Clean, connected and in-control

What tomorrow's transport technology
could mean for councils

Foreword

There is real change coming to the way we move around. Over the next generation we are going to see a major transition in cars and road vehicle technology that could eventually see our current vehicles replaced by transportation that is fully electric, automated and connected. This combination of technologies will bring about the most significant change in how we travel since the invention of the internal combustion engine.

The Government has made the future of mobility a 'grand challenge' in the Industrial Strategy so we know that it is one of their priorities in the in the years ahead. From a local leadership perspective the potential for public good from this technological revolution is significant, but the opportunities need to be grasped and challenges overcome.

Local government needs to be active in this conversation. If we are able to work in partnership with business, manufacturers and regulators, this technology could be harnessed to solve some of the most complex issues that we face, rather than simply serving narrow interests.

Back in December 2017, I chaired a meeting at the Local Government Association (LGA) where experts from the automotive and freight sectors and government told us how they were influencing technological developments in transport. The seminar raised a number of issues for councils to think about and led us to write this publication to share a variety of perspectives

This discussion paper examines developments we can expect; how innovative councils are getting involved in trials and the issues that all councils will need to address in the future.

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Chair, Environment, Economy, Housing and Transport Board, Local Government Association

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Introduction

Many councils are already developing their knowledge and experience of electric, connected and autonomous vehicles, which will help them ensure that the roll out of this new technology maximises the benefits for their communities while mitigating the risks inherent in major technological change. Some examples of council involvement are included in this publication.

We hope that this discussion paper helps all councils to do the same. By outlining the major emerging trends in transport technology and sharing the views of industry experts in the field, we hope to improve the level of understanding and awareness of all councils.

In this paper we focus on the three main technologies that are already transforming the way we travel. These are:

- electrification
- connectivity
- automation.

The pace of technological change is always increasing – no single organisation can accurately predict the impact that these new technologies will have. This is why we are very keen to hear from all our member councils on the views and issues raised in this paper. Similarly, if your council is involved in developing any of these new technologies, or has developed new insight, please get in touch so we can share with your ideas with other councils and wider industry.

The more shared evidence there is of council involvement, the more likely industry and government are to invest in, and work with, local government to ensure a smooth transition to cleaner, safer and more sustainable transport that provides better connectivity for all individuals and communities.

Electrification

Electric cars have been technically viable for decades, but the transition from conventional internal combustion engines has not taken off for a variety of reasons. That is likely to change in the near future, with the Government signalling that the UK will not sell any more cars with conventional petrol or diesel engines by 2040. This will mean that the UK will move towards electric-powered vehicles over the next two decades.

One of the issues that has held back electric vehicles is the availability of charging infrastructure and what is known as 'range anxiety'. This is the fear that the owner of an electric vehicle will run out of charge too far away from the nearest charging point, resulting in a cycle where there are not enough electric vehicles to make a business case for more charging points. The development of hybrid vehicles that make use of both battery and internal combustion engines has helped to combat this to some extent, but it does not realise the full benefits of electrification. There is a clear case for public sector investment to correct this market failure and it has been the policy of successive governments to provide funding for charging infrastructure.

There has also been significant progress in the cost and capacity of batteries in recent years, which has increased the range of electric vehicles. From 2010 to 2016, battery pack prices fell by roughly 80 per cent. Also since 2013, the estimated range for many electric vehicles has increased significantly.

For example, the range of base models of the Nissan Leaf and Tesla Model S expanded from 75 and 208 miles per charge in 2013; to about 107 and up to 249 miles in 2017, respectively.

Electric vehicles are more efficient than conventional engines and have lower maintenance costs, as electronic motors are significantly easier to maintain and less likely to malfunction than petrol and diesel engines. These factors are likely to accelerate uptake in the coming years, as are recent government policy changes. The decision to charge more Vehicle Excise Duty on new diesel vehicles and the announcement in the recent spring Statement that the government intends to review incentives for cleaner vans illustrates the Government's direction of travel.

One of the key benefits of electrifying vehicles is the elimination of tail pipe emissions. They don't eliminate emissions entirely as the generation of electricity may still produce emissions, and brake and tyre wear will still produce particulate. However, electric vehicles can be used to move emissions away from populated and congested areas. Part of the problem with diesel emissions is the 'canyon effect', where congested roads between tall buildings trap emissions. Electric vehicles will help with this and significantly reduce the overall emissions transport produces. The LGA will be working with the government to look at ways we can spread best practice on rolling out charging infrastructure.

We asked the experts who attended our Economic, Environment, Housing and Transport Board seminar back in December 2017 to contribute their views on the emerging technological agendas we have highlighted. The Society of Motor Vehicle Manufacturers and Traders (SMMT), Atkins, The Freight Transport Association (FTA) and the Transport Technology Forum (TTF) have all contributed their views.

We have highlighted key insights but each organisation's full contribution can be accessed on our website.

SMMT:

"Although plug-in cars command only 1.86 per cent of the new car market at the moment, we are likely to see steeper uptake of ultra-low emission vehicles (ULEVs) in the coming years, encouraged not least by the introduction of new models by manufacturers and supportive government policies. To grow the number of ULEVs in the entire UK vehicle fleet – which currently stands at only 132,000 of 39 million vehicles on UK roads – much will depend on how quickly the '3 As' of ULEV uptake barriers are overcome: range anxiety, infrastructure accessibility and product affordability. Overcoming these will require government and industry to work closely together by setting out realistic policy roadmaps and pragmatic market development measures that encourage motorists and fleets to switch to ULEVs."

Atkins:

Electric Vehicles (EVs) are here now. The challenge is how to facilitate their sustainable growth and to understand the role of EVs in a rapidly evolving and growing sector that will provide greater choice by opening up the provision of responsive, frictionless travel options and information across all modes of transport.

More battery charging facilities will be required – these need to be developed at home, at work and in public spaces including car parks, retail outlets, fuel station forecourts, motorway services, depots and terminals. There will be some work to achieve a sensible standardisation across the sector to ensure efficient investment and ease of adoption.

Charging points are considered for most new buildings or urban developments, but for the scale required the majority will need to be retrofitted onto existing infrastructure.

Consideration of how to plan and efficiently design on different infrastructure in both the short, medium and long term will need to be made. For example:

Battery technology will influence the speed and scale of the charging network.

Faster charging, longer life batteries could reduce the number of charging points required in public spaces. Hybrid vehicles that can self-charge – potentially powered by a low-carbon fuel such as hydrogen – could also remove the need for traditional charging points.

FTA:

Electric vans are on sale today but are too expensive and are yet to convince operators regarding capacity, capability and longevity. But we may be near a point at which costs reduce and (following recent government regulatory reform) the vehicles can carry more. Range extends all the time as batteries improve.

In around five years we would expect electric vans and smaller HGVs (probably up to 7.5 tonnes) to move to a point where they start to become a viable everyday option for operators – but it will take far longer for this to be true for smaller companies who rely on second-hand vehicles. However, for even this to be the case, a further hurdle has to be overcome: electricity supply to depots. Today FTA members often have to pay for upgrades to the supply to their yards, as well as the charging points in them. This is not viable for most companies. It would be a key area for local councils to intervene if they wish to see early uptake of electric goods vehicles on their roads.

Despite some test models and much PR, 100 per cent electrification will not be possible any time soon for larger goods vehicles. But possibilities exist for them to become hybrid electric where they could run in zero emission mode in city centres. The carbon benefits of electrification are real but not exponential until the electric supply is decarbonised, but clearly the air quality gains could be very significant.

Case study
Swindon Borough Council

EV charging and solar carports – Public Power Solutions Ltd

Public Power Solutions Ltd. (PPS) is a company wholly owned by Swindon Borough Council that has been set up to deliver innovative solutions in the areas of waste and power.

The momentum behind the electric vehicle revolution now seems to be unstoppable. The government is banning new fossil fuel-powered cars from 2040 and EV sales are climbing rapidly (as diesels decline). Government policy is supportive through the new Clean Growth and Industrial Strategies, with grants available for installing EV chargers at home and work.

Councils have a key role to play in ensuring they deliver the infrastructure that supports these changes. Public power solutions are working with Swindon Borough Council (SBC) on an EV charging feasibility study on council assets to ensure this matches residents' future needs while also being commercially viable. This will include a range of council stakeholders - from facilities and energy management to economic development - to create a plan that delivers maximum local benefit from the EV transition.

There are many factors to consider such as the availability of power needed to charge; the parking and charging rules that need to be put into place; and the various charging speeds that will be required.

Taking all these factors into account, we are coordinating both with SBC and local businesses to come up with a commercial proposition that fits the council's aspirations; this is a service we can also offer to other councils looking to embrace the EV revolution.

Further information and support

The Government currently provides an online interactive map[1] detailing the availability of public charging points as well as providing funding for councils to encourage electric vehicle take up through the Go Ultra Low Cities campaign. The Office for Low Emission Vehicles [2] provides significant subsidies to workplaces, homeowners and councils that are prepared to install electric vehicle charging infrastructure with up to 75 per cent of the capital costs funded through various schemes.

The Energy Savings Trust[3] make information available online about electric vehicles and charging.

1   www.zap-map.com/live/
2   www.gov.uk/government/organisations/office-for-low-emission-vehicles
3   www.energysavingtrust.org.uk/transport-travel/electric-vehicles

Connectivity and big data

We now live lives where we are constantly connected to the world around us. There is almost no element of our lives where we aren't in contact with others and this constant and all pervasive connectivity will soon spread to cars. Technology will allow us to receive the level of information we take for granted in our homes and phones. It will also allow cars to broadcast information about themselves; their speed, position and performance can be communicated to other vehicles, and infrastructure and network operators.

Eventually almost all manufactured items may contain sensors to provide feedback on their performance. If all elements of transport could communicate with each other simultaneously there are significant potential benefits to both safety and efficiency. Details of hazards, changing conditions and failing infrastructure could be communicated directly to vehicles, which could adjust their speed or route accordingly. It is easy to imagine the safety benefits that could be achieved especially in emergency situations.

It could also make preventative measures easier to plan. For instance, if vehicles could update a network operator about deteriorating road surfaces it could be possible to schedule maintenance before major problems and closures are necessary. There will be significant costs in upgrading existing infrastructure in this way and questions about who will own data generated by private vehicles and how it can be used.

We have already seen with the Highways England lorry platooning trial that the technology involved in connecting a series of vehicles exists. These developments improve efficiency and safety by making sure that vehicles interact with each and changes speeds simultaneously in the most efficient way. There are few limits about the amount of data that could eventually be shared between vehicles, infrastructure and the people running a traffic network.

This greater connectivity will produce huge amounts of data. Processing all of that data in a way that provides insight will prove a significant new challenge for councils. Handling and understanding the huge amounts of data that connected vehicles produce is likely to become a key function of local highways authorities in the near future.

What experts think

SMMT:

The majority of new cars today are, in effect, 'connected cars' in some form. Infotainment and telematics services are increasingly popular; the former with private buyers, the latter with fleet and business customers. From April 2018 new cars will have to be fitted with an eCall system, which automatically informs the emergency services in the event of an accident. In the future, we are likely to see the deployment of vehicle-to-vehicle and vehicle-to-infrastructure communications in new cars.

Connected and autonomous vehicles (CAVs) alone are capable of enabling more efficient journeys through optimised speeds and platooning, thus improving traffic flow and efficiency while reducing fuel consumption and emissions. A government-commissioned study suggests a 12 per cent improvement in delays and a 21 per cent improvement in journey time reliability on urban roads in peak traffic periods even with low numbers of autonomous vehicles on the roads. Another study shows that intelligent transport systems can potentially reduce CO_2 emissions by up to 20 per cent by connecting vehicles with each other and with infrastructure.

TTF:

The value to the UK from applying technology to roads is already about £7.3 billion per year.[4] Exploiting connected vehicles and other technologies gives an additional potential annual £6.5 billion value to the UK in the near future[5]. These benefits are not dependent on new vehicles, as retrofitted devices and smartphones already provide data with no cost to the public for installation as they are increasingly used for insurance and navigation.

Connecting older vehicles brings bigger safety, emission, and congestion benefits than just from new fleets. However, data availability is not enough – roads authorities need guidance to exploit these developments across the country, with confidence to move to new vehicle-based solutions. Equally, road users need to see personal benefit and gain confidence in connected vehicles and the use of data from them.

4   Connected Roads, Vehicles and People A Key National Opportunity
http://ttf.uk.net/wp-content/uploads/2018/03/Connected-VP.pdf
5   Connected Roads, Vehicles and People A Key National Opportunity
http://ttf.uk.net/wp-content/uploads/2018/03/Connected-VP.pdf

Tantalum big data

Bristol Waste Company, which operates Bristol City Council's waste collection service, and the University of Oxford have signed up to take part in Tantalum's trial with Imperial College London to road test its unique Air.Car technology.

A range of vehicles, including waste trucks, minibuses, vans, and heavy goods vehicles will be connected to the technology. Through a device connected to the on-board computer of any vehicle, Air.Car can accurately estimate real time, second-by-second toxic oxides of nitrogen (NOx) and carbon dioxide (CO_2) emissions.

Tantalum has received, along with its academic partner Imperial College London, a £1.1 million grant from Innovate UK and the Centre for Connected and Autonomous Vehicles to develop Air.Car. A vital part of the research and development is a 1,000 vehicle trial, where units will be installed in diesel vehicles to estimate real-time NOx emissions.

The project will help Bristol Waste Company to make informed choices around vehicle choice, routing and operating times to minimise environmental impact. The project's outputs will also allow the University of Oxford to measure, manage and mitigate NOx emissions from its vehicles.

The Government's Air Quality Plan expects a number of charging Clean Air Zones by 2020, which older more polluting vehicles will have to pay to enter. Air.Car will be able to enforce such Clean Air Zones in a smarter, fairer and cheaper way through incentivising better driving and so reducing toxic emissions. NOx emissions can be halved through a more ecological driving style and co-benefits captured, such as fewer accidents along with lower maintenance and cheaper insurance.

New emissions models will also be developed to inform city authorities about what the air pollution impacts are from traffic lights and speed bumps so that congestion and its impact on air quality can be better managed.

Case study
(Transport for the West Midlands) TfWM

Mobility as a service

Whim, the App provided by MaaS Global in the West Midlands, provides access to train, tram, bus, taxi, cycle hire, car hire and parking. For consumers Whim provides a personalised service that is easy to use. Whim's goal is to offer personalised packages based on a service offering and not on a mix of ticketing products, for example getting you to and from work on time. This gives Whim customers the best price for that service and the most efficient use of their time. Whim removes the hassle of having to piece together all the elements of your journey, giving easy access to all transport modes through a simple and convenient payment.

As an increasing number of people use Whim and similar products in the West Midlands, we expect to see an increase in cost and logic-based consumer choices that more closely link to conventional models for transport productivity and GVA impacts. More reliable and predictable journeys for people and businesses means a reduction in the loss of productive time. Whim itself is a new business and some public transport operators see this as a genuine opportunity to acquire new customers, which is critically important in an environment of declining bus patronage.

Whim provides feedback to transport operators on their customers, which will help them manage their operations more efficiently, putting the right services where they are needed.

TfWM have led the way with Mobility as a Service (MaaS) in the UK, but we know we do not have all the answers and we continue to work with UK, European and international partners on the development of an open MaaS eco-system.

Other traditional industries outside transport have been changed beyond recognition by the mobile digital revolution.

For example, the near overnight challenge to the Blockbuster business model of renting videos that came from on-line streaming solutions. Now is the time for the digital transport revolution. Transport is a central enabler at the centre of everybody's lives, MaaS has the potential to be at the centre of a dramatic change in our society which is closely aligned with a shift to other 'as a service' consumer solutions and growth in a sharing economy.

Automation

An increasing amount of driving tasks are being automated. This process has been going on for many years but the momentum behind these changes is becoming greater now that full automation of all driving tasks looks like it could be a realistic proposition. Significant money has been invested in the race to manufacture the first fully automated vehicle from traditional auto manufacturers, new entrants into the market and technology firms. As vehicles - in particular cars - have developed more of the driving tasks have been removed from the control of the driver.

Modern cars have a series of automatic functions that most drivers now take for granted, such as automatic starters, cruise control, gearboxes and wipers. This trend has been occurring throughout the 20th century and is now reaching a point where it is feasible to predict the removal of the need for a human driver. Doing so could profoundly change the way that we use and view a car.

It is worth reflecting on this as two divergent trends and noting there is currently disagreement on whether the trend towards increasing but not complete automation makes vehicles safer. If humans are required to take control of a vehicle at short notice after a prolonged period of automated driving it can take some time for the driver to fully engage with driving and process what is going on.

There is significant academic behavioural research showing that the human brain is not well suited to switching between long periods of low concentration and stimulation to immediately assess the amount of information required to take control of a moving vehicle.

This is a barrier that technology will need to overcome with either the switch to one hundred per cent automated driving or the development of a means for automated cars to stop safely in an emergency without human input.

There is, however, no doubt that complete automation would be a significant step forward for road safety as 94 per cent of traffic accidents happen due to human error. These mistakes could be eliminated by a fully automated vehicle fleet.

Automation is currently an innovative and fast-moving area of technological development. Research undertaken as part of the Gateway project in Greenwich, which exposes members of the public to operational automated vehicles, indicates 78 per cent support for the idea of driverless vehicles on urban streets, "provided they are safe and resistant to cyber attack".[6] The research also found that 43 per cent felt positive towards the concept of driverless vehicles but 46 per cent were undecided. Recent fatal accidents involving automated cars are likely to impact public acceptability.

You can find more information on the latest UK automation projects and trials at the Centre for Connected and Autonomous vehicles.[7]

There is also more information on innovative projects developing transport technology at the Transport Catapult.[8]

What the experts say

SMMT:

"While new technology often excites the public, it is important to ensure excitement progresses to adoption. Proper consumer engagement and education based on facts at every critical point in the journey towards automated, connected, electric and shared vehicles (ACES) is key to cultivating public acceptance. While ACES may bring many benefits, consumers need to feel comfortable with new technology and be properly informed of the material advantages from adopting new technology."

FTA:

"In some ways the most exciting area of goods vehicle automation is not this year's trial of lorry platooning, or even distant prospect of full automation, but rather technological driver aides. A first generation of autonomous emergency braking (AEB) is in use now on new trucks, and upgrades to this over the years ahead will mean it will become far less likely that HGVs will have incidents with other vehicles or vulnerable road users.

As regards full automation, the first stage we can expect for vans and HGVs is for the vehicles to be allowed in use, but only with a 'driver' still in place. When these have reached the stage of demonstrating a near-perfect safety record, we would then move on from there. It is 'trunking' where we might see them in use first, motorways represent a more 'closed' system, where the absence of cyclists and pedestrians may make the technological, regulatory and practical barriers easier to overcome. Towns and cities may prove more complicated.

When could this happen? A central case could be that we might see trials of theoretically driverless goods vehicles on public roads five years from now. It would then be ten years plus from now that autonomous vehicles would start to be used on a commercial basis – and this could easily be 20 years. Depending on the business model adopted we could see mass take-up rapidly from then on. When this happens, delivery patterns might change to overnight movements with automated drop-offs – requiring a change in the layouts of high streets and working areas."

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6   https://gateway-project.org.uk/78-of-public-support-idea-of-autonomous-vehicles/

7   www.gov.uk/government/organisations/centre-for-connected-and-autonomous-vehicles

8   https://ts.catapult.org.uk/

Atkins:

"The final stage is for connected vehicles to achieve high levels of automation (become autonomous), removing the need for infrastructure that exists simply to aid drivers.

Some of the developments we can expect are:

- fewer signs, traffic lights and street furniture (for councils, some asset investment made now may become obsolete before the expiry of a typical 30-40 year usable economic life)

- higher utilised, shared vehicles reduces the need for car parking and means urban spaces can be used in different ways

- cities will need to consider the safe execution of 'handover zones', where autonomous vehicles switch to human control

- councils will need to ensure that rural transport solutions are maintained/improved under new business models – this may need pump prime investment

- local policy will need to keep pace with technological developments to ensure communities have access to the opportunities and remain competitive

- more flexible road space – traffic can react to the quantity of journeys at any one time, so changes the road layout (for example, no painted lines)."

Automated vehicle testing

UK Autodrive is the largest of three separate consortia that are currently trialling automated vehicle technology as part of a government-backed competition to support the introduction of self-driving vehicles into the UK.

The project has been running for three years (until October 2018) with several major milestones along the way, including the start of the vehicle trials – the first of which took place at the HORIBA MIRA Proving Ground in October 2016. In the last year of the programme, autonomous and connected cars and pods will become a regular sight in Milton Keynes and Coventry.

The trials will:

- integrate autonomous and connected vehicles into real-world urban environments

- show how autonomous and connected vehicles could solve everyday challenges such as congestion

- demonstrate the commercial operation of electric-powered self-driving pods at a city scale

- provide insight for key stakeholders and decision-makers, including legislators, insurers and investors.

You can find out more through the UK autodrive website.[9]

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9   www.ukautodrive.com/downloads/

Planning for the future

How will these developments affect everyday life? How will they alter our travel patterns? Will they even change the shape of the places we live?

Decisions taken now could have profound impacts on the shape of our settlements. The engineers who invented the motor car did not anticipate the rise of the suburbs and those who invented the train had no idea that they would create the concept of commuting. Those who create new technology often do not fully anticipate the impacts it is likely to have on the future nor fully grasp the potential it could have to change seemingly unrelated patterns of behaviour.

That role falls to local leaders, especially elected members whose job it is to reflect on how technological trends could affect their area and how these developments could be harnessed to solve other problems.

It is the job of councils to plan the future shape of our settlements. With government targets demanding the highest house building rates in generations, where will these homes go? How they will look and how we will move around them? These will be key questions. We will need to consider how transport technology will influence those choices. We will also need considerable thinking about the infrastructure that will be required to facilitate these changes.

We hope that this guide will serve as a useful primer to get local politicians and senior officers thinking about the impact on their area, whether that is looking at the design standards for new homes or reconsidering their spatial plans. The LGA is seeking to work with councils in leading this conversation in the coming years and we will be planning further work to examine specific steps we can take in the near term.

Conclusion

It is difficult to be precise as to how councils may want to plan for and respond to the technological trends highlighted in this paper. New national laws and regulations will have a big influence but, working with councils, the LGA can help to shape those for the benefit of local government and their communities. Different areas will have to react to this agenda differently. The rates and level of adoption will vary as will the type of technology, but this is something that councils may be able to influence through the services they provide, such as planning policy, their purchasing power and through their community and economic leadership role. Councils will also have to take a view on whether to encourage the adoption of new technology through their decisions on infrastructure. Whatever infrastructure decisions councils take they will need to be confident that investments will be future proof.

There is an immediate challenge for councils to help encourage the growth of electric vehicle infrastructure. There is real desire among councils to help foster this agenda. However, there is also considerable uncertainty about which model is best for the installation of new charging infrastructure, how ownership of the infrastructure should work and what legal framework councils are operating within. The LGA intends to work with OLEV and other experts in the coming months to ensure that councils have access to the necessary technical and detailed advice to help them with their efforts to roll out charging infrastructure.

There are significant opportunities with connected technologies to innovate and improve services and performance.

A number of councils are making use of these opportunities to pair with technology providers to innovate in particular around viewing service performance in real time. By seeing performance in real time, transport systems can become more responsive and efficient. We have highlighted some of the ways councils are using technology to solve policy problems.

There is still disagreement about the extent to which automated transport will take off. Recent accidents and fatalities involving fully automated trials would suggest that full automation is still some way from being accepted by the public and lawmakers. However, even though there are doubts about the implementation of fully automated vehicles, we are still likely to see considerable progress in electrification, connectivity and automation. It has the potential to transform the basis on which we provide many traditional local government services, including highways services.

For example, highways infrastructure is currently designed to give information to a human and guide and constrain their behaviour. Newer vehicles may not need visual information in the same way. As operators of substantial fleets, councils will have a direct role in procuring electric vehicles and easing the transition to a more automated way of working. Connectivity presents an opportunity to receive real time information on vehicle movements to help manage traffic flows. It easy to see that there will be many other examples of how services will be reimagined.

We want to hear from you...

We are asking councils, public service providers and industry experts for views and insights on this emerging agenda. The questions below are intended to act as a prompt but we would be happy to accept representations on any element of future transport and would welcome any material that councils or other interested organisations feel is relevant.

Are you involved in any innovative projects involving charging infrastructure or connected and autonomous vehicles?

What barriers have you experienced in the roll-out of these new technologies?

What opportunities do you foresee for your service area or other services within local government?

Please email our transport team:

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