WSP

New Mobility Now

Foreword

"New Mobility", the bundle of transport, technology and mobility changes that will become the bedrock of future transport systems, is already transforming the way we move around, live and interact with each other.

The opportunity offered by New Mobility is significant and highly valuable, particularly to city and area leaders, place-makers, transport network owners, mobility and technology providers.

The major challenge is that multiple changes are in motion and a range of outcomes are possible. Each city, suburb and rural area is entirely distinct; each one has a unique starting point and specific needs. But all have one thing in common: potential.

It is time for a new focus on the "now" of New Mobility.

In our view, there is consensus around the long-run outcomes and benefits offered by New Mobility for all types of places and routes, from land value uplift to safety, and from cleaner air to network efficiency.

This White Paper shares our thinking about how to make sense of New Mobility changes, across a range of contexts, to form a practical plan of action. We are passionate about finding ways to help you make the most of New Mobility Now.

Those who engage early and with a clear plan will benefit most.

To help with this, we have created a structured approach based around **four distinct strands** of New Mobility change and one **key enabler**. These are all in motion, now, across the world, and they each bring distinct benefits and opportunities:

• Progress towards vehicle *automation* (including driverless vehicles)

• Distinct from this, the evolution towards *connected* vehicles, transport systems and networks

• Increasing appetite for *shared* use (for example, via 'mobility as a service' models)

• Increasing public interest in, and a shift towards, *electric* vehicles

In combination, these four strands of change could take our transport networks and places towards many different futures for our transport networks and places. Leaving these changes to market forces alone is a high risk strategy that will not generate the best wider outcomes.

If we are to create New Mobility futures that are popular, fair and sustainable, we see that a fifth strand – **business models and revenue generation** – is likely to play the core enabling role, encouraging collaboration between the public and private sectors, and influencing the direction and speed of change across all four areas listed above.

If you are interested in learning more about New Mobility in your region, we can offer valuable insights for different markets around the world that go well beyond the information included here. We would be delighted to share more of these with you – please do get in touch with our team at NewMobility@wsp.com.

In the meantime, thank you for taking the time to read this White Paper. We hope you find it useful and look forward to your feedback.

David McAlister,
Global Director Transport & Infrastructure

Who should read this?

This document is written to support all those who are – and want to be – involved with bringing transport and place-making change through future mobility.

- *Technology firms* who are seeking to bring new solutions to market or broaden their reach and market penetration

- *National, regional and local government organizations* who act as stewards or guardians of our places and communities and, in some cases, also have responsibility for transport network and system operations

- *Transport network or system operators*, often working with public sector organizations, who may wish to understand how the wider mobility landscape may change in the future

- *Investors, developers and strategic land-owners* who are seeking ways to maximize their uplift in value from future development and regeneration

- *Researchers* seeking to understand markets and where to focus their efforts or where to seek collaboration
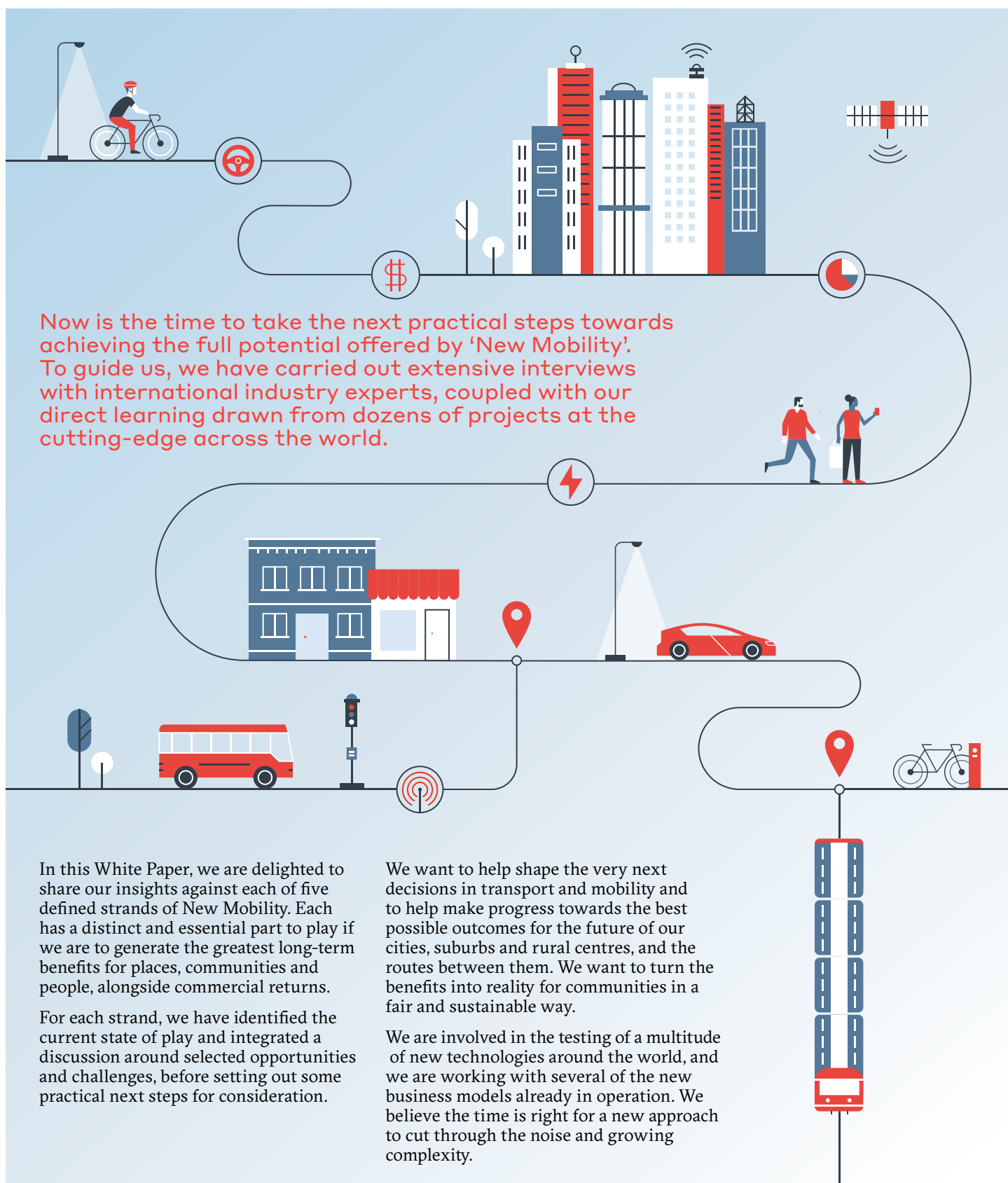
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Contributors

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- Canadian Automated Vehicles Centre of Excellence *(Canada)*

- Canadian Urban Transit Association *(Canada)*

- City of Gothenburg *(Sweden)*

- City of Las Vegas *(US)*

- City of Mississauga *(Canada)*

- City of Toronto *(Canada)*

- Colorado Department of Transportation *(US)*

- Conference Board of Canada *(Canada)*

- Connect East *(Australia)*

- Department for Transport *(UK)*

- Department of Planning, Transport and Infrastructure *(Australia)*

- Department of Transport and Main Roads Queensland *(Australia)*

- DriveNow *(UK)*

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- First Group *(US/UK)*

- Gnewt Cargo *(UK)*

- Insurance Australia Group Limited *(New Zealand)*

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- MaaS Global *(Finland)*

- Main Roads Western Australia *(Australia)*

- Maryland Department of Transportation *(US)*

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- Royal Automobile Club *(Australia)*

- Surrey County Council *(UK)*

- Taunton Deane Borough Council *(UK)*

- Telstra *(Australia)*

- Toronto Transit Commission *(Canada)*

- Transport for Greater Manchester *(UK)*

- Transport for London *(UK)*

- Transport for New South Wales *(Australia)*

- Transport Systems Catapult *(UK)*

- Transurban *(Australia)*

- Volvo *(Sweden)*

- Uber *(UK)*

- University of Michigan Transportation Research Institute *(US)*

- University of Toronto *(Canada)*

- Utah Department of Transportation *(US)*

- VicRoads *(Australia)*

New Mobility Now

Now is the time to take the next practical steps towards achieving the full potential offered by 'New Mobility'. To guide us, we have carried out extensive interviews with international industry experts, coupled with our direct learning drawn from dozens of projects at the cutting-edge across the world.

In this White Paper, we are delighted to share our insights against each of five defined strands of New Mobility. Each has a distinct and essential part to play if we are to generate the greatest long-term benefits for places, communities and people, alongside commercial returns.

For each strand, we have identified the current state of play and integrated a discussion around selected opportunities and challenges, before setting out some practical next steps for consideration.

We want to help shape the very next decisions in transport and mobility and to help make progress towards the best possible outcomes for the future of our cities, suburbs and rural centres, and the routes between them. We want to turn the benefits into reality for communities in a fair and sustainable way.

We are involved in the testing of a multitude of new technologies around the world, and we are working with several of the new business models already in operation. We believe the time is right for a new approach to cut through the noise and growing complexity.

New Mobility Now

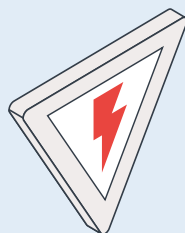## *What is really changing?*

We use the term 'New Mobility' to draw together visible change across five specific themes that are already under way, to varying degrees, around the world.

These themes are featured increasingly at the heart of today's transport and mobility change. We expect them to play a continued key role in determining the form and function of transport systems and place-making in the future.

Four of these areas relate to changes in technologies that are emerging and, in some cases, already in use across the world. The fifth strand relates to the enabling potential of new business models and revenue generation, which will almost certainly play a key role in influencing and cementing change across all of the four areas above.

Automated driving

Sometimes described as 'driverless' but with many levels of actual automation in practice, automated technologies have been emerging for decades and will increasingly affect all types of light and heavy vehicles.

Connected vehicles transport systems and networks

New and existing forms of connectivity offer the potential for far greater use of safety related features, as well as real-time and off-line information which will benefit those using the network and those who are responsible for its operation and maintenance.

Business Models

This element is critical to cost – both actual and perceived – and the ability to create change that will stand the test of time. It requires imaginative, fast and decisive action.
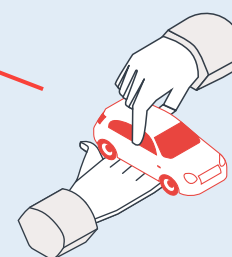
Electric vehicles

Political support for a move away from internal combustion engines and towards electric vehicles and other future forms of propulsion is gaining momentum around the world as the local and wider air quality impacts of petrol and diesel vehicles are better understood.

Shared use

This bundle lies at the heart of place-making change and relates specifically to vehicle ownership models, and to the extent to which we might be prepared to move towards shared mobility and away from private car ownership.

New Mobility Now   *Long-Term Visions*

There is widespread agreement that transport and mobility change has the potential to improve conditions for growth and returns to both private and public sector.

We know that we all want to create and sustain places where we love to live and work, and we know that we want to move between and within them. These headline goals sit at the heart of most long-term visions for future places, mobility, transport networks and systems.

This ambition fits well with the approach being taken by governments around the world where there is pressure to generate economic growth and improve productivity, while accommodating more people.

Having a vision is essential, as it gives a direction of travel, but it is not enough. We don't have all of the answers, but we are certain that a detailed plan is also needed, for the following reasons:

- *A wide range of 'New Mobility' outcomes are possible, both good and bad*. Winners and losers will vary under different circumstances. We all want the "good" and want to avoid the "bad", but mapping a route towards the best outcomes for all (both private and public sector) will demand active management, collaboration and investment.

- *One size cannot fit all*. Each town, city and country has a different start-point and context. The details of legal, political, economic, technological, environmental, social and ethical considerations matter, and will affect what is possible and desirable.

- *New Mobility changes are happening in parallel on several distinct fronts*. In our view, it is strategic yet short term decisions made across the five specific themes we have identified that will determine success or failure in the longer run.

What we all want from new mobility

- Emphatically, new mobility is *not mobility for its own sake*

- *Affordable* and *economically sustainable*, long-run solutions to allow investment and maintenance

- *Profitable* for private sector investors and technology firms, working collaboratively with national and local governments

- *Healthy, high quality experience* for all network users, including pedestrians and cyclists

- Maximum *value* and potential created for *places*, existing and future, through land use change and efficient connectivity

- Best use made of *existing infrastructure*. Long-run solution will work with what we have rather than rebuilding everything

- *Safe* and *easy to use*, for everyone of any age

- Operationally *efficient*, with roads-based services complementing mass transit corridors

- *Clean* and non-polluting

- *Attractive* and *popular* solutions that the travelling public choose to use, can afford and trust

- *Fair* and *accessible* solutions that most people can access

- *Flexible and adaptable* to future change and innovation

- *Consistent* with *progressive policy* and changing transport mode hierarchies

New Mobility

Next steps and action plans

There is no magic formula. Generic goals and solutions are not the answer for those who want to take action to get the most from New Mobility. Neither is doing nothing.

Technological change will happen whether we choose to engage or take no action. Those who sit back will almost certainly be left behind and, in some cases could be left with additional risks and costs due to change implemented by others, whether intended or not.

To make the most of New Mobility, starting now, we all need to home in on the very next steps according to context, appetite for risk and ability to influence. In forming a plan of action, we strongly recommend that each of the five aspects of New Mobility change is considered in terms of its relevance and importance, and the potential for specific next steps and actions.

We have written this practical guide to help with that process

And how will we know if we have collectively succeeded?

The very best New Mobility solutions will enhance the viability of communities and their distinct nature. These community identities will rely on the five strands of New Mobility to take root, grow and evolve, with easy and appropriate connections between them for the benefit of people and business.

Those who make great places and who create resilient transport systems will find that they have created distinctive solutions that work in the local context, which can be maintained for the long-run and which connect and make sense within their wider context.

Those who create and offer the very best mobility packages, infrastructure, future vehicles and technology solutions to the market will find that they are generating the necessary commercial returns, and can be flexible and adapted to suit an ever-growing demand and need on the ground.

Do you agree that there is great consensus for the long-run vision, and that it is now time to focus on the near-term action plans to make structured progress towards them?

Are you aware of places in the world where these goals would not be a natural fit?

Please share your thoughts with us at
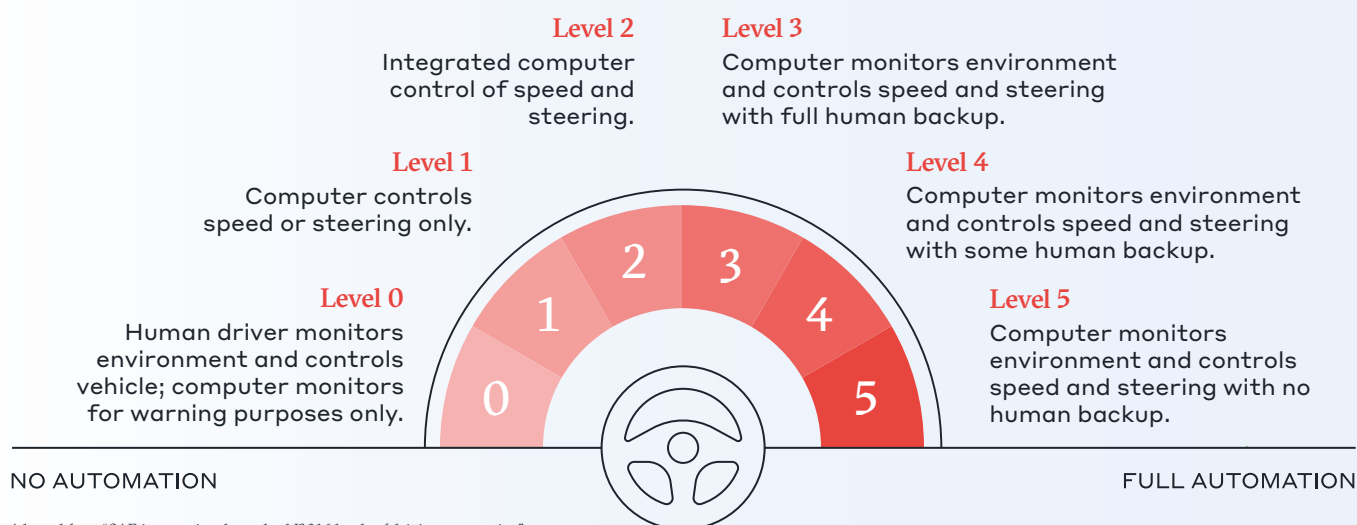NewMobility@wsp.com

Automated

Vehicle automation is not new. Over the last thirty years, we've seen increasing levels of automation built into both light vehicles and freight. With pilots and trials ongoing around the world, increasing on-board automation in new vehicles, and some operational systems already in place, we can expect continued and rapid change.

While fully autonomous operation under all driving conditions is a possible end goal, current technological advances can be broadly divided into two camps.

The first is being brought to market by several manufacturers, where everyday driving speeds are not compromised by increasing levels of on-board automation. In 'self-driving' mode, these vehicles are now able to navigate without substantial driver intervention under defined conditions. But at no time does the driver give up legal or practical control of the vehicle, and none are able to operate on the road beyond SAE Level 3.

The second approach to the development of fully autonomous (Level 4/5) operation is based around slow speed fully driverless pods. As one example, a series of UK-based pilot trials are now live, generally on footways and in defined pedestrianized areas. These trials are more focused on 'any condition' driving at speeds where the safety-related risks are low. They are also providing insight into how these vehicles are perceived and accepted by the public.

The spectrum of automated driving

Level 2
Integrated computer control of speed and steering.

Level 3
Computer monitors environment and controls speed and steering with full human backup.

Level 1
Computer controls speed or steering only.

Level 4
Computer monitors environment and controls speed and steering with some human backup.

Level 0
Human driver monitors environment and controls vehicle; computer monitors for warning purposes only.

Level 5
Computer monitors environment and controls speed and steering with no human backup.

2 3 1 4 0 5

NO AUTOMATION

FULL AUTOMATION

Adapted from "SAE international standard J3016 levels of driving automation"

Automated

What is an automated vehicle?

Quick facts:
what is an automated vehicle?

Vehicle automation refers to the spectrum of driver assistance technologies as defined by the Society of Automotive Engineers' (SAE) International Standard J3016. The higher the level of automation, the more information the vehicle uses about the driving environment to automate driving tasks.

SAE level 1-3 is relevant today whereby the human driver is required to perform some or all of the driving task(s).

An SAE level 4+ ("autonomous") vehicle has the most advanced levels of automation. Completely "hands/feet/brain off", the vehicle navigates, reads its surroundings, and interacts with other vehicles, road users and the road infrastructure.

> *There is definitely a role for AVs in existing cities to supplement transit services and to make it possible for more people to live without owning a car.*

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Increasingly automated vehicles are now a way of life and fully autonomous vehicles are coming. Key questions still need to be considered:

- What can we do to increase public familiarity with – and confidence in – increasingly automated vehicles?

- How can network operators reap the full benefits of automation?

- How can we best learn from existing pilots and trials, to avoid needing them everywhere?

- Is it inevitable that an automated future is also a connected one?

- How can we manage the increasingly complex interactions between human drivers and more automated vehicles in the interim transition to SAE Level 3?

- Are there parts of the transport network where full automation would need to be mandated? When do the key benefits emerge in relation to the transition?

- How do we protect against urban sprawl as drivers regain their driving time for other tasks? Can we create attractive yet denser urban centres to counteract this risk?

- How might we combine the benefits of automation with greater shared use? If we continue to replace today's cars with increasingly automated but privately owned vehicles, how will we manage congestion or benefit from new place-making potential?

- To what extent can urban and rural areas expect to see different automation solutions and timelines? How can we ensure that the benefits of urban areas translate to rural environments?

Automated

Opportunities

In our research conversations, we found several common international themes alongside country-specific insights that will have value across wider geographies as the transition progresses.

The precise bundle of automation-related benefits will depend on local circumstances and scale, but in overview the potential opportunity includes:

Road safety

There is little doubt that a network, route or zone that is entirely automated at SAE Level 4 or above would generate substantial safety benefits, as all moving motorized vehicles would follow agreed rules for movement. There are key questions emerging around the world, and specifically in Australia, the UK, Canada and the U.S., about the extent to which these benefits will emerge during the transition period to Level 3, and also while the network contains non-automated vehicles.

One suggestion that emerged several times to address this on more strategic routes was the presumption of segregation of automated vehicles from non-automated. In our view, however, as the mixed operations issue will be temporary, this may not generate sufficient benefits to warrant the interim network modification costs.

Another option would be to define connected and automated 'zones' where all vehicles, heavy or light, must be able to operate at a defined minimum level of automation. The levels could increase and the areas covered could gradually extend as technologies become more commonplace and the benefits are better understood in practice.

The exact safety benefit remains to be seen. We know that in countries where road accident statistics are closely monitored, we tend to find that 90% of accidents are typically caused by driver error, but this does not necessarily translate directly to the same reduction in accidents. There is little doubt, however, that progress is already being made and that the shift to SAE Levels 2 and 3 will improve road network safety.

Onwards pilots and trials for automated technologies

Two key points emerged from around the world during our interviews: first, that future automation trials must be meaningful for all parties. The early definition of specific use cases with industry partners will help everyone to understand the potential future needs and deployment opportunities that will be to everyone's advantage.

The second key point, in particular from Australia, relates to the benefits of focusing on low speed experimental trials. These will set the stage for first and last mile light vehicle journeys, as well as light/mid-sized logistics vehicles. Due to their existing levels of control, high design standards and limited access/exit points, motorways may appear to be among the easiest implementation environments. However, if high-speed automation takes off too far in advance of others, we may find that the infrastructure investment required to manage two highly distinct types of traffic could be extensive and that the outcome is an increase in movement, rather than more efficient multi-modal mobility.

Hierarchy shift: focus on freight, public transit and pods

Several of our interviewees would prefer that the effort around automated vehicles be focused on freight and public transit, and that the opportunity be taken to reimagine how these two systems could work with much greater efficiency and safety, ideally at a lower cost.

In relation to public transit, the mutually beneficial relationship with shared use and models such as Mobility as a Service (MaaS) should not be missed. A more automated, connected and shared network is one within which highly efficient public ownership and shared use could thrive, in place of private vehicle ownership. This piece is missing from automated pilot use cases, but could be fundamental to our understanding and the creation of future benefits.
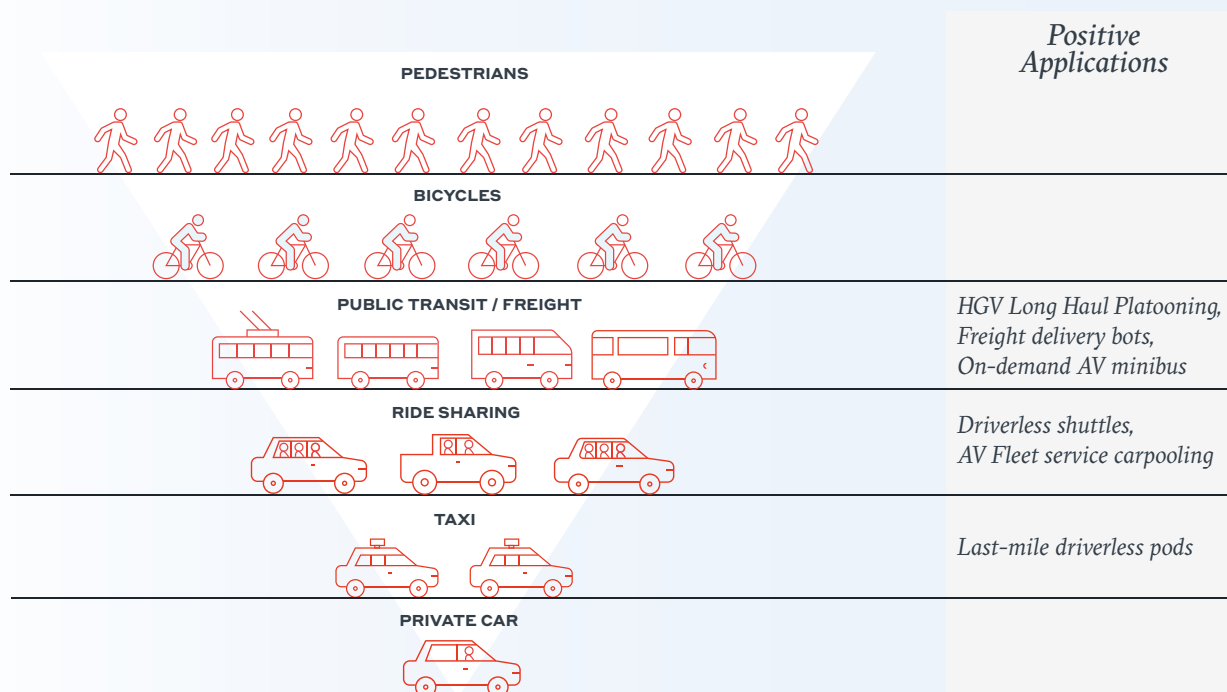
Others mentioned the related opportunity to redefine the transport mode hierarchy. This is about defining urban and suburban environments, supporting the active modes of walking and cycling, public transport and freight, as well as first and last mile movements in their local context. If and when automated vehicles become part of the public mobility offer, no matter what vehicle size, they should no longer be treated in the same way as privately owned cars.

Automated

Challenges

The roles for AVs on the modal hierarchy

Where to apply vehicle automation for a better transport system

	Positive Applications
PEDESTRIANS	
BICYCLES	
PUBLIC TRANSIT / FREIGHT	*HGV Long Haul Platooning, Freight delivery bots, On-demand AV minibus*
RIDE SHARING	*Driverless shuttles, AV Fleet service carpooling*
TAXI	*Last-mile driverless pods*
PRIVATE CAR	

The importance and value associated with automation will need to be considered carefully in due course. Consultees around the world were quick to point out that the provision of a service does not necessarily mean that everyone will be able to access it or use it without support.

Is Level 3 automation enough?

Our interviews uncovered an intriguing interim point in the transition towards full autonomy, once the benefits of SAE Level 3 have been realized for both light and heavy vehicles. At this point, the vehicles are still not able to move when empty, so two key area of benefit remain out of reach: urban and suburban place-making benefits (which are further boosted with reduced private vehicle ownership) and non-driver mobility, including the elderly, infirm and young. Even with higher levels of automation, some of these challenges will remain, as discussed.

Automation: is it really mobility for all?

Many of our interviewees expressed concern about the presumption that fully autonomous operation could provide mobility for everyone. Even with a future transport system that allows anyone to summon a completely driverless vehicle, it will still be the case that, for many people, the 'first metres' and 'last metres', to and from the vehicle, cannot be undertaken without additional support.

Next steps for automated navigation

OEMs (Original Equipment Manufacturers) are recognizing that their partnerships should extend beyond machine learning companies to include niche firms focusing on artificial intelligence. This will allow the automated vehicles to learn to read human gestures, rather than developing a more rigid set of codes to rely upon reading network data and traffic signals.

Another aspect, raised during discussions in Sweden, identifies that a major challenge that lies ahead in relation to all-weather fully autonomous navigation. Snow, heavy rains, sand storms and similar are all prohibitive with current technologies. The technology to 'read' the road surface needs to be completely reliable with everyday changes, for example when wet, in low light, in darkness or with glare.

Automated   *Challenges*

Self-parking: short-run changes to design and layout

Several of our UK-based discussions identified that today's self-parking capabilities work well for parallel and reverse parking manoeuvres but are not as well advanced for forward parking or herringbone bays, both of which are commonplace in many parts of the world. In order for the technology to take off and gain maximum exposure, flexiblity in use – and therefore popularity – these limitations will need to be overcome. Self parking offers the potential to reduce the width of parking bays and aisles therefore increase density or reduce the space needed for parking.

The impact of automation on infrastructure

It is likely that major site layouts will need to change to accommodate an increased proportion of drop-off and pick-up movements as vehicles become more automated. This is already beginning to happen as shared and MaaS solutions come onstream, and it is likely that it will increase further as 'empty operation' during parking is permitted, for example at transport interchanges and major trip attractors.

Physical impacts of freight platooning

Experts in Australia and New Zealand, based on a long history of heavy vehicles, foresee value in long-distance freight movements when platooned via connected and automated technologies. However, the same experts warn about potential issues and physical network impacts, should single lane freight loadings increase substantially.

Service vehicle automation

There are numerous opportunities for the increased automation of service vehicles, such as street cleaning, refuse collection, delivery and maintenance vehicles. Service patterns could shift, once driverless, to operate at any time of the day or night, subject to consideration of any noise disruption. This opportunity carries a potential challenge as the driver and on-board team typically represent around 50% of the cost of the service, which will lead to role changes. In some cases, roles may evolve and broaden, but it is also possible that retraining may be needed.

Managing congestion and urban sprawl for the short and longer run

One of the most frequently observed challenges for automation in relation to routes and places is congestion. Taking the automation element of New Mobility on its own, the obvious solution is to encourage a shift from non- or partly-automated vehicles towards a fleet that becomes increasingly automated over time. The key risk here is that, without some form of road user pricing, there is no direct incentive to road users to reduce congestion below its current day levels, despite the fact that almost every urban centre in the world reports congestion and poor air quality as a headline issue. In fact, if poorly managed, increased automation could add to congestion, should we reach the point where time spent in automated vehicles is perceived to be productive and low cost.

Potential solutions to these points lie not in automation alone, but also across the other four elements of New Mobility. New business models could be used to ensure that trip-making is priced and incentivized appropriately, together with an encouragement for a shift to electric vehicles to help address air quality concerns.

A combined strategy involving connectivity and a reduced proportion of private vehicle ownership could also play a key role, and would generate substantial new network efficiency. The key, of course, is to properly manage or reallocate any new-found capacity, rather than allowing it to be absorbed.

Regulatory environments encouraging genuine public/ private sector collaboration

At the moment, with some notable exceptions (in particular the UK), regulation tends to lag the evolution of new automated technologies. In our view, the most efficient path is to ensure greater public/private sector collaboration and to incentivize much greater sharing of pilot study learning. If national and local governments chooses not to engage, there is a risk that the technologies will be introduced without the benefit of 'wraparound' planning and collective encouragement, potentially risking large costs associated with future network management.

An added advantage of collaborative working will be faster acceptance by the general public, as local authorities in particular are well-placed to bring through highly visible trials to build familiarity. We heard similar themes in the UK, Australia, Canada and the U.S. on this point.

> *"Parking assist is a big deal that is helping to build trust and familiarity."*

Automated

Recommended next steps

It is clear that increasing automation in its own right is progressing well, but with the other four 'pillars' of New Mobility, the combination becomes far more powerful and relevant to today's transport, mobility and place-making challenges. To make the most of this, we recommend the following ideas for consideration in short-term action plans.

For potential developers and land investors, land-owners and similar

- Collaborate with the public sector to understand the appetite for change and the regulatory environment that is likely to apply. Identify how this could best fit with future local regeneration potential.

- For live development and regeneration proposals, build in flexibility by understanding a range of forecast scenarios for varying levels of automation, sharing and connectivity. Options that allow a rapid response to changes in demand for parking, pick-up and drop-off activity are likely to be particularly valuable. Add resilience to major campus-type developments (e.g. airports, universities) by safeguarding parking land and then, under a 'monitor and manage' approach, converting it to alternative uses (landscape, residential, retail, amenity) when trigger points are met.

For strategic and local road network operators

- Consider incentivizing fleet renewal, ideally in tandem with a more responsive and flexible shared mobility or public transit offer to discourage the like-for-like replacement of today's cars with 'cleverer' cars.

- Develop relationships with technology providers and local/national planning authorities to understand next moves and recent learning from recent pilots and trials. Identify potential routes or network sections that might suit specific types of early adopter implementation for automated technologies.

- Prioritise the creation of an automated vehicle strategy, to cover your own fleets, but also to respond to other likely market changes.

- Consider the longer-term potential for a flexible automated fleet service to fill high-cost/low-demand service gaps, or to supplement levels of service on the busiest corridors.

For national and local planning authorities

- Create national/regional/local government guidance, as appropriate, to bring through new policies and potential new business models to include capital and revenue funding.

- Collaborate with others to identify changes to planning policy requirements that will consider the effects of automated vehicles and their impacts on mobility, in the context of all five pillars of change. Know what you want and engage with the relevant providers.

- Consider a 'mobility index' in place of a public transit accessibility rating, recognizing that the gap between public and private transport is likely to narrow.

- Work to build public familiarity, trust and social acceptance, with some specific and sustained messaging around the benefits of shared use.

- Strengthen high-capacity services where land use densification (from parking repurposing) and potential AV-induced congestion increases may drive further transit demand.

- Combat the risk of regional transport planning paralysis by using scenario planning to adapt traditional travel forecasting to an AV future, allowing informed decision making to continue during this transition period.

- Create a city parking redevelopment framework that is responsive to developer interest, considers compatibility of uses and minimizes AV-induced travel demand in congested areas.

Connected

Mobility futures will be much more connected. This is inevitable, as the days of 'dumb vehicles' travelling on 'dumb roads' are already behind us in many countries and cities. Many of us already travel in connected cars or public transport vehicles.

In fact, any driver using either an in-built satnav system or a smartphone to access best route advice is already connected. In most cases, the same applications transmit data in reverse to provide near-live road condition updates to other users, while others collect data for insurance purposes.

New vehicles today are typically sold with SIM-based connectivity, although in some cases this is not activated. Actual levels of day-to-day connectivity vary widely according to vehicle manufacturer and location in the world.

Connectivity today relies largely on cellular communications networks and tends to connect individual vehicles to a bespoke service. Data collected from such devices can be aggregated by service providers and road network operators to create real time understanding of a road network.

There are multiple technologies emerging around the world that are advancing the state-of-the-art in terms of V2I, V2V and V2X solutions. These solutions may be inexpensive, yet the uplift of connectivity that could be achieved through their widespread application is significant.

The next step, which is the subject of various pilots and trials today, will be to better connect the vehicles to each other, to roadside and remote infrastructure, and to other devices to transform the information available to network operators and users.

A connected network allows the vehicles travelling on it to become sophisticated mobile sensors. In return, the same vehicles are able to benefit from information gathered elsewhere.

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If we are to capitalise on the full benefits of connectivity, there are some critical decisions to be made now. Key questions under consideration include:

- How should we start to optimize for future connectivity in a practical sense? How might we consider road hierarchy, route importance and place?

- How do we make the right "next step" connectivity decisions that will permit our road transport systems, and the vehicles using them, to adapt and remain future-ready?

- How do we ensure access to data gathered by those who can best make use of it? Much of the data gathered is unused and some is not held by those who would find it most useful.

- How can we accelerate multi-modal connectivity to enable truly seamless end-to-end journeys? To improve network efficiency and energy use, can we achieve this in parallel with reduced private vehicle ownership?

- How important is connectivity and communications standards relative to automated technologies? Are they twin-track or discrete requirements?

- How can we fund connectivity investments and upgrades for the long term, while reducing the risk of over-burdening the public purse?

Connected

Opportunities

Basic Types of Vehicle Connectivity

V2V
VEHICLE-TO-VEHICLE

V2I
VEHICLE-TO-INFRASTRUCTURE

V2X
VEHICLE-TO-X
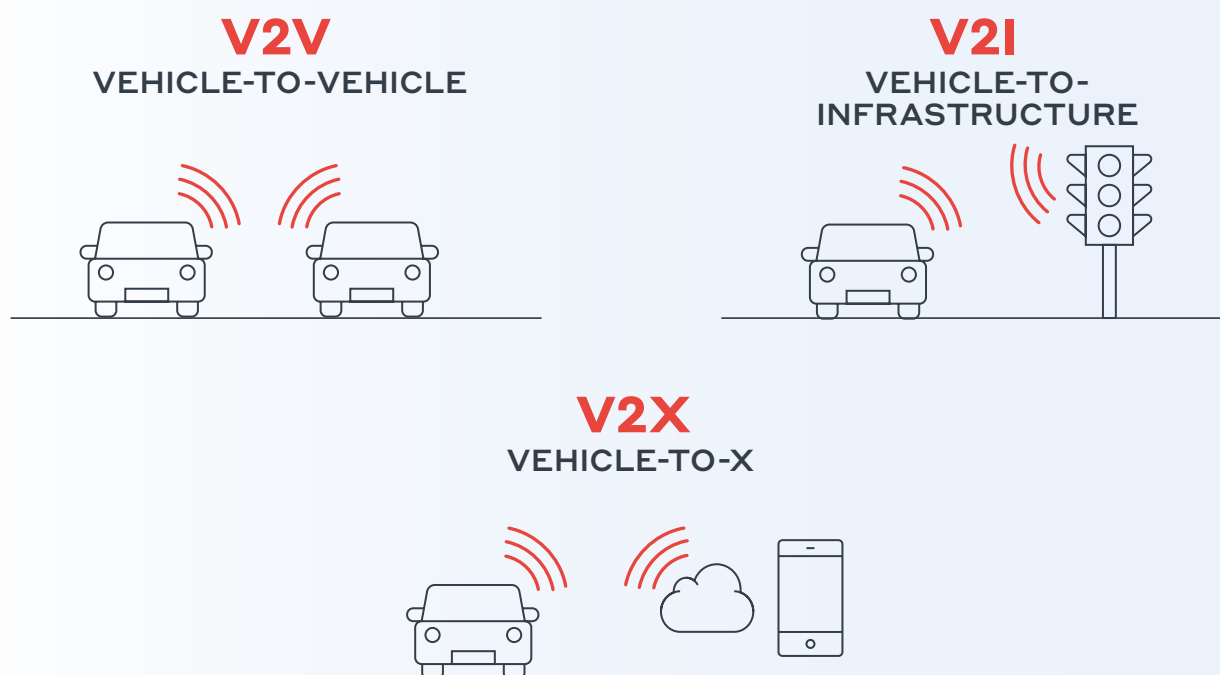
"V2V has an important role for autonomous operation, but V2I is critical, not least to control and reassign traffic. Several traditional auto manufacturers have come to the conclusion that vehicle-based sensors are not sufficient by themselves for AVs."

Connected

Opportunities

Our extensive conversations with relevant professionals around the world and direct involvement with various trials confirm that there is a large and consistent benefit available from a more connected network.

Some respondents are frustrated that take-up in their part of the world seems slower than desirable, although there is a recognition that trials elsewhere will provide a valuable springboard. The precise bundle of connectivity-related benefits will depend on local circumstances, but in overview the potential opportunity includes:

Better network and fleet management

One of the primary benefits to network and fleet operators relates to real time management and operational adjustments, based on data from their own and third party equipment. The potential for moving vehicles to act as 'monitors' of flows, speeds and incidents will, in time, provide a richer picture of network operation than is available today. This could benefit both public and private sector firms, assuming that we find the right mechanisms to make the relevant data available.

Informed personal trip-making

The benefits of better connectivity to support personal trip-making decisions are now proven. In many cities, people are already able to make better informed journey choices across the full range of walk, cycle, public transport and shared/ private car through app-based data reflecting near real-time conditions and costs. The acquisition of Waze by Google marked a key turning point in this area, and city-specific open data initiatives, for example in London, continue to generate substantial new activity.

Efficient navigation

There is a broad consensus that near real-time advice to drivers (and, in time, directly to automated vehicles) about optimized route choices is already beneficial. With progress towards Level 4/5 automation, we expect that live driver information about route choice and optimal speed will become a natural input to control automated movement around the network.

Healthier air quality

In the short run, if drivers respond to advice provided to their vehicles, greater connectivity offers the potential for smoother traffic flows and reduced peak time congestion, both contributing to improved air quality before the anticipated shift towards a more electrified fleet. We anticipate particular benefits in congested urban centres and along busy strategic road corridors. These benefits will play out for strategic transport network asset operators, city management organizations and, of course, people living and working in future urban centres.

Improved safety

The latest trials, and our market intelligence, confirm that there is a clear value in providing 'eyes ahead' information to light vehicles and freight about accidents or route issues. We anticipate that data about driver/vehicle behaviour, including steering, braking and indicator use, as well as the use of lights and windshield wipers to indicate weather conditions, could also give instant insight into everyday operations and decisions made by network operators. This data could also be used, in due course, to inform offline decision-making about short-term network safety improvements that would be beneficial until automated vehicle fleets become the norm.

Better road asset maintenance

On-vehicle sensors able to detect road surface quality issues have the potential to gather valuable data for road maintenance. The early detection of road surface failures or other infrastructure degradation would reduce road maintenance costs whilst targeting road surface renewal to locations where it is most needed. This could have wider benefits for road-worker safety and return on investment for network operators.

Enhanced planning

Off-line and historic vehicle movement data can be used now, subject to access, to provide a much richer source of information to support network analysis (e.g. changing journey times or route choices under defined conditions) and forward planning for the likely impacts of homes and jobs growth.

Go-anywhere infotainment

Full internet connectivity for vehicle occupants seems to be an implicit assumption of future vehicle connectivity, stretching well beyond functional connectivity and towards passenger entertainment.

Connected   *Challenges*

At a glance, it may seem that connectivity advances are progressing well around the world. Vehicle manufacturers and technology firms are making clear progress, and a range of trials are funded and in progress.

The links between progress in connected and automated technologies are increasingly clear and form part of the bigger picture of likely forward change. Does this mean that there is no further need to steer the connectivity agenda at a local, city, regional or national level?

No, not at all.

There are crucial aspects where key decisions and collaboration could take cities, routes and networks towards far more productive futures, with much broader connectivity benefits. It is also critical to bear in mind that the impacts of connectivity will continue to affect all types of mobility and modes, including public transport, heavy freight and logistics, cycling and walking.

The investment dilemma: smart vehicles or smart roads?

To achieve connected networks and places, one or both will need investment, but to what extent and in what balance? Recent intelligence from Australia and the UK, for example, suggests that network operators would be well-served to place much greater value on emerging digital infrastructure 'shadow' networks alongside their physical equivalents.

Trials, including several in the U.S., suggest that on-vehicle equipment is a better solution. In parallel, other research is confirming that it is possible to adapt urban streets and major highways to future mobility needs with relative ease.

Relying on vehicle manufacturers to embed the relevant technologies is not without commercial, legal or technical risk, but without careful engagement it is possible that useful data may continue to be captured and be largely ignored.

Building on this, some government agencies in Australia are now encouraging the deployment of some smart infrastructure at the roadside to improve the likelihood of seeing a wider roll-out of smart vehicle-based technologies.

Data access and equality: winners and losers?

Without careful management of data accessibility, the introduction of increasingly connected vehicles and networks could also create social and economic division. To some extent, this is the nature of a free market, but actions taken now could reduce unnecessary or unintended outcomes.

Today's road network operators essentially provide the same level of baseline driver information to all, primarily through visual cues such as signs and lines. A division is now opening up as newer, better connected vehicles and drivers are increasingly able to access additional information to optimize their journeys.

The same is happening for pedestrians, cyclists and users of public transport across the world, as data about their personal mobility choices, regardless of mode, is being gathered 24/7 by their own smartphones.

All of these changes act against people who have no access, and we can expect this risk of division to grow as the direct benefits of connectivity increase. Road network operators and local authorities will need to engage and decide how to maintain appropriate, equal and affordable levels of service for all. They will also need to find out how best to access and make productive use of data gathered by third party vehicles using their networks.

Similar questions around engagement apply to private firms wishing to make use of the same data for their own commercial purposes.

Avoiding unintended consequences for public transport, cycling and walking.

Building on the emerging findings of various connected city trials, there is a risk that we focus too heavily on vehicle-based connectivity, and in particular cars, at the expense of more sustainable and healthy modes.

Given that city policies continue to push towards greater proportions of trip-making by modes other than the private cars, it is important to recognize the risk that we might make travel in connected vehicles relatively easier, faster and cheaper, all at the expense of other modes. In time, new business and pricing models are likely to hold the key to unlocking and maintaining a healthier balance across the modes.

Connected   *Challenges*

Would we benefit from agreed standards and interoperable systems?

The easy and conclusive answer here is "yes, we would" because the connectivity challenge is not restricted to transport and mobility. Vehicle sales of all types and sizes, whether for private ownership or into corporate or public transport fleets, are already global. Thousands of suitably equipped vehicles could connect more fully now, all over the world, but the lack of common and widespread infrastructure and agreed standards is restricting the potential benefits.

Presenting a clear and current challenge to national, regional and local governments around the world, there are key questions to be answered around specific communications needs at various scales, such as latency and spatial accuracy, and decisions to be taken around immediate and ongoing funding. The constantly shifting technological landscape means that high level outcome-led requirements at all scales are likely to be more valuable and sustainable than specific technology regulation.

System resilience and coverage – does one size fit all?

As authorities and road network operators become more reliant upon connectivity, its availability and coverage will become more critical, as will the importance of upgrades to software and equipment. It is worth considering that the consequence of disconnection will vary by function: a lack of access to infotainment is an irritation, but down-time in safety-critical connectivity could introduce fatal risks.

This brings through some key questions around system design, capacity, flexibility and resilience, which in turn suggests that solutions will vary and not be generic. In Canada, for example, there is already recognition that the need for connectivity across much of the remote network expanse, where demand from heavy and light vehicles is small, will be highly distinct from its urban centres. This example is at the extremes, but our recent work indicates that variations are likely to exist at local, regional and national levels. Requirements will need careful definition, although we anticipate that there will be common ground between similar places and/or route types.

Data privacy and cyber-security

Already on the public interest agenda, concerns around data privacy and security need to be addressed, not just by the data owners, but also by public authorities from a wider public interest perspective. We expect that data captured by connected vehicles and infrastructure will have increasing value for multiple parties over time. In the vast majority of cases, this will be constructive and valuable, but we cannot ignore the small minority who may have malicious intent. In the mobility sphere, this is sharply defined in terms of the need to protect the everyday safety of network users. In theory, a malicious third party could send a message into a vehicle that causes wrong information to be presented on a satnav or to takes control of steering, acceleration and/or braking functions. Where connectivity is V2I such an attack could send malicious information into a traffic control centre, and potentially beyond.

Given this core concern, it is unlikely that decisions around the appropriate use, protection and security of mobility data could be made locally or in isolation.

This is a challenging area, as new connectivity will generate more and more data that can be put to use for better public and personal decision-making. However, by definition, it will mean that we need to work harder on data security and associated risk management, as well as on generating much greater public acceptance and understanding. Various standards are being developed to protect against cyber security attacks and, as the technology becomes more sophisticated, so will the need for greater levels of security. It may be useful to keep a close watch on parallels in the mobile/cellular phone sector.

> *"Big data is the biggest technological trend right now. We don't have to collect data on everything, but we do need to develop a data requirements specification to define what is needed, how often and its source."*

Connected

Selected highlights from connected vehicle and infrastructure pilots

Ann Arbor Connected Vehicle Test Environment, United States

— Extensive US pilot, now expanding from 115 V2I lane-kilometres in the city's north-east quadrant to cover the city of Ann Arbor
— 2800 vehicles since 2012, rising to 5000 vehicles by 2018

Michigan pavement marking trial, United States

— Low cost paint and road sign trials
— Designed for future vehicles equipped with infrared and magnetic readers

European C-ITS Corridor, Germany, Netherlands, Austria

— Multi-national collaboration along 1300 kilometre route
— Creating a connected V2X motorway from Rotterdam to Vienna via Frankfurt
— Using wifi and cellular connectivity

Connected Intelligent Transport Environment (CITE) corridor trial, UK

— Advanced connectivity across 70 kilometres of urban and motorway network
— 30 month funded V2X test-bed

A2/M2 Connected Corridor Pilot, UK

— Creating a connected corridor from London to Europe via Dover
— Test-bed for V2V and V2I connectivity

Cross-Europe platooned freight convoys, Belgium, Denmark, Germany, Netherlands, Sweden

— 2016 trial of connected and automated technologies, working together
— Six wifi-connected freight platoons with on-board radar and optical sensors

Melbourne Integrated Multimodal EcoSystem, Australia

— Australia's first large-scale connected vehicle ecosystem
— Involves five government agencies and 20 industry partners
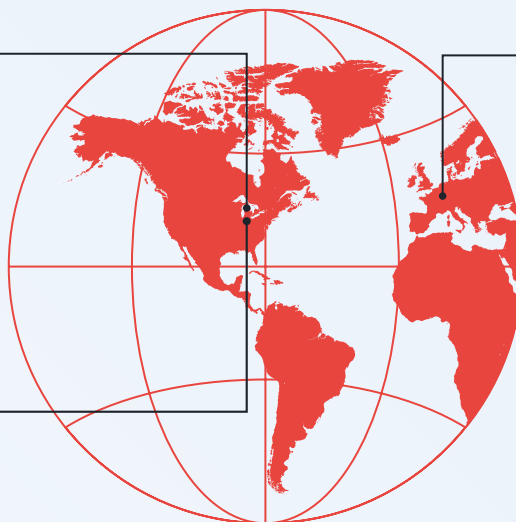
Connected

Recommended next steps

The critical input of the connectivity strand means that we can have confidence in the need for continued investment in the broad connectivity arena. To maximize the overall benefits for places, routes and people, the links between these aspects will be crucial.

The greatest benefits of connectivity will be created by those stakeholders who invest time and effort to think about what information they need and why they need it, when and from whom. In particular, seemingly small decisions made – or not made – about data access and ownership could have significant future consequences for both private and public sector.

In addition to the opportunities and challenges explored above, here are a series of next steps to consider.

For potential developers and land investors, land-owners and similar:

- Engage with the relevant public and local authorities to understand local appetites for innovation and the short/medium term value of new connectivity in existing places or within a future development portfolio.

- Look for existing smart city trials that could benefit development and regeneration proposals where they are relatively easy to 'translocate', ideally straddling both the connectivity and shared mobility streams.

- Seek advice on emerging technologies and consider the specific benefits, for future residents, employees and visitors, as relevant.

For strategic and local road network operators:

- Understand what data is already being collected by vehicles and people already using your networks.

- Start to define how connectivity might vary to suit specific network needs across your unique balance of city, suburban and rural networks, as well as where there are gaps and what might be done to fill them.

- Consider where additional connectivity data would be of greatest value to your network operation, and engage with the relevant stakeholders. This may include data at the interface between national and city networks.

- Engage with others to understand the existing position in terms of connectivity strategies, and the future role of road network operators in your context. Decisions made will affect the need for future investment and revenue streams.

- Understand funding opportunities for pilots, trials and early adoption of connected technologies across the V2V, V2I and V2X landscapes.

- Support and/or seek national government decisions around connectivity and data standards

- Recognize the value of the road infrastructure as a valuable physical asset, on which mobility-focused technology providers depend. If not in place, make links on this basis with key technology providers and start early conversations about collaborative working potential across the automated and connected strands.

For national and local planning authorities

- Understand the potential and appetite to support long-run investment in transport and mobility connectivity, perhaps through new business models.

- Recognize and investigate the opportunity to tap into new sources of data that might support local planning, place-making and operation. These could be beneficial at the day-to-day level or more strategically.

- Encourage links between strategic land-owners and connected technology providers, and look for ways to collaborate for long-run community benefit.

- Support and/or seek national government decisions around connectivity and data standards

Electric

The air quality agenda has reached a tipping point and countries, cities, car manufacturers and fleet operators are now reconsidering vehicle propulsion options. The result is a shift from petrol-fuelled combustion engines towards a focused strategy for the electrification of vehicle fleets.

Today's electric vehicles remain a small proportion of the total, but one that is growing and is well supported by both government and the vehicle manufacturers.

In 2017, multiple governments set tangible policy goals to ban petrol and diesel cars in the 2030-2040 horizon. These decisions are linked to the Paris Climate Agreement, from which the U.S. has since withdrawn (despite commitments by New York City and elsewhere).

Interestingly, there has also been positive momentum in the private sector demonstrated by car manufacturers, presenting their own commitments to manufacture electric vehicles, in some cases only offering electric and hybrid versions of the vehicle fleet.

What is an Electric Vehicle?

An electric vehicle (EV) consists of a powertrain with an electric motor as the primary source of propulsion. In this report, we are considering the shift towards plug-in hybrid electric vehicles (PHEV), battery electric vehicles (BEV), and fuel cell electric vehicles (FCEV) as opposed to (conventional) hybrid electric vehicles (HEVs). The latter tend to provide improved fuel efficiency, but operate in a similar way to 'traditional' vehicles. The former present significant implications about the charging infrastructure needed and how vehicles will be able to access it.

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There is a growing recognition of the need to consider electric mobility strategies as part of a broader and fully integrated national electrification agenda. Still, there are a number of more subtle issues for consideration in the context of the wider New Mobility debate:

- Should we subsidizte private ownership of new electric vehicles?

- What about the charging infrastructure? A lack of infrastructure or energy network capacity is a showstopper.

- How can we best maintain the necessary charging infrastructure? Does smart charging and vehicle-to-grid charging affect these investment decisions?

- Where is the best location for the charging infrastructure? Do these locations consider changes in vehicle trip patterns associated with all five aspects of future New Mobility beyond the electric strand itself?

- How can we create a productive energy network that capitalizes on the full potential of electric vehicles? How does this fit within any wider constraints on the energy grid?

- What proportion of the vehicle fleet can be electrified? Is there potential and appetite for retrofitted designs? How can an electric strategy support public transport and freight operational needs?

- How environmentally friendly is electrification of the entire vehicle fleet? Are there alternative means of propulsion that will become more efficient and environmentally friendly in the future?

Electric

Opportunities

Of all five aspects of New Mobility, the immediate benefits of an electric fleet are highly visible and well-recognized across government, the private sector and consumers.

The precise extent of the benefits will depend on the local circumstances, but there is a general consensus that the key opportunities include:

- Healthier air quality, particularly in urban centres, due to reduced local emissions.

- Reduced costs for users, initially only available over shorter journeys due to battery life and vehicle range, but expected to increase as developments in battery technology continue.

- Better vehicle reliability relative to petrol and diesel models, due to a simple mechanical powertrain and a reduction in the number of systems within the vehicle.

New government commitments

Germany

Prime Minister in favour of a ban of new petrol and diesel cars by 2030 or 2040', but government not yet wiling to set a firm date

France

Ban petrol and diesel cars by 2040

United States

Cities throughout the US are supportive of the Paris climate change initiative.
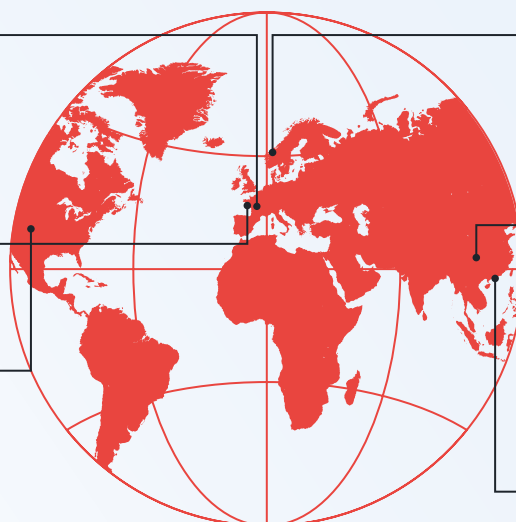
Norway

Full electric goal by 2025, supported by a 25% tax exemption on electric vehicle purchases

China

Considering joining the initiative on a similar timeline; rapid uptake in electric vehicles and charging points. New cleaner fuel 'Hydrozine' has been developed from corn stockpiles.

Hong Kong

Tesla sales fell after the government slashes the tax break

Private sector commitments

— Tesla: fully electric fleet
— Volvo: exclusively electric and hybrid vehicle manufacture from 2019
— Jaguar Land Rover: exclusively electric and hybrid vehicle manufacture from 2020
— Mercedes: will offer entire fleet as electric and hybrid versions by 2022

— Volkswagen: will offer entire fleet as electric and hybrid versions by 2030
— Uber: will offer a fully hybrid and electric fleet in London by the end of 2019, assuming that current licensing discussions can be resolved
— TEO Taxi Montreal, Canada: all electric taxi fleet
— Taxi Electric, Schiphol Airport: all electric taxi fleet

Electric   *Challenges*

The conversion to an all-electric fleet could, subject to the charging infrastructure being in place, continue ahead of many other aspects of New Mobility. Our interviews around the world confirm that the challenges in this area are distinct but well understood.

That said, there are clear opportunities to link fleet electrification with other aspects of New Mobility change, which could increase the overall benefits further.

Reliable, available charging infrastructure dictates the local uptake of electric vehicles

Regulation of the technology (both charging points and visibility of pricing) is therefore key to widespread distribution. Without sufficient density of charge points, drivers may suffer range anxiety due to limited battery life.

In planning terms, this raises an interesting angle around the location of charge points. Poorly planned infrastructure could lead to an increase in distance travelled on the network, therefore adding to congestion and delay.

We heard from several stakeholders that the utilities industries should advise on the best locations for high capacity charging stations on the energy grid. To maximize efficiency, there is also a need to understand the best model for vehicle-to-grid charging and energy storage.

Models

Ownership models for electric vehicles are now centred on sales or leases for private use, although there is some evidence of taxi firms encouraging an all-electric fleet.

Today, many governments offer tax incentives for new vehicle purchase/hire, and also for charging costs. It is not clear what will happen when these incentives expire.

Our discussions revealed a general consensus for movement towards a combined electric and shared mobility strategy, possibly incorporating aspects of the automated and connected streams due to the natural evolution of on-board vehicle technologies over time.

Short term regulation changes to reduce adoption barriers

The regulation ecosystem needs to adapt and reduce barriers to EV fleet adoption.

As one example, the TEO taxi in Montreal needed permission from the province to delink the taxi registration between the driver and vehicle. This allowed a single taxi permit to be registered to a particular driver who used several vehicles, thereby allowing them to cycle between fully charged vehicles.

Large fleet operators, including freight haulers, local authority services, public transport and private hire fleets, have a major opportunity to change the electric vehicle mix significantly within a very short timescale. This relies on them having confidence that the vehicles and supporting regulation will meet their everyday operational requirements.

Vehicle charging

Electric vehicle charging metadata needs to be factored into the business model and pricing mechanisms, as and when these start to emerge around the world.

There is a challenge ahead to ensure that users pay to reflect the impact of their network use, for example according to the real-time capacity of the energy grid and the 'green-ness' of the energy supplied.

Longer run shift to inductive charging

Further into the future, a shared, electric and increasingly automated network would become more viable if inductive charging technologies enabled the vehicles to restore battery power while moving.

Inductive charging could be particularly beneficial on heavily used future public transit corridors into and across inner city locations.

Fuels beyond electric?

There are other fuel options and distribution methods that could challenge the economic and environmental credentials of an electric mobility strategy.

Today's ambitious electric vehicle production depends on the global supply of rare battery minerals (primarily lithium and cobalt). China's initiative to use E10 biofuel, containing 10 percent ethanol, is headed towards a planned 2020 roll-out across the country.

Electric

Recommended next steps

There is little doubt that electric vehicles are gaining public confidence and popularity. It is possible that other new propulsion technologies will emerge, but at this point the shift to electric has buy-in from both the public and private sector.

The wider benefit for places and congested routes relates to air quality, and this adds a valuable set of benefits to the parallel shifts towards a more connected, automated and shared fleet.

Specific local next steps will vary according to circumstances, but some ideas that could help to get the most from these evolutionary changes are set out below from the perspective of key stakeholders:

For potential developers and land investors, land-owners and similar:

- Recognizing the strong uptake in practice, target electric charging infrastructure provision beyond evolving policy levels. Consider a range of charging types to accommodate needs of shared, freight and personal vehicles for short-term and long-term charging demands.

- As a very simple step, prioritize the convenient location of electric vehicle parking bays over traditional parking bays.

- Explore opportunities to work with local transport and/or planning authorities to establish sites for a shared electric fleet that could transform mobility within major regeneration proposals, noting that their use and cost should align with the need to encourage walking and cycling, and avoid competition with public transport.

- Engage, possibly through planning authorities, with energy sector partners to better understand and prioritize the optimum locations for new development and regeneration in relation to renewable and sustainable energy supplies. Explore on-site renewable energy generation opportunities.

- Consider medium term vehicle to grid opportunities on local energy network.

For strategic and local road network operators:

- Consider ways to encourage the use of electric vehicles on the network, such as information about available charge points. There may be links with the connectivity stream here, similar to cycle hire docking point availability apps.

- Understand the barriers to uptake and, if appropriate, consider the appetite for introducing or facilitating a fleet of electric vehicles for shared use (similar to a current car club model) to complement other modes.

For energy suppliers:

- Seek collaboration along the supply chain to advise on what constitutes a clean energy strategy by time, location and level of vehicle charging.

- Explore opportunities for vehicle to grid charging and highlight the benefits to consumers from new revenue streams associated with energy being put back into the grid.

For national and local planning authorities

- Tie regional and local electric mobility strategies to a national electrification agenda, similar to Germany's 'Energywende'.

- Consider new targets for ultra low emission zones in specific locations, especially in congested urban locations.

- Support developers and fleet operators in bringing through creative electric vehicle solutions, perhaps in combination with other aspects of New Mobility.

- Encourage electrification for authority -owned/leased fleet vehicles unless limited by operational requirements.

- Establish comprehensive policy standards for electric charging provision by location and land use, without incentivizing inner city private car ownership.

- Expand the availability of rapid charging stations across the on-street network and review parking policies to support the use of shared electric vehicles.

- Explore policy/pricing measures to encourage smart charging and new business models for the installation of new charging infrastructure.

Shared
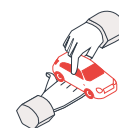
Shared mobility is a well-established concept that has accelerated and diversified over recent years, mainly due to the rapid changes offered by the availability of digital information and app-based tools. The basic premise is that sharing can create much more efficient patterns of network use at costs that are less than private car ownership.

In the context of the transition to New Mobility, a greater degree of shared use also brings forward the potential for significant place-making benefits for our cities and rural centres. This will be maximized if the shared use is put together in a collaborative way to create a single system rather than encouraging competition.

What is Shared mobility?

"Shared mobility" is used to describe any transportation service that is shared by users. It includes all forms of public transit such as buses, metro and trains, all of which are – by definition – shared by users, but also extends to much smaller vehicles and individual modes of transport.

The sharing can take place simultaneously using the same vehicle (for example, ride-sharing and courier network services offering on-demand logistics) or consecutively (for example, bike sharing and car clubs). Taxi and quasi-taxi (sometimes known as 'ride-sourcing') services are part of the shared mobility picture, and an area where there has been substantial recent change due to the emergence of Uber, Lyft and others.

The key is that all users are able to access suitable vehicles on a short-term basis, as-needed. None of them are owned by the users and access is typically charged on a pay-as-you-go or subscription basis.

Where does Mobility as a Service or MaaS fit in? MaaS formalizes the shared mobility offer by commercializing it for either personal travel or the shipment of goods. A particular trip can take advantage of one or more of the above shared mobility options to produce a seamless journey experience. A wide range of on-demand services are on offer, across the range shown above, with the exact options dependent on location, origin and destination. Trips are usually planned and booked via digital apps and similar, with costs that are either pay-as-you-go or bundled.

MaaS models work best where there is already a wide range of transport modes, where data access is relatively open, where operators offer contactless sales or e-ticketing, and where they are open to third parties selling their services.

Traditional public transportation services, such as buses and trains

Vanpools, carpools, shuttles, transport network companies (TNCs) and rideshare pools

Carsharing, bikesharing, scooter sharing in all its forms

Flexible goods movement and courier network services (CNS)

Shared

Definition

In many modern societies, learning to drive is often a rite of passage, as is car ownership. Nevertheless, over recent years, the high cost of living in urban centres, new public interest in sustainable lifestyles and the emergence of smartphone-based mobility apps have supported a proliferation of new shared mobility options. Until now, these have tended to be focus on urban areas where demand and returns are likely to be greater.

Smartphone availability has transformed the commercial marketplace for personal shared mobility, enabling the emergence of Uber, Gett, Lyft and many similar firms offering pay-as-you-go car-based trips on demand for individuals or shared groups.

Contactless payment cards continue to transform everyday access to public transit systems, bypassing the need for specialist ticketing or travelcard systems.

In parallel, bike sharing schemes have seen a rapid take-off, growing from an initial scheme in Amsterdam in 1965 to 75 schemes in 2005, and now to 750+ separate schemes around the world.

We also anticipate that car clubs and peer-to-peer models now being promoted by many car manufacturers, including fractional vehicle ownership, will continue to grow in popularity from now.

The operating models across the modes and companies vary, but they all share a common reliance on data and analytics to manage both vehicles and user booking requests.

Looking ahead, the potential for shared mobility is large, and there is a great deal of flexibility in the concept to suit a wider range of situations and locations that have not yet been fully explored.

We foresee that the outcome of this will be a continued blurring of the boundaries between long-established public transit and new shared forms of private hire, minibus and carpooling. These present challenges for transport network regulators and operators in the context of everyday network management, but also opportunities for better collaboration, for example to infill routes that have traditionally been 'difficult' to support in a commercial sense until now.

The ongoing transition is supported by better service information to help users understand the range of shared mobility options on offer. This is being achieved by popular journey planner applications ranging from Citymapper in London to the Digital Matatus project that has been used to map Nairobi's informal minibus sector.

Meanwhile, the freight industry is responding to increased volumes of households and businesses ordering items online with an expectation of fast delivery. Shared mobility in this sector is focused on reducing 'empty running' through freight brokerage platforms, via shared and consolidated deliveries and through a more efficient means of last-mile logistics.

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Key questions that need resolution over the short term include:

- How can we better use data to inform new opportunities for shared mobility services? How can the data generated by an increasingly connected transport network be joined into existing app platforms for shared mobility?

- How do we best accommodate new shared mobility services in our existing streets, developments and infrastructure?

- What are the opportunities for shared mobility in the freight and logistics sector?

- Does the shared mobility 'offer' vary between cities, suburbs, towns and rural centres? How can we create powerful collaboration between service operators, transport network operators and local authorities to generate the best solutions?

- How can we improve incentives to adopt shared mobility while improving equitable social access for all?

- How can we start to work towards the longer run place-making benefits on offer from shared mobility, in the context of an increasingly connected and automated network?

Shared   *Opportunities*

The strongest consensus of our research engagement from both public and private sector emerged around our shared mobility investigation.

This is probably because the concept is relatively well understood and visible in many locations around the world. An overview of the key opportunities offered by shared mobility is summarized below.

Increased network efficiency

There is consensus that increased use of shared mobility would allow us to move more people and goods, more efficiently and effectively, using fewer vehicles and without the need for extra infrastructure capacity. This uplift is likely to be maximized where it is possible to provide shared first and last mile services to link in with the highest capacity transit options. Smaller vehicles have the potential to play a key role in infilling radial routes in particular, especially where there is no mass transit equivalent.

With freight, empty running is reduced as digital platforms efficiently match goods movements with available load capacity on the network. This helps operators in terms of their commercial returns but also aids network operators by reducing the numbers of heavy and light goods vehicles on local and strategic networks.

New place-making potential and reduced need for parking

The unique potential offered by shared mobility relates to new place-making potential.

Regardless of currency, there are millions if not billions to be made in the hearts of the largest cities around the world, where land values and the potential for uplift tends to be the greatest. 10-15% of total urban land area is typically used for parking (both on and off street), and if we can move towards a New Mobility solution that relies on shared mobility then some or all can be reallocated for other uses. In smaller centres and more rural areas, the land value uplift will be smaller but there is still potential to create better, more liveable places.

In combination with the other strands of New Mobility, this creates a powerful force for productive change, and could enable the creation of substantial new homes, jobs and leisure space. This place-making benefit is only activated if the sharing strand remains a key part of the New Mobility bundle, and is managed collaboratively between planners, network operators and service providers.

Reaffirm a fair modal hierarchy

Well-managed shared mobility will create new opportunities to strengthen a sustainable modal hierarchy, with active modes – pedestrians and cyclists – at the top. This, in turn, will help to create and maintain better places and routes for all.

The parallel challenge is to ensure that any disruption affects private car trips and does not compete with active modes, successful high capacity bus or fixed infrastructure such as rail, light rail and metro schemes. Much of this will be driven by perceived pricing and the journey experienced across the different transport mode options for a specific route.

Access to services

Planned and delivered alongside new development, shared mobility strategies will provide a more equitable, improved level of access to jobs and other public services. This will benefit new residents and employees, but also those living and working in the surrounding areas, either directly or indirectly, by relieving pressure on congested services.

"Mobility Orientated Development"

With the New Mobility model, we see the potential for a new 'mobility oriented development' strategy, with shared mobility at the heart of plans to facilitate increased densities and development locations that would previously have been unviable or politically unacceptable. This would require a new index for measuring mobility that takes into account the full range of new options for movement, incorporated into planning policy.

The concept of 'transit oriented development' (TOD) and close variants has existed around the world for some time. A TOD strategy has the goal of promoting sustainable development and growth around the most accessible points on the transport networks. This has typically been centred around single major rail interchange stations.

OEMs show a willingness to learn

Our research and direct experience around the world confirms that many of the firms at the forefront of the shared mobility transition are already enhancing their understanding of transport planning and policy as it relates to New Mobility goals. Some manufacturers, for example, are learning from their car clubs experience with a view to applying their new knowledge to shared (and increasingly connected and automated) vehicles in the future.

Shared

Challenges

New platforms enabling shared mobility are already perceived by many as a quick win, offering benefits without significant investment in new infrastructure.

Greater collaboration between public authorities and private sector providers

One of the core challenges is that these platforms are operated by private sector firms in parallel, but not in close collaboration with, public sector authorities who are responsible for the everyday performance of road and rail networks.

There is also a great deal of confusion about MaaS operation in practice. Commercial returns tend to be held by the private sector operator, while local government authorities are not putting their weight behind greater use, even where it could benefit their own investment plans. Policies are emerging, and engagement to create win/win operating models are beginning to form. However, truly collaborative work for mutual benefit, across both supply and demand sides, remains rare.

To achieve this, new business models and cooperation between entities that have historically competed for customers will be needed. For example, in the U.S., shared mobility largely operates at a state and/or local level, which can make expansion and innovation complicated. It is likely that stronger guidance at federal or national levels to generate greater consistency will be needed, but will be a challenge.

Balancing transport policy and innovation: foster innovation or seek greater regulatory powers?

Shared models and digital platform enabled mobility services are highly adaptable to different cities and can be implemented quickly. This is proven by the rapid uptake in shared solutions for car-based and bike-based solutions across multiple cities around the world.

The key question for city authorities is whether to welcome innovation or to regulate against it to protect and maintain their control of transport operations. In reality, the challenge is to balance the two.

Building confidence in shared mobility solutions, rather than hard infrastructure

The mitigation of development impacts has tended to be based on physical infrastructure elements including parking, public transit and road network upgrades. New shared mobility models are more virtual and fluid in nature, operating on existing networks rather than providing any hard infrastructure in themselves. There is a significant challenge to build confidence that shared mobility services can be secured in perpetuity to support existing and new development.

Buses and shared mobility

Our research confirms that some bus services (including those subsidized by government funding) are already suffering significant competition from shared mobility choices. The challenge – and the opportunity – is for the bus operators to decide how best to engage with the transition to an increasingly shared mobility model. Demand for mass movement along key corridors shows no sign of reducing, but operating models involving fixed routes and fares risk losing appeal.

Some bus operators are starting to respond to this challenge, with plans to provide high quality demand responsive transit in rural areas and small towns, perhaps using a wider range of vehicle sizes and perhaps still with government subsidy. In urban and suburban areas, current experiments to provide fixed-route, flexible frequency services that infill other routes are being watched with interest.

A social backlash against sharing?

We tend to underestimate the level of attachment of some people to their existing (and future) cars at our peril. It seems that there are generational changes in play, and we can expect that these will continue to shift over time. But the issue will resolve itself. With real estate and property prices continuing to rise, cars may become a stronger status symbol than in the past.

Policy-makers and service providers have a challenge ahead to convince communities, perhaps gradually, of the benefits of shared mobility and incentivize the most efficient outcomes at a local level.

> *With regard to cities and AVs, we have designed away from the private car for the last 20 years… the next step should be no different.*

Shared

Recent selected highlights for shared mobility

As shared mobility options are already operational across the world, a small selection of interesting and leading-edge examples are included below:

Lyft & Amtrak collaboration, US

— Lyft first/last mile option is offered as an integrated option when purchasing an Amtrak ticket

San Francisco, US

— At Parcmerced, car-free residents are credited with $100/month to use with Uber, Clipper and Getaround
— Half of city-wide Uber trips are UberPOOL. Half of Lyft trips are Lyft Line

Evolution of Citymapper, London

— Working with Transport for London and taking advantage of its open data approach
— Filling gaps in public transit
— Live trials of a 'pop-up' circular bus route in central London completed in 2017

TimoCom freight transport, Europe

— Connects road haulers, freight forwarders and manufacturers
— Carries more than 500m tons of freight each year
— Typically has 750,000 live 'offers' of vehicle space to transport freight

Moda Living & Uber partnership, UK-wide

— Property developer Moda Living offers car-free living
— Residents receive up to £100/month to use on Uber services

Uber in Tangocho and Nakatonbetsu, Japan

— On-demand rural town service to give access to key services for the elderly
— Uber is licensed to operate in places too small to support public transport

Beeline SG, Singapore

— Offers an open, cloud-based smart mobility platform for shuttle buses
— Commuters are empowered to 'crowd-start' and suggest new routes

oBike, Sydney & Melbourne, Australia

— Shared bike scheme just launched
— Push-back from councils who consider the shared bikes as clutter and nuisance

Shared

Recommended next steps

A good shared mobility strategy has the potential to improve network efficiency, enable better place-making and free up space for alternative uses, while reducing over-reliance on private cars.

The greatest benefits can be realized when the developers and strategic land investors embrace shared mobility as a key objective, and where service operators bring new collaborative innovations to market that provide a return to both the provider and the public sector, together with an improved service for all user groups.

In the wider New Mobility context, shared mobility strategies are likely to work best where:

- There is recognition that **unique solutions will be needed to suit the local context**, including demographic, cultural and regulatory aspects. The existing urban fabric of a city will play a part in determining its suitability for different shared solutions, which will affect uptake.

- Consideration is given to **incentives for walking and cycling**, rather than using shared mobility as a push towards vehicle-based shared journeys. This will promote healthy mobility but also much more efficient solutions.

- **Public and private sector collaboration** is strongest, to address accessibility and operational efficiency issues. The most efficient solutions will enable data sharing for a wide range of purposes, crossing ownership boundaries and perhaps reflecting reciprocal arrangements. Google's Waze, for example, contains data that can support car-pooling, and cities may wish to consider the extent to which they could support this effort rather than funding alternatives.

A short series of possible next steps for specific stakeholder groups is suggested below but is not intended to be exhaustive:

For potential developers and land investors, land-owners and similar:

- Consider opportunities for collaboration in providing shared mobility 'car-free' living from the outset.

- Challenge policy which dictates parking minimums and ensure developments are supported by a strong sustainable suite of travel options.

- Recognize the potential impact of a reduction in private car ownership on development design, for example in relation to parking design, and its potential adaptation for future alternative uses.

For strategic and local road network operators:

- Engage more closely with shared mobility operators to understand the potential for more collaborative service definition.

- Analyze options for greater network efficiency through greater sharing and more efficient vehicle occupancy, and build this into network investment plans as appropriate.

- Act as a convener, perhaps with the planning authority, between shared mobility service providers and public transport operators, to create efficient solutions that work for all.

Shared

Recommended next steps

For public transport operators and funders:

- Understand loss-making routes or specific low-patronage services and work to create (or partner to include) a wider range of better quality service options. This may be particularly applicable in a rural or first mile / last mile context.

- Recognize the value of existing data collected on route operation and performance, and seek to share this on open platforms to allow others to promote and understand the services.

- Form partnerships with shared mobility providers and operators of MaaS digital platforms to build better analytical shared datasets that can inform service quality reviews and future service amendments.

For national and local planning authorities:

- Incentivize collaboration between public and private sector operators in the shared mobility space, and seek consensus around common objectives that benefit each

- Consider how 'Mobility Orientated Development' might be measured against planning and mobility objectives, explicitly enabling shared mobility to drive development planning processes and support uplifts in development densities.

- Linked to this, investigate the creation of a New Mobility index to measure accessibility levels (considering access to public transport, electric charging, multiple shared mobility options, time mapping and walk/cycle options)

- Develop policy and quality targets for the range of sharing mobility models. These could relate to reliability, cleanliness, affordability service indicators applied to carsharing (car clubs, fractional ownership), ridesharing, public transport and bikesharing in order to achieve specific modal shares and reduction in private car usage.

- Consider policy incentives for shared mobility options such as preferential parking/drop-off locations, high occupancy lanes or signal prioritization.

For shared mobility service operators:

- Take the next steps around collaboration with key stakeholders at national, regional and local levels (as appropriate) to better embed the service offer as a key part of the wider whole.

- Understand the potential for demand and revenue growth through the above process, and the quid pro quo sharing of a proportion of these returns with network owners and operators.

- Better understand the needs of the public sector, in particular the generation of wider non-commercial benefits, to support the growth of commercial shared mobility services across a greater proportion of the population.

Business Models and Revenues

The chosen business model, in particular its reach, its incentives, its influence and its 'teeth', acts as a fundamental enabler for the whole of the New Mobility concept. Done well, this enabler could take separate elements of change related to automated, connected, electric and shared mobility and bind them together so they are mutually reinforcing.

Some specific aspects of New Mobility already have their own commercial business models, but these tend to operate in relative isolation between private businesses and consumers. Decisions about vehicle purchases, season ticket renewal or membership of a car club, to take just three examples, are entirely separate.

In most countries, car users are unaware of the full economic and social cost of their decision to drive, as most of the costs are sunk (vehicle purchase, insurance, road tax and similar) before deciding to make a particular trip.

Now and increasingly in future, new forms of data will give us the potential to use much more refined pricing mechanisms to manage network behaviour, assure fair access and achieve the transport vision we want. These can then be fine-tuned in real-time to manage network efficiency, whilst generating revenues for improved transport infrastructure, future service provision and social access.

In terms of returns, greater collaboration between the public and private sectors should include agreements to define and ring-fence returns to network operators and maintainers, fleet operators and similar.

?

Key questions that need resolution over the short term include:

- How can pricing be used to encourage an optimal transition?

- How can trip pricing be used to avoid increasingly automated mobility leading to extra demand and/or distance travelled?

- Is it possible to build a business model where the users' perceived cost of travel is less than today?

- Can multi-modal trip pricing be integrated so that users make the 'right' decisions for system-wide efficiency, incentivizing the best decisions and behaviours for wider public interest?

- How can existing shared mobility business models be adjusted so they align better and help to fund local plans for new and maintained infrastructure, in particular roads?

- What regulatory controls will be needed to manage New Mobility business models, and at what level (national, regional or local)?

- How can regulation be best used to achieve specific objectives such as cross service subsidies, special pricing strategies or access for all?

Business Models and Revenues

Current trends

Regulation are needed in the new business models, pricing and regulation in the context of the four core aspects of New Mobility.

Fuel taxes as a base for infrastructure funding are unsustainable

Many countries are experiencing decreases in revenue streams because of the increased fuel efficiency of vehicles.

Since the latter is very desirable for other objectives, fuel taxes as a funding base are unsustainable for the future. As alternatives, carbon taxes and distance-based charging are increasingly under consideration in different regions around the world. Our interviews and research show that appetites for wider road pricing, in particular, are growing in many economies around the world.

Electric vehicles are gaining market share

Adding to the fuel tax challenge, the rise of electric vehicles, admittedly from a very low base, is expected to create a larger tax revenue deficit in time.

To counteract the current high cost of vehicle purchase, countries and cities are implementing a range of policies to increase the uptake of electric vehicles. These include purchase subsidies, free charging, free parking and use of bus lanes.

These are needed to counteract future changes in fuel prices and the falling price of second hand non-electric cars, but in time we expect to see moves that reconsider vehicle ownership models and go a step further by encouraging people to give up private ownership altogether.

Car manufacturers are already exploring new pricing models

The private sector is already moving towards new ownership models.

In a move away from a flat fee ownership model (i.e. selling a car), most manufacturers now offer leasing, fractional ownership and pay-per-use pricing, each of which marks a move towards selling mobility rather than a physical vehicle. The latest moves are similar to a software technology service applied to hardware, with Tesla, for example, offering remote upgrades to access new functionality and performance, via software updates, for a fee.

Air quality problems and global warming require a policy-led reduction in transport-based emissions

Countries and cities are looking at diesel and petrol car bans starting between 2030 and 2040.

Several European cities already have environmental zones around city centres for heavy vehicles, cars or both.

Any new pricing and regulation models should take the opportunity to act against emissions, the prevalence of polluting vehicles and overall levels of congestion.

Urbanization is already putting increased pressure on infrastructure capacity

Different countries already apply relatively blunt methods of regulation and taxation to reduce the use of privately owned cars.

License plate based bans in China and South America are an example, as are additional purchase taxes applied to vehicles in Denmark and The Netherlands. Singapore and Beijing restrict the number of vehicles that can be registered, and cities such as Oslo and Barcelona are working on banning cars from specific areas.

Many cities still permit development on the presumption of minimum parking standards

This policy was designed to ensure that sufficient parking would be available around new urban developments to avoid wider impacts on existing residents.

To discourage car ownership, many cities are now seeking reductions in typical development-related parking provisions or switching to a maximum parking provision model.

Parking revenues underpin local urban investment

Pulling against change, many local authorities around the world are heavily reliant on income generated by parking and enforcement charges.

The degree of ring-fencing varies but any onward change in the business model would need to demonstrate how it would replace this revenue stream.

Business Models and Revenues

## Mobility pricing examples
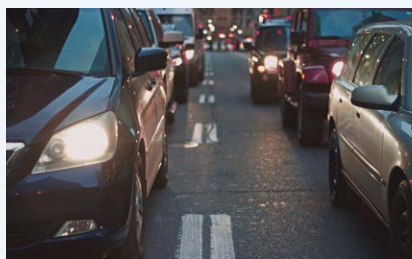
① British Columbia's Carbon Tax, Canada

Introduced in 2008, a revenue neutral carbon tax covers around 70% of British Columbia's greenhouse gas emissions, including transport. It has reduced total emissions by 5-15%.

② London Congestion Charge

The Draft Mayor's Transport Strategy references a pay-per-mile mechanism. Low Emission Zones could be suitable test beds for new road pricing.
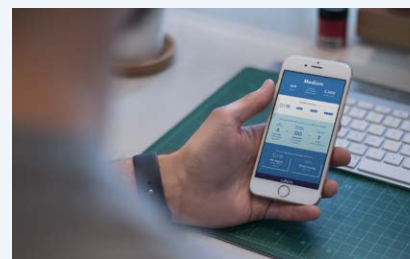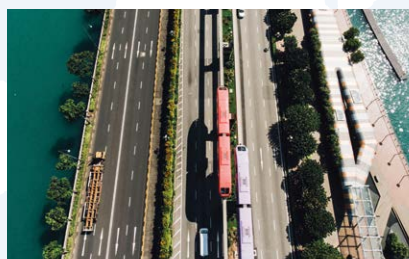

③ Whim, Helsinki, Finland

The Whim platform, a MaaS Global Pilot scheme, offers bundled mobility for a pay-as-you-go price or monthly fee.


④ Melbourne CityLink & 407 Express Tollway in Toronto

Locations of vehicles can be identified and movement profiles built up. Few people take up the anonymity option offered.

⑤ Singapore's Electronic Road Pricing System

The first and most sophisticated congestion charging system in the world with the ability to vary prices based on traffic conditions and by vehicle type, time and location.
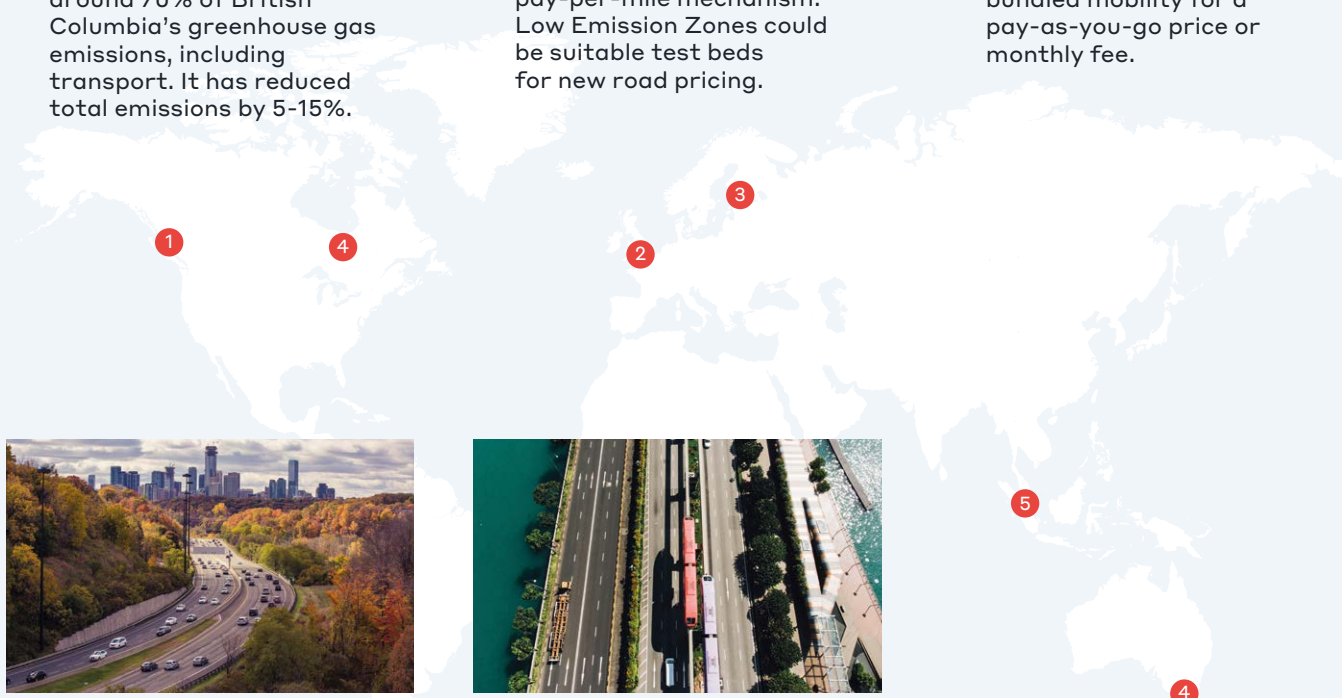
Business Models and Revenues   *Looking Ahead*

We see potential in particular for new business models that wrap up all four aspects of New Mobility – automated, connected, electric and shared – to encourage a purposeful shift towards the best possible outcomes for our places and people over the long-run.

The single enabler across all of these areas is the fast-expanding availability of data, which is the key to a fair and accessible future mobility system for all. It is unlikely that a generic business model will work, as needs and priorities will vary between countries, and at the level of individual cities and regions, as will costs and benefits.

It seems possible that some of the more advanced pricing models already on the market, in particular those in the shared mobility space, could adapt to cover a wider remit with a wider range of stakeholders in both the public and private sector.

On this basis, we offer a range of guiding principles for the creation of a New Mobility business model:

- To create a fair, sustainable and politically acceptable operating model that is self-maintaining and makes the most of all four aspects of New Mobility, recognizing their unique individual contributions to desirable wider outcomes.

- To create the right conditions for collaboration between key stakeholders at a range of levels, to maximize public participation, preserve existing revenue streams for the public sector (e.g. parking income) and commercial returns for all partners.

- To guard against unnecessary increases in vehicle kilometres and congestion, via a mix of planning policy to prevent sprawl coupled with dynamic pricing that builds in incentives for shared mobility and travel at less busy times. Surcharges should apply for highly inefficient or, in time with automation, empty running.

- To provide an integrated multi-modal system for the efficient completion of end-to-end journeys, where pricing reflects the options chosen in an intuitive way and where unnecessary competition is minimized. It should be possible to create a model where trip costs reflect not just distance and speed, but also the range of alternatives on offer.

- To persuade against personal private vehicle ownership via visible incentives, given that it is unlikely that government will legislate directly in this area. The business model should reflect a relatively high cost of entry and ongoing participation costs for those choosing to use their own vehicles over the long term, once alternatives are in place and proven.

- To plan for and fund new development, across the residential, commercial and leisure sectors, that underpins New Mobility principles in terms of both physical layout, but also everyday operation from day one. Find ways to engage both long-term strategic land investors and those with shorter-term interests.

- To give clarity to the distribution of public sector income for wider benefit, for example to enable access for all, to fund public realm improvements or to invest in transport infrastructure and service upgrades. Coupled with individual experiences of mobility, this will be a core element that influences public perceptions and long-run popularity.

- To consider differential application and costs according to location, recognizing that options in urban, suburban and rural areas will be dramatically different and that mobility needs will vary.

- To incentivize electrification (or other future sources of energy) while reflecting cost variability. Factors such as affordability of electricity, environmental cleanliness of local electricity generation and distribution challenges (particularly in rural and remote areas such as the Canadian territories and the Australian outback) will each have an influence.

- To start to set New Mobility targets and carry out scenario tests, from now, for a range of outcomes reflecting different future values of mobility and time, and then to keep a close watch on the actual influencers of this value in the context of New Mobility change.

- To begin now.

Conclusion

Everyone reading this will have a personal and professional stake in creating a purposeful transition to the best possible New Mobility outcomes. What "best" looks like will, of course, vary according to your specific interests and goals, so individual plans of action are needed for the next steps.

In closing, we summarize the core benefits brought by each strand of New Mobility and then offer five simple steps by which you could define your unique pathway, starting now.

The need for all five New Mobility strands

The transition to New Mobility is underway. Some countries and cities are ahead of others and appetites vary, but onward change against the four key aspects – automated, connected, shared and electric – is inevitable. The fifth element, business models, acts as the enabler or "glue" between the other four.

We are convinced that all five aspects are essential, as they each add distinct value to the potential on offer from New Mobility. Without any one element, we are unlikely to maximize the benefits of the transition.

- The *automated* and *connected* strands, together, are the two pieces that will *transform future network efficiency, safety and access to mobility*. They will allow the creation of a *single data-led multi-modal transport system*. Without the other New Mobility strands, however, they are unlikely to reduce demand or associated congestion, nor can they be expected to create substantial improvements in air quality or the quality of our places.

- The *electric* strand (or alternative fuels yet to emerge) is the primary New Mobility element that holds the *key to substantially cleaner air* for our communities in the long-run.

- The *sharing* strand holds the *transformational power around future place-making across our cities, towns and rural centres*. This is because there could be far fewer vehicles parked, compared with today. This is only possible if we can encourage a substantial move away from private vehicle ownership by offering a high quality, flexible and affordable mobility service that works as well as (or better than) today's car ownership and lease models.

- Finally, the *business model* strand, linked closely with pricing, will unlock the shift from today's seemingly eclectic selection of pilots and operating models across the automated, connected and electric strands to a truly sustainable New Mobility 'bundle' for the long-run. The shared mobility strand already has various business models in operation, but we see that these would evolve and become more integrated with the wider New Mobility concept. In the interests of simplicity but also to maximize returns, we will want to move towards *integrated system operation* where the cost of trip-making are clear and understandable, and where levels of use are maximized but in a way that *manages congestion* and *encourages efficiency*.

New Mobility business models also hold the key to *capturing commercial returns for both private sector participants* (whose returns should increase through collaboration) *and public sector bodies* who are responsible for maintaining and investing in our multi-modal transport networks over time. It is also the core piece that will steer public engagement and opinion, building popularity as long as the quality of service is good and user costs are perceived to be fair and affordable.
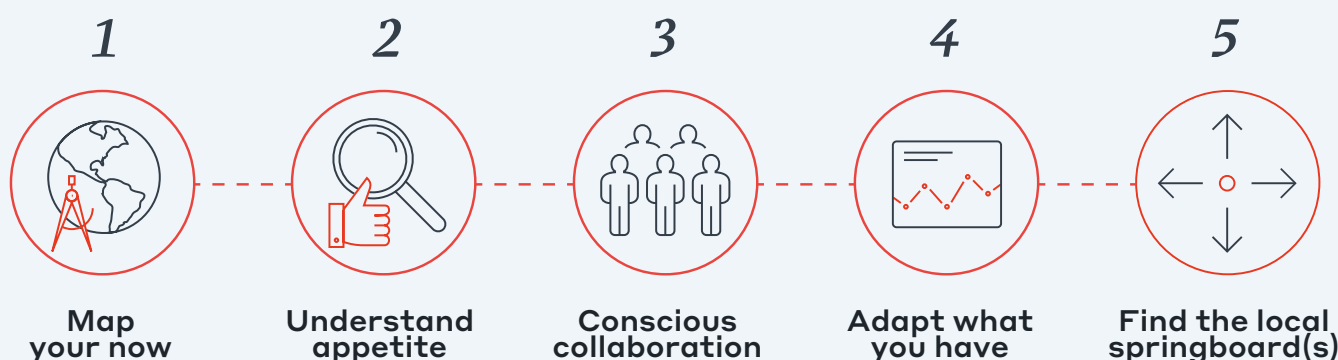
Unfortunately there is no easily defined single "bundle" that will work everywhere. It will be the local application, and onward growth, of specific yet tailored solutions that will bring genuine benefit to our places and routes of the future. Some players have the power to generate widespread multi-national change, while others hold much more local influence as enablers and agents of change on the ground. Each needs the other if they want to maximize popularity, commercial returns and wider benefits.

Conclusion

Five steps to New Mobility success

Five steps

1 — Map your now

2 — Understand appetite

3 — Conscious collaboration

4 — Adapt what you have

5 — Find the local springboard(s)

The following five steps could be taken by any organization to make the best progress towards New Mobility.

Step 1

Map your 'now' against the five elements of New Mobility

Using the chapters of this publication as a guide, take time to map your current position against each of the five New Mobility elements, relative to others. In doing this, consider their relevance and importance, your current and intended level of engagement and the urgency for any change.

Some organizations will have an interest in one or two specific strands of New Mobility as a priority, particularly those bringing a specific technological solution to market. Others, particularly the planning and transport authorities, are more likely to find that a balanced approach across all five strands, with an eye on wider social benefit as well as direct commercial returns, is most likely to generate the greatest value.

Step 2

Understand appetites for change

The key choice that is open to all of us is the extent to which we each choose to engage and lead change from now. Appetites for New Mobility and the power to accelerate or hold back change vary widely. This range is particularly visible in the public sector, at both national and local scales, from 'we'll wait and see' to 'we want to be at the front'. We would suggest that a simple exercise to consider your own – and relevant others' – appetite(s) for change could be highly valuable.

There may be nothing wrong with waiting on some aspects of New Mobility, although the risks of doing nothing when others are increasingly active should be considered carefully.

It is worth bearing in mind that we do not need to do everything, everywhere, and that given the range of live operations, pilots and trials already in play, it should be entirely possible to adapt learning from one place to another.

As a final point, being keen to engage with New Mobility does not mean that everything has to be decided and mapped out now. There will be many unknowns, and much more change ahead, so the first step is to identify what decisions are really needed now and which can wait.

Conclusion

Five steps to New Mobility success

Step 3

Collaborate, consciously

Throughout this White Paper, we have homed in on better collaboration as a major opportunity.

We are absolutely clear that collaboration is the key to maximizing returns and generating faster change towards productive New Mobility outcomes.
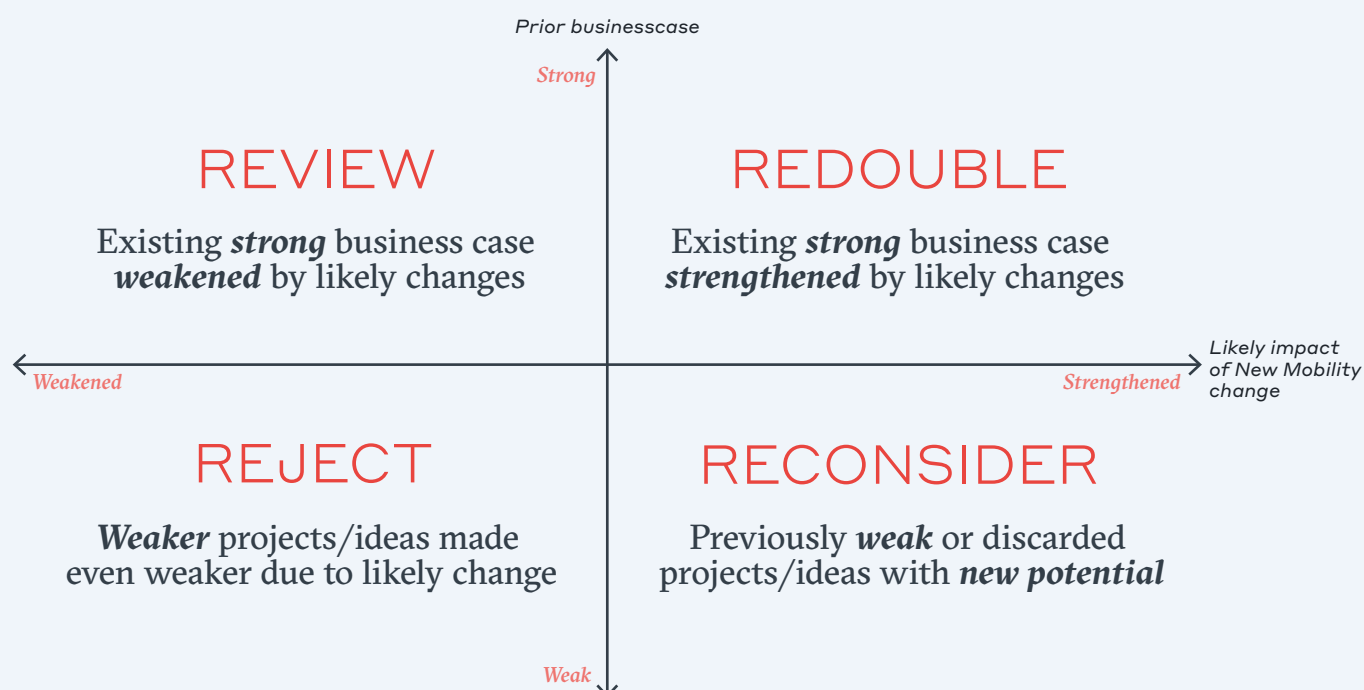
It is clear that nobody will make the most of the transition to New Mobility if they try to achieve it alone. We need all sorts of people – enablers, technologists, funders and visionaries – to craft and shape the landscape, then reshape it as necessary, as onward change will not stand still.

That said, it is not about collaboration for its own sake, or automatic collaboration with anyone who happens to ask. We would recommend a much more conscious process, where possible partners and stakeholders are considered and approached for the specific value and opportunity that they bring, and their alignment with your plans and goals. The process is, by definition, two-way.

We can see this beginning to happen in practice. We are moving from connected and automated vehicle trials designed to prove a specific technology, to efforts to marshal this learning and to understand the potential and impacts on places and routes. Similarly, some of the newer shared mobility providers are now learning that collaboration and the formulation of shared goals with the relevant national and local planning and transit authorities can pay dividends in terms of their integration with – rather than competition with – other modes and services.

The other aspect of vital collaboration is with the travelling public. New Mobility is a highly technical and specialized area, and yet the everyday experience of moving around our places and networks is familiar to everyone. Efforts to explain, listen and demystify the changes ahead will be the key to public perception and popularity.

New Mobility Business Case Framework

Prior businesscase

Strong

REVIEW

Existing **strong** business case **weakened** by likely changes

REDOUBLE

Existing **strong** business case **strengthened** by likely changes

Weakened ←   → *Strengthened*   *Likely impact of New Mobility change*

REJECT

Weaker projects/ideas made even weaker due to likely change

RECONSIDER

Previously **weak** or discarded projects/ideas with **new potential**

Weak

Conclusion

Step 4

Adapt what you already have

Having focused on aspects of change, it is easy to forget that some of what is already planned or available could be adapted to suit New Mobility futures. In the case of infrastructure, where is there potential to get more from the existing network? Similarly, for proposed developments, how can we adapt existing plans to fit with what we see ahead?

The simple framework above can be helpful in rethinking and adapting existing investment plans.

Step 5

Find your 'springboard'

Through the previous steps, a series of early actions will emerge. Some will be well defined and others will need further exploration before they can be added to plans for next steps. Our final recommendation is to identify a specific 'springboard' or focal point that can be delivered in the short term to make a statement about the tone, style and speed of your move towards New Mobility in your context. This might reflect a prior involvement in existing pilots and trials or an area where you are already in a market leadership position, or it might be an area where you are lagging, but where you can see enormous short-run potential for visible change and benefit.

In combination, these five steps should provide a balanced start-point for an action plan across all the strands of New Mobility, with plenty of routes for immediate focus and action. We hope that the details of this publication will provide useful connections to recent examples and learning from around the world, as well as insight into the current opportunities and challenges of New Mobility.

We would love to hear your feedback on this research and sincerely hope that you have found it helpful. If you would like to speak to one of our local experts about New Mobility in your region or elsewhere, please do get in touch at NewMobility@wsp.com.

#FutureReady

#NewMobility

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