



Select Committee on Science and Technology

Corrected oral evidence: Autonomous Vehicles

Tuesday 15 November 2016

10.40 am

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Members present: Earl of Selborne (The Chairman); Lord Borwick; Lord Hennessy of Nympsfield; Lord Hunt of Chesterton; Lord Mair; Baroness Morgan of Huyton; Lord Oxburgh; Lord Vallance of Tummel; and Baroness Young of Old Scone.

Evidence Session No. 5

Heard in Public

Questions 40 - 47

Witnesses

[I](#): Michael Hurwitz, Director of Transport Innovation, Transport for London (TfL); and Darren Capes, Transport Systems Manager, City of York Council.

USE OF THE TRANSCRIPT

This is a corrected transcript of evidence taken in public and webcast on www.parliamentlive.tv.

Examination of witnesses

Michael Hurwitz and Darren Capes.

Q40 The Chairman: Good morning, gentlemen. We are grateful to you for joining us. I should say that we are being broadcast, so if you would like to introduce yourselves for the record and if you would like to make an opening statement, please feel free to do so. Mr Hurwitz, would you like to start?

Michael Hurwitz: Thank you. I am Michael Hurwitz. I am director for transport innovation at Transport for London. By means of introduction, we welcome the opportunity to present to the Committee as the Mayor of London's integrated local transport authority. Our purpose is to keep London moving, working and growing, to make life in London better. We deliver the mayor's transport strategy to deliver a modern, affordable and sustainable transport network, promoting public transport.

The emergence of autonomous vehicles is significant for transport and, as stated in the mayor's recent consultation document, *A City for All Londoners*, we want to ensure that our investment plans can adapt to technological changes and new business models such as these, and to explore and understand the opportunities they present to us, as well as the risks.

We noted that many of the Committee's questions refer to highly or fully autonomous vehicles throughout, but we believe, as the transport operator, that it is useful to separate out some of the underpinning elements of this, which is a very rapidly evolving concept. Autonomous vehicles become possible as a result of a number of factors, including better connectivity, sensing data, the emergence of artificial intelligence and others. If these features are combined, they do indeed lead to a situation where fully autonomous vehicles are possible. However, the various steps on the way towards this, such as the data and information available from connected vehicles, or indeed the application of advanced driver assistance systems without full autonomy, also have potential benefit and implications in their own right, which we also believe are worth discussing.

Thank you again for the opportunity to contribute to the inquiry, and I am happy to comment on this or any other questions you may have.

The Chairman: Thank you. Mr Capes?

Darren Capes: Thank you for the opportunity to give evidence to this Committee. My name is Darren Capes and I am the transport systems manager for City of York Council. My experience is that of a traffic engineer working for smaller, non-metropolitan highway authorities, which are responsible for the majority of the country's roads. In England and Wales around 5% of the road network is under the control of Highways England or the Welsh Assembly Government. That means that the remaining 95% of the network is the responsibility of over 140 local authorities of varying size and capability, so I welcome the opportunity to be able to give evidence on their behalf to this inquiry.

Although trials are now under way, generally authorities need to understand what supporting connected and autonomous vehicles will mean for the policy and funding decisions that they need to make now. They need to understand what technology decisions need to be made as existing highway systems reach the end of their life and new systems are considered. They need to do this against a backdrop of pressure to reduce costs and find further efficiencies in delivering services. They also need clarity on how the co-ordination of countrywide delivery of connected and autonomous vehicles will be managed between national and local government and the public and private sectors. Connectivity and some degree of autonomy is inevitable and will be driven by industry, the motor manufacturers and public demand. However, I feel that most local authorities are not yet sufficiently prepared to deliver it.

Again, I welcome the opportunity to present to this Committee.

- Q41 The Chairman:** Thank you very much to you both. I should make it quite clear that we entirely agree with you that we see incremental progress of assisted automation, and we have already, of course, a number of incremental automations, such as AEB and the like. It is not, as you have just said, a question of whether but of how these can be managed and what happens when we eventually get to the stage of fully autonomous vehicles, if we do. Perhaps we should have made that clearer in the call for evidence a month or two ago. Nevertheless, having established that we are looking at the various implications of incremental progress towards automation, what do you see as the benefits and drawbacks of introducing these technological changes to our vehicles, and what might be the impact on congestion or, for that matter, on safety?

Darren Capes: I think there is an obvious benefit in network optimisation. There is a benefit in being able to smooth out the way in which vehicles drive. That will allow vehicles potentially to drive more closely together and allow capacity in the current highway network to be increased. It will also allow for vehicles to behave in a more co-ordinated way, and it will also potentially have accident-reduction benefits.

With autonomy there are also benefits that are perhaps not often talked about in freight and delivery. Certainly managing freight deliveries in historic city centres is a real issue, and the use of small van deliveries for services such as Amazon and the like is on the increase. Autonomy presents a way of dealing with that in a sensible and co-ordinated way, and using its benefits to much better co-ordinate how those services are delivered in cities.

Michael Hurwitz: I agree with many of those points. I wanted to talk a little about opportunities for road safety, and share a couple of data points that may be of relevance to the inquiry. Across London the statistics show that road safety performance is moving in the right direction: 2015 had the lowest number of killed and serious injuries since records began. Just over 2,000 were killed or seriously injured; there were 136 fatalities. In the context of over 5.5 billion road trips a year, that is a relatively small number, but every one of those is a tragedy to be avoided,

and indeed one of the priorities for the new mayor is a vision-zero approach to safety on London's network.

I will, if I may, break down some of that information, as it provides a potential insight into the opportunities for road safety. As I have said, there were 136 fatalities in 2015, of which 66 were pedestrians. We have extensive analysis of road safety, which also looked at the number of collisions between vehicles and pedestrians. In total in 2015 there were 728, and of those the vast majority were a pedestrian crossing the road and being hit front on by the vehicle. That is the first data point and indicates some of the causes of serious injuries and incidents on the roads.

Another data point is a research study that we commissioned from the Transport Research Laboratory and published back in 2013. It investigated the potential for driver assistance systems to mitigate road safety risks and identified a number of key technologies that have the potential to reduce casualties in the coming years. There are examples of those which vehicles already have: emergency braking for pedestrian collision avoidance technologies; intelligent speed adaptation, ISA; and secondary measures so that if unfortunately there is contact, the vehicle is also adapted to protect the pedestrian in those circumstances. They started to put an empirical basis on the opportunity there. Those are the technologies that would be an absolute minimum requirement of vehicles with high-level or fully autonomous systems, so there is an opportunity, we believe, that has real road safety benefits.

The Chairman: Mr Capes, you said that many local authorities are not yet equipped or perhaps are preparing to be equipped for developing, delivering, managing these new technologies. What assistance or legislation, if any, do you think such local authorities would need from central government?

Darren Capes: To link that into the other part of your first question, looking at drawbacks, most of the drawbacks around moving towards full autonomy are in how we transition from the current environment to a fully autonomous environment. Most local authorities, York and similar authorities, have very little understanding of how a mixed fleet could operate on the UK road network, and we do not see a great deal of guidance or research to help us with that. There was a lot of research around the technologies, as Michael has just outlined, around autonomy and how they will work, but we feel that there is not enough evidence around how this transition will be managed. It is around how we manage the use of mixed vehicles in the same road space, whether we need to segregate them or not, how we manage autonomous vehicles with pedestrian and cycle flows, whether we need more segregation between autonomous vehicles and pedestrians and cyclists or less. Obviously, in many urban centres at the moment there is a chaotic mix of pedestrians and cyclists, and that works quite well. Once the vehicle fleet becomes automated and reacts in a more autonomous way to pedestrians, and vehicles stop more readily when pedestrians step in front of them, it may well be hard to stop pedestrians doing that, and it will become part of people's psyche that they can stop the traffic by stepping into the road and autonomous vehicles would stop for

them, so you may need to increase segregation; you may not be able to have city centres that look as they do now.

These are all issues that at the moment we do not feel there is enough research or any real guidance on, and this of course makes planning and developing city centres and developing policies for the next 10 or 15 years on how city centres will develop difficult, because it is likely that in the next 10 or 15 years we will be in a mixed environment and it is difficult to see how authorities should react to that.

The Chairman: Would you like to add anything to that, Mr Hurwitz?

Michael Hurwitz: I think the points Darren was making around how you integrate the developments into a transport system are really important and relevant to us, and indeed to all cities. When we look across London, essentially the priorities are for a healthy city, an active city, and also to allow people to visit, do their work and their leisure activities in a smooth and seamless way. And what you see emerging is a hierarchy; if you look at different parts of London they have different requirements. We want to make sure that we promote active modes—cycling, walking; and if you have to move people around in motorised form, mass transit, public transport is the most efficient. But if you look at the characteristics in outer London and in other areas, the percentage of mode usage is very different. In outer London over half the trips are still in private cars, and the latest data I have is that, of those private car journeys, 60% have one individual in the car. If it can be evolved and shaped in such a way that it is a complement to public transport, a complement to active modes; if it can be done such that it increases shared ownership or shared vehicle usage and higher occupancy and higher efficiency, it can be a complement. We would not want to see it evolving in a way that takes people away from the more efficient or healthier modes. Maybe we will talk later about the opportunities of regulation in the Modern Transport Bill but our approach is to make sure it is shaped in such a way as to complement the city objectives rather than provide a detriment to them.

Q42 Lord Oxburgh: As you pointed out, there are many local authorities in the country and they are responsible for the majority of our roads. How can this diverse group of local authorities keep up with what is happening in technological development and regulation? Do you see potential clashes between a central approach and a local approach, because in many places there are local regulations for the management of traffic which are different from city to city? How do you see this system going, how do you keep in touch, and are there organisations for local authorities to talk to each other about this?

Darren Capes: To take your last point first, traditionally there have been groups and fora that local authorities met in, certainly around transport and the technology of transport. Over the last few years they have waned somewhat but now, as the challenges of connected vehicles and autonomy come, they are starting to re-form; and there are new groups such as the Transport Technology Forum, which has been started in the last 18 months, which is again trying to draw local authorities together, and draw together the whole range of interests around traditional

transport technology and the new technologies that are coming. I think government has a role to play in seeding that process and arranging for those groups to form and be supported. If that happens, there are plenty of willing volunteers among the local authorities who would relish the chance to be involved in that, and that is the way that local authorities traditionally have shared experience and generated a base of knowledge about technology.

As to the support that we need to roll it out in a homogenous national way but still support individual authorities, again, that comes down to how national legislation evolves around road traffic and transport. The technology needs to grow in a way that allows autonomous vehicles to be able to understand the particular traffic regulation orders that apply in each city. Currently that is the way the mechanism works, so national law sets out, obviously, the general law of how we drive and how we behave on the road; laid on top of that, local authorities are able to use traffic regulation orders to ban particular movements, to make particular local provisions. The technology needs to grow in a way that allows that still to happen, and again, that may require some government-sponsored national database or national data standard that allows vehicles to readily access local information and comply with the standards.

I do not see the fundamental way in which the law applies to the highway changing for a very long time. The way it applies, and the way we have this national guidance and national law which applies generally, and the ability of local authorities to use provisions in the Highways Act to enact local traffic regulation orders, is a very sensible way of doing things, and I do not think autonomy needs to change that. I think autonomy needs to grow in a way that allows it to fit into that model.

Lord Oxburgh: Some roads have HGVs barred, for example. Would you envisage the possibility of autonomous vehicles being barred?

Darren Capes: In the short term you may, and again, this comes back to the question we have no answer to at the moment: how do we manage the mixed environment of autonomous and non-autonomous vehicles? Ultimately, of course, you would say no, you want autonomous vehicles to go everywhere, because you want them to be a viable choice for people buying a new vehicle or operating a new service, but in the short term you may well end up with a new category of traffic regulation order which bans or limits the use of autonomous vehicles. Again, enacting that is not a problem, because the mechanisms are there within law; it is how you get that information into the autonomous vehicle so it knows automatically which roads it is barred from or what restrictions apply to it.

Michael Hurwitz: To add to a number of Darren's points, London, by virtue of its size and scale, has a different circumstance and role. We are involved in the UK's Urban Transport Group, UTG—we are full members of that; we engage directly with the automotive industry; we have our own automotive forum, but we are also engaged internationally. People come to us asking for our views, so we are on the board of ERTICO, who I believe presented to the Committee earlier. We also have other international activity. The Mayor recently signed up to Michael Bloomberg's

Aspen Initiative, for city leaders to try to determine the appropriate mix of policies and regulations for this new set of developments.

On the point of routes and how it might flow out, there was a categorisation I first read of in one of the OECD reports about how this will evolve, and they talk about two factors. You will have everything, full autonomy, in some places, and partial autonomy everywhere. That is quite a helpful way to think about it, because on the latter you will start to have elements of autonomy or of driver-assist, or of greater connectivity rolled out into the general vehicle parc, into operations, and for our freight, private transport and indeed public transport movements. In many respects that will not be in any way disruptive, because it will improve safety, it will improve information, and it will provide opportunities for optimising the network.

When you talk about full autonomy, you will have that in some places, and it will start, as I think we are seeing—and we are very much in a development in a trialling phase—in certain environments. The GATEway example in Greenwich is a captive environment. It might move to campus environments, and then on to certain routes deemed as the most appropriate. In Singapore they have certain dedicated routes where the autonomous services are running, and we would do the same. I would say the process will be sequential and it will build up. We will actively manage a mixed fleet by engaging with the early deployments to determine the optimum way of incorporating those in the streets.

Lord Oxburgh: Do you see local consultations about its acceptability playing an important role?

Michael Hurwitz: Absolutely. Darren was mentioning it. Often you talk about technology and technology developments on this, but a big priority for us is to understand the consumer side, the citizen side, the operator side, where behavioural responses are not yet known. Even if you do current assessments of attitudes, right now, for many people, it is talking about a concept that has yet to be experienced, so this is fundamental. In any engagement with new technology in Transport for London, our approach is to engage extensively with customers, staff, and even unions.

Lord Oxburgh: Thank you.

Q43 Baroness Young of Old Scone: You have begun to answer my question, which is really about the way in which this thing will roll out, and particularly timeframes for eventually getting to highly automated vehicle deployment. Perhaps I could encourage both of you, in the context of your own city, to take a punt at predicting how this will go and at what pace.

Darren Capes: I think the difference between the majority of UK local authorities and Transport for London is that TfL is of a size where it can influence the market. Most of us are of a size where we react to what the market does. That is the way it is, unfortunately, or maybe fortunately. For a city such as York, we are in the hands of the manufacturers and of the public and how quickly they want to take up this type of technology. We have been pulled in various directions. It will depend on how quickly legislation comes along, how quickly the UK defines a unified way of

altering the highway to allow for autonomy, but ultimately it will be down to how quickly manufacturers bring this technology to market and have it approved, and how eager people are to start to use it. I feel we will end up having to react to that. It will be out of our control. Our job is to ensure we are scanning the horizon sufficiently well to see these developments as they come along, and see what the large beacon authorities such as TfL are doing, and make sure we are in a position individually as authorities and nationally as a collective of authorities to be able to react to that.

Baroness Young of Old Scone: In the context of York itself, before we go on to London, it is a fairly narrow, winding place with not much scope for adaptation.

Darren Capes: It is, and again, that will have an effect. There are some areas we would want to encourage early—freight and deliveries would be an area of autonomy we would want to see happen quickly, because that has an immediate benefit, as Michael has already alluded to; there is a benefit without many disbenefits there. I think there are some real obstacles to wider use of autonomy in a city like York. You could see certain captive fleets, such as bus fleets and fleets of delivery vehicles, moving fairly quickly to autonomy. In the private car fleet I think it will take a lot longer. There are ultimately benefits in that but, again, we do not yet have a clear view as to how you manage the mixed fleet of autonomous and non-autonomous vehicles in narrow streets and in a very congested city centre.

To finish that, the early stages of autonomy obviously are already with us; the advanced driver aid systems are already with us, and that is of more use in an inter-urban setting. The driver vigilance and lane discipline type tools that are already with us are very useful in an inter-urban environment. I do not think they are that useful in the city centre. It is very hard to predict how quickly the types of autonomy that would benefit traffic in a city centre will come forward. Again, I think that is an area that is quite hard to put a figure on.

Michael Hurwitz: I will start where Darren finished. A lot of things are happening now, and many of the incremental technologies will be dictated through the internationally run type-approval process. There are a number of things due to come to market in the next couple of years, such as highway assist, which is the kind of technology Darren was talking about, but also traffic jam assistance technologies and valet parking technologies. They will be coming in the next couple of years, and they are quite well publicised for most of the major automotive manufacturers.

As for when we will start to see more advanced things, London indeed is different. It is by no means the only place in the UK where there is a significant interest in trialling, research and development, and early deployment, but they are happening already. Lord Borwick is involved in the GATEway trial in Greenwich; Volvo will be trialling vehicles that run at least part of the way in fully autonomous mode on London streets from next year, from 2017; and there are a number of other research deployments or early trial deployments that people are considering in London, so you will see trialling and research happening very soon.

Our approach to that as the authority is that we engage with anybody who wants to work on our streets. As an example, we are responsible for all 6,300 traffic light junctions in the city, so if they are driving on a network, we need to make sure that we are engaged and ensure it works as safely as possible. Interestingly, and this is another value, we want to see what intelligence and data we can glean from those studies to help us promote our safety objectives, our environmental objectives, and learn what we need to about the policy as we develop it for future years.

In the longer term I think the safety debate and the approvals debate are very important in dictating those timeframes. I am sure Messrs Yarnold and Forbes, who spoke on behalf of the Government, will have explained the UN and EU approvals processes which dictate when the mass market options will be made available.

Lord Vallance of Tummel: I was quite taken by your model that you would have full autonomy in restricted environments but partial autonomy everywhere. When you were talking, it was about location, but when you were talking it seemed to be not by location but by fleet type, delivery, and so on and so forth, so you have two partial set-ups. What does that mean? Do they clash with each other? Is it very partial because it is both by location and by fleet type?

Darren Capes: I think they are complementary. The way I would see it developing in cities like York is that you would have certain captive fleet types that run at certain times of the day on certain routes. For instance, in York we have an extensive park-and-ride network, and we are very keen to use the best technology we can, so we are currently in the process of electrifying all the buses that run our park-and-ride service. That will be a very small, easily managed captive fleet that could move to autonomy. It runs on fixed corridors in a fixed part of the city. That would be a good candidate. Maybe, as trans-shipment services start to develop around the country, where deliveries are trans-shipped from large vehicles into small vehicles for the last mile into the city, you could see those small vehicle fleets being autonomous, running through the night, for instance. Then as you move on into wider trials and possibly the use of autonomy in privately owned vehicles, as Michael said, there is the idea of different levels of autonomy in different parts of the city.

Q44 **Lord Mair:** My question relates to mobility services. Do you expect highly automated vehicles to enable mobility services that currently cannot be provided to be provided, or do you see mobility services as being very much improved or changed by autonomous vehicles?

Michael Hurwitz: I am happy to start on this. Let us look at both sides of that coin. I fundamentally believe that the rise of autonomy and greater connectivity will lead to new services and consumer propositions being developed. I noticed, around a week ago, that Nissan have started a model where, rather than owning a vehicle individually, four or maybe five individuals would jointly own a vehicle, which encourages lower private car ownership, which is a positive thing from a city perspective. You can see how autonomous systems, or a vehicle that might be able to take itself to a pick-up point, would encourage a new model of personal vehicle ownership such as this.

I think it will lead to developments in the evolution of mobility services. Now, this is hard to predict. It is an area that is rife with innovation and with very talented technology developers, so it is hard to predict exactly. One point I would like to make about another opportunity: the accessibility potential is significant. Again, referring to London data, those who are less able and older use public transport options less frequently. Of all Londoners, around 39% use the tube every week. That drops to 16% for the disabled community and 23% for those over 65. If there are ways in areas that are less well served with public transport, or less well served with active travel options, or for individuals who are less able to take those up, there is an opportunity we would want to explore about whether that could provide a complement to the wider environmental, healthy city, transport network objectives.

Lord Mair: The other side of the coin there is, might people in general become less incentivised to use public transport? Could this lead to more congestion because more people think it is more convenient to order up a private car?

Michael Hurwitz: Yes, and I refer back to the hierarchy that I was alluding to earlier. If the business models emerge in a way that is lower emission, that is better than traditionally powered vehicles. If it leads to shared ownership and high vehicle occupancy, that is better than private ownership. If it evolves in a way that provides, for example, a supply to public transport networks or a complement to areas that are less well served, that is a good thing. What we would not want to see is this leading to a rise in private vehicle ownership and use where the network is already crowded. That is the role for national government but particularly for local authorities and local transport providers, to shape that mix of regulations, incentives, approvals, to ensure it is a complement, not a detriment.

Darren Capes: I think that for groups that currently find it hard to use transport, and for rural authorities, one of the biggest gains in terms of access to transport is around autonomy. Certainly rural authorities are finding it increasingly hard to provide high-quality bus services into rural communities. The demographic of the rural communities is ageing faster than the city communities, and we face a real issue around how we provide transport for those communities. Autonomy has a real role to play in allowing people currently excluded from car-driving to have some form of personal mobility. For rural communities that is a real plus point.

To echo Michael's point, York has for a long time now had a hierarchy of road users, and it has tried to push people towards using healthy modes, such as cycling and walking, wherever it can. That is partly because it is difficult to accommodate more vehicles in the city, and we obviously want to reduce vehicle numbers, and that basic challenge does not change if those vehicles are autonomous; we still have a finite amount of road capacity we can fill in the city. It is also because of the health benefits. We would not want to see people starting to make choices to call up an automated pod to bring them into the city. We would rather they walked and cycled, and that has a great benefit for the health agenda in the country to continue to encourage people to do that. I think it is a real benefit, but it needs to be managed carefully, and the consequences need to be carefully considered.

Lord Mair: Presumably, from the rural community point of view, it will be a lot more

convenient to call up a pod than waiting for a bus that only comes twice a day.

Darren Capes: Absolutely, yes. As budgets become ever more strained, and they will probably continue to be, the ability for authorities to afford to run meaningful, useful bus services into rural communities is more difficult. Again, this is a potential alternative to doing that. In a lot of cases now we are running large diesel-powered buses to carry three or four people, and that is a very inefficient way to provide transport. Autonomy offers a much more efficient way of delivering that service to small but very needy communities.

Michael Hurwitz: To build on that point, this is another area where the incremental developments have huge potential. You referred to the classic scenario of an under-filled service. Before you get to full autonomy there is a lot of development now around the area of demand-responsive transport, dynamic routing. All of these technologies, which do not require full autonomy but utilise some of the same algorithms about routing, and sharing of information and optimisation in use of the asset, can be applied to solving some of these problems on the journey towards a greater level of automation. Again, that is a really great point of areas where we need to look at how the latest technologies can help not just a very futuristic world, but to improve the effectiveness and the consumer proposition for existing services.

Lord Borwick: London was really a pioneer in getting wheelchair accessible public transport in the taxis and buses, way ahead of other cities around the world, I believe, but the recent growth in mini cabs and Uber has moved away from accessibility in the grouping of personal transportation. Of course, a large number of the users of wheelchair-accessible transport are baby buggies, babies travelling in wheeled transport. Do you think part of the possibilities for the future that you have just welcomed for wheelchair accessibility should include the use of bus lanes for such wheelchair-accessible transport, even though they are not licensed taxis?

Michael Hurwitz: You are asking me to make a very bold policy statement.

[Laughter]

Lord Borwick: I was asking you to predict the future.

Michael Hurwitz: In fact, predicting the future and bold policy statements are both quite challenging.

Lord Borwick: Indeed so, particularly the future.

[Laughter] **Michael Hurwitz:** I have to refer back to the answer I gave—that once we know more about the options, the business models and the challenges and dilemmas this will present, we can look at any given policy, in full consultation with stakeholders, the technology providers and the representative bodies. So I am afraid that I am going to say it will really depend and will be one for the future. It is an insightful question, and it raises another of the issues that this presents to all of us, as operators and policymakers, regarding some of the new challenges that we are going to have to adapt to, and potentially quickly.

Q45 **Lord Hunt of Chesterton:** I was a city councillor in Cambridge in the early Sixties,

when we had double-decker diesel buses going down very narrow medieval streets, and we moved to pedestrianisation—healthy Cambridge—but now my own interests is the question of development of modelling and simulation in urban areas. Many boroughs of London have relatively standardised methods of dealing with traffic and air pollution, air quality, which is one of your things. I am just wondering, as you move forward, for all these different boroughs to have wide policies, is there a move to develop model simulation methods that a wide number of local authorities can use? If everyone has a different one, it would be very difficult to do. I notice from your CV that you are on the IET. Is IET encouraging a standardised or general modelling that local authorities can try out? As you say, you want to try out these new methods in simulation mode.

Darren Capes: I think this is more a question about co-ordination between authorities than modelling. There are a fairly limited number of modelling options. It is not that authorities are using wildly different ways of modelling; there are a number of accepted ways of doing it. It is how you arrange the organisation to tie authorities together. This is more a role outside London for the emerging combined authorities and city regions, the larger-scale transport bodies that are starting to appear around the country, to do that on a regional level. In the past, when transport outside London was dealt with by a small number of large shire counties, that would happen. In my previous experience working for a county we did county-level modelling. As local government has fragmented, that has been lost to a certain degree. I think the opportunity really lies with the city regions and combined government and the larger bodies maybe to a level of Transport for the North and the like to take that on again and use the modelling tools which already exist to do that. I do not think a great deal of it is being done at the moment outside the large conurbations.

Lord Hunt of Chesterton: Does not, for example, TRL have some role in developing a national system that everybody can try out?

Darren Capes: To refer you back to an earlier answer of mine, I think government has a role in promoting the types of fora that local authorities can get together in and discuss this thing. It is really about engineers within the authorities themselves deciding on the best tools to use for this. As I think I said earlier, there has been a move away from that kind of joint working over the years, and it is now starting to turn around and we are starting to see more of it. This is an important role for that type of forum as it develops to discuss standards and probably to set informal standards that authorities can use. That is now starting to emerge but it is not there yet, by a long way.

Lord Hunt of Chesterton: Can I raise one small last point? You mentioned Singapore. Singapore, of course, developed some of these earlier methods of congestion charging and indeed modelling. Are we learning something from Singapore that we can apply here in the UK?

Michael Hurwitz: We have an MoU with the LTA, the Land Transport Authority in Singapore, so we have close relationships with them, yes.

To add to Darren's point, I think there is a role for central government but there is also a role for local transport authorities to make sure we share. As Darren has alluded to before, we have significant capacity. We have not done the modelling yet but we are currently in an in-depth process of looking with our academic partners and frameworks where we can do some more detailed modelling. We have a number of techniques that are worth sharing. We produced back in 2014 a number of categories called Street Types for London, where we look at the different balances between movement and then place, what the different road types in parts of the city need to perform. We are looking at how we would model various scenarios on those. It is not ready yet but we will be working on it and I think it is incumbent upon all of us to share this. I think it is very important to evolve this in a way that reflects the differences between cities. There is a capability issue in the small authorities regarding how you can stay ahead of the game.

Lord Hennessy of Nympsfield: Michael, when you were making your statement you said your purpose is to keep London moving. I was very struck with the verb "keep", because my memory of London traffic goes back to 1951 and the last trams on Highgate Hill, as immortalised in the "Goon Show". I remember the Buchanan report, the box motorway, a fragment of which was built with park and ride, and all sorts of things. We have always been behind the curve; all the estimates seem to have underestimated the congestion and so on. Looking at this inquiry, it seems to me that the possibility of having mixed fleets of non-, highly, and fully automated vehicles all operating at the same time raises the possibility of chaos on a truly heroic scale. I wonder if your modelling will look at the worst cases, because there is a danger—I do not mean to be disrespectful to anybody—by the very nature of this inquiry, that we will attract as witnesses evangelists for the future, which we are all very keen on but you can be slightly gung-ho. There is a slight sound of the tambourine being rattled sometimes.

Baroness Morgan of Huyton: Can I add to that, because I am interested in the London aspect as well? Are you also, thinking about the congestion, looking at a very radical approach of moving much more quickly in London—with all this stuff about public consultation—but really using it in a dramatic way to tackle congestion?

Michael Hurwitz: The answer to both questions is yes; and yes, there are opportunities but there really are risks. Our approach is that, because of the scale of London, you have the opportunity to shape the market in a way that others do not. You have to look at all the scenarios and understand everything, and we will absolutely do that. But, alongside that, we have the advantage of scale and influence. Particularly at the moment, when you have companies looking to early deployment, they are looking, obviously, to international regulatory bodies in terms of how this would evolve. But, frankly, they are looking to major cities, in particular the megacities, where we have quite extensive ranges of regulations, licensing or pricing, and of course we will model a completely unfettered situation or scenario. In the various studies done so far that we have seen, we have not yet found an approach that we like. They tend to say, headline one: "Here is the huge range of impacts that this could have"; and two: "But it all depends on the policy". But the

answer is yes, you can be reassured that we will ask ourselves as many difficult questions as enthusiastic ones, but we also recognise that we will have a shaping function to make sure it evolves in a way that we intend to be complementary to our wider goals.

The Chairman: Baroness Morgan, are you happy with that?

Baroness Morgan of Huyton: That is fine, thank you very much, yes.

Q46 Lord Hunt of Chesterton: The other feature we have to ask here is the question of how the introduction of autonomous systems will interact with how the streets are designed, the signals, and the white lines. Do you feel that will all change dramatically, or will autonomous vehicles work within the existing system?

Darren Capes: I do not think there will be any great change in the short term, or even the medium term. I do not think, even with autonomy, we will be moving away from rubber wheels on tarmac roads for a long while yet. Even fully autonomous vehicles will probably take that form. The basic construction and form of streets that we have now will continue.

I also think, and I think it is the view of most authorities, that it will be a very long time before we start to dispense with lining, signs and traffic signals, because of course, in an urban environment traffic signals, lines and signs are also there for cyclists and pedestrians; they are there to aid other road users, other than just vehicles, so it will be a very long time before we get rid of those, because I do not see what the alternative is, for instance, to assist pedestrians in crossing the road to some form of green man-type pedestrian crossing.

I also think until you move to a situation of full autonomy, which is a very long way away, you have to configure a road network to allow vehicles to operate in un- or semi-autonomous modes, as they undoubtedly will do, and that of course means putting a human back in control again, and for that you will need to retain the focus we have at the moment on visual aids to allow that to happen.

I think there is an underlying point here that many authorities, like myself, are very keen to get across, in that you have talked about evangelising and the sound of tambourines. We have a similar concern that we do not look too strongly at this and forget the basics of road maintenance, mending potholes, keeping the roads working as they are now, and it is very important that we continue to receive suitable levels of funding to undertake that job, because, as I have just said, I do not think the basic form of how vehicles interact with the road will change massively in the medium term, even if the method of control changes.

Lord Hunt of Chesterton: Will you have much more data? Presumably this is an additional element to the whole system, and that requires a lot more data.

Darren Capes: That is a very insightful point. One of the very early wins with autonomy is data. Of course, for any form of autonomy to work, you need connectivity between the vehicles, and between the vehicles and the infrastructure. That immediately presents authorities such as York and others with much bigger data sets to use than we previously had, and that allows us to do things like

configure the way urban traffic control works better, so we are not just counting vehicles passing over loops; we are able to see a much richer data set of what the vehicles are doing. It potentially allows us to extract much more data from vehicles about how they are behaving and where they are travelling over potholes—we will be able to see that from how the suspension reacts. Where groups of vehicles start to put their fog lights on, we will be able to determine where fog is on the highway. This is all data that is pretty much available now, because most vehicles, certainly most high-end vehicles, currently collect that data using their own internal vehicle network. What they do not currently do is share that data with the infrastructure, and that is very possible technologically. Trials are already under way. Certainly, York is currently involved in a government-funded trial to see how large data sets potentially from connected vehicles could help influence the way we manage traffic signals in the city and the way we manage congestion. For authorities such as mine and TfL, that is probably a very early win in the move towards autonomy.

Michael Hurwitz: Can I add one point to that? York and London are doing similar things. I agree on the infrastructure requirements. One of the things we are all doing is ensuring that when we upgrade our systems, we now have all of our centrally controlled traffic lights wired up to a private broadband network. That is for control. That was done because SCOOT, the intelligent transport system we have now, already reduces delay by on average 12 seconds at the junctions we have. We are upgrading that anyway because we need to keep the network running, but also we make sure it is done in such a way that it could facilitate use of further data in future.

I really wanted to second what Darren was saying about the opportunities. You asked the question, Lord Hunt, around a significant amount of data. I think one of the routes to this is that it is easy to fall into the assumption that we will be showered with huge amounts of data that we may not be able to deal with. I genuinely believe an option to looking at this is on an exception basis. One of the conversations we have had, a further example, is on modern cars, for traction control, anti-lock braking purposes, they can tell you when the road surface starts to become slippery. That could be from ice, water, a spillage. What we do not need as the operator is to be told every second that everything is okay, everything is okay, which creates a huge storage and analytical problem. What we do want on an anonymised basis, is when it happens; because the management of incidents and the management of flow presents to us as a network operator a significant opportunity to predict and prevent the likelihood of a negative incident. Privacy will always be absolutely paramount, but data need not be overwhelming for an authority to deal with.

Lord Vallance of Tummel: This is a very interesting session because, if you will forgive me, it is where the rubber hits the road; it is the practicalities. Correct me if I am wrong, but the picture you both seem to be painting is one of incremental, piecemeal introduction over a long period. There will be trials and errors, some things will be put right and eventually optimal solutions will come. What you need to get started with that is a consistent framework and a set of standards within which to operate. Is that what it is?

Darren Capes: Yes.

Lord Vallance of Tummel: Some of those standards will be international standards for technologies, communications set-up and so forth, and some of them will be at least national, looking at legal, insurance and regulatory standards. Have I got that right—that the way that this is likely to develop is piecemeal, bit by bit; people will try it in different ways in different locations with different fleets, and so on, but to operate that you need to have a framework which is reasonably consistent?

Darren Capes: Absolutely, yes, and I think you are right to say that there are strata of standards, and certainly the motor industry, which operates on a worldwide level, will implement standards across the world. Certainly, at an operator level, at a local authority level, we will look to national and maybe even European standards to determine how data is presented between vehicles and infrastructure, and the UK has a role to play in that. There is a very important point there, and this is going back to data: there is a potential that the data that comes out of vehicles is commercial and is owned by commercial providers. This could be vehicle manufacturers, the mapping companies, the TomToms and Googles and so forth. That presents a real danger to how this rolls out and how we utilise that data. There is a real issue around how we deal with that and ensure that authorities have access to the data they need at an affordable level.

There is also a danger with specific manufacturers or specific groups of manufacturers in areas such as traffic signal equipment locking in certain standards to force authorities to have to buy a particular type of equipment to work with another particular type of equipment. It is very important that the UK continues to play—we do already—a central role in ensuring that the standards that are developed are as wide as possible, so the market is as big as possible, but ultimately open, so that we have the maximum choices we can possibly have for procurement, and we limit the degree to which we are locked into proprietary and potentially costly standards.

Michael Hurwitz: I would add to that the rider that it is an area where some of the world's greatest engineering and software development minds are active, and a lot of potentially disruptive businesses looking at where they can come. There is the process that we are talking about, which is orderly; but I have the sense that it is the traditional challenge of the regulatory bodies or the standard-setting authorities keeping up with a very high level of pace. Perhaps there will be an orderly process, but I think it will potentially be punctuated with rapid steps forward, quite ambitious early deployments, which I think will create a degree of, I hope constructive, tension. But I do not think it is necessarily right to say it will be a slow and incremental trajectory.

Lord Vallance of Tummel: I do not demean that by saying piecemeal. Yes, there could be leaps backwards and forwards, but it will not be a nice, smooth, planned process at all. This is a marketplace.

Michael Hurwitz: Yes.

The Chairman: I was going to ask about how we handle this data and how we

secure it for public access, but I think we have dealt with that very well.

Q47 Baroness Morgan of Huyton: I think that part of my question has been covered as well. It was really about the regulatory regime, so it is going a step further than the conversation about standards perhaps. To what extent are you already having conversations about what sort of regulatory regime will be necessary, and is that at the national, European, international or local level? I am particularly thinking about insurance and liability perhaps, as well as technical standards, and driver licensing. We are interested in what sorts of conversations are already happening.

Michael Hurwitz: There are a lot of conversations for a local transport authority. You point to the ones most relevant to you and the ones that you have an opportunity to shape. You have mentioned a couple of those areas included in the Modern Transport Bill, which is looking at insurance liability first, and some of the nearer-to-market technologies as well. We are involved. Maybe we have slightly more capacity to be involved than others, because people look to us for our opinion.

There are a couple of important points to make on this. The first is that, as you said, because this is where the tyres hit the road, we will be the locations and the geographies for early deployment, and we need to make sure we have the right mix of regulatory levers, incentives, et cetera, to make sure it is not a chaos scenario but a positive scenario that we are aiming towards. It is important for central government to have an active, ongoing dialogue with local authorities.

The second thing is, on regulation—it is a real challenge, and potentially this is a discussion for national government—we have to retain the ability to be agile. I think there are new mobility services that are not covered by the current mix of regulation. To give an example, as we wrote in our submission in advance, the taxi trade, the private hire trade and the buses are provided for in regulations and other incentives; but if you have a rental fleet or a privately owned set of autonomous vehicles, I am not quite sure how that would be covered; whether the existing type approval mechanisms would be covered; or whether we as local authorities would want to have a requirement to encourage the hierarchy that we spoke about before. How can we make sure they are low emission? That they share a degree of data that we believe useful? That we promote shared occupancy rather than perpetuating private car use? There are gaps, and the real challenge for us is that we are going to need to make sure that that voice is heard and that, whatever happens on a national basis, we can react.

The Chairman: We have time for one last question.

Lord Hennessy of Nympsfield: Who do you think will be legally accountable for vehicles that think for themselves when there is a crash?

Michael Hurwitz: Can I refer back to the answer that Mr Ian Yarnold gave this Committee a few weeks ago? The system of law in the UK is that if an unfortunate incident happens, all relevant evidence will be presented to the court and they will take an informed view as to where that resides.

Lord Hennessy of Nympsfield: What do you think they will determine?

Michael Hurwitz: There will be greater information collected on incidents in reality. There will be a very active debate. Again, this is a very tragic scenario, but if you look at the debate currently going on within the incidents on the Tesla vehicles, where there was a fatality, maybe that is starting to give an indication of the kind of questions that will be raised when you have those incidents. It is a combination of what was happening in those circumstances: what is the right role of the vehicle, was an individual complying with what they were meant to do, how culpable was the decision-making algorithm, what was the sensing information that was being collected? It is a very important question and one that is very actively debated.

I have given a long answer. I was going to say I think you should refer to Mr Ian Yarnold. I thought he said it very well on the various factors that will be taken into account in the UK system.

The Chairman: I fear that brings us to the end of this session. We hope to visit the GATEway Project in Greenwich in December so that we can follow up and see at first hand some of the schemes that are being tried, as Mr Hurwitz has described. If there is anything on which you would like to send us further evidence as a follow-up, on reflection, please feel free to do so. You will of course have a transcript and if it is inaccurate in any respect, again, you will have an opportunity to correct it.

On behalf of the Committee I thank you both very much, Mr Hurwitz and Mr Capes, for joining us this morning and helping us with our inquiry.