London Assembly Transport Committee

Call for evidence: Future Transport

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A submission by:

University of Southampton, University of Westminster, University of Lancaster and University College London

As part of the Freight Traffic Control 2050 project

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Background

We, the above named academics, are currently working on a project entitled Freight Traffic Control (FTC) 2050 (www.FTC2050.com) which has received funding from the Engineering and Physical Sciences Research Council (EPSRC). Partners in the project include freight transport companies and city transport authorities (including Transport for London). The FTC2050 project is currently investigating several topics that should be considered by authorities when developing integrated urban traffic management strategies to address and mitigate congestion which specifically tackle urban freight issues. These include to:

- Work with freight carriers to study their current operations in London and to quantify the geographical patterns and extent of driving and walking on vehicle delivery journeys.
- Identify the key issues and difficulties associated with these freight transport operations from public and private sector perspectives.
- Develop new computational approaches that can enhance vehicle and walking routeing and scheduling decision-making, and to demonstrate its potential effectiveness.
- Analyse what will happen to the efficiency of these vehicle operations and their negative traffic and environmental impacts if they are subject to slower vehicle speeds and more unpredictable journey time reliability in future.
- Trial and evaluate new methods of carrying out these deliveries that involve consolidation, including the use of walking porters to receive parcels at kerbside and carry out deliveries on-foot.

- Investigate using a ‘carrier’s carrier’ for last mile distribution where one carrier hands over goods to another to make the final deliveries using cleaner vehicles, in order to consolidate goods onto fewer delivery vehicles. Evaluate whether the logistics industry will be able to implement more efficient and sustainable operations in the face of pressures that include reducing road space allocation, slower vehicle speeds and logistics sprawl, or whether it will be necessary for a third-party ‘Freight Traffic Controller’ (which could be a private organisation or a city authority) to aid the management of vehicles over the urban last-mile for the more equitable and efficient use of road and kerbside space and time.

All of our answers provided below are the output of the work we are carrying out in the FTC 2050 project, and therefore refer specifically to freight (goods and service) transport. We have only answered those questions which relate directly to the FTC 2050 project.

Key questions

1. How are current developments in transport technology supporting or challenging the Mayor and TfL’s overall objectives for the transport system, particularly in terms of health, accessibility and affordability?

Our research carried out in the Freight Traffic Control (FTC) 2050 project is demonstrating the impacts e-commerce is having on delivery systems in urban areas and in what ways technology could make ‘last-mile’ logistics more efficient.

In an analysis of parcel carrier operations in London, we found that drivers use vans to drive short distances between stopping locations, but then walk to, on average, two different consignees buildings with their parcels at each stop. On average, the vehicles spend approximately 60% of the total journey time parked at the kerbside while the driver unloads, sorts and delivers parcels on-foot. The average horizontal distance walked by a driver on these multi-stop vehicle journeys is 8 kilometres (i.e. 5 miles, not accounting for the vertical distances travelled climbing and descending staircases).

Walking accounts for approximately 30% of the total journey distance travelled from the depot, with 95% of vehicle stops taking place on-street at the kerbside. The average driving time between vehicle stopping locations is approximately 4 minutes, with an average 8 minutes kerbside parking time at each vehicle stop. These delivery personnel could therefore as easily be termed ‘walkers’ as ‘drivers’.

In the FTC2050 project we have studied the difference in performance between experienced delivery drivers and novices, the former sometimes being as much as 50% more efficient in terms of the distance travelled per parcel delivered. Given the high rate of turnover in delivery drivers among most freight transport companies, which results in less efficient freight transport operations (greater vehicle kilometres travelled, journey time taken, kerbside space and dwell time occupied and environmental impacts), we believe there is an important role for human-computer interaction (HCI) to aid novice drivers and make last-mile parcel operations more efficient.

In the case of delivery drivers working on multi-drop parcel delivery rounds in London we have identified several unique tasks involved, and have considered the extent to which novice drivers could be assisted in improving their performance in conducting these through HCI:

1) Locating the consignee and wayfinding

Computer based vehicle routing and scheduling solutions do not currently address rounds which involve substantial amounts of walking and this is an area being addressed in the FTC2050 project. They do not allow for the optimisation of the walking task or the selection of the most appropriate vehicle stopping locations to serve walking patches. Technology such as What3words (www.what3words.com) can aid in identifying the exact delivery point in buildings to improve driver efficiency.

2) Clustering consignees for more efficient walking strategies

Understanding what combination of consignees that can be served from the van on foot given the weight and size of the parcels to be carried relative to the distances involved is important. HCI can aid the driver in this decision making where the addition of dynamic collection requests on the round as well as failed delivery attempts can add inefficiencies into an already complex decision making process. The FTC2050 project is addressing this through new cluster modelling approaches.

3) Using urban delivery systems in the last-mile

The FTC 2050 project will also soon trial and evaluate innovative urban delivery systems for parcel delivery in London. First, the use of delivery porters who would meet arriving freight vehicles at the kerbside and then make these deliveries on-foot, thereby allowing the driver and vehicle to depart the kerbside quickly (freeing up substantial kerbside space and time whilst also reducing vehicle driving distance and time).

Second, the use of micro-consolidation centres to reduce the stem distance driven from the depot to delivery catchment area and which also provides the opportunity to use electric and other cleaner vehicle fuels.

Third, encouraging collaboration between freight operators and their customers, so that these delivery companies can facilitate goods consolidation upstream in their supply chains so as to reduce vehicle trip generation prior to its last-leg despatch to/within the urban area - with companies working together to share their work for given geographical locations.

Fourth, the application of internal logistics/concierge systems and collective procurement to reduce the time that vehicles are parked on-street when making deliveries to large and multi-tenanted buildings. Currently, the driver has to enter such buildings, using lifts and staircases to arrive at the specific receiver's location.

The FTC 2050 research carried out to date is also indicating the potential to better understand and influence other important vehicle technology and operational factors that have an important bearing on company efficiency and urban sustainability in the road freight industry. These include: selecting the correct vehicle for the job (size, weight etc.), using appropriate technology to transport deliveries between the vehicle and the point of delivery, using the most suitable portable device to obtain proof of delivery at reception points and convey tasks to drivers, and using the manifest data concerning individual freight transport companies' operations to gain insight into freight delivery hotspots and using these to consider road freight infrastructure requirements across London.

2. How effectively does TfL plan for the possible largescale adoption of new technology?

TfL is a partner in the FTC 2050 project so is kept informed of developments by the academic research team.

The FTC 2050 project takes the view that there is expected to be a continued reduction in road space allocated to road freight vehicles in London as a result of increases in bus and cycle lanes and pedestrian priority, making freight journeys will become more difficult, slower and less reliable. Also, without interventions by TfL and/or other public sector bodies, there is also likely to be a continued relocation of freight depots ever further away from the centre of London – these will be expected to move towards the edge of London and beyond as land prices / rents continue to become ever less affordable by the freight industry.

Given these pressures, it is assumed that, at some point in the coming years, if the freight industry is not able to organise itself to bring about improvements in efficiency (through internal company initiatives and through joint operational collaboration between freight companies), then it will be necessary for TfL or another institutional body to take the role of a 'Freight Traffic Controller' to manage the movement of freight into urban centres and, given all the freight and traffic data available to it, potentially become responsible for high-level allocation of goods flows between freight companies and their vehicle fleets in order to bring about more efficient and sustainable freight operations in London (and other cities).

In the meantime TfL needs to continue to work closely with the freight industry to find effective ways to prevent these changes in road space availability and depot locations resulting in inefficiencies and delays in in the provision of goods and services to London's businesses and population.

At present TfL does not have the technology and data needed to perform the role of Freight Traffic Controller, in order to implement more efficient methods of goods flow allocation between companies and hence less traffic-intensive and environmentally damaging road freight operations.

Various forms of freight consolidation are being investigated and analysed in FTC 2050 – but these would potentially require TfL and other public sector bodies to: assist in the provision of small parcels of land for micro-consolidation centres and mobile depots; identify methods of incentive and if necessary compulsion to change the behaviour of those ordering goods (businesses and private individuals); become responsible for greater traffic information provision, and to potentially, in the longer term, become the Freight Traffic Controller for London and the surrounding area.

In the area of electric vans and cleaner HGVs, TfL has a role in planning for, implementing and assisting with the locations and management of recharging/refuelling infrastructure and its related technology. In the case of vans and heavy goods vehicles, this recharging/refuelling infrastructure is unlikely to be located on-street but will instead be on private land from which vehicle operations commence and end. TfL has an important role to play in helping firms establish this technological capability in terms of organising and affording upgrades to their national grid connections.

3. Does TfL have the powers it needs to deliver fair and accessible transport services in a more technologically advanced future?

If TfL were to become the Freight Traffic Controller at some point in the coming years (as described above) then it would require additional data and information (about the flows of goods and how best to allocate these between freight carriers) and computing capabilities to provide efficient and sustainable solutions to the allocation of this workload between carriers.

4. How effectively does TfL influence regulations that affect transport in London?

TfL already has some regulatory powers concerning freight (goods and service) transport in London, and the freight vehicle trip generation rates at buildings receiving goods and services. However, there is much potential for TfL to use existing and additional regulatory powers in future to be able to further encourage and dictate efficient and sustainable patterns of freight transport operation in London. These include:

i) Using its powers (in conjunction with the GLA) to make public sector land available at affordable rates for innovative, sustainable freight transport scheme.

ii) Using existing planning powers (in conjunction with the GLA) to safeguard existing logistics land in London from being used for alternative purposes (and increasing the stock of logistics land available in London in future if necessary by reassigning it from other uses)

iii) Imposing sustainable freight transport-related planning conditions (in conjunction with the GLA) on more new developments in London than happens at the moment (to bring about collaborative procurement, use of various types of goods consolidation schemes, the imposition of concierge/in-house logistics systems on multi-tenanted and large buildings, restrictions on vehicle activity times etc.)

iv) Considering extending sustainable freight transport-related planning conditions for new developments (as discussed in the point above) to existing buildings (in conjunction with the GLA)

There is also an important role for TfL to play in education and awareness raising concerning the potentially negative traffic and environmental impacts of 'free' delivery operations, and thereby attempting to discourage environmentally-unfriendly purchasing decisions by companies and private individuals. If education and awareness-raising prove insufficient in addressing this problem, it may be necessary for TfL (in conjunction with other public sector bodies) to extend their role further in relation to this issue through the adoption and implementation of compulsion and/or pricing signals.

Autonomous vehicles

5. What is the likely extent of the introduction of autonomous vehicles in London in the next ten years?

The London Assembly investigation document refers to two types of autonomous delivery vehicles: (i) drones which it defines as 'autonomous delivery vehicles in the air' and (ii) droids which it defines as 'autonomous delivery vehicles on the ground'. Given the engineering efforts currently taking place it would be preferable to subdivide this definition of droids into two categories: (i) autonomous road freight vehicles which are able to self-drive and self-navigate on London's roads while conveying goods, and (ii) delivery robots that convey goods within buildings and using pavements (i.e. do not operate on the public road network). This distinction between ‘autonomous road freight vehicles’ and ‘delivery robots’ is used in our response to Questions 6-13 when considering ground-borne freight transport in London.

It is possible that autonomous vehicles will be introduced into freight transport operations in London in the next 10 years. A small-scale trial of a pavement-based delivery robot is already taking place in London. Much progress is taking place into the development and trial of drones in non-urban locations, and into autonomous road freight vehicles (in terms of from self-driving goods vehicles operating in convey through to fully autonomous self-driving vehicle).

However, it is likely to be many years before drones and delivery robots are technologically, operationally and financially feasible for use in mainstream, widespread freight transport operations in public air space and on public pavements in London. By contrast, for technological, operational cost, safety and regulatory reasons, delivery portering concepts using autonomous road freight vehicles in conjunction with human delivery porters (as described in our response to Question 6) are likely to materialise more quickly in London freight transport operations than the widespread use of drones and delivery robots.

6. What would the impact of autonomous vehicles on congestion be?

Autonomous road freight vehicles would be expected to improve traffic speeds, and increase journey time reliability. These benefits would result from both the improvements that autonomous vehicles would be expected to make to vehicle driving (driving more closely together and with a far reduced risk of accidents) and vehicle parking (with less disruption on moving traffic when ingressing/egressing the kerbside).

As previously mentioned (see answer to Question 1) work is being carried out in FTC 2050 to investigate the role that delivery portering systems could play in making road freight transport operations more efficient in London, reducing vehicle driving distances and times, as well as the time spent and space occupied by vehicles at the kerbside. These human portering systems would also be able to be used in conjunction with future autonomous road freight vehicles when these vehicles are ready for deployment. Given that autonomous vehicles will only be able to stop at the kerbside or off-street loading areas, human assistance will therefore be required for the last-leg of the delivery from the vehicle to the delivery point in the loading bay or elsewhere inside the building. These portering solutions will also offer employment opportunities that will help compensate for the loss of freight vehicle driving jobs that the deployment of autonomous vehicles will be responsible for.

Drones and droids

10. Do drones and droids have significant potential to reduce the level of delivery traffic on the roads?

Drones and delivery robots have some potential to reduce delivery traffic in London, but this remains a long-term goal due to the many technological, legal and safety issues involved. It is likely to be many years before these can be adequately addressed so that regulatory authorities would be prepared to accept large-scale use of such technologies in a dense urban area such as London. Even then, applications are liable to be limited to specific sectors and product types.

In the case of drones, there are several current examples where small machinery parts and medical samples have been successfully moved by drone between fixed locations (e.g. DHL

Parcelcopter (http://www.dpdhl.com/en/media_relations/specials/parcelcopter.html), and the Matternet Station (https://mttr.net). Despite the legal and regulatory hurdles, drones do offer potentially large savings in journey times and emissions over conventional transport with a study by the University of Southampton looking into patient sample movements from seven central London clinics to a main hospital suggesting time and emissions savings of up to 61% and 93% respectively over the conventional courier operation.

Drones have several operational difficulties when thinking about urban freight. These include: how to get safely inside buildings – they are unlikely to be flown through doors and windows and cannot be navigated inside buildings; they cannot readily be used to travel up or down buildings internally, and are currently incapable of posting items through letter boxes etc. For drones to become potentially of use in urban areas, it may require the extensive redesign of delivery reception facilities at commercial and residential buildings.

In the case of delivery robots (i.e. droids using the pavement network) they also currently exhibit various shortcomings and weaknesses that prevent their widespread use for freight transport operations on London's pavements. These include problems in pressing buttons to cross roads, knocking on doors and pressing doorbells, climbing stairs, calling lifts, etc. Droids would also be likely to interfere with pedestrian flows in busy London locations with high footfall. They are also prone to theft and vandalism on the street. Droids are more likely to be used for freight operations inside buildings rather than on-street in the coming years. For instance they have already been deployed within factories and hospitals for moving goods over relatively short, repetitive uncomplicated distances. For example, Aethon TUG autonomous mobile robots (or droids) are currently used in manufacturing plants such as those of Continental Automotive Systems. In addition, 450 of these Aethon TUG droids have so far been deployed in American hospitals to transport medicines, medical tools and equipment, meals, linen, and waste, and using wi-fi are able to open doors and call lifts (http://www.aethon.com/tug/how-it-works/). A trial using a droid for making deliveries in London is already underway in Greenwich by Starship Technologies but currently faces the operational difficulties outlined above in relation to pavement operations and building access (https://www.starship.xyz/starship-launches-in-uk/).

A 2017 report by Cebr indicated a positive relationship between robotics automation and economic development, and that the UK density of robot units in workplaces per million hours worked in 2015 was less than one-tenth of that in the USA, Japan and Germany. This indicates the potential for substantial growth in uptake in UK working environments (https://cebr.com/reports/new-study-shows-u-s-is-world-leader-in-robotics-automation/).

11. What are the specific safety hazards arising from the widespread use of pavement-based droids?

In much of inner and central London droids would take up considerable pavement space and thereby negatively interfere with existing pedestrian activity given the high footfall rates in many locations at peak hours.

12. How will access to airspace for drones be managed, if at all, and by whom?

It is likely that drone use would continue to be managed by the Civil Aviation Authority (CAA). Existing regulations make use of drones for urban freight virtually impossible – such as not being able to fly them within 50 metres of an individual or 150 metres of a crowd; and the need for one pilot per drone who requires a clear line of sight of the drone if it weighs more than a certain amount (including any cargo carried). If there were large numbers of drones in the air at any one time, this would require a new air traffic management approach to organise and control it, and may lead to losses in airspace for other vehicles.

13. What regulation is needed to ensure drones and droids are used safely?

There would also be major safety and terrorism concerns associated with the use of drones in urban areas. In addition, the economics of drones are not currently attractive - the cost of training drone pilots currently far exceeds that of van, motorbike and bicycle drivers, and employment costs may well also be higher for drone operators.

MaaS, apps and data

14. What are the next steps in developing app-based transport technologies?

We foresee an increase in lifestyle couriers in the freight sector servicing the retail and home delivery food markets. Such operations use sophisticated app-based management platforms to allow networks of freelance couriers to engage with carriers to provide the last-mile transport link between consignor and consignee. This will naturally lead to more complex interfaces which allow individual couriers to:

- Visualise delivery and collection opportunities in their area that suit their preferred working time and style
- Plan their work and use built in optimisation tools to organise their daily activity
- Work for different consignors across multiple carrier platforms moving different products
- Track their work progression, transactions and payments in real-time
- Collaborate with others to share transport resources and reduce costs