



Greenwich Automated Transport Environment

This is Just the Beginning

Positioning the UK at the forefront of automated mobility



Led by:



Supported by:

Innovate UK



Centre for Connected
& Autonomous Vehicles

“As we explore the future of mobility solutions, it is essential that we consider the experience and benefits delivered to the consumer. This is why understanding and exploring the public perception to automated services has always been at the heart of the GATEway project.”

Richard Cuerden
TRL, Academy Director

Welcome to the GATEway Project!

Looking back over the past 3 years to the beginning of the GATEway project, it was difficult to imagine what would be achieved and delivered. We faced many unknowns as we embarked on our journey to make a real difference to the challenges and opportunities for the future of transport.

In that time, technology, in particular that of automated vehicles, has continued to develop at significant pace. It is testament to the skills and contribution of our consortium partners, that we have achieved all our goals and objectives against this rapidly changing landscape.

Through the positive contribution of research organisations such as TRL, University of Greenwich, Commonplace and the Royal College of Art (RCA), GATEway has been able to deliver new insights as to how people can interact and feel about using and sharing space with self-driving vehicles.

We have helped advance the UK's position in the automated vehicle revolution through partnerships with Westfield Sportscars, Fusion Processing, Gobotix and Oxbotica. These partners have provided real-time development and innovation to enable the multiple field trials we have undertaken, ranging from automated valet parking through to home deliveries and an urban shuttle service.

The knowledge and new perspectives we have gained are now contributing in shaping specialist areas such as insurance, with input from insurance group Royal Sun Alliance (RSA), and in the connectivity space through participation from O2 Telefónica.

The contribution from the Royal Borough of Greenwich and DG Cities has proved invaluable in understanding how our learnings can be replicated and applied to cities across the world, ultimately helping place the UK at the forefront of this exciting sector.

This project summary provides an overview of the main findings from the GATEway project and explains how we will continue to accelerate future development through the creation of the Smart Mobility Living Lab: London.

As we embrace Mobility as a Service (MaaS) and continue to support other programmes and initiatives, we know that GATEway is just the beginning and has been an exciting step forward on an exceptional journey.

Thank you,



Richard Cuerden
TRL, Academy Director



The GATEway Project

Exploring perceptions and acceptance of automated vehicles

GATEway is the first project of its kind to explore the public's hopes, fears and attitudes towards automated vehicles (AVs), by inviting them to be part of trials demonstrating brand new service models using prototype technologies.

Inviting the public to experience prototype technologies in a real-world setting, complete with pedestrians, cyclists, rain and snow, was ground-breaking. This focus on people rather than technology provided novel opportunities to gain insight into the challenges of implementing new forms of transport in complex real-world environments.

Presented here are just some of the interesting findings from the various trials and demonstrations, which included: driverless shuttle services; automated urban deliveries; remote teleoperation demonstrations; and high-fidelity driving simulator trials.

Research from GATEway has undoubtedly helped advance the UK's position in the automated vehicles revolution, but what makes it truly unique is its primary focus on people.

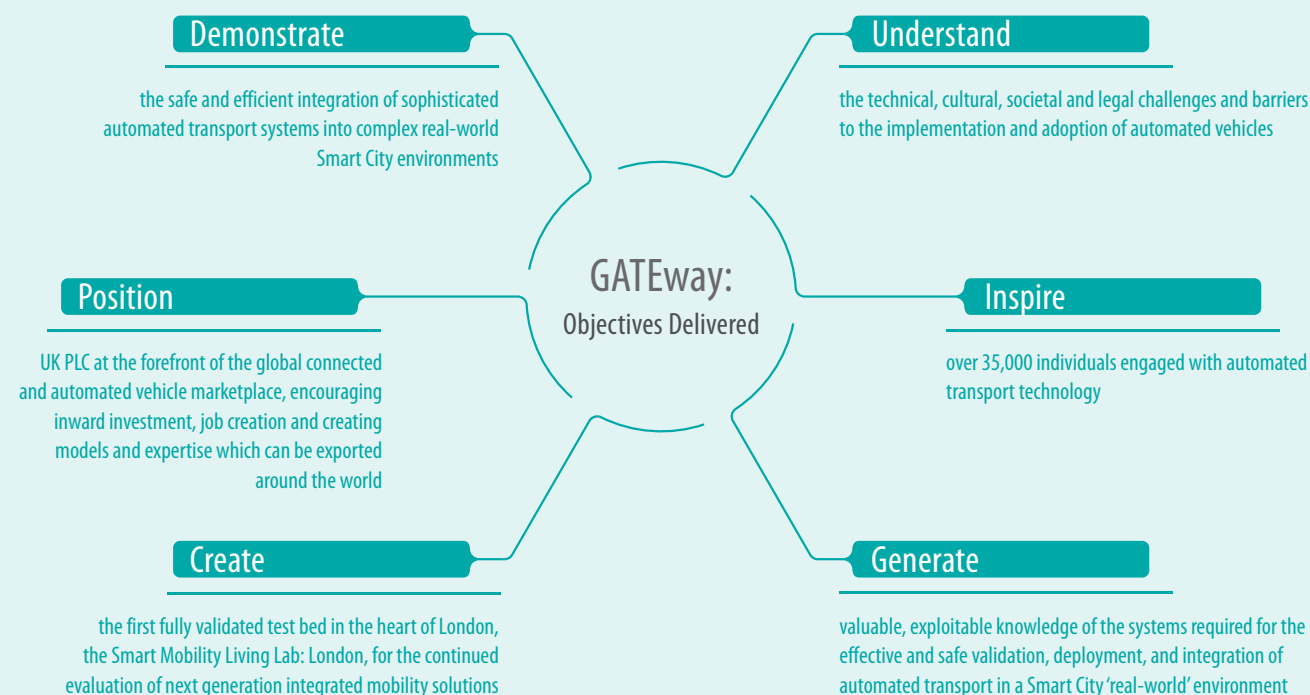
Through exploring how we feel about using and sharing space with automated vehicles, GATEway is providing valuable sociological insight into mobility solutions and the part they could play in our cities of the future.

"Driverless cars are the future. I want the UK to be open-minded and embrace a technology that could transform our roads and open up a brand new route for global investment."

The then Transport Minister Claire Perry on the launch of the GATEway project

GATEway: Objectives, Delivered.

The GATEway Consortium, led by TRL, set six key objectives: to Understand, Inspire, Generate, Create, Position and Demonstrate. Three years later, every one of those objectives has been achieved to ensure the UK takes a lead role in this important and rapidly expanding market.



The Changing Landscape

Staying ahead in a dynamic market

The GATEway project has been delivered against a backdrop of significant change and investment in the future of transport globally. The drivers for this change include safety, population growth, congestion, and air quality, and are evident in virtually every country in the world.

New technology provides the opportunity to reshape the way in which we move goods and people. The pioneering research of GATEway has provided invaluable insights into how to develop and test these new technologies and business models safely and effectively through:

- Building an evidence-based safety case framework, setting best practice for ensuring the welfare of passengers, pedestrians, cyclists, drivers and all those involved in trials.
- Establishing new relationships with Local Authorities and Government, in order to facilitate collaboration on real-world services provision and potential integration with existing transport infrastructure.
- Delivering principles and models replicable to other cities worldwide.
- Collaborating with key stakeholders to ensure that laws and regulations concerning development of automated vehicles are both relevant and appropriate and do not stifle innovation.
- Influencing the development of trials and technologies, whilst remaining impartial to ensure an agnostic and independent approach.

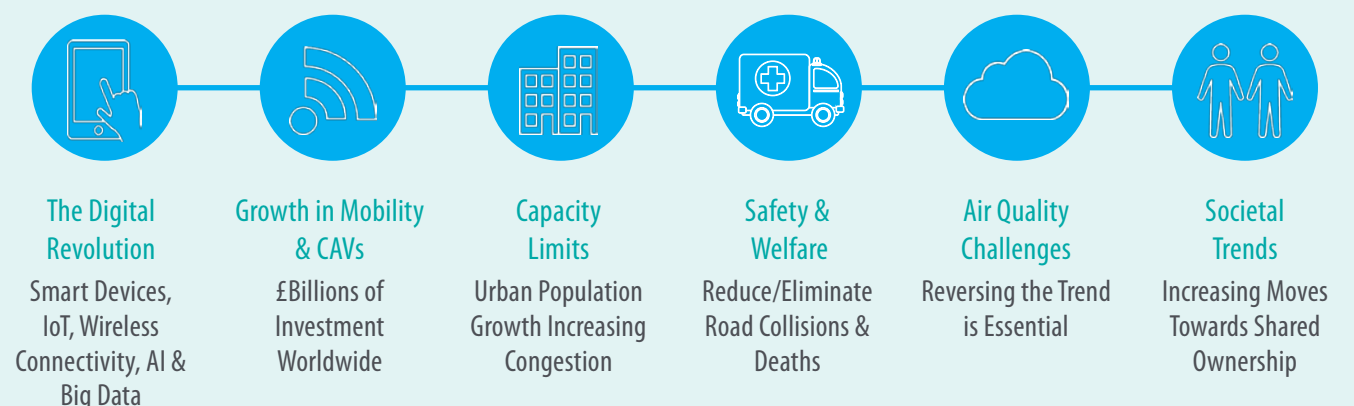


"The results of the GATEway project will influence the development and deployment of Connected and Automated Vehicles in our cities. The project has provided new insights into the role CAVs can play and how, as part of an integrated approach that brings together spatial planning, urban design and new mobility services, they can help address some of the key challenges our cities face. GATEway has been important in putting the needs of cities and their residents at the heart of the CAV debate."

Trevor Dorling
Director, Digital Greenwich

The GATEway project has demonstrated the need for continued investment, focused not just on technology, but inclusive of the perspectives of residents, consumers, businesses, cities and Governments.

The Drivers for Change



Creating the Virtual Experience

Understanding how driver behaviour will adapt to automated vehicles

One area of interest for the GATEway team was understanding how human drivers might respond and react to the presence of automated vehicles in the driving environment.

As vehicle automation becomes more prominent, we are likely to see a mixed fleet of non-automated, partially-automated, highly-automated and (eventually) fully-automated vehicles for many years to come. Through that transition period, human drivers and other road users will be encountering automated vehicles in increasing numbers.

The way in which human driven and automated vehicles interact will have major impacts on traffic flow dynamics and road safety. Understanding how these vehicles will coexist as we move through this transition phase will be critical for infrastructure planning and road safety.

To investigate this important element in a safe and controlled environment, TRL partnered with modelling and simulation experts, Agility 3.

This partnership enabled the creation of a photo realistic, 3D virtual model of the Greenwich Peninsula. The model was accurately reproduced down to the smallest detail.

Utilising this model in TRL's state-of-the-art, high fidelity driving simulator, various scenarios were tested to investigate human driver behaviour when encountering AVs in an urban environment.

This provided GATEway researchers with essential learnings as to how drivers will react and respond to driverless vehicles in real-life road scenarios.

Results found no indication of human drivers seeking to manipulate automated vehicles (e.g. forcing them to slow or stop). In fact there were signs that human drivers found AV traffic to be more predictable.



Crossing a 'give way' junction

Participants pulled into smaller gaps between vehicles only when there was a higher proportion of AVs in the traffic flow.



Overtaking on a dual carriageway

Participants typically chose to wait until the approaching vehicle had passed, regardless of whether the vehicle was an AV.



The virtual Greenwich Peninsula

Agility 3's model of the Peninsula was photo realistic, even down to the location of flowerbeds, bridges and landmarks.

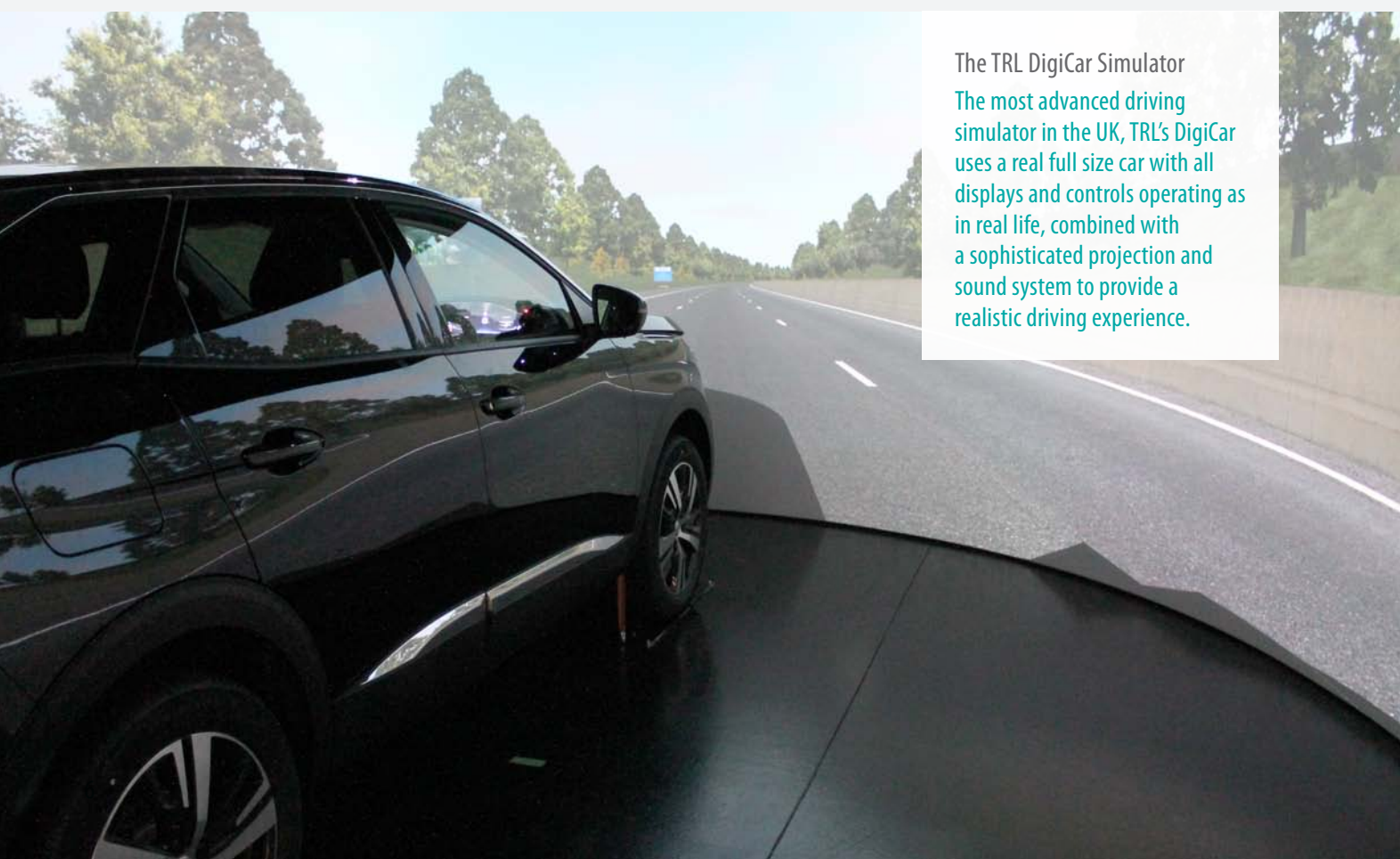
Human drivers still place importance on assessment of traffic conditions (e.g. gaps between vehicles), regardless of whether other vehicles are human driven or not. However, driver behaviour may change as exposure to automated vehicles and knowledge of them increases.

Ongoing research is required to understand what factors of AV knowledge or interaction will impact human driver behaviour. As advancements are made and automated vehicles start appearing on our roads, simulator based research will remain a critical element in safely and effectively investigating and understanding the effects this will have on driver behaviour.

Potential Areas for Future Research

Some areas identified by GATEway for future research include:

- If under time pressure will drivers react differently to AVs?
- How do drivers interact with AVs following a period of exposure to them in the driven environment?
- Could different driving styles influence the way drivers interact with AVs?
- How do human drivers interact differently with AVs compared to human driven vehicles in different manoeuvres on urban roads or motorways?
- Do human drivers interact differently with partially, compared to totally, automated vehicles?



The TRL DigiCar Simulator
The most advanced driving simulator in the UK, TRL's DigiCar uses a real full size car with all displays and controls operating as in real life, combined with a sophisticated projection and sound system to provide a realistic driving experience.

Automation, Experience and Service

Testing technology, engaging the public

GATEway delivered the first public shuttle service trials of its kind in Europe, providing a unique opportunity for members of the public to engage with AVs in a real-world environment.

Over several weeks, people were able to 'walk up' to take rides on a fleet of four shared driverless vehicles and provide feedback on their experience; whilst they were also able to engage in discussion of future deployment of such services via online surveys.

Around 320 members of the public took a ride in one of the four trial pods which covered a total of 2,299 miles of the Greenwich Peninsula during the trial period.

Setting the Safety Standard

Throughout the trial the safety of the public and the trial team was of the utmost importance. The GATEway team worked relentlessly to establish evidence-based processes and protocols to ensure the safe and effective operation of driverless shuttles in a public space.

The work undertaken on GATEway has enabled TRL to develop an industry-leading safety case for the testing of automated vehicles in the UK which will inform future research and policy.



"Loved this experience and the future of this tech! Fingers-crossed it becomes acceptable and readily available in my lifetime."

"Whilst obviously it was in a speed restricted area, for them to be viable as transport solutions they would need to be faster than walking speed. That said, I love it. The sooner these are rolled out, the better."



"I think this idea could be great once the software is sorted and proven to be safe. Some people won't trust it, but once it's proven, people will come around to the idea and everyone will use it."

Advancing British Automated Technology

The vehicles were based on the driverless pods currently in service at Heathrow Airport, but it took the collaboration of three British companies to develop and adapt them sufficiently to navigate the designated, shared space on the Greenwich Peninsula.

Westfield Sportscars were responsible for the manufacture, design and testing of the vehicles with Heathrow Enterprises providing vehicle software engineering.

The automated control system (ACS) was designed by Fusion Processing Limited and uses Fusion's CAVStar® solution with complimentary sensor technologies such as radar and camera.

Each pod was able to carry four adults (including the safety steward) with ramp access for wheelchair users.

The Real-World Environment

The Thames Path on the Greenwich Peninsula was selected because it offered a complex environment where interactions with pedestrians and cyclists were common and the service could link existing transport hubs.



Engaging the Public

TRL created detailed qualitative surveys for participants to complete after they had experienced a ride in a driverless pod.

The qualitative design aspect was particularly informative due to the exploratory nature of the trials, enabling participants to explain their thoughts in their own words rather than tick pre-determined boxes.

The trial demonstrated high levels of true public engagement with (54%) of passengers stating that they had just 'turned up' to a pod stop rather than registering their interest previously.

Around three quarters of respondents were quite (41%) or very (32%) satisfied with their overall journey experience, with participants stating they would be willing to pay an average of around £2 for using this type of service.



"I'm excited for a mass electric car future which is not too far away and very excited for automated cars and public transport - if it's electric. I really like the idea of sharing vehicles and that owning a car (human driven) being just a weekend 'toy' for certain high end models."



Passengers commented that directly experiencing how the vehicle behaved when pedestrians or cyclists were nearby helped them to feel safe. This is supported by the survey data which showed that 92% felt quite or very safe during their ride.

This public trial and the data collected demonstrates that integrated AV services are a viable public transport solution of the future, but highlighted that building the public's confidence in the technology will be a critical factor in its successful adoption.

The knowledge gained will help to shape the national agenda for future transport and to provide the foundation for the development of new legislation, regulation and research.

Solving the Parking Challenge

Teleoperation and auto valet solutions

While fully integrated driverless solutions may be considered as future technology, there are already automated technologies available which can be utilised to provide assistance to drivers – particularly those with additional travel needs.

Through an Automated Valet Parking Trial and a Teleoperation Demonstration, GATEway explored how these technologies could be used to take the first step on the road to using automated technology to deliver new mobility solutions.

Automated Valet Parking Trial

Automated valet parking means that drivers can exit their vehicle at their destination and leave the vehicle to find a place to park. The vehicle can then be summoned when required. Such services can reduce congestion, make more efficient use of parking space, improve safety, save fuel and be more convenient for the driver and their passengers.

Using a bespoke extension of the Gobotix remote driver assistance service app employed within a Toyota Prius, participants were given a unique insight and experience of automated valet parking and self-drive capability, as well as the opportunity to inform thinking on its future deployment in cities.



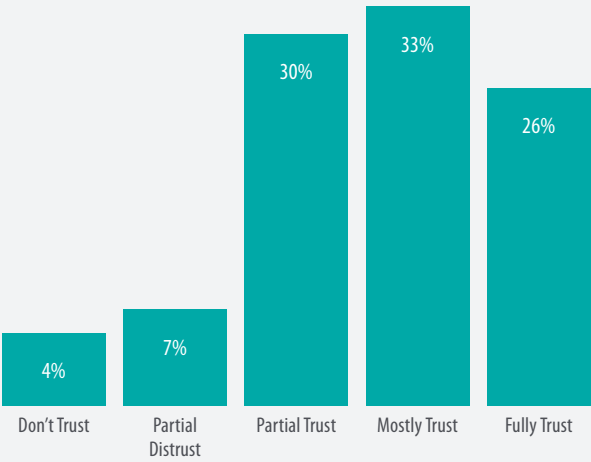
The trial (the first of its kind in the UK) saw participants drive the adapted vehicle around a predefined route at the Greenwich Peninsula, before employing automated functionality at the InterContinental London - The O2 hotel. The participant exited the vehicle, which went on to park itself. The participant then summoned the vehicle for their return journey.



Workshops, designed and delivered by RCA, were held with participants to capture opinions on the experience and thoughts on how this type of service could be used in day-to-day life.

Overall, the research showed that people are positive about automated valet parking and see it as a service that will save them time, cut stress and collisions, improve their personal safety and increase inclusive mobility.

While participants generally trusted the technology, some were worried about their loss of control and wanted to make sure that they could choose when and how to use it depending on their needs and the situation at hand. Many saw auto valet parking as a stepping stone to fully automated journeys and were keen to see the technology available.



Participants trust in Auto Valet Parking Technology after the trial



Teleoperation Demonstration



Finding a suitable parking space can be a challenge for all drivers, but for those with additional mobility needs this can be serious enough to stop them from driving completely.

Cars parking too close preventing access to the driver's door, uneven surfaces like gravel or grass and hazards such as steep curbs, slopes and cambers mean a lot of spaces just aren't viable.

"The use of a simple app to remotely park the car would be warmly welcomed by myself and many others with mobility problems and help to remove parking anxieties and improve independence".

Toby Veall, Disability Consultant

GATEway partners Gobotix and O2 Telefonica collaborated to successfully demonstrate how near-market technology can provide a solution to these challenges by enabling remote operation of a vehicle.

In this demonstration, Toby Veall, a Disability Consultant and full time wheelchair user, used the Gobotix 'TouchDrive' app to manoeuvre the adapted vehicle in and out of a parking space at low speed, showing how a driver could move a vehicle to an area accessible for them to enter or exit the vehicle.

There was also an Automated Valet Park option allowing the driver to disembark at their location and by simply pressing 'park' on the app the vehicle parked itself. This technology is already viable today on the majority of cars through a software addition.

Delivering Flexibility and Efficiency

Exploring the new home delivery opportunity

The UK grocery market is undergoing a seismic shift, as more and more customers choose to place their grocery orders online. Convenience is the main driver for change, with the ability to place orders via smartphones or tablets, as well as consumers increasing desire and expectation to fit deliveries around changing lifestyles.

To meet these growing demands, retailers are having to adapt and offer more choice and flexibility, resulting in pressure on retailers to offer more delivery slots and creating longer working hours for retail staff.

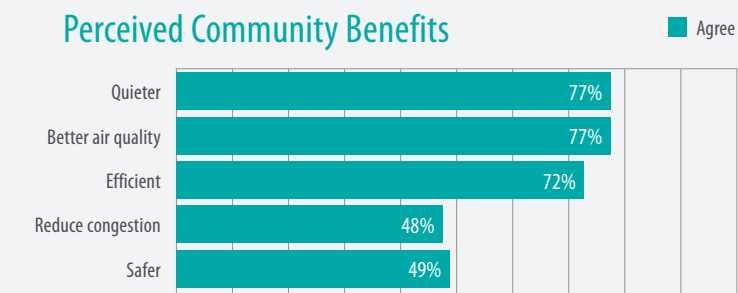
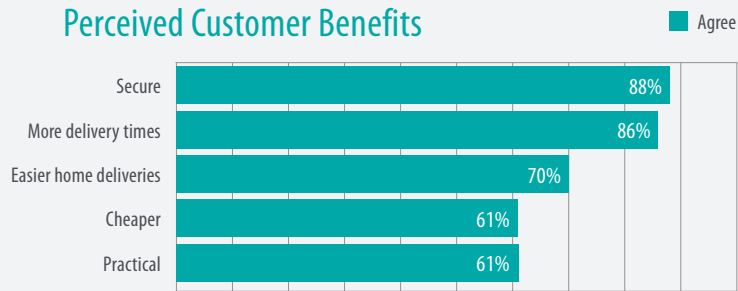
Automated vehicles have the potential to revolutionise the delivery model for both consumers and retailers, whilst significantly improving air quality and noise levels by using low carbon delivery vehicles, reducing congestion and enabling more flexible delivery schedules.

To demonstrate the potential of this technology, GATEway, in collaboration with Ocado, undertook the UK's first trial of an automated delivery vehicle in a residential area at the Royal Arsenal Riverside development in the Royal Borough of Greenwich. This location enabled a circular route to be mapped for the CargoPod, providing access to a high proportion of houses and apartments.

A New Delivery Model

Existing Ocado customers participated in this trial, receiving a text or call in line with their usual delivery preferences, to advise them of the time of their delivery and the location of the delivery vehicle. On arrival of the vehicle, the customer opened a secure locker containing their selected grocery delivery, withdrawing their delivery bag and carrying the goods back home.

For the purposes of this trial, as well as a safety driver who could take control of CargoPod at any point if necessary, an Ocado Agent was also present to talk the customer through the process and ask for feedback via a specially created survey to capture their immediate perceptions on the experience. This model provides the potential for 'drivers' to focus more on customer service, calling customers regarding their delivery and undertaking admin tasks whilst the vehicle is in motion.



The survey responses showed an overwhelmingly positive response to the service experience (96%) with 86% agreeing that driverless services would enable deliveries over a broader range of times and days, 88% believing it would be a secure service and 70% stating that it would make arranging home deliveries easier.

Whilst the majority of participants were happy to carry their goods to their homes, they did raise concerns that this could have accessibility issues for those with additional mobility needs. This highlights the need for further research in this area to ensure that inclusive models for this type of service are created.

“Ocado Technology is delighted to have worked in partnership with the GATEway project to complete a very successful grocery delivery trial using driverless vehicles. We are always looking to come up with unique, innovative solutions to the real-world challenge of delivering groceries in densely-populated urban environments.

This project is part of the ongoing journey to be at the edge of what is practical and offer our Ocado Smart Platform customers new and exciting solutions for last mile deliveries.”

David Sharp, Head of Technology 10x, Ocado



The Benefits of Scale

The popularity and acceptance of driverless delivery vehicles will partly depend on convincing the public that they can provide additional community-wide benefits including improving air quality and reducing noise and congestion, when compared with conventional delivery services.

To demonstrate the wider reaching potential of the CargoPod model, DG Cities and Immense Simulations developed a complete, virtual simulated environment of the Royal Borough of Greenwich. This enabled the single CargoPod to be scaled up to a whole fleet and for different scenarios to be modelled and played out to demonstrate the potential impact and benefits which running a fleet of automated delivery vehicles could have on an urban area.

Utilising participatory development, DG Cities developed and explored a suite of potential scenarios. This included the use of consolidation centres around the outskirts of the Borough, taking deliveries during the night from Heavy Goods Vehicles (HGVs) which would then feed a small fleet of electric, automated vehicles which could deliver direct to businesses during the day.

The model showed that this approach could see a total elimination of HGV trips in Greenwich Town Centre during the day and a reduction in the number of delivery vehicles needed to enter the town centre from 50 to 8, significantly improving safety and congestion and reducing noise during the day. It would also deliver an annual reduction in CO₂ emissions by over 420,000 tonnes.

A Vision of the Future

How do you inspire people to imagine the unknown?

Driverless cars have the potential to reshape our cities through transforming how people move around, opening up a world of new possibilities.

Governments, cities and companies worldwide are already contemplating what our driverless future may look like, with potentially massive change to our urban environment in order to create a transport system that is safer, cleaner, more affordable and accessible to all.

However, to truly understand how these technologies will fit into society and the cities of the future requires an understanding of the needs of the people living in those environments.

How will our future selves, young or old, rich or poor, able bodied or in need of additional support, want or need to use future mobility solutions? What are the future services and business models that these vehicles will provide and how will the interiors and exteriors of these new machines adapt to meet these needs?

The challenge for GATEway was to inspire people to imagine a future with no limits, embracing new possibilities without being constrained by the present. This was the brief provided to the Royal College of Art (RCA), home to the world's most prestigious vehicle design courses.

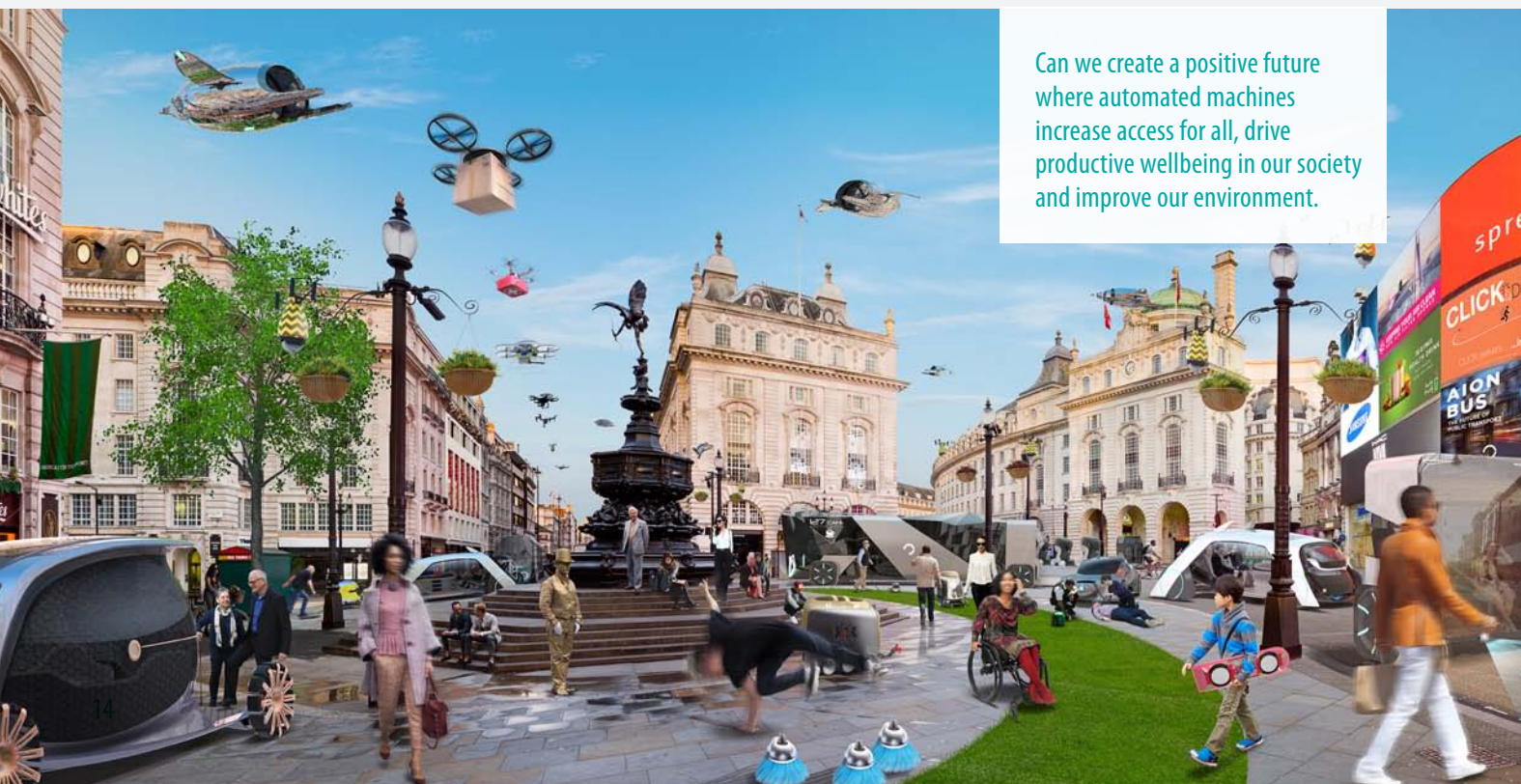
The RCA ran a series of workshops where they engaged with the public in a creative and open environment, encouraging them to share thinking and explore the potential impact of these vehicles on their lives.

Designers from the College then used people's hopes for a positive future (safer, cleaner and more inclusive), and fears for a dystopian one (isolated, mechanistic, driven by profit and exclusivity), to create a series of visually engaging and stimulating graphics, some of which are showcased on these pages.

For six weeks these images and models were displayed in an urban design exhibition at the Transport Museum in London, reaching over 30,000 visitors who were all encouraged to comment on the concepts presented and to develop further opportunities and challenges.

The work of RCA in this area will continue, with the aim of creating a design guide for driverless futures to demonstrate how to design driverless vehicles, environments and services that are not only functional and effective but also delightful and truly inclusive.

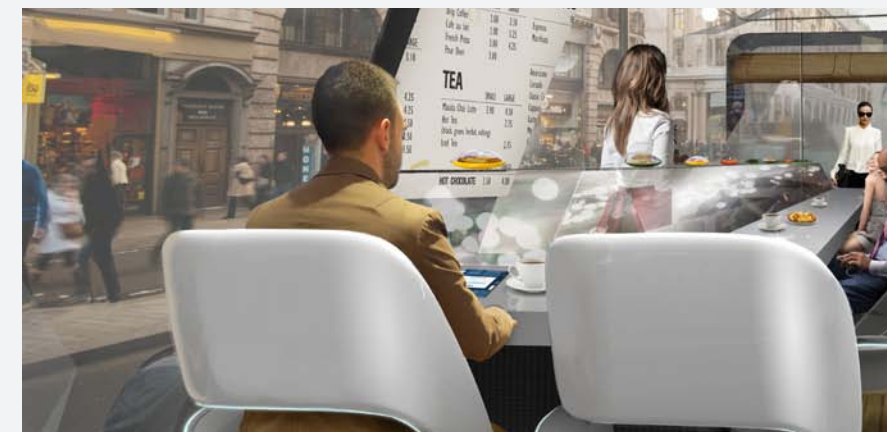
Utopia Vision - Technology and People Living in Harmony



Can we create a positive future where automated machines increase access for all, drive productive wellbeing in our society and improve our environment.



Assisted Living
How will we receive our deliveries in the future? Driverless pods could carry your shopping, or drop off your goods at home.



Changing Commutes
Will our commuting behaviour change as a result of driverless vehicles? Buses could be cafés shops or gyms. Bus stops could be obsolete as a bus pod could collect and transport you to a moving coffee shop that takes you to your destination.



Out and About
Future vehicles should be accessible for all. Integrated assistance could help everyone to get around more easily without highlighting a person's disability.



Transport Museum Exhibition
Our wall of ideas was constantly being filled and restocked. By the end of the exhibition we had collected over 1500 contributions.

The Human Factor

Placing people at the heart of technology development

The research undertaken as part of the GATEway project represents some of the industry’s first insights into public perceptions of driverless vehicles, after a direct experience of the technology.

Engaging with the public and gaining a deep understanding of their hopes and concerns relating to driverless technology was considered so important that GATEway employed innovative techniques, each deployed by experts in their respective fields, to capture and analyse the findings.

The ability of participants to actually experience a driverless vehicle and the combination of different techniques to capture perceptions meant that this research was able to generate a more in-depth view of public opinion over previous research projects.

“I am partially sighted so unable to drive, but a driverless car could take me anywhere.”

“It’s the future and will enable you to do something else such as reading, studying, working, and why not even sleeping!”

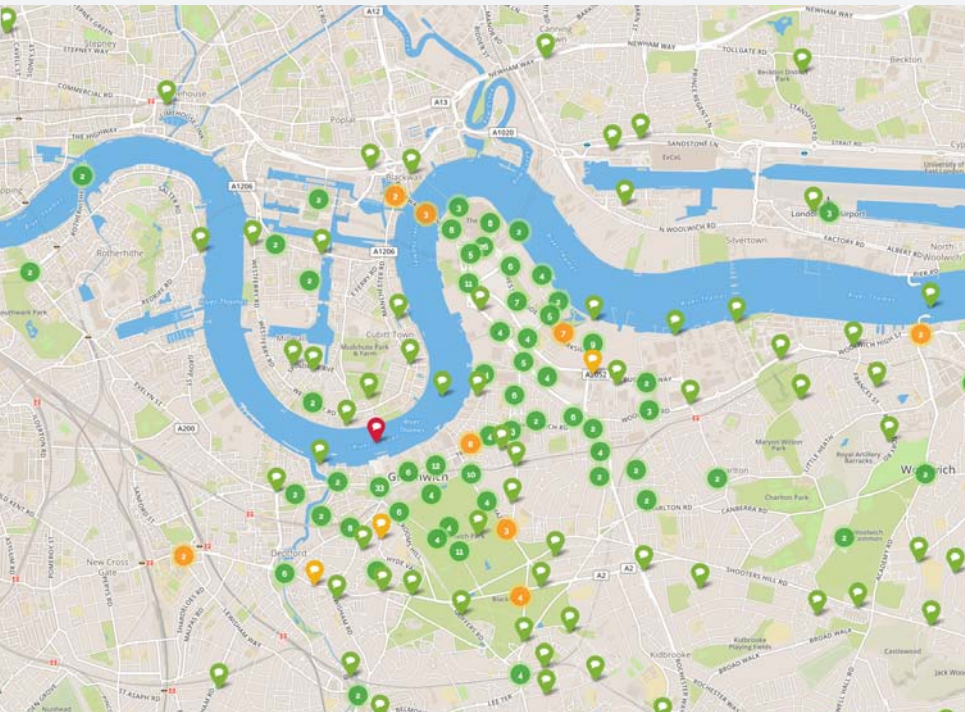
Sentiment Mapping

Sentiment mapping monitors social networks to identify how people in communities feel in regard to public transport, road traffic, commuting nodes and other transport infrastructures.

Using their innovative digital engagement platform, Commonplace were able to provide online interactive sentiment maps to capture the perceptions of riders, pedestrians and onlookers to the GATEway automated vehicles.

Sentiment mapping was used to capture general observations from the public regarding the GATEway vehicles, and also to capture the perceptions of people who had boarded one of the driverless shuttles.

The sentiment maps reached over 21,000 people and over 3,000 people actively interacted with them. Overwhelmingly, those who commented on the sentiment maps were positive about the opportunities and experience of driverless vehicles in the trial.



79%	see automated vehicles as a very positive opportunity
100%	of people who identified as having mobility challenges were positive
39%	of comments highlighted safety benefits for pedestrians and cyclists
53%	of comments highlighted environmental benefits

People who had observed a driverless vehicle were asked where they had seen it, and to describe how they felt about it, whilst people who rode in the shuttles were given the opportunity to rate their experience.

Data suggests the public perceived the vehicles as safe, convenient and accessible. Automated vehicles were considered to have the potential to be more economical and better for the environment, whilst a number of people also commented on how they would provide positive safety benefits for cyclists and pedestrians.

Negative comments were limited to frustration at the very low speed of the vehicles, which was intentionally limited to meet the safety requirements of the trial taking place on public routes, or concerns focused on the ability of driverless vehicles to navigate complex road situations.



“Beneficial for parking, allow users to drink without driving.”

“Technology of the future, reducing traffic and making roads which are only accessible by foot usable.”



Observing Behaviour

In addition to the research by TRL and Commonplace, GATEway also utilised the expertise of the University of Greenwich’s Fire Safety Engineering Group (FSEG) to conduct observational studies on how pedestrians and cyclists behaved around the automated vehicles.

This type of observational study is often utilised in other areas, but this was the first in-depth study involving interaction with automated vehicles.

On the whole, this study suggests that people adapt very quickly to the presence of automated vehicles in their environment. When crossing in front of an AV, behaviour was in line with that of crossing in front of any vehicle, with people increasing their speed if a pod was less than 10 metres away.

When passing the shuttle in the shared lane, the majority of people moved to one side without varying their speed at all.

Interestingly, people were more likely to remain in place and not move to one side when travelling in a group, (which is in line with other group or pack behavioural research), or if the shuttle was approaching from behind, which may simply be down to not being aware of it’s presence.

The dataset collected during this observational study provides unique insights into how humans interact with automated vehicles and FSEG is already investigating how this could be utilised in commercial applications, including the possibility of combining with simulation capability to help model the impact on behaviours of integrating automated vehicles into densely populated urban areas.

Safety and Cyber Security

Mitigating risks, setting the standard

The design, delivery and analysis of AV trials with multiple vehicle and automated control system (ACS) platforms in real-world environments facilitated a plethora of opportunities and challenges around safety. Safety experts at TRL, who successfully delivered trial safety without any major incident occurring, have built on the experience and knowledge gained through the project to develop a comprehensive Safety Framework which can be employed to assure all future AV activity.

The framework, which encompasses critical areas such as site/route validation; risk assessment and mitigations; delivery practices and training; vehicle safety testing; and reporting and monitoring, now operates as a proven and transferable model, and has already been utilised in other areas such as the UK's first Platooning Trial and the Innovate UK funded DRIVEN project.

Within GATEway, the primary objectives were to ensure comprehensive safety standards were maintained across the project duration, whilst enabling the valuable research to be conducted.

In order to proceed, it was necessary to ensure compliance with both the Department for Transport Code of Practice issued at project commencement and then demonstrate sufficient levels of safety rigour to enable full insurance to be provided by RSA.

In collaboration with Imperial College London's Institute for Security Science and Technology (ISS) department, potential risks from cyber activity was assessed at every stage of the project with guidance on the appropriate technical and organisational measures needed to protect the integrity of the vehicles and their systems.

By appraising the potential exposures in this way it was possible to highlight areas needing further validation and assessment as to how cyber security may potentially impact the future of automated mobility.

TRL then maintained a live, iterative safety case document throughout the trials to ensure lessons learned were fed back into the risk assessment along with associated mitigation measures.

In the critical areas of Safety and Cyber Security, the findings from the GATEway research and similar projects will continue to help inform codes of practice, build specifications and help shape necessary changes to legislation.



TRL's Safety Framework



Insurance Insight

Understanding the potential issues with automated vehicles

The insurance industry has a primary interest in the technological development of connected and automated vehicles, to fully understand the impact of regulatory change and standards for the sector as a whole.

Participation in the GATEway project provided Insurance partner RSA with the opportunity to:

- Appreciate the need to understand and reflect the role of the hardware, software and algorithms on the vehicles to inform future underwriting and pricing models.
- Understand the growing importance of data, video footage and other vehicle information as part of the insurance process and its timely availability in the event of an incident.
- Explore the practical implications of changes needed to Insurance policies, wordings and certificates, for example to include Cyber and other 'new' and emerging issues.
- Examine and assess on new insurance rating factors, pricing and risks assessments where - in new scenarios - the driver is 'out of the loop'.

"The GATEway project has greatly enhanced our understanding of how and whether we should be involved in Insuring AVs. Where previously appetite would have been limited due to unforeseen risks, I would now be actively encouraging RSA to underwrite this business."

Ian Kemp
Product Director, Commercial Motor,
UK Underwriting, RSA

The Impact on Cities

Planning the future of integrated mobility

Transport has determined the shape of our cities from the very beginning. The car, in particular, has contributed to what we now see as 'Urban Sprawl'. The introduction of Connected and Automated Vehicles gives us the opportunity to re-imagine our approach to the design of our cities, and influence why and how we travel.

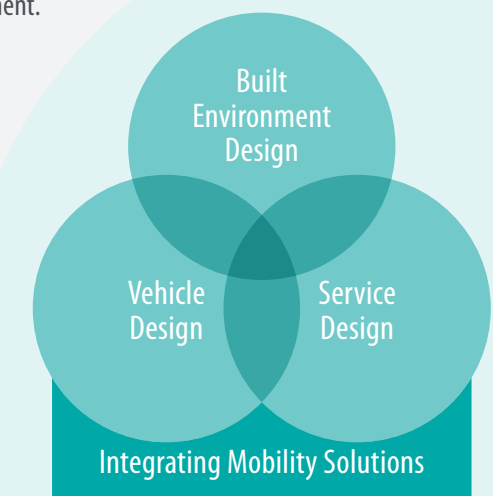
Cities are becoming increasingly congested, driven by a growing population. Automated technology has the potential to both aid this growth and disrupt our current transport systems and approaches.

The work done by DG Cities and Royal Borough of Greenwich (RBG), as part of GATEway, shows it's not just about replacing the car, but re-thinking its role, and examining the potential of CAVs to replace privately owned vehicles and integrate with other modes of transport and the environment.

GATEway has been instrumental in demonstrating how bringing together the essential elements of Built Environment, Service Provision and Vehicle Design challenges our pre-conceptions and enables new ways of thinking.

Technological innovation will require changes to planning (and policy) to enable transport systems to be designed in tandem with the built environment providing a more seamless end-to-end experience, and reducing the environmental impact of journeys. RBG is continuing this work to truly understand what people want and need from the cities of the future. DG Cities will work closely with Local Authorities and Government to help shape policy with future technology and services in mind.

GATEway has helped us take a significant step on that journey.



The Future is Ours to Shape

Continuing the GATEway journey

The selection of GATEway as our project name was no coincidence. The research undertaken throughout the project was designed to establish a 'gateway' through which we could move on to even greater developments and achievements.

One of the primary goals of the project was to empower the establishment of the first and fully validated test bed for the continued evaluation of next generation integrated mobility solutions, in the heart of London.

Thanks to the success of the last three years, GATEway has now clearly met this objective with the formation of the Smart Mobility Living Lab: London (SMLL: L), one of the most significant open innovation testing environments in the world. Where connected and automated vehicle (CAV) systems, services and processes can be safely developed, evaluated and integrated with the local environment.

GATEway was the first step on an exciting journey to demonstrate how smart mobility services can operate reliably in the real world. It highlighted the importance of testing not only the technology, but also engaging with the users of new services at an early stage, to understand their perceptions and needs to create relevant new business models.

It is clear that significant innovative technologies already exist; the challenge is to understand how best to integrate these technologies into existing complex urban systems, enhancing rather than replacing existing transport solutions.

With developments currently fragmented across the industry, technology interoperability and isolated pockets of data, the need for consistent technology standards and legislation are just some of the challenges to be overcome. The cost of market entry is high for all players, but possibly even prohibitive for some of the smaller, innovative technology developers.

GATEway identified the opportunities, challenges and barriers for future development and was instrumental in creating the frameworks, gathering the evidence and building the relationships necessary to take advantage of the opportunities and overcome the challenges and barriers.

SMLL: L will be capitalising on the key learnings, processes and knowledge gained through GATEway, to create the foundation for future investment, innovation and development. It is not only about driverless or automated technology, nor is it another research programme, it is so much more than that.

The Smart Mobility Living Lab: London is the route to market for future mobility solutions.

"This is just the beginning. We are excited to be part of shaping the future of mobility solutions."

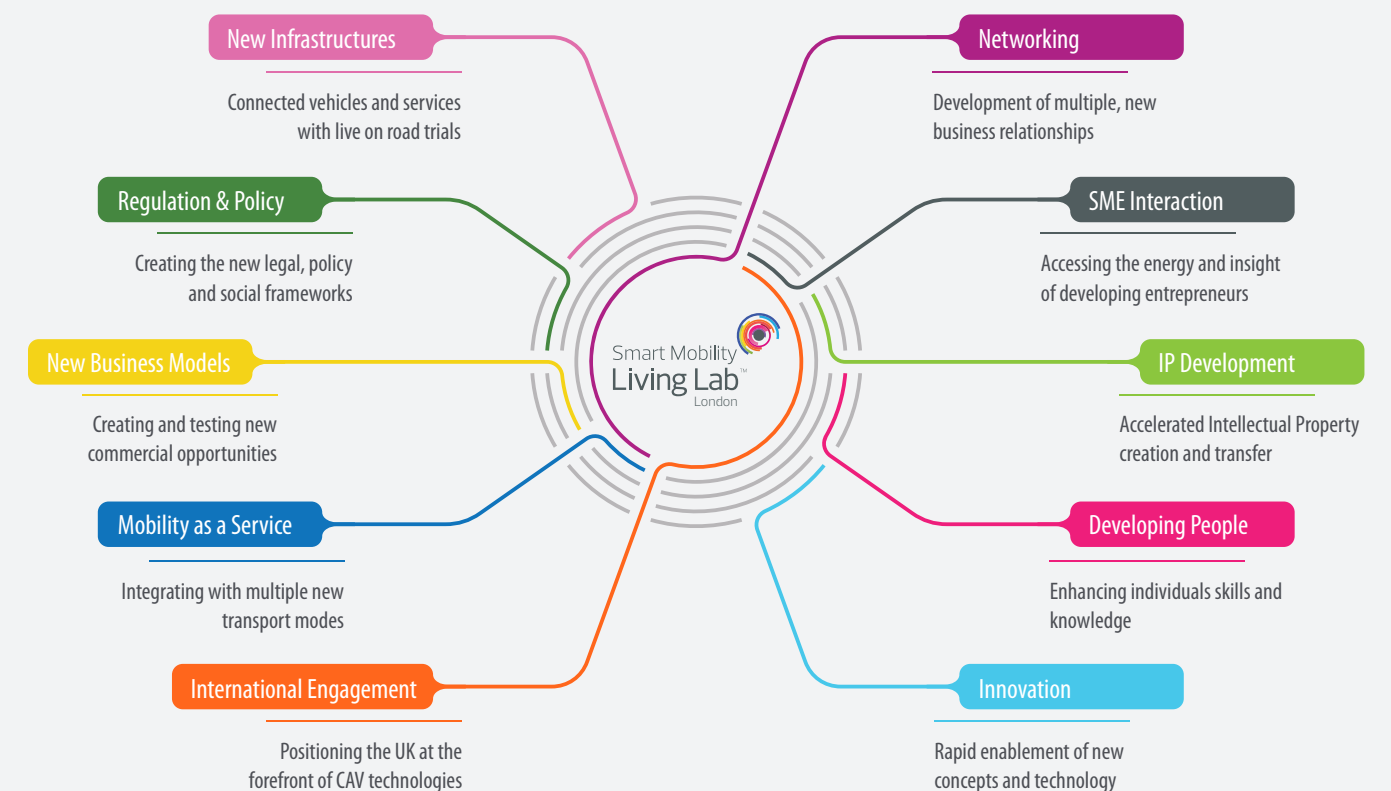
Richard Cuerden, Academy Director, TRL

The Smart Mobility Living Lab: London will be designed to operate as an open innovation environment where innovators in the automotive sector, transport service and technology providers, SMEs, local and central Government and research bodies, can come together to exchange ideas and develop technical and business solutions for the future development of smart mobility solutions.

It will provide access to world class facilities, but most importantly will facilitate working partnerships, building strong relationships, sharing the cost of testing and development and therefore significantly reducing the timescales of bringing new technologies and services to market.

The SMLL: L will provide continued focus and investment in areas central to understanding and enabling the development of smart mobility solutions in the UK and worldwide. This has been made possible as a direct result of the GATEway project's achievements.

Central Areas of Focus for the Smart Mobility Living Lab: London



Profile of Smart Mobility Living Lab: London

The Smart Mobility Living Lab: London has been formed as a Consortium of organisations being led by TRL in collaboration with DG Cities. It has been established through a £14.5 million investment award from Innovate UK, and is in turn planned to receive match funding from industry.

The programme is being rolled out with the support of the Centre for Connected and Autonomous Vehicles (CCAV) and Meridian, the organisation created by Government and industry to develop a co-ordinated national platform of CAV testing infrastructure.

To find out more, please visit www.smartmobility.london

The GATeway project has truly captured the imagination of the nation and we believe that is due to its primary focus being ‘people’.

Whilst the technology and software used were of paramount importance to the success of these trials, through placing people at the heart of the project and seeking to understand their perceptions and needs, we were able to provide a unique, never seen before, insight which was of interest to a significant number of media channels.

In addition, the project was also visited by numerous MPs and Local Councillors throughout its lifetime and was used as a backdrop for ministerial announcements such as the Automotive and Electric Vehicles (AEV) Bill and the recent review into driving laws in preparation for self-driving vehicles.

This interest was a significant benefit to the project as a whole, enabling us to reach a wide and varied audience with information on what GATeway was looking to achieve and deliver.

Here is just a selection of the articles and pieces of broadcast coverage.

Kristen Fernández Medina
Senior Psychologist and GATeway Technical Lead, TRL



The Telegraph

“I realise something pretty remarkable: This machine is finding its own way around the world, almost like a living thing. The engineers on this project have built something that behaves like a living creature.” [Reach: 25 million](#)

The Register

“it was just like a journey in a London taxi – right down to Lycra-clad cyclists whooshing past within inches of the vehicle” [Reach: 40 million](#)

AUTOCAR

“GATeway is definitely pushing the safety and control margins of manoeuvring in a hazard strewn environment to a new level” [Reach: 30,753](#)

MailOnline

“Nearly six out of 10 (57%) UK adults believe connected and autonomous vehicles will improve their quality of life, according to a recent survey of 3,641 people by the Society of Motor Manufacturers and Traders.” [Reach: 2,009,108](#)

The Telegraph

“This is one of the best answers I’ve seen to the question of sustainable mobility, not to mention the most meaningful application of autonomy I’ve ever encountered.” [Reach: 25 million](#)

METRO

“I felt extremely safe aboard the driverless pod. For a start it had a top speed of 5.5mph, and it stopped to think every time any pedestrians or cyclists got too close.” [Reach: 1,469,446](#)

“The attention from the media at the launch for the GATeway project was on a par with the recent Olympics!”

Trevor Dorling, Director, Digital Greenwich

alpha

“[The GATeway project] it’s trying to understand how we humans feel about the machines.” [Reach: 10.6 million](#)

Clean Technica

“not only to test the functionality of the pods themselves but also and perhaps more importantly, sense how the public receives the vehicles.” [Reach: 3.5 million](#)

FirstNews
NEWS TO GET YOUNG PEOPLE TALKING

“this is cutting edge research after all, and the software is still learning.” [Readership 2.2 million 7-14 year olds](#)

sky NEWS

“Overall though, me and my friend found it completely changed our view on the cars. I think they are safe in this use and I would definitely use one if they were a bit quicker.” [Reach: 765,085](#)

WIRED / MAGAZINE

“Autonomous vehicles are being developed by a number of companies around the world, including Ford, Tesla, Google and – if rumours are true – Apple.” [Reach: 262,904](#)

BUSINESS INSIDER

“The GATeway project exemplifies the innovation that the UK excels at.” [Reach: 505,635](#)

TV Coverage



BBC LONDON



BBC RADIO 5 live



LONDON LIVE



The GATEway Team

Delivering through strength

TRL, Project Lead



With more than 50 years' worth of experience, TRL is at the forefront of the automated vehicles revolution developing thought leadership, safety standards, and supporting businesses and Government in decision making and driving future transport and mobility solutions, making TRL the ideal project lead for GATEway.

As well as forming and leading the GATEway consortium, TRL's expertise in safety was critical to the successful running of all trial activities and led to the creation of a comprehensive, industry-leading safety case for the trialling and testing of automated vehicles. TRL has also advanced evidence-based understanding of human perceptions and behaviours surrounding connected and automated vehicles.



The Royal Borough of Greenwich, which provides local services for residents, businesses and schools across the borough, has a growing reputation as one of the UK's leading locations for Smart City innovation.

The Greenwich Peninsula site, with its multi-model transport services and users, was an ideal location to demonstrate how new mobility solutions can be integrated with existing infrastructure and services. As well as providing the venue for the trial, RBG also investigated the wider implications for city authorities. RBG along with nearby Queen Elizabeth Olympic Park in Stratford will be the location for the Smart Mobility Living Lab: London.



O2 Telefónica is a company that is aware of the new challenges posed by today's society. For over 90 years they have facilitated communication between people, providing them with the most secure and state-of-the-art technology.

With a vision to 'create, protect and boost connections in life so people can choose a world of unlimited possibilities' they were an ideal connectivity partner for GATEway, focused on understanding the networking implications of automated vehicles and the impact they will have on O2 Telefónica's business and consumers' connectivity needs.



DG Cities Ltd is the commercial arm of Digital Greenwich. It enables the organisation to work flexibly with external partners in research consortia, local Government, consultancy and other new business opportunities related to Smart City development.

DG Cities facilitated the Greenwich trials and local stakeholder engagement and management. It also looked at the interdependencies between connected and automated vehicles, the design of the built environment and smart mobility services and the role of cities in accelerating take-up.



The University of Greenwich's Fire Safety Engineering Group (FSEG) specialises in computational engineering and their expertise and tools have been used the world over in safety, security and pedestrian dynamics research projects.

As an interdisciplinary research group, FSEG also have many years of experience in researching psychological aspects of human behaviour, through the use of experiments, observations and surveys.

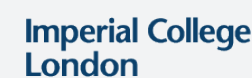
For GATEway, they applied this expertise and experience in pedestrian dynamics, safety and human behaviour to examine public perceptions of and interactions with automated vehicles.



With over 300 years of heritage, RSA is one of the world's leading multi-national quoted insurance groups with a commitment to constant innovation and improvement in their chosen markets.

For GATEway, RSA provided the insurance for the vehicle trials as well as investigating how automated vehicles might disrupt the motor insurance market and determine how a future insurance policy might be underwritten – including from a coverage, rating and pricing perspective.

Alongside this, RSA are supporting the risk mitigation strategy and looking to understand the impact on the frequency and severity of claims that are likely to arise from future wide scale adoption.



Imperial College London is a world top ten university with an international reputation for excellence in teaching and research which has changed the world with cutting-edge innovations; from the discovery of penicillin to the world's first invisibility cloak.

Amongst numerous awards and Fellowships they have received 14 Nobel Prizes. Working with TRL on the wider safety case, ICL undertook research to consider the cyber security implications of the specific trials and the future implementation of connected and automated vehicles.



Commonplace is the leading online engagement platform for places. It offers a deep and comprehensive way to understand and map what matters to people about the place they live, and how it could be improved. Commonplace is widely used by local Government, private developers and infrastructure providers.

For the GATEway project, Commonplace adapted its technology to map and analyse how people responded to driverless vehicles before and during the trials.



Shell is an integrated energy company that aims to meet the world's growing demand for energy in ways that are economically, environmentally and socially responsible.

As well as finding and producing oil and gas in the North Sea for more than 30 years, Shell also provides fuels, lubricants and chemical products to millions of customers across the UK every week.

Shell's interest in GATEway is understanding how automated vehicles will impact its existing business models.



Royal College of Art (RCA) is the world's leading university of art and design, specialising in teaching and research, and offering degrees across the disciplines of architecture, arts & humanities, design and communications.

The RCA used its internationally recognised expertise to focus on public engagement and people-centred design research, drawing on techniques of inclusive design and design thinking, to provide detailed insights into the public's attitudes to vehicle automation.



Gobotix is a rapidly growing micro company with strong expertise in robotics, navigation, computer vision, information engineering and related systems and software.

They are very much involved in the development of the Smart City and believe that through the use of appropriate digital and communication technology it is possible to enhance quality and performance of urban services whilst reducing cost and engaging more effectively.

The GATEway Team

Delivering through strength



In an age of manufacturing imports, Westfield Sportscars are proud to boast high quality British craftsmanship in every aspect of their production, built right in the heart of the UK.

Westfield Sportscars used this expertise and knowledge to deliver the procurement and build of the GATEway pod vehicles as well as the overall systems integration, working closely with Fusion Processing to ensure successful and safe vehicle operations during the trials.



London Heathrow is responsible for the original design, testing and engineering of the original pods, which our GATEway pod vehicles and their control software are based upon.

The GATEway pods are developed from the ones you may have seen at Heathrow Terminal 5, which provide an on-demand direct shuttle service from the dedicated Pod Parking area to the Terminal.



Oxbotica is a fast growing start up company formed in 2015 as a spin out from Oxford University. Using the latest in computer vision and machine learning, Oxbotica is creating software to power the next generation of automated vehicles which learn from their environments and share experiences with each other.

The Oxbotica autonomy software system Selenium, which enables real-time, accurate navigation, planning and perception in dynamic environments was used in the first phases of the GATEway project.



Fusion Processing Ltd, founded in 2012, utilises radar and machine vision expertise, together with in-depth knowledge of leading edge processor technology, with the aim of providing a step change in automotive and transport related products.

Their CAVstar® situational awareness technology combined with high level control algorithms enable vehicles to be partially or fully-automated. Fusion were the sensor and ACS provider for the final phase of the GATEway trial, providing sensing and control equipment on the brand new pods built by Westfield Sportscars, ensuring successful and safe vehicle operations.

“It has been a privilege for TRL to lead such a landmark project as GATEway. Working with our partners, GATEway has created an invaluable wealth of knowledge, experience and evidence-based research on how to develop and test new technology and business models.

GATEway has provided the strongest foundation for us to now move forward and continue to realise the potential of integrated mobility solutions.

At TRL we are looking forward to continuing this journey through the Smart Mobility Living Lab: London.”

Rob Wallis
CEO, TRL

Supported by:

Innovate UK



The GATEway project is supported by the UK Government’s Centre for Connected and Autonomous Vehicles (CCAV), a joint Department for Business, Energy and Industrial Strategy (BEIS) and Department for Transport (DfT) unit established to ensure the UK is at the forefront of testing and deploying connected and automated vehicles (CAVs).

TRL, Project Lead



Supported by:

Innovate UK



Imperial College
London



Commonplace



Heathrow
Making every journey better

OXBOTICA
robotics & autonomous systems



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