.

Investible.

Supporting economic growth and attractiveness to inward investment.

Smart and fit for the digital age.

Leveraging digital technology and innovation to enhance efficiency and effectiveness.

The appropriate application of CAV for each city has the potential to positively influence all these outcomes. Yet at the same time, each city is at a different stage of the journey.

Progress towards a fully operational CAV environment is at different levels of maturity across the globe, and this will impact the steps a city must take to successfully achieve its mobility objective and enhance its attractiveness for growth.

HOW CAN CITIES EVERYWHERE SEIZE THE CAV OPPORTUNITY?

Citizen engagement.

Engage with the population to gauge appetite and build confidence in CAV solutions.

Encourage ridesharing.

Ridesharing services, enabled by digital platforms but operated by humans, are an important step towards the proliferation of CAV – many CAV solutions will operate this way.

Incentivize, regulate and license.

Create the environment for CAV solutions to operate, thrive and deliver good outcomes for all.

Pilot testing.

Enabling CAV testing in your city is an important step to exposing citizens to its benefits as well as developing CAV solutions that are suitable for the cityscape and encouraging CAV companies to focus on your city.

EV charging.

CAV can only deliver on many of the desired outcomes if electrically powered. As a result, the development of comprehensive EV charging infrastructure, charge points and supporting electricity distribution and generation is a critical enabler.

Build CAV into the city planning process.

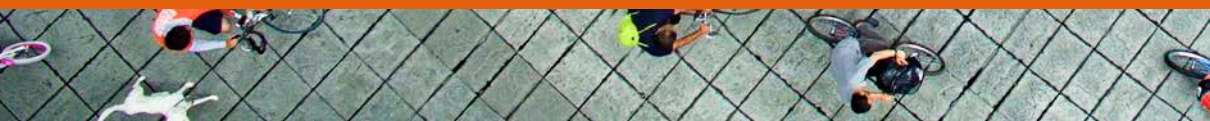
CAV will have an impact on the buildings and infrastructure of cities. If the MaaS vision of CAV is realized, fewer car parks will be needed, for example. Similarly, CAV could supplement the operation of mass transit in suburban areas. Planning for the impact of CAV now will help enable its development.

Engage with the private sector.

Engaging with private sector providers to ensure CAV arrives in a planned way - tailored for the city - is key to achieving the right outcomes for citizens.

Work towards MaaS.

Build on existing initiatives to provide MaaS and integrate CAV with other modes of transport.
This is a crucial element of realizing many of the benefits of CAV.



It is clear the emerging CAV revolution provides a new frontier of disruption in city mobility. The power of big-tech players means that the march of CAV is an inevitability. However, cities do not have to be supplicants and can proactively respond to CAV disruption in a way that works best for them and their citizens.

For cities that proactively shape CAV to meet their needs and ambitions, it offers a colossal opportunity to improve mobility outcomes. For those that do not, it threatens to disrupt the status quo and could damage a city's ability to compete if not harnessed in the right way.

Are you seizing the CAV opportunity to better meet your mobility objectives and improve quality of life?

ARE YOU DRIVING THE

FUTURE OF YOUR CITY'S MOBILITY?

_ REFERENCES

.id

ABC News

Amsterdam Smart City

Amsterdam.nl

ATSE

Australian Government

Autovista Group

BBC

Berlin.de

Bloomberg Aspen Initiative on Cities and Autonomous Vehicles

Brussels Institute for Statistics and Analysis (BISA)

Brussels Smart City

Business Insider

Business Times

California State Treasurer

CityLab

Culture Trip

Curbed LA

Data USA

Data.gouv.fr

Data.gov.sg

Deloitte

Digital Trends

Dubai Future Foundation

Dubai World Challenge for Self-Driving Transport

Dutch Mobility Innovations

Edinburgh University

Edinburgh.gov.uk

Electrek

Engadget

EY Sweeney

Federal Government of Germany's "Electric Mobility Showcase"

Financial Review

Financial Times

Fleet News

Gateway-project.org.uk

Gov.scot

Government of Dubai: Road and Transport Authority (RTA)

Government of the Netherlands

GovTech.com

GovTrack.us

Gulf News

Herald Sun

Highsnobiety.com

Hong Kong Smart City Blueprint

HongKong.net

Iamsterdam.com

iMOVE Cooperative Research Centre (CRC)

Independent

Infrastructure Victoria

INRIX Global Traffic Scorecard

Institut d'aménagement et d'urbanisme de la région Île-de-France (IAU)Invest Edinburgh

Invest Victoria

Investitionsbank Berlin (IBB)

Ipsos

KPMG

Land Transport Authority

London.gov.uk

Los Angeles Department of City Planning

Los Angeles Department of Transportation (LADOT)

Louisiana Department of Transportation and Development (DOTD)San Francisco Committee on Information Technology

MBC Research

Melbourne.vic.gov.au

Metropolitan Transportation Authority

Mobilit.belgium.be

Moovit Public Transport Index

NBC

New York City Department of Transportation

New York State Department of Motor Vehicles

New York State Department of Taxation and Finance

New York State Energy Research and Development Authority (NYSERDA)

Newmobility.news

News.com.au

Newsweek

NYC.gov

Office of the New York State Comptroller

Paris.fr

Paris2024.org

Parliament of Victoria

Plan de Déplacements Urbains Île-de-France

Provision of Electric Vehicles in HK

Public Transport Research Group (PTRG)

Public Transport Victoria

Regional Plan Association

Reuters

Roads Australia

San Francisco County Transportation Authority

San Francisco Department of the Environment

San Francisco Municipal Transportation Agency (SFMTA)

Shrinking the Carbon Footprint of Metropolitan America, by Marilyn A. Brown, Frank Southworth and Andrea Sarzynski

Singapore Government

Smart Dubai 2021

Smart Nation Singapore

Social Indicators of Hong Kong

Société du Grand Paris

South China Morning Post

Southern California Association of Governments (SCAG)

State of California Department of Motor Vehicles

Stib-mivb.be

Sustainable Edinburgh

Sydney.org.au

TeleGeography

Telegraph

The Australian

The Center for an Urban Future (CUF)

The Committee on Energy and Commerce

The Federal Ministry of Transport and Digital Infrastructure (BMVI)

The German National Platform for Electric Mobility (NPE)

The Government of New South Wales

The Government of the Hong Kong Special Administrative Region

The Guardian

The International Council on Clean Transportation (ICCT)

The London Assembly

The Los Angeles Transportation Technology Strategy

The Sydney Morning Herald

The United Nations Economic Commission for Europe (UNECE)

The Verge

TheConversation.com

TODAY

Transport for London

Transport Scotland

U.S. Department of Transportation

Uber

Urban Transportation Innovations Worldwide: A Handbook of Best Practices Outside the United States, edited by Roger L. Kemp, Carl J. Stephani

Victoria State Government

Virgin Hyperloop One

Vision Zero

Westfälische Rundschau

WhatsOn.ae

Wired

World Population Review

ZDNet

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