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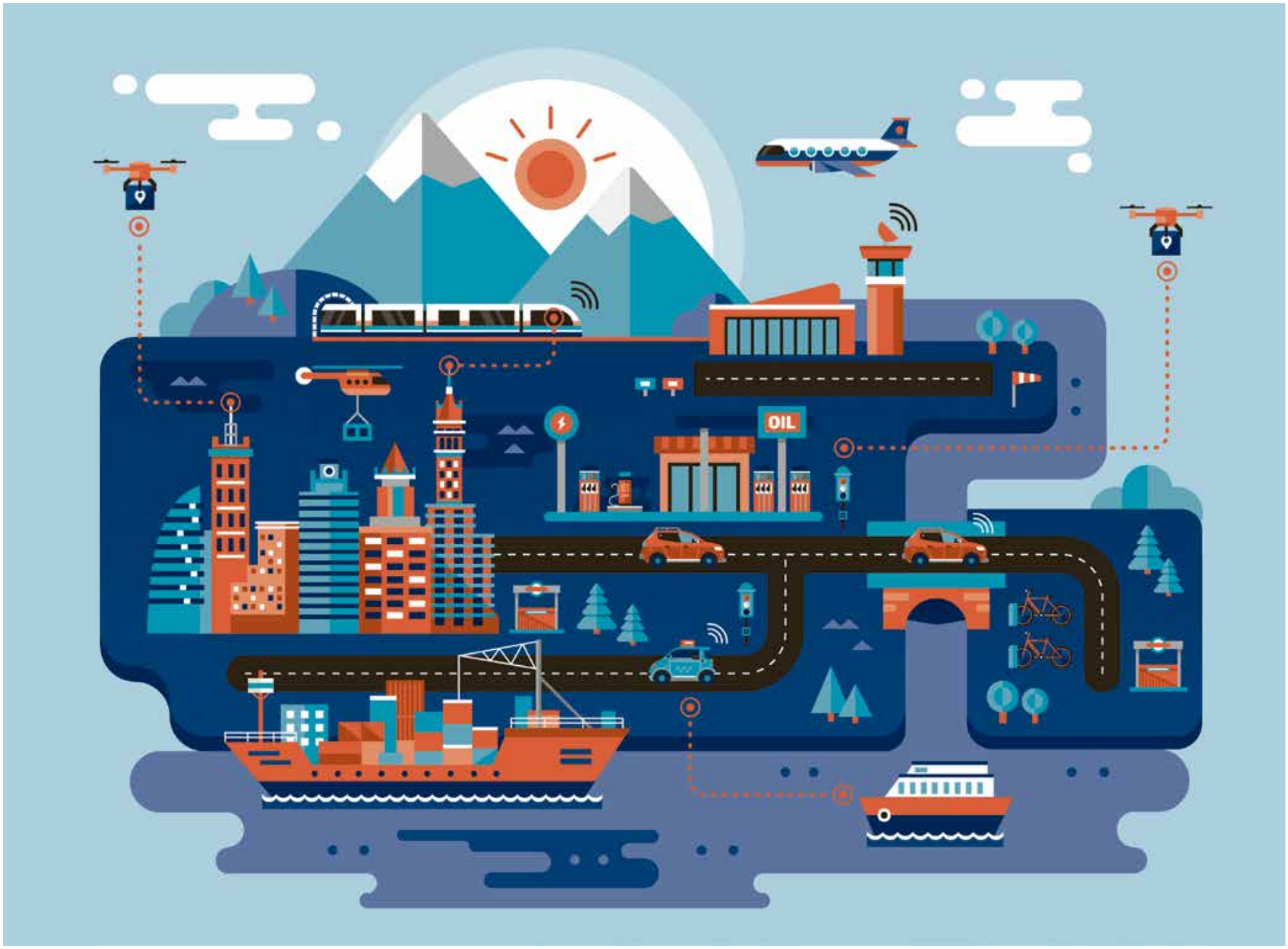
FUTURE of TRANSPORT



The evolution of intelligent traffic management

Aimsun Online simulates each vehicle inside a lane-based road network faster than real time to evaluate traffic management strategies and predict travel times.
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Transport heading in new directions

Travel and transportation are evolving in response to customers' demands and technological advances, but the movement of people and goods must be sustainable in its impact on society and the environment

◆ **OVERVIEW**

● **FELICIA JACKSON**

Transport is currently undergoing significant disruption, not only from transformative changes in existing modes of travel, but also because of innovations shaking up the sector.

As Bhoopathi Rapolu, Cyient's head of analytics for Europe, the Middle East and Africa, says: "New technologies, such as drones, auto-pilot cars and remotely piloted aircraft systems, are fundamentally changing the dynamics of the market by enabling visionary companies to develop cheaper, sustainable transport solutions."

It's not just consumer transport facing disruption. Increasing environmental concern and changing regulations are having a dramatic impact on the supply and logistics market. With e-commerce now constituting a large part of the economy, shippers need to rework business models to manage last-mile delivery.

Digital technologies and the need for omnichannel fulfilment are seeing synchronisation between procurement, transportation, warehousing, order management and fulfilment. This confluence is also driving convergence across different transport sectors.

On a sector-by-sector basis, there are different stress factors. The International Civil Aviation Organization has predicted world scheduled air passenger traffic will grow by double global GDP growth in 2015.

E-ticketing and other streamlining opportunities are improving efficiencies, including the implementation of e-freight. This intends to build a paperless, end-to-end transportation process for air cargo across the entire air cargo supply chain.

The International Air Transport Association says it wants to see the industry move towards 100 per cent e-freight, starting with adoption of its e-Air Waybill. Yet programmes developed to increase efficiency and cut emissions, from a green taxiing system to the Single European Sky programme, have been delayed through a combination of funding problems, politics and challenges from the trade unions.

In freight terms, sea has its advantages and is up to ten times cheaper than air, per unit weight, according to Boeing. Indeed, there has been a refocus on the role of shipping within the supply chain.

While relatively small, at three million TEUs (twenty-foot equivalent unit containers), the King Abdullah Port, the first major deep-water port south of the Suez Canal, lies directly on the main Asia-Europe trunk line and can reduce East-West trans-shipment times by five to seven days. It is part of the $100-billion King Abdulla Economic City (KAEC) project that is also supported by a new high-speed railway network to connect Mecca, Jeddah, KAEC and Medina, which is expected to start operating in early-2016.

> **There is not an element of the global transportation network that isn't being affected by changes in technology and demand**

In the UK, Peel Ports is investing £300 million in Liverpool2 to create the country's most centrally located deep-water container terminal. Currently Liverpool can only handle 5 per cent of the container ships that sail, while Liverpool2 will be able to handle 95 per cent, doubling the port's throughput from 750,000 containers a year to 1.5 million TEUs.

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But when China's Yangshan Deepwater Port in Shanghai is completed in 2020, with 50 berths and an annual handling capacity of 20 million TEUs, it will surpass Singapore's existing status as the world's largest port.

Better connected and more efficient transport networks are the goal of most countries, but in the developing world this can still mean building roads. However, in the developed world the aim is to get people off roads and on to mass-transit systems. Infrastructure improvements, such as electrification and modernisation of rail tracks to accommodate faster trains, are priorities in the UK, Germany, France, Japan, Korea and elsewhere.

An example is Melbourne, which is developing the AUS$1.5-billion Metro Rail Project. This will involve the construction of two nine-kilometre underground rail tunnels. Evan Tattersall, chief executive of Melbourne Metro Rail, says: "Melbourne Metro's five new underground stations will directly support the growth of inner residential, commercial, health and education precincts, and make central Melbourne an attractive option for new business, generating significant investment opportunities and further positioning Melbourne as one of the world's most liveable cities."

The challenge is transport investment often suffers at the hand of political expediency. In the UK, this can be exemplified by the history of London's Crossrail projects. Despite the fact that passenger numbers on the Tube have increased by 40 per cent in the past 15 years and the equivalent of the population of Manchester now rides underground in the capital every day, the £27-billion Surrey to Hertfordshire Crossrail 2 project has yet to be approved. The delay has been put down to political disagreement on the exact route, agreeing a funding deal and finalising the construction timetable.

Taking an overview, there is not an element of the global transportation network that isn't being affected by changes in technology and demand. While investment in shipping, aviation and rail continues unabated, with new projects attempting to include the latest technological breakthroughs, it is perhaps road transport that looks to be most affected by changing paradigms.

The impact of telecoms and the internet on road vehicles cannot be underestimated. In a world that is increasingly connected through big data and the internet of things, traditional transport models must continue to adapt and evolve.

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◆ **RAIL**

● **MIKE SCOTT**

Getting on track for UK high-speed rail

The rail industry is in the midst of a transformation from a system based on infrastructure created in the Victorian era to one fit for the 21st century

1.7bn

journeys are made on UK railways every year, 34 per cent more than just five years ago and more than double the number 20 years ago

Source: Network Rail

Although the UK rail network is the fastest-growing in Europe in terms of passenger numbers, the system that transports these passengers has failed to keep pace with this growth – like a glacier, change is happening but so slowly that it can be hard to see.

"We have a lot of pretty aged infrastructure, so lots of investment is needed to improve the network," says David Moore, a rail expert and partner at law firm Clyde & Co.

According to the government, there are 20 per cent more services today than 15 years ago, but they are running on essentially the same network.

"Although there is lots of criticism, the industry is in pretty good shape," Mr Moore adds. "It carries more people on much better rolling stock and is much safer than it used to be."

Demand for rail services has never been higher, says Alistair Gordon, chief executive of Keolis UK, which operates a number of rail franchises, including HS1 and Thameslink as well two light rail networks, the Docklands Light Railway and Nottingham's tram service.

"Understandably, this puts significant strain on our network which makes capacity-increasing measures essential. Our rail system, the first in the world, has changed little since the Victorian era," says Mr Gordon.

As a result, he says, it is in urgent need of additional capacity. "Fortunately, we are seeing significant levels of investment into infrastructure improvements and new rolling stock across the rail network."

The biggest project currently under way is Crossrail, which is improving links across London, with Crossrail 2 under consultation at the moment. Crossrail 1 will link stations from Reading to Heathrow, central London all the way out to Canary Wharf and Brentwood in the east of London. Crossrail 2 will improve links from Surrey and Hertfordshire into London.

"Huge projects such as HS2 and Crossrail are really important, but there are other big upgrades going on as well," says Richard Robinson, Aecom's chief executive of civil infrastructure in Europe, the Middle East and Africa.

The government has identified a number of key upgrade projects including:

- The Northern Hub rail upgrades; a £600-million rail investment programme to create up to 20,000 jobs and boost the northern economy by billions of pounds
- An additional 1,000 kilometres of track being electrified, including the important Great Western and Midland Mainline intercity routes
- A £300-million scheme to electrify more than 160 kilometres of track in South Wales.

But, says Mr Moore: "The whole process takes far too long. As the Crossrail website says 'after 35 years of planning and development, Crossrail finally broke ground on May 15, 2009'." The first trains are due to use the new line in 2017.

Part of the problem is that "infrastructure can take many years to be implemented, while the parliamentary cycle is five years", he adds. "Elections get in the way of infrastructure."

Another issue, particularly when it comes to upgrading existing lines is that, because the network is so intensively used, any work must happen without disrupting services. Mr Robinson says: "It's not unlike trying to fix the wings on a plane while it is flying."

However, upgrading the network is vital for the UK's future job creation and economic growth, he adds. In a survey for Aecom and the CBI, more than nine out of ten respondents said infrastructure is essential for their investment decisions. "The link between good transport connections and economic activity is undeniable," says Mr Robinson.

Industry leaders say new intercity capacity must be high-speed rail, in part because the UK lags far behind its European neighbours in high-speed capacity – we have just 100km of track, while countries such as France and Germany have thousands of kilometres – and partly because a new high-speed network will ease congestion both on existing rail networks and on the nation's roads.

"A new line dedicated to long-distance train journeys would mean that more paths are available on the existing lines for commuter travel and for rail freight, easing congestion on our overcrowded road network in the process," says Stuart Andrew, co-chair of the All-Party Parliamentary Group on High-Speed Rail. "Critics have argued that a new line does not need to be high speed and that the distances covered by the network are far too small for HS2 to be a valid option. However, a high-speed line will only cost 9 per cent more than a conventional line and will alleviate pressure on existing networks."

There are other measures that can increase capacity on existing networks, says Steven Brown, director of rail at engineering consultancy Ramboll. "Advances in signalling technology mean we can take control of trains from thousands of line-side signals and consolidate them into maybe a dozen control centres that can look after the whole network. It will lead to safer, faster, more reliable journeys," he says.

There is also scope to help improve journey times and release capacity on the network through electrification projects, such as the one being planned for the TransPennine Express route, Mr Gordon adds.

All this modernisation costs money, which is coming from a variety of sources on top of government spending. "There is a lot of investor appetite for these projects in the UK," says Mr Robinson.

Mr Moore agrees, saying that interest is coming from domestic and foreign investors, sovereign wealth funds and governments. "But they will want to see a return on their investment," he says. "If all the money comes from fare-payers, there will have to be some kind of government subsidy to plug the gap."

However, Crossrail has opened up other funding streams that were initially contentious, but have proven to be very effective, says Mr Brown. These include a business rate supplement on business that will benefit from the scheme and a community infrastructure levy.

"The rail sector is in a healthier state than it was 15 to 20 years ago," he concludes. "When I joined the industry in 2000, it was not fit for purpose. Since then we have seen massive changes."

CASE STUDY: HYPERLOOP

Elon Musk, co-founder of PayPal, made electric cars sexy with the Tesla – now he wants to do the same for trains.

In 2013, annoyed at proposals for a high-speed rail system in California that would be "both one of the most expensive per mile and one of the slowest in the world", he outlined an alternative proposal called Hyperloop, to link cities that are less than 900 miles apart; longer than that and you need supersonic air travel, he says.

"Short of figuring out real teleportation, which would of course be awesome – someone please do this – the only option for super-fast travel is to build a tube over or under the ground that contains a special environment. This is where things get tricky," he writes on the website of another of his companies, SpaceX.

His idea is to build a low air pressure tube mounted on pylons between cities, such as Los Angeles and San Francisco, through which pods would run at speeds of up to 700mph on a bed of air instead of rails, propelled by magnetic accelerators. It is a cross between the pneumatic tubes large offices routinely used to send messages and a maglev train, and could cut the LA-San Francisco trip, or London to Glasgow, to half an hour.

"By building it on pylons, you can almost entirely avoid the need to buy land by following alongside the mostly very straight California Interstate 5 highway, with only minor deviations when the highway makes a sharp turn," says Mr Musk. Although his idea would cost billions, it would be a tenth the cost of a high-speed rail line, he claims. He even says the scheme could be self-powering if solar panels were placed on top of the tube.

While Mr Musk is not developing a Hyperloop system himself, he is helping to make the scheme a reality by running a competition to design and build Hyperloop pods, which can be tested on a one-mile test track SpaceX will build near its California HQ in June 2016.

Crossrail Ltd

Crossrail tunnel at Bond Street Station

COMMERCIAL FEATURE

A TIME-TRAVELLER'S TALE FROM 2022

Travel in the future could be very different. Enabled by the internet of things and on a flat rate for all modes of transport, our daily commute and business trips could be combined in one clever, convenient and economical contract – Mobility as a Service (MaaS). Supported by innovative and cutting- edge Kapsch technology, hypothetically, this is how life might look...

kapsch >>>

Picture the scene... today is the November 17, 2022. It's 6.50am and Kate (our fictional future self) is fast asleep, dreaming of a leisurely stroll along a Caribbean beach.

Her sunny island vision is shattered as the alarm wakens her to a rainy-day commute in London. Bad weather is not all bad news though. The downpour means an extra ten minutes' snooze, thanks to Kate's smartphone mobility butler who, knowing she would forgo a soaking bike-ride to the station, ordered a car-pooling service for her instead.

With no physical entry barriers any more at the station, access is a breeze and Kate sails through to the platform, where the train is on time. Her phone connects automatically to on-board wi-fi and she starts checking e-mail. The ticketless transfer from train to tube is just as smooth.

> "With no honking car horns and plenty of fresh air, the city centre can be so pleasant, freed from congestion and pollution

Coming up from the Underground, Kate enjoys her short walk to the office, despite the rain. With no honking car horns and plenty of fresh air, the city centre can be so pleasant, freed from congestion and pollution.

After a busy morning preparing for an important client briefing that afternoon, Kate decides to grab lunch at her favourite bistro with her boyfriend. With the skies now clear, her smartphone suggests a nearby bike-sharing station, and her calendars sync meeting venue details and timings.

Lunch was great, but her phone now tells her she has to leave if she wants to take the car and be on time. There is a lot of traffic on the motorway and road tolls are soaring. Kate can extend her lunch for another 20 minutes, though, if she takes the train and a shared car for the last mile.

On arrival at the station, she puts the meeting address into the car dashboard, turns up the music and starts driving. On route, her car reduces speed dramatically just as she approaches a crossroads. That was a close call with an ambulance coming unseen and at speed from the left – accident prevented.

Kate resumes her journey at the speed indicated on the dashboard. She doesn't have to change gear, as all traffic lights are green on approach. As she reaches her destination, the blue "P" on her dashboard starts blinking. She taps it and is navigated to the closest parking spot. She lifts her hands off the wheel and the car parks itself. Right on time.

The meeting went really well. Her clients will be signing an extension of the contract – time to celebrate. She drives her shared car directly to the pub where friends are waiting. Since she has enjoyed more than a glass or two, Kate's phone recommends the green bus home, safe and sound.

Once again, the decision of Kate's employer to move from company cars to the Greater London XXL MaaS package has paid off. Kate's journey, if she had purchased services individually from different transport providers, would have cost £350. And the time she saves by using MaaS? Priceless.

www.kapsch.net
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1 Kapsch solution: Mobility as a Service (MaaS)

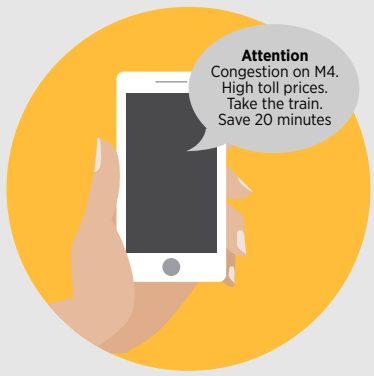
Kate has the MaaS application on her phone for intermodal transport planning, information and payment. Using personal settings, it calculates the best route to any given destination, any time. With an interface to different means of transportation, plus real-time passenger information (RTPI), it also allows for such as selection of transport options, specific reaction to specific conditions on weather or traffic – and even oversleeping.

2 Kapsch solutions: Railway Comms, Automated Ticketing, plus Train and Tube Control communication

Kapsch is the world leader for GSM-R, a mobile and mission-critical communications system for railway operators, such as Network Rail. With Kapsch communication solutions train and tube control headways can be improved too, as with the Tyne and Wear Metro, Newcastle, for example.

3 Kapsch solutions: City Access and Congestion Charging

Municipalities are restricting entry to certain parts of their cities, such as historical centres, pedestrian areas or environmental zones. By using ANPR (automatic number plate recognition) camera technology, Kapsch Limited Access Solutions can detect registered vehicles to control and monitor movements. The same cameras can be used for congestion charging.



4 Kapsch solutions: Integrated Corridor Management and Automated Traffic Management

The Kapsch integrated toll collection and traffic management solution enables both dynamic pricing in case of increased traffic volume and alleviation of congestion. The new calculated rates will be displayed on signs or the MaaS app, allowing drivers to make informed decisions whether to continue by car or switch transport.

5 Kapsch solutions: Vehicle-to-Vehicle and Vehicle-to-Infrastructure (V2X) Communication, and Streetline Smart Parking

Communication between cars and cars and infrastructure such as traffic lights is based on a special wi-fi radio link. Kapsch V2X enables vehicles to exchange messages about hazards and traffic incidents, both with other vehicles and roadside infrastructure. The Streetline Smart Parking platform provides real-time information, via smartphone or in-vehicle navigation.

6 Kapsch solution: Eco-Drive

Kate's green bus is included in her flat rate. The green bus is actually London red, but the footprint is small, because the driver is eager to get his "green driver's award", third time in a row. Kapsch's Eco-Drive solution shows him how to optimise his driving style, in real time.

Speeding into a new world of smart cars

The automotive industry has begun a journey into the future when self-driving electric cars will be intelligent technology platforms

◆ **CARS**

● **TRISTAN McALLISTER**

If you visited Silicon Valley a decade ago, it was hard not to be impressed by the disruptive – and quite welcome – antidote to a world that loved fossil fuels with an electric hybrid at nearly every four-way stop.

At the time it felt like the true future of the automotive space was about hybrids and Toyota, a long-standing player and dominant manufacturer, seemed to hold the key to backing the competition into a low-emissions corner.

The area's residents, who live in a state with regulations that favours cars with lower emissions and are arguably obsessed with being seen as "doers of the right thing", embraced a tech innovation they didn't even invent.

This, perhaps, seeded Silicon Valley's interest in just how much traditional ideas about cars could be changed. Back then, it felt like we would all be driving something as nifty as the Toyota Prius by 2015.

Well, it's now 2015 and many a Prius on Highway 101, running through the heart of the San Francisco Bay Area, don't look quite as leading edge as they used to. Still, in many ways the large-scale adoption of hybrid cars certainly laid the groundwork for even more revolutionary vehicles, such as Tesla's Model S, Silicon Valley's automotive zeitgeist darling.

Tesla's all-electric, wirelessly connected and autonomous-drive-capable cars can literally be refreshed with a software update. Yet another disruptive reality check for a slow-to-change automotive industry.

"Tesla's very aspirational offer pushed the industry to invest seriously in the electrification of their portfolios. Alternative powertrains like fuel cells are also finally reaching the market," says Demian Horst, programme director for transportation design at the Umeå Institute of Design in Sweden. "It is true the automotive industry moves quite slow, but that has a lot to do with the complexity involved in creating products which must perform in a very controlled set of legal parameters."

Additionally, Mr Horst thinks digital and design innovation, as well as evolving consumer expectations, will give our cars a whole new purpose. "We update their software, and suddenly feel we have a fresh and more capable product in our hands. We see more concept vehicles now fuelling the discussion," he says. "They will basically make greater use of all the technology and intelligence that is already packed in – radars, cameras, sensors and so on. This transition period is important to build trust in the technology. More radical solutions will follow."

> **Large-scale adoption of hybrid cars certainly laid the groundwork for even more revolutionary vehicles**

This was clearly a line of thinking adopted by Mercedes in early-2015 when it unveiled the F 015 Luxury in Motion concept car. Those who jumped in for a test drive quickly learnt that the driver's seat was made to rotate 180 degrees. So too was the passenger seat, which meant those sitting in front could turn to face those in back, all while the car zipped autonomously through the streets. A small table of sorts popped from a centre console, at which Mercedes even suggested a busy commuter should be able to sit in traffic and do office work at a makeshift desk. If the driver decides to engage in the actual driving, a motion sensing screen allows commands to be input.

When the German maker invited the world's automotive press to see and experience the F015, they did so at an old test-drive airstrip across the bay from San Francisco. It seemed an apt place to showcase a car that was more tech than traditional powertrain, and it was a shot across the bows of hometown heroes Tesla and Google, whose Android operating system has been adapted for some cars.

Mercedes says it was one of the first traditional automotive manufacturers to open a research facility in Silicon Valley in 1995. That's probably why the brand feels it has the local kudos to be sure Apple and various other venture-backed competitors don't get all the automotive press.

During the course of a few days, Mercedes gave journalists an immersive experience, ushering them through mini exhibits that meticulously explained not just the materials behind the car and its snazzy sci-fi look, but also what it stood for.

The German tour guides insisted that this car of the future wasn't just autonomous and all-electric, but that it might also give something back to the environment through which it drives. For instance, at a stop the car would be "smart" enough to shine lights that could project a crosswalk on to the roadway in front of it, while on-board speakers tell pedestri-

1

3 Hadrian / Shutterstock.com

CASE STUDY: CAR-SHARING

Cars, despite being a key investment many of us will make at least once in life, sit idle on average 96 per cent of the time. This means we actually need our cars less than one hour every day. So it's not surprising that many disruptive startups think the sharing economy is the way to be sure our cars don't sit idle.

One such company is DriveNow. Launched in 2011 as a joint venture between car hire company Sixt and BMW, this Munich-based premium car-sharing company has operations in cities around the globe. DriveNow's edge is that users drive a car and then simply leave it within a designated service area, not in a specific parking spot. As long as it's parked legally, the car is ready for its next user.

People looking to hitch a ride and not borrow a whole car would be well served by French startup BlaBlaCar. Simply put, this service is essentially the Airbnb of the transport world. Drivers with empty seats on trips between two cities are connected via an app with digital hitchhikers heading the same direction. Those in need of rides split the cost of petrol and road fees, but not with a mark-up. Of course, BlaBlaCar takes a small fee. The company is growing fast and already has 20 million members in 19 countries. As for the name, it's simply a play on a user's ability to rate how "chatty" (blablabla) they're willing to be with others on the ride.

But, if you're in need of a whole car or not feeling chatty, DriveJoy's offer is an interesting proposition. Again, a nod toward the Airbnb model of sharing the things you aren't using, this service has set up a digital marketplace where those looking to hire or lend a personal vehicle can easily and safely do so. DriveJoy provides the insurance framework for the user, who meets the vehicle owner to exchange keys, and each party can write a review of the other.

Success for services such as DriveNow, BlaBlaCar and DriveJoy seem to be less about the public's willingness to use them and more about government's lack of response to the disruptive forces in the market. "A lot depends on policies and infrastructure. Once mobility needs are satisfied to a greater extent, people will have less need to own a vehicle," says Demian Horst, programme director for transportation design at Sweden's Umeå Institute of Design. If that's the case, then BMW and all the other car makers are smart to be thinking about a future with these disruptive players in it.


Robert Gubbins / Shutterstock.com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1. Mercedes F 015 Luxury in Motion concept car at the North American International Auto Show in January 2015

2. Toyota Prius hooked up to a charge port

3. Tesla Model S at a showroom in Paris in November 2014

ans it is safe to cross.

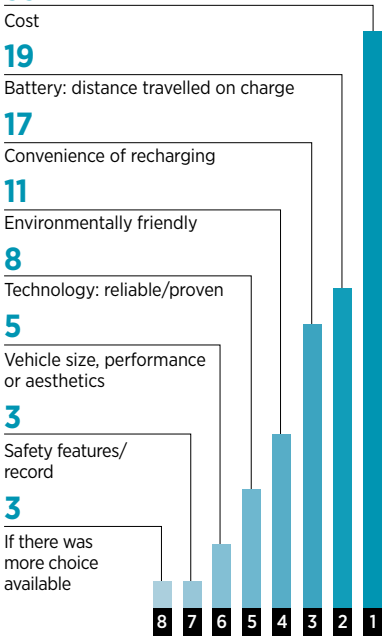
The team also posited that owners may want a car that takes them to work, but then autonomously runs errands or provides Zipcar-like and Uber-like services while the driver's not using it. Mercedes carefully constructed a narrative that seemed to be partially built on Zipcar and Uber's car-sharing and ride-hailing concepts.

"We keep challenging ourselves and are not afraid to be the disruptor of our own business," says Mercedes spokesman Bernhard Weidemann. Disruptor or not, the F015 is merely a concept; an honest attempt by a long-standing automotive juggernaut to address the questions its non-traditional cohorts are forcing it to answer. In truth, the real story wasn't about Mercedes. The maker simply hosted a conversation about reframing the way we use our cars every day.

The public relations staff at the world's major automakers used to ask journalists if they would be attending the motor shows in Geneva, Frankfurt and Detroit. Now those same people ask the auto critics and transport editors if they also plan to attend the consumer electronics shows in Shanghai or Las Vegas. And it's no wonder. "We now expect that the experience with a vehicle will be quite similar to the one we have with our favourite gadgets," says Mr Horst. That means people soon might rely on the car in ways we have never even imagined.

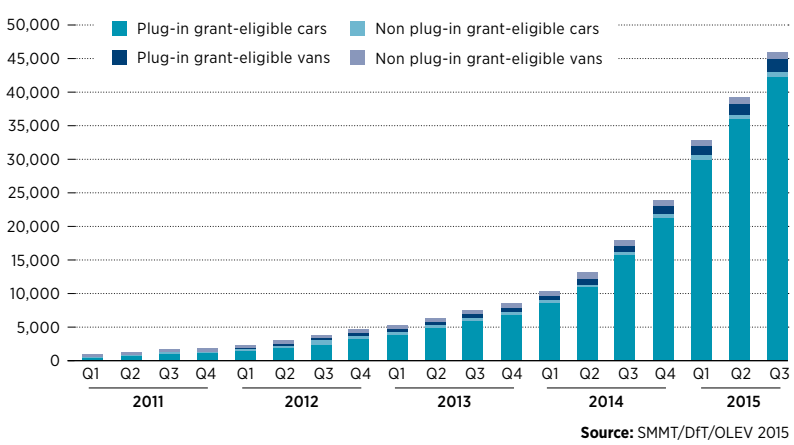
REASONS FOR PURCHASING AN ELECTRIC VEHICLE (%)

When buying a new or second-hand car or van



Source: Office for National Statistics 2015

CUMULATIVE ELECTRIC VEHICLE REGISTRATIONS (UK) 2011-2015



Source: SMMT/DfT/OLEV 2015

On the road to safer, more co

Cars connected through the internet to each other and online agencies provide a range of information services, as well as in-car

◆ **CONNECTED CARS**

● **FELICIA JACKSON**

The world has become evermore connected with SIM-fitted vehicles that "talk" to each other and autonomous cars purported to be safer and "smarter".

Technological challenges remain in terms of developing widespread sensor networks to communicate data, and concerning mass data analytics and security. But the question has become whether the future is going to be one of autonomous cars, seamlessly moving from place to place with no input from a driver, or will cars provide drivers with a wide range of support?

Assisted driving already exists and, with the enormous amount of computing power available in the average vehicle, most already qualify as "connected". Tesla recently even upgraded autopilot software in its cars, following stress-testing which involved people driving from San Francisco to New York using autopilot mode for more than 96 per cent of the trip.

IBM predicts that by 2020 the car will be the most connected app, and 250 million vehicles will be connected and fully packed with sensor technologies.

The work Google and Apple have been doing in developing driverless vehicles, combined with deep expertise in data management and analysis, suggests traditional car makers may be behind the curve in the connected car market.

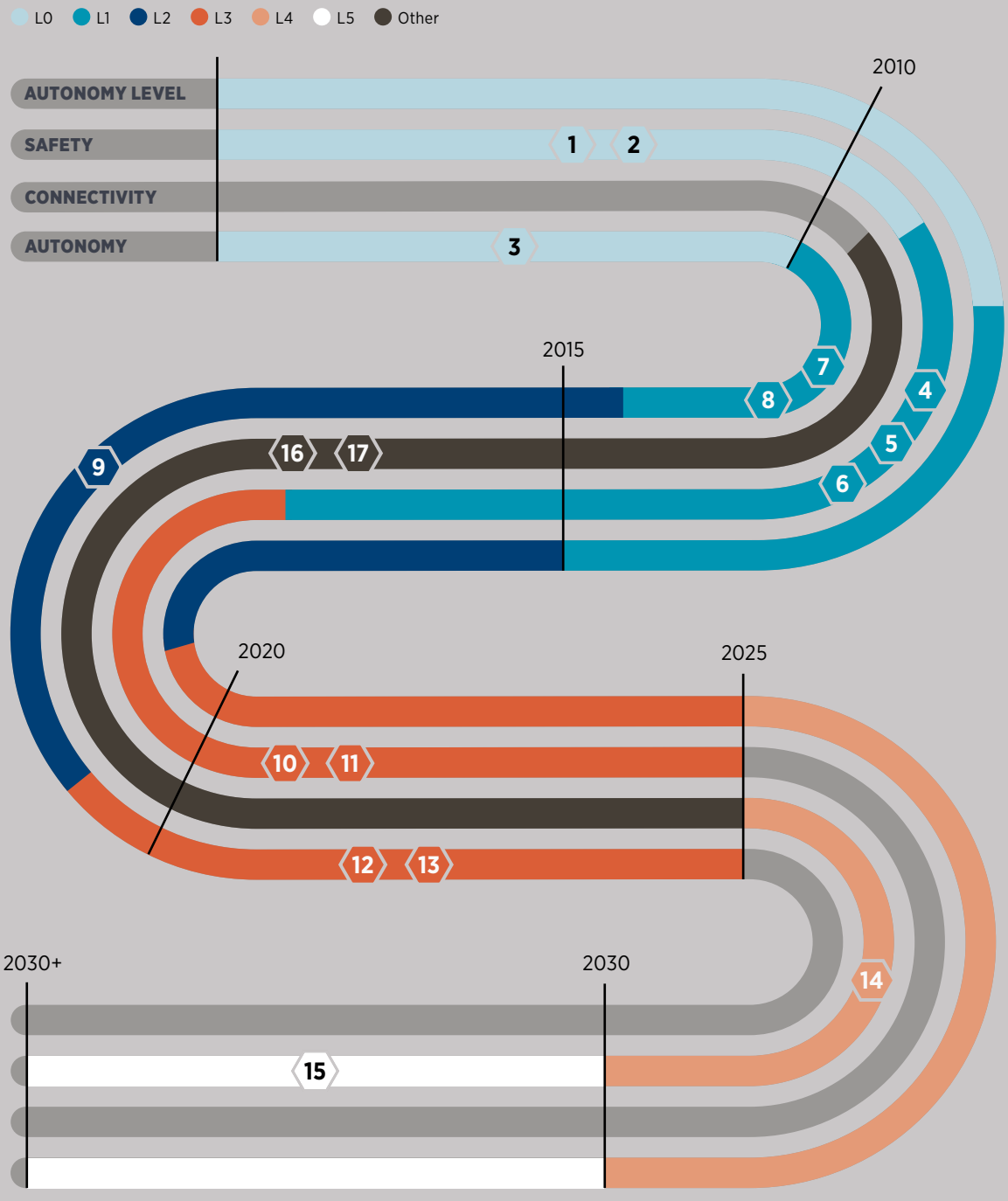
But Stuart Young, a partner at law firm Wragge & Co, sounds a note of caution when assessing the digital potential of automotive manufacturers. He says: "We may be underestimating their systems integration capabilities."

As IBM executive Martin Borrett points out, new cars are already "like a small data centre on wheels". Perhaps the expertise that comes with years of physically engineering vehicles will make more of a difference than the tech giants expect.

Richard Candler, head of product strategy at Nissan, is not chasing the ideal of the driverless car, arguing there is as yet no customer demand. Mr Candler says: "People enjoy driving," and suggests there is a long way to go before driverless cars will be accepted. "How can we be 100 per cent sure that we can anticipate any situation?" he asks, with technology and liability issues still to be worked out. There is lot of deep learning needed to move such vehicles out of controlled environments where they currently operate, he adds.

Instead Nissan is focusing on assistance, taking the hassle out of driving on motorways, in traffic jams or when parking. The company has already launched Safety Shield, which can do a lot of what an autonomous car does and is already on 50 per cent of Nissan cars. With its new Piloted Drive 1.0, Mr Candler believes the cars will have a system that by 2020 will be able to take over the driving when necessary.

CONNECTED AND AUTONOMOUS VEHICLE TECHNOLOGY ROAD MAP

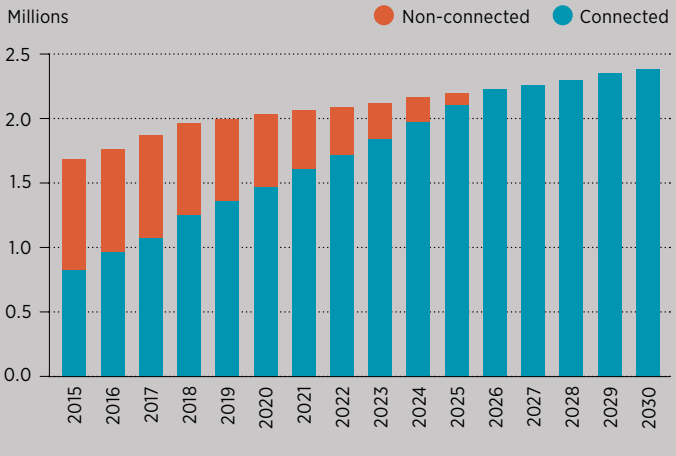


TYPE OF TECHNOLOGY

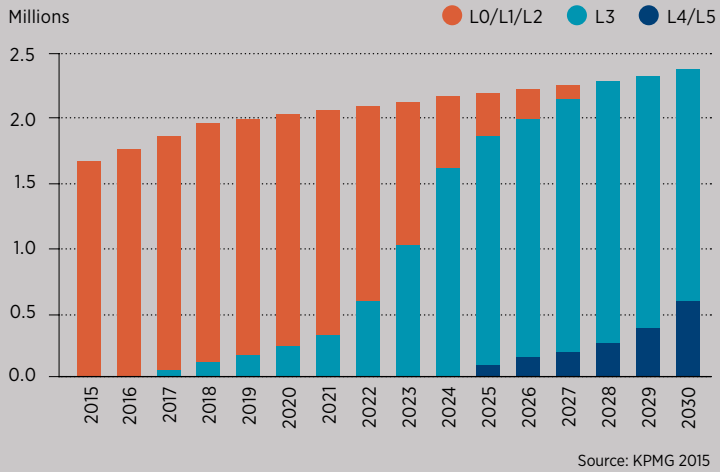
1. Blind spot monitoring
2. Lane departure warning
3. Cruise control
4. Intelligent speed adaption
5. Lane keep assist
6. Autonomous emergency braking
7. Adaptive cruise control
8. Park assist (steering only)
9. Traffic jam assist
10. Intersection pilot
11. Emergency driver assistant
12. Highway autopilot
13. Valet park assist
14. Certain driving situations, for example remote parking and urban automated driving
15. Full end-to-end journey
16. 3D cloud-based navigation
17. Vehicle-to-vehicle, vehicle-to-device and vehicle-to-infrastructure communication

Source: KPMG 2015

FORECAST UK PRODUCTION OF CONNECTED CARS



FORECAST UK PRODUCTION OF AUTONOMOUS VEHICLES

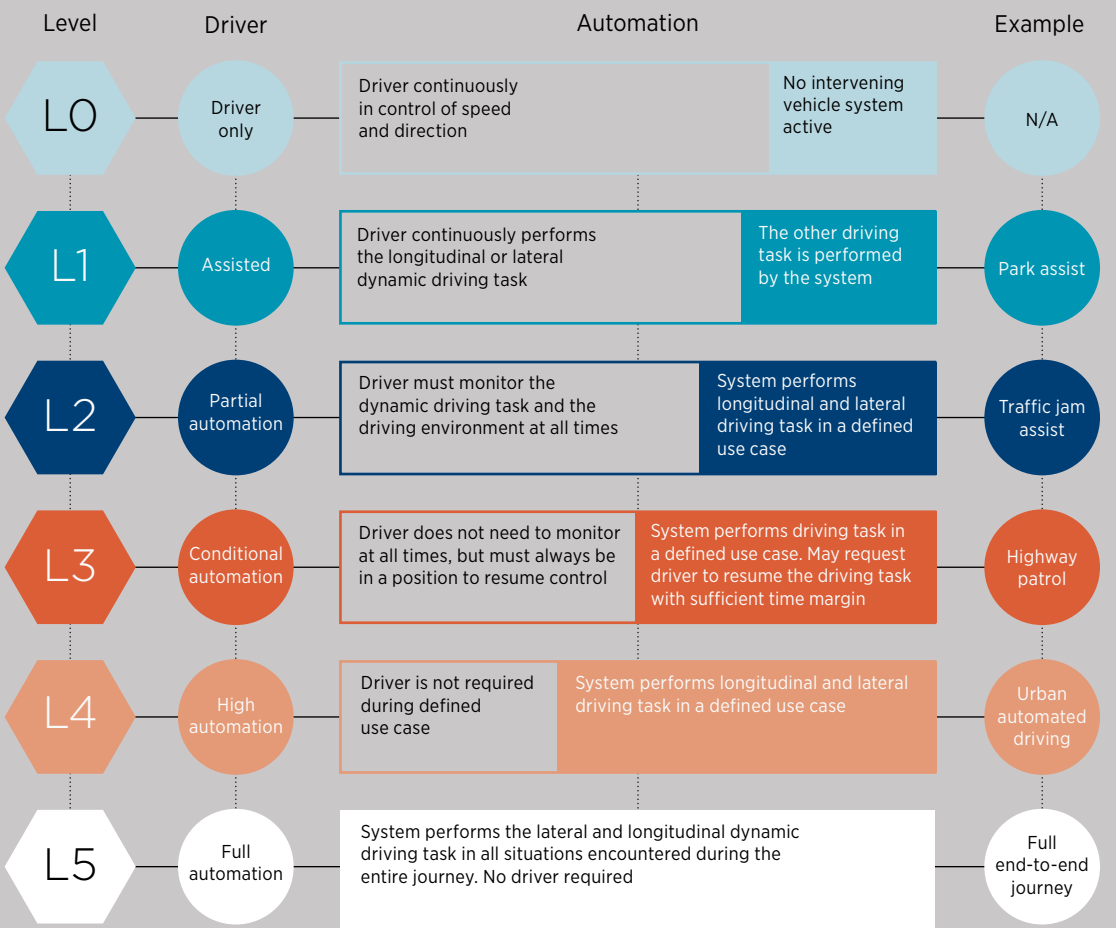


Source: KPMG 2015

omfortable driverless cars

r entertainment, which are revolutionising the driving experience and could eventually take the wheel

LEVELS OF AUTOMATION



Source: KPMG 2015

IMPACT OF HIGH-TECH VEHICLES

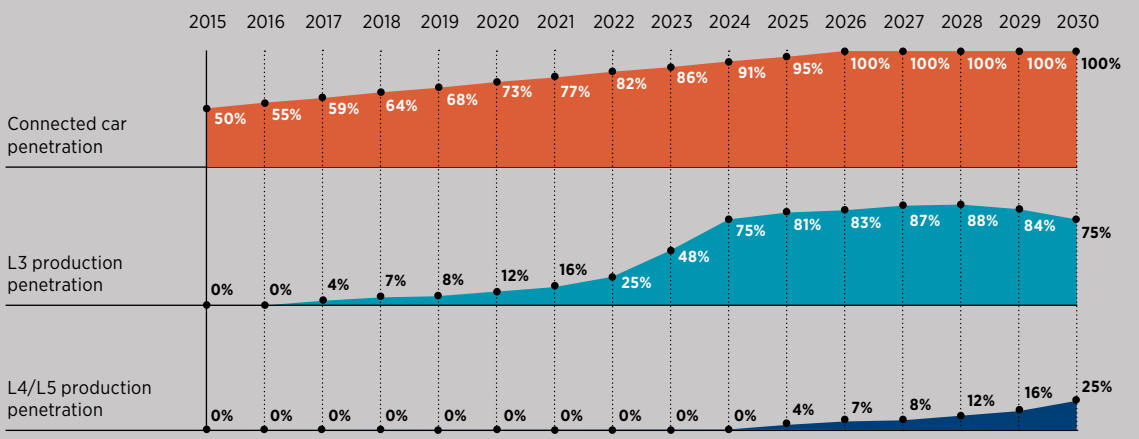
235hrs
are spent on the roads by the average driver in England
Source: Department for Transport 2015

94%
of road deaths and injuries involve human error
Source: Department for Transport 2015

25,000+
serious accidents will be prevented by connected and autonomous cars between 2014 and 2030
Source: KPMG

£51bn
estimated economic benefit of connected and autonomous cars by 2030
Source: KPMG

PENETRATION OF CONNECTED AND AUTONOMOUS CARS



Source: KMPG 2015

At Mercedes-Benz, attention is on the passenger within the connected car. Rather than focus on taking over the driving, the company has developed an app with Pivotal. Mercedes.me is designed to give drivers deeper insight into the driving experience with access to a variety of information about the status of the vehicle, remote control of things like auxiliary heating, the ability to open and close door locks from afar, a convenient navigation tool via iPhone and Apple Watch, and other new features.

Daimler has taken yet another approach, looking to connect vehicles to the enterprise. It recently announced a strategic partnership with telematics service provider WirelessCar, which is part of Volvo, and has signed a strategic internet of things partnership to extend service offerings to fleet management services. The joint venture is due to start in 2016 with services including location and vehicle follow-up, as well as extensive reporting through portals and mobile apps, increasing vehicle uptime and utilisation.

However, it is possible that the greatest disruption will come through the development of services, rather than new technologies. As design and strategy consultancy Frog points out: "New relationships are forming between the digital and physical worlds as infrastructure, services, vehicles and people connect in new ways."

> **New relationships are forming between the digital and physical worlds as infrastructure, services, vehicles and people connect in new ways**

Perhaps the most important thing for the automotive industry to understand, especially for asset owners, is the "uberisation" of transport, where companies such as Uber and Lyft are challenging by focusing on customer preference and ease of use.

Nicholas Farhi, a partner at OC&C Strategy Consultants, says: "In car hire, aggregators like Cartrawlers have been able to grow rapidly because they are better at selling and pricing the rental companies' own assets than the hire companies themselves.

"Even in the world of long-distance train travel, ride-sharing businesses like BlaBlaCar are offering credible alternatives for a certain type of customer. BlaBlaCar's French business is now a major competitor of France's state-owned railway SNCF and already delivers a quarter as many long-distance journeys."

Helsinki is one city that has taken this idea of personalisation to heart. It is taking an entirely new approach to the concept of mass-transit, by turning it into individual and personal transit. Finland's capital is exploring the concept of a city without cars by 2025, through the creation of a point-to-point transport system providing mobility on demand.

It is hoped this will be created by combining various modes of public transit with ride-sharing services using innovative technology and cutting-edge data analytics, all accessed via portable devices.

But Nissan's Mr Candler warns there are a number of challenges still to overcome in the connected car market, notably customer demand, technology, experience, liability, security and regulation.

French Caldwell, chief evangelist at MetricStream, argues that as companies develop new innovative technologies, the biggest challenge facing the transport sector is regulation that is irrelevant, out of date or impossible to comply with. This is going to be increasingly complicated as the shift from assisted to driverless vehicles is not likely to be binary; there will be some crossover.

Security will remain a challenge, although Mr Borrett points out that IBM already manages secure analysis across enterprises. Assessing liability is also likely to be difficult as the industry begins to grapple with who would be responsible for an accident.

Caroline Coates, head of automotive at business law firm DWF, says: "Clearly this extends past the traditional relationship between drivers and their insurers to include manufacturers, and possibly infrastructure, communications and technology providers."

Perhaps the biggest challenge, however, will be public acceptance and the government's Innovate UK has funded three pilot studies to explore exactly this impact. Arup is leading one, named UK Autodrive, a £19.2-million project featuring a programme of feasibility studies and practical demonstrations in Milton Keynes and Coventry. The goal is to provide insights for vehicle manufacturers, cities, commercial operators, legislators and insurers to develop the legal framework for the roll-out of autonomous mobility.

If we are to achieve a future of driverless cars, we need to understand how the necessary roadway sensor systems will be funded, as well as how policymakers will manage regulation in an unforeseen environment. Most important though, will be public trust. Consumers have to trust that the technology, systems and legal environment are all in place. And that may prove more difficult than expected.

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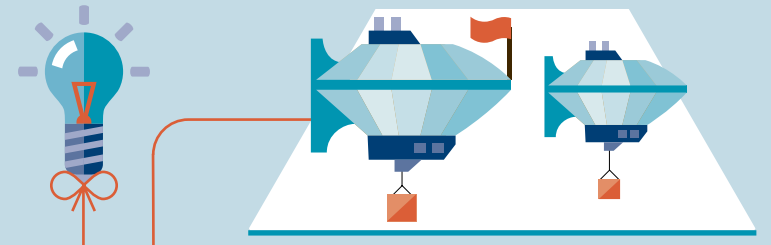
Zeppelins for heavy metal

From a pedal-powered monorail to bike-shaped holograms and an airship revival, the transport sector is buzzing with ideas to transform the way we move

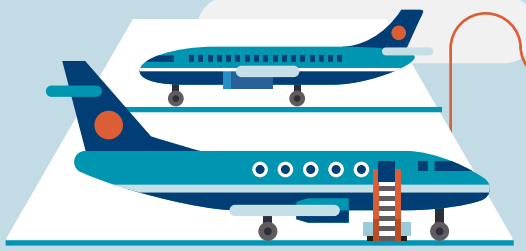
◆ **INNOVATION**

● **NIC FILDES**



01 AIRSHIPS

There are those who mourn the loss of the airship which, nearly 80 years after the Hindenburg disaster, has been reduced to a novelty advertising bollard. Yet zeppelins and dirigibles are starting to make a comeback as the skies over Siberia darken with the return of the once futuristic design that is back in vogue. It has been revived by the mining industry which cannot afford to build roads and bridges to support 4x4s, never mind the 87-tonne trucks needed to extract nickel, copper and gold from mines. No wonder heavy metal star Bruce Dickinson of Iron Maiden is investing in a 302-foot airship called the Airlander that is the largest in the world.



02 AIRLINES

The airline industry may have lacked a real wow factor this year despite the long-haul plans of Qantas to carry passengers from London to Perth without a stopover. However, the three-storey AWWA Sky Whale, the brainchild of Barcelona's Oscar Viñals, seems a more likely vision of what airline passengers can expect when boarding a plane in 20 years' time. The potential behemoth, with an 88-metre wing span, can seat 755 people who will benefit from seats akin to those in cinemas and virtual reality controls, while the plane can take off from a standing start. It has yet to get off the ground, but some form of the Sky Whale looks likely to be where increasingly huge planes are heading.

03 BIKES

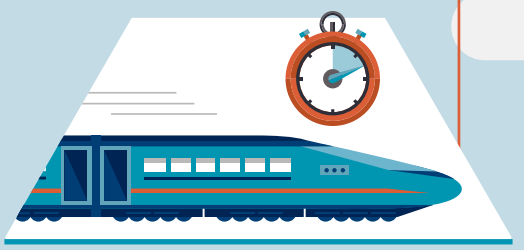
The humble bicycle has been the source of near-constant innovation ever since it was invented. Yet the future of cycling will be as much about the environment around the cyclist as the machine itself. Blaze, a small British company backed by Sir Richard Branson, has put bike-shaped holograms on the road a few metres ahead of the real bike so drivers can see them before they get there. Meanwhile Swiss company Stromer has plugged its electric bike into the web to unlock new routes and traffic information for the rider. Much of the focus of smart cities has been about connected cars, but places such as Ljubljana in Slovenia have instead designed their regeneration around two wheels, not four.

04 CARS

Car shows have been taken over by technology companies so it was only a matter of time before gadget shows were hijacked by auto makers. For all the talk about Google's autonomous cars and Apple's plans, it was Mercedes that stole the show at this year's CES (Consumer Electronics Show) in Las Vegas with the F 015 concept car which can drive itself using 3D cameras, ultrasonic sensors and radar. Touch-screen windows monitor passengers' eye movements to adjust temperature and music volume for comfort, and the cabin is designed more like that of spaceship than a traditional car. Concept is the key word with Mercedes trying to move the debate about autonomous cars from one of safety and utility to consideration of comfort and style.

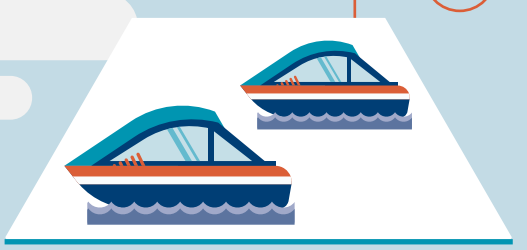
05 MONORAIL

Did the people at Google not see that episode of *The Simpsons* where the residents of Springfield were fleeced by a monorail project? Obviously not as the technology giant has invested $1 million in turning a wacky human-powered overhead monorail project from Rotorua, New Zealand, as part of a bet on the future of transport. The Shweeb was developed as an extreme racing sport where contestants would enter a pod hanging from an overhead cable and pedal furiously as a team. Google has seen an opportunity to turn that Kiwi frivolity into a real-world green transport solution. Perhaps there's a use for all those old telephone poles and wires once all the copper is retired after all.



06 RAIL

It was the 1964 Olympics that led the Japanese government to invest in its famous bullet train network and the impending 2020 Tokyo games have triggered plans to set a new standard for rail. The upgrade of the link to Haneda Airport is expected to cut the travel time to central Tokyo from half an hour to 18 minutes, with the first part of the project to be delivered in time for the Olympics. It is a long way off the dream of "vacuum trains" – airless tubes that could propel passengers along at speeds of 2,500mph and cut the commute between New York and London to just over an hour – but the Japanese plan is more pragmatic. For now, the prospect of vacuum trains remains in the realm of science fiction.



07 WATER

It looks like something dreamt up for a 1970s Bond film, but the Jet Reptile could prove a practical way to zip around the waterways in the future. Pitched somewhere between a mini-luxury yacht and a fibre glass buoy, the Reptile can seat nine people comfortably and is aimed at wealthy young yacht owners who want to jet their friends between parties and restaurants along the coast. A powerful engine means the Naples-made vessel can reach a speed of 50 knots. The company behind it, founded by an Italian car designer, has also developed a prototype water taxi on the lightweight design, looking forward to the mainstream.

COMMERCIAL FEATURE

ON TRACK FOR SEAMLESS MOBILITY

An innovative technology platform aims to make booking travel tickets a truly one-stop journey

Aaron Gowell
Co-founder and chief conductor

SILVERRAIL

Railways often appear to have missed out on the technological advances that have transformed other forms of travel. SilverRail plans to change that and to bring rail travel into the 21st century – as part of its drive to bring about "seamless mobility".

"In all of travel, high-speed rail is the fastest-growing segment," says SilverRail Technologies' co-founder and chief conductor Aaron Gowell. "Why? It's 90 per cent greener than air travel and 70 per cent cleaner than cars. Moreover, it solves huge congestion problems. Trains can carry three times as many people as a jumbo jet and they can leave minutes apart."

But while the industry has done an amazing job at building beautiful, fast trains, with a superb on-board experience, the simple act of buying a ticket has not kept pace. "Train companies are not software companies. They don't build great consumer tools. And the rest of the travel technology community has completely overlooked this market," he says.

"Our view was that the carriers were doing their job deploying fast trains and refocusing on the customer experience. Now it's the technology industry's job to support them and build better consumer tools."

Mr Gowell, with co-founder Will Phillipson, entrepreneurs who previously built one of the largest travel technology and distribution companies in the United States for booking cruises and other holidays, turned their attention to making train travel as easy as possible.

"The first wave of technology companies in this space are all planning companies, such as Google Maps, moovit and Citymapper, which don't let you book your journey. Meanwhile, the apps that do let you book tickets can only do it for one aspect of the trip," says Mr Gowell. "Many people are frustrated that they have to access a number of apps to get across cities. It's a fragmented experience and it's getting more complicated."

SilverRail's core technology platform already simplifies the process, allowing travel sellers, whether rail companies, online or offline travel agents, to sell a ticket for any journey, in any country, in any currency.

"We wanted to work with the rail and travel industries to make train tickets effortless to find and buy. We all take it for granted that we can go on to our favourite travel website and book air travel almost as easily as ordering a pizza. Rail needs to be as accessible – simple, easy and all the complexity is hidden from the consumer," he says.

"In air travel, the airlines got together really early on after the advent of transatlantic flights because they wanted customers to be able to move seamlessly across different airlines. But rail networks were never designed to work together so we have had to bring rail out of the 'e-commerce dark'."

However, while the company's focus has been on rail, at a recent sustainable mobility conference hosted by former US vice president Al Gore, Mr Gowell came to the realisation that seamless mobility is actually about far more than just rail.

"We came at this problem thinking it was all about trains," he says. "But at this conference, which was pretty car-focused, the ministers of transport of five of the world's fastest-growing megacities were saying 'I don't care if your car is electric, drives itself or if you share it – I am going to try to kill it'. Rail is going to be at the heart of the transportation system of the world's megacities – and we can help to make it a reality."

That is why SilverRail is now driven by a vision of seamless mobility that allows travellers to plan and transact within a single platform, across all modes of transit, including taxi, Uber, bike and bus, door to door and end to end.

"The next step and one we are working towards is a single ticket that can work across the major public transit modes. That's the future of true seamless mobility – plan, buy, travel, all in a single app, with a single ticket," says Mr Gowell.

> SilverRail is driven by a vision of seamless mobility that allows travellers to plan and transact within a single platform, across all modes of transit

"Solving rail problems is cool. But solving big, complex city travel problems is even cooler. The step-changes we are making towards seamless mobility, the need for a joined-up solution to help us move people from point to point, with as little friction as possible, is the obvious step for both mass-transport technology and for SilverRail."

www.silverrailtech.com

SILVERRAIL TECHNOLOGIES

SilverRail Technologies is a transformational technology business that is unlocking the potential of the rail industry, its much heralded renaissance, by powering comprehensive online distribution.

Its mission is to make global rail content available, affordable and accessible by tackling the big problems blocking rail's renaissance, namely the outdated and fragmented processes that make planning and buying rail travel hard work – adding cost and complexity to the industry.

Legacy booking systems impact everyone: train operators, travel distributors, travel managers and passengers. SilverRail's solution is SilverCore – the world's first unified platform for global rail, connecting rail carriers with the worldwide ecosystem of travel distributors and managers.

SilverRail is an exceptional performer: more than one billion online rail searches a year; 80-plus providers and carriers connected; 20-plus million bookings per year and over 1,500 corporate customers served.

To further unlock rail distribution, SilverRail is focused on five key standards which are critical to the future of the industry:

1. A common language for global rail across equipment, fare classes, amenities, stations and tickets
2. A common index for all journeys so anyone, anywhere can plan, manage and book a journey
3. A comprehensive inventory of global rail, rigorous in its accuracy, relevancy and consistency
4. Real-time routing, pricing and scheduling
5. A single, seamless ticket for any journey.

The five standards show a way forward for the industry that enables co-operation and benefits everyone. They are the blueprint for the future success of rail across the globe and they, and SilverRail, are at the very heart of the worldwide rail renaissance.

RAIL IS ONE OF THE MOST FREQUENTLY USED NETWORKS IN THE WORLD, CRITICAL TO OUR DAILY LIVES

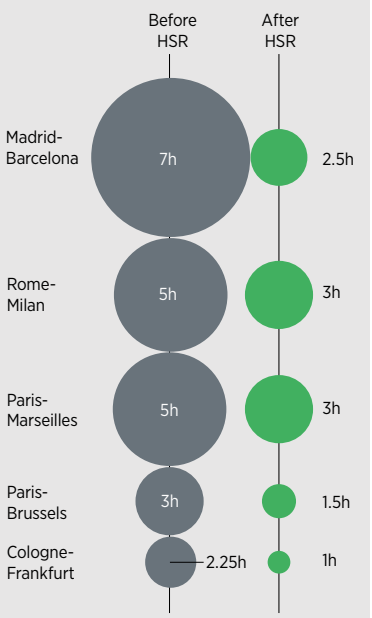
18X more rail stations than airports in the UK

30% more people walk through Waterloo Station than Heathrow Airport

80% choose to travel by rail rather than air when journey time is reduced to 2.5 hours

PERCENTAGE OF RAIL AND AIR MARKET BOOKED ONLINE

TIME REDUCTION AFTER HIGH-SPEED RAIL



COMMERCIAL FEATURE

INTERNET OF THINGS FOR VEHICLES IS DRIVING BUSINESS

With billions of pounds at stake, who will come out on top in the race to capture the potential market for connected vehicles and fleets?

GEOTAB
management by measurement

The internet of things (IoT) is taking over and there's no stopping it. Consumer demand for 24/7 connectivity is shaping the economy of the future. A 2015 McKinsey & Company Global Institute report predicts the potential economic value of the IoT will be $3.9 trillion to $11.1 trillion in the year 2025, with vehicles comprising $210 billion to $740 billion of the total.

The tremendous market potential for connected vehicles in particular will be interesting to watch because of its impact on the automotive industry, transportation systems and the day-to-day lives of people.

But what is IoT in vehicles? A connected vehicle has embedded technology enabling it to connect to the internet, devices and even other vehicles or systems. The IoT in vehicles will deliver a faster, safer and richer experience for drivers. It is now possible for drivers to access information about traffic, road conditions, fuel usage, vehicle diagnostics, driving behavior and more.

And vehicle IoT is increasing in importance. In addition to the commuter car, other types of work and service vehicles are getting connected, including trains, buses and trucks. Companies are integrating vehicle IoT into their IT systems to automate business processes. Fleets of every size rely on connected solutions such as Geotab for monitoring and managing critical information related to productivity, driver safety, fuel consumption and compliance.

In fact, vehicle IoT takes connectivity even further with the tracking of goods. This provides visibility of goods throughout the supply chain, by monitoring the temperature of refrigerated food, tracking the transport status of expensive merchandise or reporting on the driver's health, for example.

Businesses will rely more and more on connected technology and vehicle IoT as they look for ways to improve productivity, efficiency and reduce costs. "The value of vehicle IoT for businesses is the ability to tap into data that will assist in making measured management decisions," says Colin Sutherland, vice president, global sales and marketing, for Geotab Inc.

The benefits of vehicle IoT even extend to society at large. Enabling communication between vehicles and systems, and collecting and analysing data at scale can reduce carbon emissions, alleviate traffic congestion and create safer roads.

But who will lead the connected vehicle market? Auto manufacturers have embraced IoT in response to market demands. A study by PwC Strategy and Das Auto Institut, analysing the connected car industry from 2009 to 2015, identified Volkswagen and Daimler as the top auto makers leading innovation, with Ford, BMW and Toyota close behind. To remain competitive in the future, car companies will have to evolve from vehicle manufacturers to technology providers.

> "Businesses will rely more and more on connected technology and vehicle IoT as they look for ways to improve productivity, efficiency and reduce costs

Technology companies are also poised to become key players in the connected car market. Apple and Google have both developed car dashboard operating systems. Over the next five years, the number of cars using CarPlay and Android Auto will skyrocket into the tens of millions, according to BI Intelligence. The Mobileye smart camera system for vehicles is just one example of a company leading the pack in connected car tech. Technology companies have the know-how and can move quickly compared with auto manufacturers who have a longer product cycle.

Mobile network operators, auto parts suppliers and insurance companies also stand to benefit from the coming IoT boom.

So which regions will see the biggest IoT impact? As reported by McKinsey & Company, the IoT market has growth potential in both advanced and developing economies. The connected vehicle is already taking firm root in Europe and North America. The European Parliament mandate for an eCall emergency auto-calling system on all new cars by April 2018 will further develop the market.

Recognising the expansion of the connected vehicle sector, the US Department of Transportation is developing a plan for measuring and regulating the impacts on driver safety, transportation systems and the environment.

Asia-Pacific is also expected to see growth. The prevalence of mobile devices in China makes it prime territory for development of the connected vehicle industry, *The Wall Street Journal* reports.

The growth of the connected vehicle sector will be affected by a number of factors, as recently outlined by *Forbes*. Some of the key challenges include keeping up with the pace of technology, defining and complying with laws and regulations, protecting the security and privacy of drivers, co-ordinating activities between industries, and delivering solutions at a price that satisfies customers.

There are almost no limits to what the future holds for vehicle IoT. The self-driving car is closer than ever to roll-out and will revolutionise the landscape of cities everywhere. As with any new invention or innovation, it is easy to get excited at the new possibilities offered. However, we must also consider the risks to be able to manage and mitigate them.

E-mail testdrive@geotab.com or connect with us on Twitter, Facebook and YouTube
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@GEOTAB

Take a flight into the future

The aviation industry is enjoying increasing demand, but from evermore discerning passengers, and amid competition from low-cost carriers and environmental regulation


Getty Images

◆ **GLOBAL AIR TRANSPORT**

● **PAUL SILLERS**

The socio-economic benefits of the global air transport industry are irrefutable – connecting people and cultures, providing access to global markets, and underpinning trade and tourism growth. The metrics are sublime too – airlines, airports and air navigation agencies employ 7.6 million people, and across the sector's broader ecosystem, aviation supports 58 million jobs and contributes $2.4 trillion to the world economy.

As global airline traffic surges from the current 3.3 billion passengers annually to a forecast of 7.3 billion by 2034, aircraft manufacturers are rubbing their hands together. Boeing's market outlook sees a need for 38,050 new airliners over the next 20 years valued at more than $5.6 trillion. Rival Airbus's similarly upbeat prognosis anticipates a requirement for 32,600 aircraft over the same period.

But as these extra planes fill the future skyscape there are questions of capacity, CO_2 emissions and noise, not to mention the fickle demands of passengers, for whom being shuttled from A to B doesn't quite cut it; they're now looking for a connected, seamless, personalised experience.

To provision for this growth, stakeholders, comprising the manufacturers, airlines, airports, as well as safety, security and air traffic management infrastructures, are experiencing significant growing pains while they develop disruptive technologies to address market demands.

Then there's our planet. "Our world is changing, the climate is altering and populations are increasing. We need more power, but not at any cost to society. We're committed to research and technology in order to develop innovative and advanced power systems that can help," says Caroline Day, head of marketing, strategy and future programmes, at Rolls-Royce, alluding to its $2-billion annual research and development investment.

Two new engine designs, Advance and UltraFan, will become available from 2020 and 2025 respectively as new engine architectures and materials improve airliner efficiency by up to 25 per cent.

But futuristic eco-efficient aircraft won't solve the market-growth issues if passengers are stuck in a frustrating holding stack in the skies above the world's mega-hub airports. In China, 100 new airports are under construction; around 60 are underway in India. But Europe's topography inhibits that scale of ambition; the UK still awaits government deliberation on Heathrow's extra runway.

So air traffic infrastructure – a determinant of passenger experience – needs radical innovation to address capacity and CO_2 concerns, which is why Rolls-Royce along with Airbus, Bombardier, Lufthansa Technik, and various other manufacturers, airlines and airports participate in the Advisory Council for Aviation Research and Innovation in Europe (ACARE), a key player in setting the stringent *Flightpath 2050* goals to reduce CO_2, NOx (nitrogen oxide) and noise by 75 per cent, 90 per cent and 65 per cent respectively, compared with millennium-era aircraft.

"The steadily growing demand worldwide for flights makes it necessary to develop environmentally friendly technologies for future aircraft – this is the purpose of Clean Sky," explains Eric Dautriat, executive director of the European public-private undertaking which integrates "players from academia to large industry into an innovation value chain where both environment and competitiveness are addressed at once". Clean Sky co-ordinates and funds Europewide research and development in green aeronautics, and is the main contributor to reaching ACARE's goals.

While Clean Sky focuses on aviation's product development, the capacity and flow of future airline traffic is addressed by SESAR (Single European Sky Air traffic management Research).

"SESAR contributes to the targets of the Single European Sky by designing, defining, developing, validating, and deploying innovative technological and operational solutions for managing air traffic in a more efficient and greener manner," explains Peter Hotham, deputy executive director and chief corporate quality, planning and support of SESAR Joint Undertaking.

"The goal is to reduce the fuel burned per flight by up to 500kg by 2035," he says. That's up to 1.6 tonnes of CO_2 emissions per flight. Initiatives, such as time-based separation, keeping planes apart by time rather than by distance, are already enabling London's Heathrow to handle more landings per hour.

As the industry deploys infrastructure to improve capacity using environmentally benign technologies, joining the dots that concern the passenger means offering connectivity across journey touchpoints, starting with bookings.

Nothing is more perishable than an airline seat; once the gate closes, an empty seat means lost revenue. But long gone are the days of sweet-talking the check-in clerk to let you sit in front of the class partition. Companies such as Plusgrade and Optiontown are enabling passengers, pre-flight, to bid against other passengers in online upgrade auctions. More than 30 airlines including Lufthansa, Qantas and Etihad are using auction technology.

> **Manufacturers, airlines, airports, as well as safety, security and air traffic management infrastructures, are experiencing significant growing pains while they develop disruptive technologies to address market demands**

Upgrade availability is just one factor in a complex matrix of decision-making criteria determining ticket purchase. The top three factors are price, convenient schedules and loyalty programmes. These options are being augmented, even leapfrogged, by demand for end-to-end connectivity.

According to Honeywell Aerospace, on-board wi-fi availability influences flight selection for 66 per cent of passengers, with 22 per cent of passengers admitting they've paid more for wi-fi-enabled flights. Indeed, a survey by Persistence Market Research values the global in-flight wi-fi market at $5.5 trillion by 2021.

Passenger connectivity is omnipresent in aviation retail too. Singapore's Changi, Amsterdam's Schiphol and Dubai, long-established retail haven airports, face unprecedented competition from on-board wi-fi as passengers while away in-flight hours connecting their smartphones via cabin wi-fi to their favourite retailers.

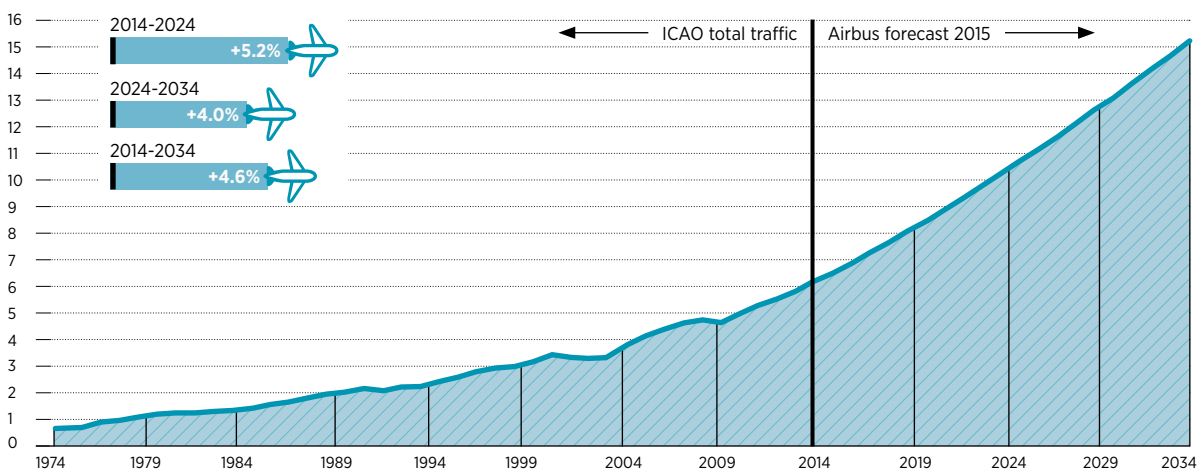
Pre-flight retail therapy isn't taking this lying down of course. Beacons are the silver bullets that airports hope will reinvigorate engagement with passengers before they reach the gate. By 2018, 80 per cent of airports will use beacons to provide way-finding services and 74 per cent to provide passenger notifications, according to air transport communications and information specialists SITA.

Some 83 per cent of air travellers now carry smartphones, and in 2016 mobile apps will be the conduit for 16 per cent of check-ins and 37 per cent of ticket purchases. When it comes to on-board entertainment, SITA's *Passenger IT Trends Survey* reveals that 67 per cent of passengers want access via their own devices for entertainment compared with 56 per cent for airline-provided content. Passengers also want to send and receive text and e-mails (60 per cent) as well as stream live content (56 per cent).

Flying is a compelling paradigm for connecting people and cultures. The paradox is passengers can no longer wait until touchdown for that sense of connection.

GLOBAL AIR TRAFFIC (TRILLION REVENUE PASSENGER KILOMETRES)

Traffic is expected to double in the next 15 years



Source: International Civil Aviation Organization (ICAO)/Airbus 2015

At the crossroads of transpo

Four opinion leaders answer questions at the crossroads of transport. Should you build roads to satisfy demand or manage

MICHAEL KODRANSKY
Global research manager at the Institute for Transportation and Development Policy, New York

"Most new developments in the United States are being designed to enable driving by private car for every single trip. Yet the majority of trips in metropolitan regions are short – less than five miles – which can easily be done by walking, cycling or a combination of modes. What people really want is access to destinations and a means of access that is comfortable, attractive, affordable, flexible and safe. The future of mobility does not bode well for single-occupancy driving trips, especially with the emergence of shared mobility, where access to assets, such as vehicles, is valued over ownership.

As the former mayor of Bogotá in Colombia and current board president of the Institute for Transportation and Development Policy (ITDP) Enrique Peñalosa says: "An advanced country is not where even the poor move about in cars, rather it's where the rich use public transport."

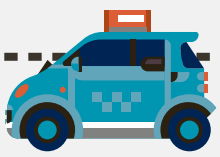
Demand for walkable, compact neighbourhoods in the US has been on the rise in the last decade, at the same time that vehicle miles travelled have levelled off in all the top metropolitan regions. Meanwhile, investment in high-quality mass transit in the US lags far behind many other developed countries. According to the ITDP, France has 18.8 miles of mass-rapid transit per million urban residents, for example, while the US has just 5.5 miles. Expanding road capacity to meet driving demand has shown only short-term gains. Eventually, congestion returns. Alternatively, when driving lanes are removed, congestion disappears as people adjust their travel behaviour. The only way to really build out of congestion, without eliminating the city in the process, is by increasing all other modes of access like walking, cycling and public transit.

> **The only way to really build out of congestion is by increasing all other modes of access like walking, cycling and public transit**

Cities are taking the lead in crafting solutions to the mobility challenges they face, especially as national governments prove incapable of addressing the multitude of needs in maintaining existing infrastructure at a state of good repair, while expanding travel choices with new sources of dedicated funding. High-occupancy vehicle roads in the Bay Area of San Francisco and around Washington DC that reward carpooling has crystallised an ad hoc cultural phenomena of casual car-poolers in which strangers share a ride with those heading in their same direction.

Local jurisdictions are also starting to eliminate parking requirements as part of zoning ordinances to stop undermining the possibility of shaping mixed-use, compact neighbourhoods with high-quality public space. In the long-term, mobility management coupled with land-use planning has the potential to get all people moving and out of traffic."

OPINION COLUMN



FRANCESCA MEDDA
Professor of applied economics and finance, University College London

"Despite consensus on the importance of infrastructure investment in achieving economic growth, there is less agreement on how this should be achieved, particularly at a local level. Infrastructure is divided into silos and sub-silos. Transport, for example, is perceived as a series of separate sectors: road, rail, shipping, aviation. The problem is exacerbated by the fact that transport infrastructure provision is far from even across the EU, or indeed the rest of the world. Differences will arise dependent on the country, the state of regional transport networks, different policy goals and whether the decision impacts an urban or inter-urban context.

Looking at infrastructure as interdependent can prove a source of additionality, however, if compared to single infrastructure benefit baselines. It's one thing to build a road and quite another to use the same project to lay water pipes or communication cables, or as part of a regional regeneration plan. A systemic approach to infrastructure with clearly synergistic goals seems common sense. This strategic approach is often ignored, however, due to the siloisation of infrastructure planning, additional cost implications and a lack of cohesive cost-benefit assessments for synergistic development. As the financial environment evolves, this could be set to change.

> **It's one thing to build a road and quite another to use the same project to lay water pipes or communication cables**

The significant global tightening of credit, brought on by the economic and financial crisis, is emblematic of the fundamental need to broaden financial channels worldwide and explore new flexible financial options for infrastructure investment. Indeed, new trends are already posing challenges to established institutions and some of these institutions are losing favour. Information economics and modern technologies, for example, have motivated citizens to redefine their perceptions of infrastructure asset ownership and public goods through the use of crowdsourcing and peer-to-peer financing. Is a perceptual shift in relation to infrastructure also looming on the horizon?

Recent advances in driving technologies, for example, suggest that a new infrastructure paradigm is emerging. This paradigm is characterised by economic, environmental, cultural, and social aspects that are interwoven with technological advances and working knowledge of the interdependencies between infrastructures. Importantly, what is central to this new paradigm is commitment to the design of new business models. Whichever transport solution decided upon will require new agents and institutions to lead the way as initiators and guarantors of infrastructure investment initiatives, not only as guarantors of capital sources, but also as providers of technical support, in order to reach the most efficient and effective use of finance for infrastructure."

Articles first published in *Willis Transportation Outlook*

rt and mobility...

demand to address congestion? And are we beginning to see a trend towards mobility rather than transport as an end in itself?

One of the defining tensions in economic development has been between quality of life and value-creating activities – the need for people to interact with each other and to transact goods and services. The former requires space, peace and safety in which to work, exercise, relax and socialise; the latter requires transport systems which, since the use of horse-drawn transport in medieval cities, have taken up space, created noise and pollution, and are often dangerous.

The internet, smartphones and social media represent the most significant mode for supporting transactions and interactions since the internal combustion engine. Around a quarter of the world's population now uses such tools to communicate and transact, and they have enabled small and micro-businesses to reach markets across the world that were previously accessible only to much larger organisations with international sales and distribution networks. More recently, the emergence and maturation of technologies, such as 3D printing, open-source manufacturing and small-scale energy generation, are enabling small businesses and community initiatives to succeed in new sectors by reducing the scale at which it is economically viable to carry out what were previously industrial activities – a trend recently labelled by *The Economist* magazine as the "Third Industrial Revolution".

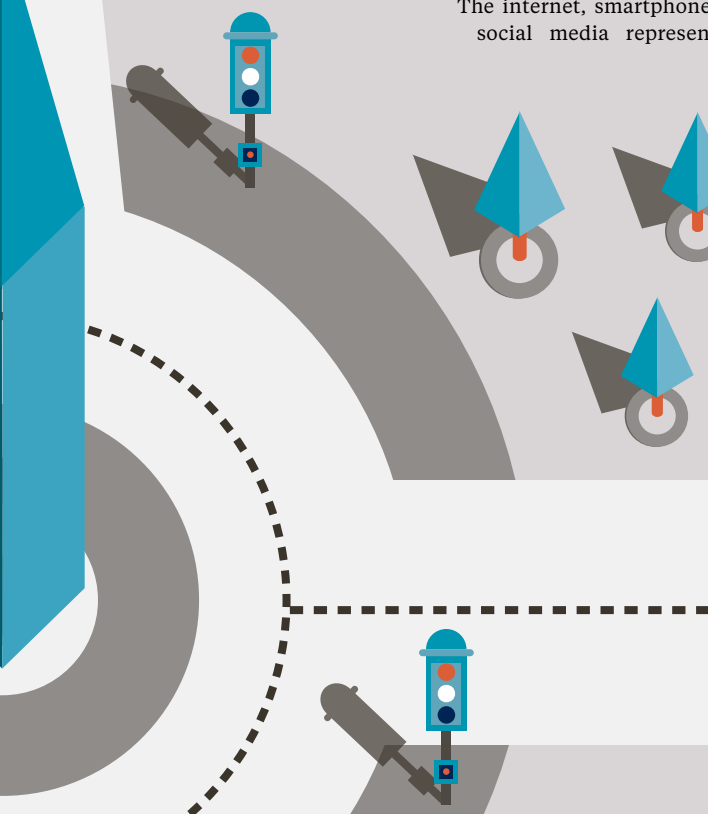
> In an increasingly digital world, transport will still be a vital service, but mobility will be the defining driver of economic growth

While these business models contribute to social mobility by creating business and employment opportunities, they also increase and complicate our need for transport services, as the existing bulk-movement patterns of monolithic supply chains are replaced by thousands of smaller, peer-to-peer interactions created by transactions in online marketplaces. We can already see the effects of this trend in the vast growth of traffic delivering goods that are purchased or exchanged online.

Just as developments in the use of technology play a role in creating this challenge, they will play a role in addressing it: through reducing the impact of existing modes of transport by switching to electric or hydrogen power for vehicles; by predicting and optimising the behaviour of traffic systems to prevent congestion; by optimising public transport as IBM has helped Abidjan, Dublin, Dubuque and Istanbul to do; by creating new capacity-sharing transport services; and by improving the spatial organisation of transport through initiatives such as Arup's Regent Street delivery hub.

In an increasingly digital world, transport will still be a vital service, but mobility will be the defining driver of economic growth.

RICK ROBINSON
IT director of smart data and technology at Amey



Whether we should build to demand or manage demand is a very interesting question. Quite frankly we need to do both. However, how much emphasis should be laid on each will vary depending on the level of urbanisation. Also, the strategy for reducing demand will vary depending on how far a city has grown.

In the developing world, where current levels of urbanisation are low, cities are expected to grow for the next several years, perhaps decades. In such cases, it is important to build to meet the projected demand over the next few years. As more people move in, the travel demand will grow even if very strong demand management measures are adopted and so it is essential to build to meet a basic level of demand.

However, in such cities spatial plans are still evolving and it is here that a very important demand-management strategy can be adopted – namely to plan for compact cities where mixed land-use policies get adopted. Here travel involves only short trips and often walking or cycling is adequate. Having compact cities with mixed land use is one of the most effective demand-management strategies, but can be adopted only at an early stage in a city's development. At later stages, this is not possible as land-use plans get locked and become very difficult to change.

> Demand-management strategies will emphasise reducing the need to travel and discouraging the use of personal motor transport

Yet another very important demand-management tool that needs to be taken up at an early stage in a city's development is to lay the foundation for a good public transport network, one that is easy to access, safe, convenient and affordable. This helps create a culture of using public transport in preference to personal motor vehicles. Once people get used to cars, getting them out is not easy.

In more developed cities, where the projected growth is not expected to be very high, the need to build will come down. In such cases the emphasis will be on demand management. Further, the demand-management strategies will emphasise reducing the need to travel and discouraging the use of personal motor transport.

Telecommuting, e-commerce, online shopping and so on are ways by which certain kinds of trips can be avoided.

O.P. AGARWAL
World Bank and chairman of the Transportation Research Board Committee on Transport in Developing Countries, India

Higher fuel taxes, congestion charges and high parking fees are ways in which people can be persuaded to leave their cars at home. High cost of car ownership, such as very high vehicle registration fees and inadequate parking space, can persuade them to not buy a car. Thus, the strategies would vary depending on the stage of development.

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