

Behavioural Aspects of Transport Decarbonisation

David Metz

Honorary Professor

Centre for Transport Studies, UCL

david.metz@ucl.ac.uk

Decarbonisation of transport will involve both technological innovation and investment, and behavioural change. Given the wide range of expert advice available to the Department on technology, I will restrict my comments to behavioural change. The challenge is to understand possible changes in response to interventions qualitatively, and then to quantify in order to estimate the contribution of such interventions to the net zero carbon target.

In this note, I discuss qualitative changes in travel behaviour in response to interventions. These can be complex, given the range of travel modes and impacts that are both spatially and socially distributed. An important source of uncertainty is the long run consequences for travel behaviour of the coronavirus pandemic.

Active travel

The Secretary of State has announced £2 billion of investment to boost cycling and walking in response to the pandemic. The Mayor of London has plans that he hopes will increase cycling ten-fold and walking five-fold post-lockdown[[1]](#footnote-1). These ambitious intentions take advantage of current constraints on use of public transport and are certainly praiseworthy, but there are serious questions about feasibility, both in London and elsewhere.

Increasing cycling in London ten-fold would take its share of trips to that found in Copenhagen, where there are segregated cycling lanes on all roads with significant traffic, in a city that is relatively small and flat, such that you can cycle from the centre to the edge in an hour or so. Nevertheless, car use in Copenhagen is only slightly less than in London, while public transport mode share is half that in London. This indicates that people can be attracted off buses onto bikes, which are cheaper, healthier, better environmentally, and no slower in traffic than public transport. But it seems more difficult to get people out of their cars, even in a city where virtually all motorists have current or past experience of cycling. A decrease in use of public transport, while helpful while the pandemic lasts, would lead in the longer term to loss of fare revenue and of level of service.

Transport for London (TfL) analysed cycling potential in 2017, considering which trips by motorised modes could reasonably be cycled, mainly taking into account trip length[[2]](#footnote-2). If achieved in full, cycling would be responsible for 40% of all trips, which would be consistent with the Mayor’s ambition. However, a large proportion of potential cycling trips are currently done with at least one other person, which would limit switching. Beyond that observation, considerations of behaviour change and public acceptability were not taken into account. Likely limiting factors include carrying encumbrances, chain trips for multiple tasks, and concerns about personal safety. A further consideration is the potential enabling impact on cycling of ebikes, which have emerged since the 2017 study.

Boosting walking five-fold is even more problematic, to say the least, given that its mode share of trips in London has long been stable at 25%[[3]](#footnote-3). Some increase in the near term is to be expected as people avoid short journeys on public transport. Perhaps the Mayor has in mind to increase the distance walked per trip, again to be expected to some degree in the near term. Yet walking is the slowest mode of travel and time available for travelling is always a constraint. A TfL analysis of walking potential in 2017 estimated that there are more than two million potentially walking trips in London per day, compared with just under one million at present, but most potential walking trips could also be cycled[[4]](#footnote-4). So it is very hard to see how a five-fold increase in walking could be achieved, even before we consider behavioural factors, in particular the reasons why so many people prefer to drive rather than walk short journeys.

To see if the Mayor of London’s ambitions are realistic, a full analysis is needed from TfL, taking into account behavioural considerations, including travel time constraints, and avoiding double counting. TfL also needs to show that the cost of new cycling infrastructure to meet objectives is affordable, given the current loss of fare revenue, and to recognise the implications for public transport of the longer-term loss of fare income.

Motorised travel

Growth of car ownership after WWII prompted investment in roads, both urban and interurban. Investment in interurban roads continues, especially on the Strategic Road Network (SRN), but enlargement of urban roads has almost entirely ceased. Indeed, some previous increases in urban carriageway have been reversed, to lessen the impact of traffic and to rebalance towards ‘place’ rather than ‘mobility’. In London, for example, the combination of population growth and shrinking road capacity has led to a decline in car mode share of trips from 50% around 1990 to 36% at present, while at the same time the city has prospered economically, culturally and socially.

Paradoxically, while a reducing share of journeys by car is generally seen as desirable in cities, increasing car use made possible by additional road capacity is seen by many as desirable beyond cities, supposedly to improve connectivity and reduce road traffic congestion.

Investment in the SRN is set to continue, with RIS2 worth £27 billion, announced at the time of the recent Budget. The stated main priority is to maintain the existing roads. Only where existing roads are ‘simply not up to the job’ is the Department asking Highways England to develop wider, realigned or, in a few cases, wholly new roads to keep people and goods moving. Given this order of priorities, it is surprising that expenditure on maintenance is expected to be £12bn, less than capital enhancements worth £14bn.

RIS2 was announced prior to the huge commitments of public expenditure to combat the Covid pandemic. It would be appropriate to scrutinise the funding allocated for roads as the Government attempts to manage its enormous increase in borrowing. We need to ask to what extent road investment represents good value for money. Civil engineering is very costly, such the rate of addition of lane-miles to the SRN in recent years has been less than the rate of population growth.

The road traffic forecasts underpinning the investment programme need to be reconsidered, to recognise that home working may become more common in the future, lessening commuting traffic at peak hours when the road network experiences greatest demand. The Committee on Climate Change has proposed prioritising investment in broadband over the road network, to help achieve a shift to positive long-term behaviour.

Digital navigation

Without going as far as the Committee on Climate Change, there is unrecognised scope for investment in digital technology within the RIS2 budget. One odd feature of this DfT/Highways England publication is the disregard of digital route guidance, provided by Google Maps, Waze, TomTom and others. This technology is in very wide use by drivers because they find it of benefit in optimising routes under congested conditions and in estimating journey times. Roadside variable message signs are an outmoded technology, providing too little information, too late to be of much use.

There is an illustration of a route guidance app on page 38 of the RIS2 document, but no mention of its relevance. There is a statement that ‘Highways England will work with Transport Focus to investigate future opportunities to make more granular information about delay on the SRN publicly available. We anticipate that this might include reporting on a regional basis, journeys between conurbations, and maps showing delay across the network on a link-by-link basis.’ For some reason, Highways England has turned a blind eye to the real world in which all this is already being provided.

Investment in digital technology would be far more cost effective than in civil engineering to improve the performance of the road network. Cooperation between public road authorities and private providers of digital navigation would be needed to optimise performance. Regrettably, the private providers are very secretive about the functioning of their algorithms for providing individual drivers with optimal routes through congested traffic. So we do not know how provision of route guidance to large numbers of drivers impacts on the overall efficiency of the network.

However, legislation exists, dating from 1989, that requires dynamic route guidance systems to be licenced by the Government. The intention was to facilitate a pilot system developed by the Transport Research Laboratory (then part of DfT), although in the event this did not proceed. A licence may include conditions concerning unsuitable roads that should not be offered in route guidance, and provision of information on traffic conditions to road authorities. No such licence has been issued, yet this mechanism would provide the basis for public/private collaboration that would be very cost effective in achieving better outcomes for road users. It would not conflict with the business models of the private providers, which depend on selling either location-specific advertising opportunities to retail businesses or equipment to car manufacturers.

Digital route guidance can optimise routing through a congested network, minimising carbon emissions. Provision of estimated journey times as a function of starting time goes a long way to reducing the uncertainty that is perceived as the main problem arising from congestion. Congestion cannot be lastingly reduced by increasing capacity on account of the new traffic induced by the added carriageway. Conversely, it is difficult to reduce congestion by measures to reduce demand. Congestion is self-limiting in that if traffic builds up, delays increase and some road users make other choices, depending on feasibility, whether to travel at a different time, or to a different destination, or by a different mode, or not to travel at all. Interventions to reduce demand, such as road pricing, deter some road users thereby initially reducing delays, which attracts other users willing to pay the charge, restoring congestion to what it had been, as happened in London. It would be possible to reduce congestion with a sufficiently high charge, which, in a city like London with many car drivers having relatively high incomes or able to charge to a business, may have to be higher than is politically acceptable. This may be less of a problem in cities where the range of incomes is narrower.

Irrespective of the impact of a road user charge on congestion, it could be a useful source of revenue to transport authorities. There would be a good case for charging electric vehicles according to road use, given that they do not contribute to the cost of maintaining the road network through road fuel duty, although this would need to be deferred until the capital cost of EVs reduced sufficiently to make them more attractive to conventional vehicles in terms of lifetime costs and performance. At that point, a further reason for charging EVs for road use would be to avoid undercutting public transport, which involves lower carbon emissions per capita.

While road traffic congestion is difficult to influence by measures that would be publicly acceptable, the volume and composition of traffic can be varied by adding or subtracting carriageway, and by dedicating some part to buses and cycles. Accordingly, to help meet the net zero carbon target, it would be desirable to maintain the existing road network in good order but to avoid adding capacity, which would increase the volume of traffic and of carbon emissions, at least until road transport no longer uses oil as a significant fuel.

Fuel economy

There is scope for reducing carbon emissions through more efficient driving techniques such as minimising engine idling, maintaining a steady speed, and avoiding sharp acceleration and braking. A review commissioned by DfT in 2016 found limited evidence of scope for interventions that would reduce emissions.[[5]](#footnote-5) An effective measure to improve fuel economy would be to raise road fuel duty, which would incentivise purchase of smaller conventional vehicles and electric vehicles. Enforcing the speed limit on the SRN would also be possible.

Air travel

Civil aviation is the most problematic area of transport in terms of technologies to reduce carbon emissions. The pandemic has largely interrupted air travel. Long-term growth of demand could resume in due course if the opportunity is not taken to intervene to manage demand downwards.

Most straightforward would be to rule out new runway capacity within the UK. The case for a third runway at Heathrow is overstated. Most air travel is for leisure purposes. Even at Heathrow, only 25% of passengers are on business trips. The UK has a negative balance of trade in tourism. Given the numbers at peak times at the main UK visitor attractions, there is little case for expansion of inbound tourism. There is ample scope for increase in business travellers, whether for access to overseas markets for UK exporters, for inward investment or to London as a world city. This would happen in the market by displacing leisure passengers, particularly from Heathrow where business travellers would pay a premium for the convenience and connections of that airport. Leisure travellers would be displaced to other airports with spare capacity, such as Stansted or Luton. When all such spare capacity comes to be used, air fares would tend to rise, limiting demand. A recent survey found that half the flights taken by young men were for stag parties, and a third of those by young women were for hen parties[[6]](#footnote-6). Rather higher fares might shift preferences from Barcelona to Brighton, with little loss of enjoyment.

Increasing taxation on air travel would dampen the growth of demand. An airport capacity constraint would generate economic rents to airlines and/or airports, with scope for taxation to secure revenues to the Exchequer.

Modelling

The behavioural factors relevant to transport decarbonisation discussed above will need to be quantified and incorporated into models for their potential impact to be assessed. Forward looking relationships are not available, of course, and historic data is of limited value, so ranges of order of magnitude estimates will need to be made, to be incorporated into suitable models.

The energy/carbon models employed to assess the impact of interventions across all sources are too broad-brush to allow for the kind of behavioural factors relevant to travel demand. The transport models might be able to cope in principle. However, these models were established well before the current focus on decarbonisation, and a review of their suitability would be desirable, as regards both bias and behavioural validity.

Given all the future uncertainties, bias in projections are hard to avoid. Transport models are mainly used to support investment decisions and for that reason often tend to overestimate future travel demand. On the other hand, models that address options for decarbonisation may tend to underestimate demand since that may make it more feasible to achieve political targets.

The behavioural validity of existing models needs to be considered. For example, scenario 7 of the Road Traffic Forecasts 2018 addresses the consequences of a shift to zero emission vehicles and projects a 51% increase in road traffic 2015-2050, compared with 35% on the reference case, reflecting a reduction in fuel costs and assuming no changes to government policy on taxation. However, a behavioural consideration that is disregarded in this model is the way in which the availability of time constrains travel behaviour.

Travel time has been measured in the National Travel Survey for the past 45 years and on average has remained close to an hour a day. This implies that the time available for travel is constrained. A reduction in fuel costs therefore does not lead straightforwardly to an increase in distance travelled, which would only arise if either higher speeds were possible (not to be expected from a switch to zero emission technology) or higher car ownership occurred (not assumed in the model).

Conclusions

There is considerable scope for behavioural changes that would complement technological innovation in decarbonising the transport system. However, there are interactions that need to be recognised, for instance the likelihood that increased cycling would reduce public transport use. The opportunities for digital navigation technology to optimise use of the road network need to be better appreciated. And the scope for locking in part of the present reduced demand for air travel needs to be addressed. Models are needed that allow such interventions and interactions to be taken into account. Accordingly, review of available models would be desirable.

26 May 2020

1. <https://www.london.gov.uk/press-releases/mayoral/mayors-bold-plan-will-overhaul-capitals-streets> [↑](#footnote-ref-1)
2. <http://content.tfl.gov.uk/analysis-of-cycling-potential-2016.pdf> [↑](#footnote-ref-2)
3. <http://content.tfl.gov.uk/travel-in-london-report-12.pdf> Table 2.3 [↑](#footnote-ref-3)
4. <http://content.tfl.gov.uk/analysis-of-walking-potential-2016.pdf> [↑](#footnote-ref-4)
5. <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/509972/efficient-driving-rapid-evidence-assessment.pdf> [↑](#footnote-ref-5)
6. <http://drivingchange.org.uk/hen-and-stag-parties/> [↑](#footnote-ref-6)