

Date: 13 July 2017

Item: Future Mobility Business Models

This paper will be considered in public

1 Summary

- 1.1 This paper provides an overview of connected and autonomous vehicles (CAVs) and demand responsive transport (DRT), examples of emerging trends which could have significant implications for future travel in London.

2 Recommendation

- 2.1 The Panel is asked to note the paper.

3 Background

- 3.1 The rapid and accelerating pace of change in technology (from vehicle sensors and connectivity, to analytics and artificial intelligence) and the emergence of the 'sharing economy'¹ means that new mobility business models are coming to the transport sector.
- 3.2 TfL's Transport Innovation Directorate is responsible for identifying areas where disruptive business models² and emerging technology could potentially impact TfL's business. Its purpose is to identify, anticipate and advise on emerging business models to ensure they deliver Mayoral and city objectives.
- 3.3 The Transport Innovation Directorate also investigates the potential negative consequences arising from emerging business models. TfL's job is to make sure all innovations and developments within the transport market support the Mayor's Transport Strategy (MTS), to ensure TfL operate safe, efficient and sustainable services.

¹ A sharing economy is an economic model in which individuals are able to borrow or rent assets owned by someone else

² Disruptive business models is a term used to describe innovations that create new markets by discovering new categories of customers by harnessing new technologies, developing new business models and exploiting new technologies in new ways. (source: Clayton Christensen, Harvard Business Review)

4 Demand Responsive Transport (DRT)

- 4.1 DRT is a smart, flexible form of mobility service that mainly operates without fixed routes or schedules. DRT services are often characterised by fleets of small to medium sized vehicles that adjust their stops, routes and schedules to respond to passenger demand, and can be thought of as a cross between a bus and a taxi, although increasingly there is interest from the car club sector.
- 4.2 DRT is not a new concept, with such services existing in various forms for several decades, for example services in rural areas or for reduced mobility passengers (e.g. Dial-a-Ride), with trips booked in advance and vehicle routes/schedules calculated by a dispatcher.
- 4.3 With the introduction of new technologies such as smartphones, improved connectivity and advanced optimisation algorithms, it is now possible for DRT services to operate a fully dynamic service, with trips booked on the go and routes calculated and provided to drivers in near real time subject to the necessary licences being obtained.
- 4.4 It is also important to note that these services will also be impacted by ongoing technological development. For instance, these services are increasingly likely to utilise electric vehicles and could also employ driverless technology as these abilities develop.
- 4.5 Market conditions have evolved to take account of changing technology, with multiple market players investigating the viability of a DRT service in London. This is unsurprising as London represents a huge opportunity for DRT operators, with its large and growing population. Some early movers are already recruiting staff in preparation for launches in the capital, but TfL expect there to be a growing number of potential new entrants to London's DRT market in the coming months.
- 4.6 Due to the number of services which could reasonably be termed DRT, there are multiple routes to delivery each may take, often determined by vehicle type. These include:
- (a) Private Hire Vehicle (PHV) licences (operator, vehicle and driver) are required for any vehicle that seats up to eight passengers and is available for hire with a driver;
 - (b) a Public Service Vehicle (PSV) operator licence is required to operate a vehicle for hire or reward that can carry nine or more passengers, or to operate a smaller vehicle carrying passengers and charging separate fares for the journey. It is issued by the Traffic Commissioner; and
 - (c) a London Service Permit (LSP) covers a large variety of services, but can be understood most simply as a permit required to operate a London local service that does not form part of the London Bus Network. It must be obtained in addition to a PSV licence and is issued by TfL subject to criteria set down by the Mayor.
- 4.7 Although DRT will not replace mass transport such as core bus and rail services, it may have a role to supplement the public transport network to feed mass transport, help improve first/last mile trips and provide services where it is not

financially viable to operate a local bus service (e.g. suburbs and geographically constrained areas).

- 4.8 Analysis included within the forthcoming MTS suggests that it is worth further exploration into where DRT may benefit London, and under what service models DRT could complement the transport network. If DRT emerged in London, TfL would want it to improve air quality and help tackle congestion, improve accessibility and connectivity and overall enhance the public transport offer.
- 4.9 TfL does, however, recognise that it is important to ensure that this market is shaped to complement the MTS. Any iteration of DRT needs to avoid any risks of increasing car dependency, reducing cycling, walking and public transport. Ultimately we need to preserve the customer offer, to ensure it is consistent with TfL's aims for services in the capital to be clean, accessible and inclusive. In the coming months, TfL will be investigating DRT in greater depth to assess the scale of each benefit and disbenefit. This work is ongoing but will likely involve:
 - (a) monitoring of international market developments, trends and new market entrants;
 - (b) engaging with the market, both existing operators and new entrants, to explore DRT opportunities;
 - (c) considering the existing and possible future regulatory frameworks for such services to ensure that if and when they emerge, they remain a positive, inclusive part of the London transport system; and
 - (d) offering internal strategic procurement advice.
- 4.10 This work is ongoing, and the results, which will be available in due course, will be shared with the Panel.

5 Connected and Autonomous Vehicles (CAVs)

- 5.1 Looking further ahead, CAVs have the potential to change how Londoner's travel more radically. CAVs are seen as a likely revolution in the automotive sector, with market players, including the large vehicle manufacturers and technology companies, recognising this resulting in heavy investment.
- 5.2 It is important to distinguish between connected and autonomous vehicles:
 - (a) connected vehicles are ones which communicate with other vehicles and/or infrastructure. Connectivity can range from infotainment such as music streaming and satellite navigation, through to providing real time vehicle optimisation and safety critical information;
 - (b) autonomous vehicles are vehicles that perform at least some of the driving task themselves. The level of autonomy depends on how much the vehicle can do (e.g. steering, acceleration, braking) and how much responsibility the driver retains (e.g. performing some driving functions, just monitoring or free to do other things); and

(c) there are five levels of automation and progress within these levels are incremental. See Appendix 1 for an explanation of these levels.

5.3 While fully autonomous vehicles are not yet available in the market, vehicle manufacturers and high-profile technology companies are aiming to launch increasingly connected and driverless technology within the next three or so years, with each iteration incrementally improving capabilities. Small-scale real world trials of highly autonomous vehicles are already underway in a number of locations around the world, and industry aspirations for this technology increase in scale from the 2020s onwards. Whilst the specific applications are not yet known, there is potential for impact on vehicles of all shapes and sizes, including freight and public transport vehicles. In light of such strong trends, it is therefore imperative that preparations take place now, in order for London to fully benefit from this potentially disruptive technology.

5.4 The long term impacts of CAVs are yet to be determined, but could be either negative or positive.

5.5 Disbenefits may include the following:

- (a) cheap, convenient car travel could be extended to Londoners who don't have a car or a licence, therefore reducing public transport patronage;
- (b) increased use of CAVs for last mile journeys potentially hindering efforts to increase active travel and public transport mode share;
- (c) more congestion on the road network caused as a result of CAVs being delivered in an uncontrolled fashion which is not managed; and
- (d) cyber-security may bring a whole new dimension to the risks of car travel and security, particularly if vehicles have progressed to full automation where no driver input is required. This risk extends to all vehicles equipped with driverless technology, including buses and freight vehicles.

5.6 Benefits may include:

- (a) enhanced ability to travel for those currently less able to, such as those with mobility impairments, the young and the elderly;
- (b) improved road safety through a reduction in human error and vehicles designed for urban environments;
- (c) more efficient use of London's constrained road space through smoother traffic flows and greater uptake of shared occupancy vehicles, consequently improving air quality through less idling and more efficient driving styles; and
- (d) the overall transport proposition in London could be improved with an integrated, connected transport network enabling seamless mobility for Londoners.

- 5.7 Nationally, the UK has a permissive approach for testing CAVs; it is one of the most open regulatory environments for testing in the World. Testing is governed by the Department for Transport's (DfT) 'Code of practice for testing of automated vehicle technologies'³. TfL is keen to ensure any organisation wishing to trial technology in London fully engages with us prior to testing to ensure safety and maintain effective operation of the road network.
- 5.8 London is an iconic city with a strong heritage for innovation and transport and as such, many organisations are keen to be seen in London and use the city as a showcase for their technologies across the globe. TfL is taking an active role in monitoring the development of CAVs, aiming to ensure policies are in place which can positively encourage the emergence of this technology. This role has involved liaising with the Metropolitan Police Service, relevant Boroughs and key stakeholders. Examples on London's streets include:
- (a) Nissan undertook their first European trial of autonomous technology in late February / early March 2017 in the Borough of Newham, using three electric Nissan Leaf vehicles;
 - (b) Volvo is assessing a proposal to trial level 4 technology as part of their "Drive Me London" programme. TfL is liaising with Volvo and awaiting updates; and
 - (c) "GATEway" (Greenwich Automated Transport Environment) is an £8m research project, led by Transport Research Laboratory. The trial began in April 2017 with one autonomous pod designed for level 4 operation, operating on the Greenwich Peninsula. There are plans to increase this to a maximum of seven vehicles during summer 2017.
- 5.9 In April, Innovate UK announced the winners of a recent Innovate UK CAV competition for a share of up to £35m of central government funding. The successful projects which had a London element are:
- (a) "CAPRI" is a project being led by transport consultancy AECOM, and aims to deliver four to five autonomous pods to the Queen Elizabeth Olympic Park in April 2019. Prior to this, testing will occur in Bristol;
 - (b) "DRIVEN" is a project being led by Oxbotica, an Oxford University spinoff, to examine the insurance and safety implications of operating fully automated vehicles. The project plans to begin in July 2017; and
 - (c) "STREETWISE" is a project being led by the autonomous vehicle technology software providers, fiveAI. This project will develop and demonstrate the technology, safety, insurance and service models for delivering an autonomous shared solution to replace private cars, including the design of a shared service in outer London. The project plans to commence in August 2017, with an aim to launch operational tests in 2018.

³ DfT (2015) The Pathway to Driverless Cars: A Code of Practice for testing. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/446316/pathway-driverless-cars.pdf

- 5.10 TfL is actively involved in DRIVEN and STREETWISE and will have an advisory role in CAPRI. TfL is adopting a safety-first approach and will ensure the trials support our Healthy Streets vision.
- 5.11 Learning from these, TfL will work to create the appropriate mix of policy and regulation to ensure CAVs emerge in a way that is consistent with the policies and proposals set out in the Mayor's Transport Strategy.
- 5.12 All trials will be monitored closely, and key updates will be provided to the panel in due course.

6 Conclusion

- 6.1 TfL's Transport Innovation Directorate will continue to stay abreast of all new mobility trends and entrants via the horizon scanning function of the programme and active engagement with industry, ensuring TfL's strategies and policies of the future are informed and relevant.

List of appendices to this report:

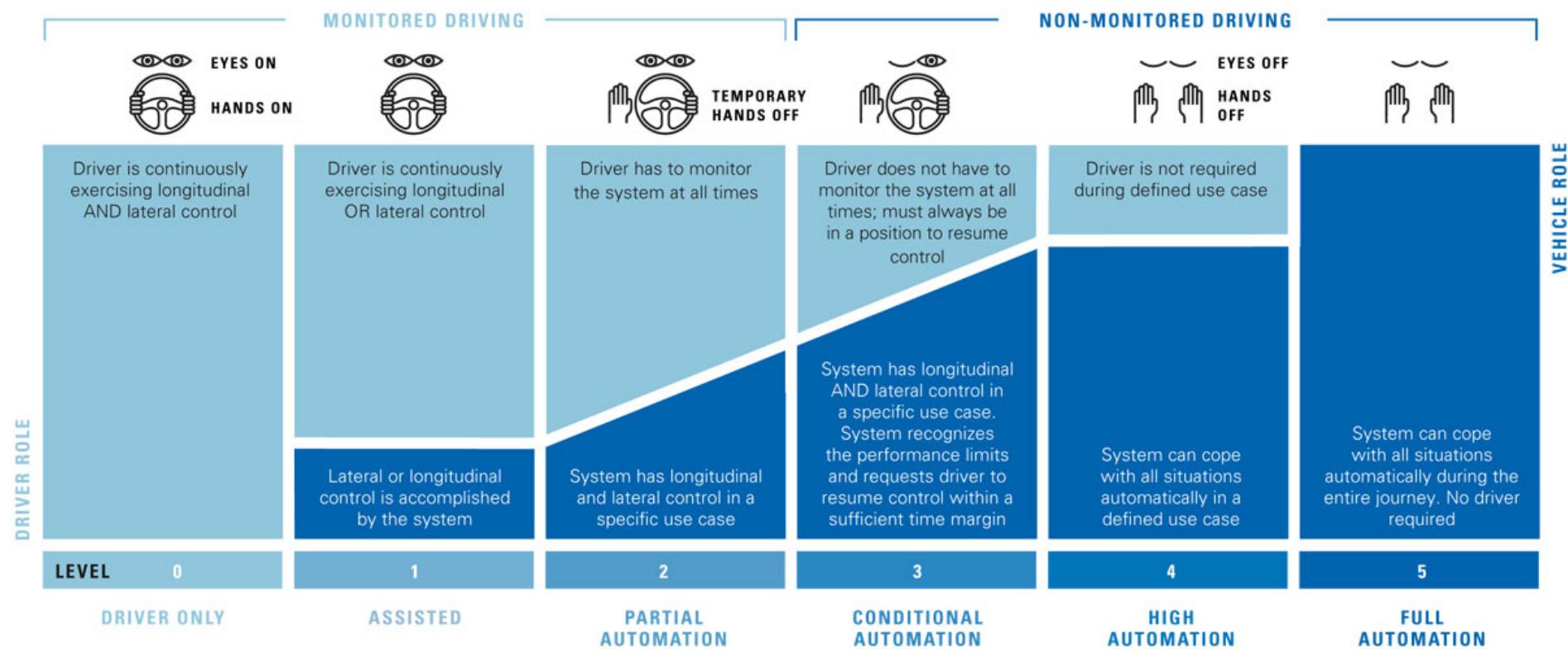
Appendix 1 – Levels of automation

List of Background Papers:

None

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Appendix 1 – Levels of automation



Source: University of Birmingham (2016)

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