The Benefits of Transport Investment: and why we can't build our way out of congestion

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In this submission I offer evidence of the ways in which transport investment benefits individuals and society, in particular how this contributes to economic growth. I compare and contrast the rather different situations of London and the Northern cities.

Long term trends in travel behaviour

The Department for Transport (DfT) commissioned the first National Travel Survey fifty years ago and has repeated this regularly for forty years. Figure 1 shows the key parameters on a per capita basis covering all modes of travel (except international air). Average journey frequency has remained at about 1000 trips per person per year over the period. Average travel time has held steady at around 370 hours a year or an hour a day, a figure found globally for settled populations. What has changed is the average distance travelled, which increased from 4500 miles a year in the early 1970s to 7000 miles by the mid-1990s, since when there has been no further growth.

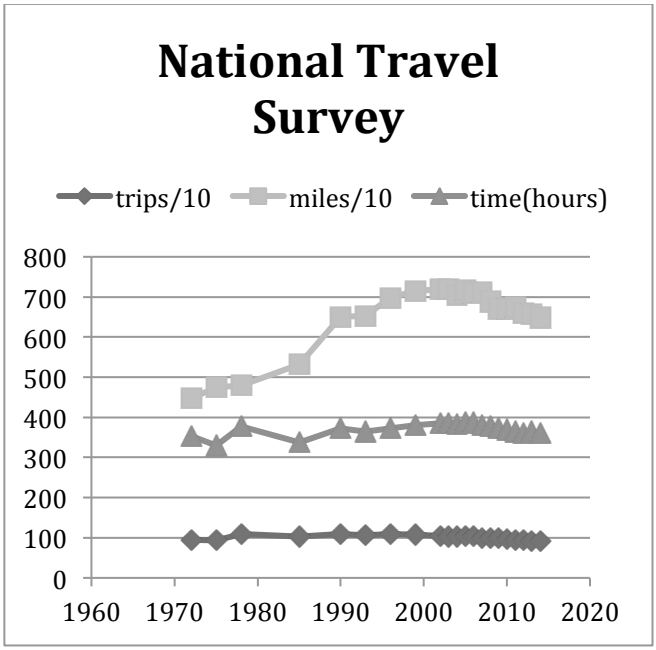

Figure 1 Source NTS(2015)

People have travelled further in the same amount of time because they have travelled faster, the consequence of investment in speedier forms of transport – private investment in cars, public investment in road and rail infrastructure and trains. It is important to recognise that people have taken advantage of higher speeds to reach more distant destinations, not to save time travelling to unchanged destinations. We travel further in order to have more access, opportunities and choices. For instance, by travelling faster on the journey to work, we have more choice of employment accessible from where we live in the time we allow ourselves for commuting, more choice of homes accessible from our workplace, and similarly more choice of shops, schools etc.

Figure 1 shows that there has been no growth in per capita travel for the past twenty years. Growing personal incomes are no longer an important factor in the growth of travel. Rather, population growth is now the main driver of overall demand growth.

Three-quarters of the average distance travelled in Britain is by car, hence we find that the average distance travelled by car has also ceased to grow, starting well before the recent recession. This cessation of growth of per capita car use is found for most of the developed economies for which data is available, a phenomenon known as 'peak car'. A number of contributing factors have been identified, including less interest in cars by the urban young, changes in company car taxation (in the UK), saturation of demand for access to daily travel destinations, and technological constraints on faster travel (Metz, 2013).

Economic benefits of transport investment

The convention of transport economists, central to the DfT's investment appraisal methodology, is that the main economic benefit of transport investment can be estimated as time saved through faster travel. Such time savings are valued because they permit more productive work or desired leisure. However, the evidence of the National Travel Survey is that there are no time savings in the long run, as seen in Figure 1, which is in effect an evaluation of the impact of cumulative investment over a forty year period. Time savings are therefore short run and mislead as regards the benefits of investment in long lived infrastructure.

People take advantage of higher speeds to travel farther, which results in changes in land use, development in particular. This is evident in the regeneration of East London, Docklands and beyond, the consequence of public investment in urban rail that has made brownfield land accessible for development by private sector developers who construct commercial and residential properties that accommodate jobs and homes for the city's growing economy and population. The causal mechanism linking transport investment to economic benefit is via improved access and resulting development.

Notional time savings by those who, for instance, will travel from home to Canary Wharf using Crossrail when opened do not illuminate the case for this investment since these depend on both uncertain forecasts of passenger

numbers and problematic Stated Preference experiments intended to value individuals' trade-offs between time and money. Moreover, the 'wider impact' benefits that are conventionally added to the time savings are based on econometric estimation of agglomeration and related effects – further notional benefits, not directly observable.

Changes in land use and enhancement of land values are not included as benefits in conventional appraisal because this is seen as double counting benefits already included as time savings. However, this is a theory-based approach. An evidence-based approach would count what is real and observable, which would avoid double counting because people can do only one thing at a time – if they are taking the benefit of faster travel to gain more access, opportunities and choices, they cannot be saving time to carry out other activities, and vice-versa.

Investment appraisal of proposed transport investments should accordingly be based on evidence of expected benefits, as assessed from evaluations of outcomes of similar completed schemes. In general, changed land use and real estate development will constitute an important part of the benefits, which it would be misleading to disregard.

Road and rail investment

The case of investment to catalyse the development of Docklands is characteristic of new rail routes. Recall the USA in 1840, populated largely along the coasts and inland waterways, the economy about the size of that of Italy's. There followed a boom in railway construction that opened up the interior to agriculture, mining and industry such that by 1890 this was the largest economy on the world.

Rail investment can effect a step change in access. For roads, the effect is generally incremental. Consider England's Strategic Road Network (SRN) where much investment is planned to cope with forecast growth of traffic. Congestion largely occurs near to populated areas where local users take advantage of the network for daily travel, whereas remote from such areas the traffic generally flows freely. Thus about half the traffic on the M25 comprises long distance users, for instance between the south coast ports and the Midlands and the North, avoiding London, the purpose for which this orbital route was built. The other half is local traffic, in particular journeys to and from work giving rise to the familiar morning and evening peak congestion.

The conventional approach to investment appraisal sees a congested motorway as an opportunity for investment to increase capacity. Time savings per vehicle multiplied by the large number of vehicles, then multiplied by standard values of time savings, generate monetary values of economic benefits that are compared with the construction costs to allow judgment about value for money. However, the time savings per vehicle are quite small.

Evaluation by the Highways Agency of a large number of what it terms 'major schemes' indicates average time savings of 3 minutes at peak, less away from the

peak usage. There is debate about the significance of such small times savings. On the one hand, it is argued that these are too small to change behaviour and so should be disregarded. On the other, it is contended that small time savings add up and so in logic must be counted.

While 3 minutes saving on a long distance trip is immaterial in behavioural terms, such time saving is likely to be significant for a local user. The faster travel made possible by an extra lane or improved junction, for instance, allows more opportunities and choices, particularly when people come to change jobs or move house. More generally, in those parts of the country where demand for housing exceeds supply, it must be expected that local users will take advantage of additional capacity on the SRN to seek more distant housing opportunities that they can afford. A similar effect is seen with urban rail improvements such as London's Overground. Some of the largest percentage increases in house prices in London in recent years have been found near stations on this route south of Docklands, in locations like New Cross, of limited inherent attraction but with relatively low priced housing.

When analysing the case for road investment, it is important to consider the different kinds of user and how each may benefit (as is done for rail investment, where commuters are distinguished from long distance travellers). Available evidence is consistent with the proposition that the main benefits of investment in the SRN accrue to local users who are enabled to travel further on their daily trips. The extra traffic thereby generated is known as 'induced traffic', which is the consequence of road construction and arises because in the long run people take the benefit of faster travel by travelling further, not by saving time. This extra traffic restores congestion to what it was before the investment and is the basis for the maxim 'You can't build your way out of congestion', which we know from experience to be generally true.

The increased access made available to local users leads to changes in land use - property development where planning consent is granted, increased prices of existing property where not. Such development is largely unintended. There is, however, a case for intentional road construction to foster development, but this has to be led by the developers and planners. If they agree that a site is suitable and commercially attractive for development, whether residential or commercial, and if investment in road access is needed to permit the development, that could be an appropriate claim on a roads budget, whether local or national, subject to a value for money test.

An example is the plan for a new 'garden city' on a former military site near Bicester, where 13,000 new homes are to be built and where the DfT has allocated £44m for road construction, including a link to the M40. This illustrates both that new housing on greenfield sites will require road investment on account of car ownership by residents, and that decisions about the location of such investment must be based on the intentions of the planners and developers, bottom up, not as part of a top down national strategy.

Tackling congestion

The rationale for much roads investment is to relieve congestion. One stated aim of the Government's Road Investment Strategy is a 'free-flow core network, with mile a minute speeds increasingly typical'. But if we can't build our way out of congestion through investment in civil engineering technologies, how is this aim to be achieved?

One possibility would be to toll new road capacity, partly to finance the construction and partly to deter local users who impede long distance traffic. The M6 Toll road operates successfully in this way.

A second approach addresses the reason why congestion is a problem. Surveys of road users indicate that an important factor is lack of reliability - the uncertainty of journey time. This can be tackled by providing users with good predictive trip time information. An example is the motorway roadside variable message sign predicting the time to the next junction – albeit short range and hence of limited utility. A more ambitious service is provided for freeway users in the Seattle area of the US who can input to the Department of Transportation website the locations of their home and work, the time they wish to arrive at work, and are advised the time to leave home to be at work on time 19 times out of 20. A further example is Google Now, which includes predictive travel times on the road system.

As well as providing useful information to individuals that lessen unreliability associated with congestion, there are benefits to the network as a whole. There are two kinds of road user: those who need to be at their destination at a particular time (for instance, going to work, to a meeting, making time-critical deliveries), who can use predictive journey time information to decide when to set out; and those who are more flexible in trip timing (going shopping, making am/pm deliveries), who can use such information to avoid peak traffic. This is win-win since the more the flexible users can avoid peak times, the less the congestion experienced by those who cannot avoid them.

The scope for mitigating the uncertainty associated with congestion is indicated by the ability of efficient road freight hauliers to offer clients just-in-time delivery. A haulier may contract with a supermarket chain to deliver from the central warehouse to the stores within 30-minute time slots, which the haulier can achieve because of the good understanding of the network and the ability to manage the location and performance each vehicle in the fleet using real-time and predictive traffic data from commercial sources.

Transport and economic performance

This road freight example is one instance of the way in which investment, in digital technology in this case, can contribute to improving business performance. It should be seen in the broader context of retail distribution taking advantage of faster travel on the road network to optimise efficiency by

consolidating many regional depots into a few large central facilities, thereby saving estate and inventory costs while improving distribution to high street outlets, so enhancing competitiveness.

It is, however, difficult to generalise about how transport investment may be expected to improve economic performance where the road and rail networks are mature, so that investment is at the margin, rather than transformative. The What Works Centre for Local Economic Growth at the London School of Economics has reviewed 29 impact evaluations that met minimum standards of evidence (WWC, 2015). Key findings, mostly based on a small number of studies, include:

- Road projects can positively impact local employment. But effects are not always positive and a majority of evaluations show no (or mixed) effects on employment
- Road projects may increase firm entry (either through new firms starting up, or existing firms relocating). However, this does not necessarily increase the overall number of businesses (since new arrivals may displace existing firms).
- Both road and rail projects tend to have a positive effect on property prices, although effects depend on distance to the project (and the effects can also vary over time)

The general lessons from this review of transport investments are:

- The economic benefits of transport infrastructure spending – particularly as a mechanism for generating local economic growth – are not as clear-cut as they might seem on face value.
- Arguments for spending more in areas that are less economically successful hinge on the hope that new transport is a cost-effective way to stimulate new economic activity. We do not yet have clear and definitive evidence to support that claim.
- Our findings raise fundamental questions about scheme appraisal and prioritisation, and about the role of impact evaluation in improving decision-making around transport investment.

Transport investment in London

The population of London is growing quite rapidly, but the city long ago decided not to accommodate additional car use, so the share of journeys by car has fallen from a peak of 50% of all trips in 1990 to 37% currently, with further decline to about 27% expected by 2050 on the basis of forecast population growth (central case) and continuing policies to invest in rail but not increase road capacity. Figure 2 shows an estimate of the share of journeys by car in London over the century 1950-2050. This exemplifies the concept ‘Peak Car in the Big City’.

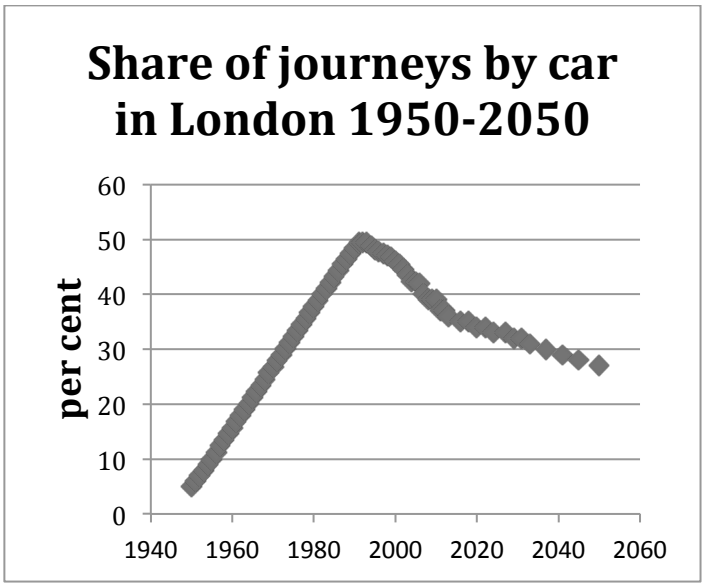

Figure 2 Source Metz (2015)

London is thriving - economically, culturally and socially – both despite and because of the decline in car use. Two key policies are largely responsible: a road capacity constraint plus parking controls in the inner boroughs and congestion charging in the centre; and major investment in rail that provides speedy and reliable travel for work trips, compared with the car on congested roads. As we see at Canary Wharf, well paid professionals can be attracted out of their cars onto trains through the stick of limited parking and the carrot of frequent fast rail services. In contrast, cities that rely on buses for public transport find it much more difficult to get commuters out of their cars.

The Mayor of London is responsible for both the transport system and for spatial planning, a helpful combination which contributes to the success of the city. The London Infrastructure Plan 2050 outlined options for investment in transport and other infrastructure to respond to population growth from 8.6m currently to 11.3m central estimate by mid-century and the corresponding growth in employment. This spatial plan provides a suitable strategic context for specific schemes such as Crossrail 2.

The economic case for each individual scheme will need to be made. This case needs to be grounded on evidence-based expectations of the benefits, in particular development of real estate (land and property) that will accommodate jobs and homes. Benefits from travel time savings should be counted only when these can be observed. Notional benefits from 'wider impacts' would be subsumed within market values of property and rents.

Given that the long term benefits from transport investment are found as real estate development, Transport for London should work closely with developers and planners to secure the benefits from its investment. In favourable cases, the enhancement of land values may be sufficient allow the developers to contribute to the cost of the transport investment.

Transport investment in Northern cities

The example of London argues for a spatial plan to provide the context and rationale for transport investment in the Northern cities to accommodate population and economic growth. One possible outcome, perhaps tacitly, would recognise Manchester as the main centre of the region, with an emphasis on the development of that city as a centre for business services. Another, perhaps politically more feasible, would be a multi-centric region of medium sized cities, somewhat analogous to the Thames Valley, with a mix of manufacturing and services. One key question is how to take advantage of the research potential of the universities, both for the cities in which they are located, and across the region. Related to this is the question of where to locate business in relation to the availability of skilled staff (it is noteworthy that Amazon has recently moved its UK HQ from Slough to central London).

At present there is no mechanism for spatial planning across the Northern cities as a group, and hence no consideration of options for location of population and economic growth across the region. Absent a spatial plan, decisions on transport investments will be an important influence on spatial development in ways that need to be addressed as part of the investment case.

It is not straightforward to develop a persuasive case for specific investments in the context of the Northern cities. Estimates of benefits based on travel time savings give no indication of the spatial location or likely scale of development. Estimates of 'wider impacts' depend or either rules of thumb or ambitious modelling which cannot be validated. It is therefore hard to say how transport investments will benefit the economies of these cities, based on conventional appraisal methods.

It is easier to predict changes in land use arising from transport investments that change travel to work patterns. Faster travel may be expected to result in people seeking housing and employment opportunities further afield. This would both improve the efficiency of labour markets and create opportunities for housing developments. For rail investments in particular, the location of new housing should be planned as part of the investment case.

Urban rail investments can allow cities to grow to higher density while meeting the mobility needs of the population. Regional rail plays a similar role. The tram-train being piloted at Sheffield-Rotherham is a relevant innovation. Bus rapid transit likewise provides speedy, reliable travel but at a cost lower than light rail (trams). Higher urban population densities generate agglomeration benefits, not only economic but also cultural and social, which enhance the attractiveness of cities, provided other aspects of urban liveability receive adequate attention. Accordingly, both urban and regional rail investments justify positive consideration.

What is unclear, however, is the extent to which better regional rail links that improve connectivity *between* cities would generate economic benefits over and above those associated with housing and labour markets for individual cities.

Road investments are even more problematic. For instance, the scheme to enlarge the M62 to four lanes along its entire length is intended to support the Northern economy but would induce local commuter use that would limit the benefits to long distance users. A new road link, largely in a tunnel, between Manchester and Sheffield might be of less benefit to commuters but would be expensive and hard to justify for improved connections between two cities that are otherwise well connected. More generally, road investments intended to improve connectivity within the region, whether north-south or east-west, are likely to be nullified by the stimulation of local use. Altogether, the ambitious plans for road construction set out in the Northern Transport Strategy seem of very uncertain benefit, albeit more consistent with a multi-centric region in which manufacturing remains important.

On the other hand, the plans for integrated information and ticketing across all public transport modes, part of this Strategy, are clearly sensible and, as digital applications, may be expected to be far more cost-effective than investment in civil engineering technologies. More generally, opportunities should be sought for other digital technology investments to improve the operations of the transport system and to enhance the experience of users. Predictive journey time information on the road network is one important possibility.

Modelling and forecasting

The standard approach to justifying transport investment of any scale involves modelling that compares a 'do something' case (ie with the investment) with a 'do minimum' case (without the investment). Most models estimate travel behaviour changes in the absence of land use change, generating travel time savings resulting from the investment that are used as inputs to the economic appraisal. However, for reasons previously discussed, assuming no changed land use is not consistent with evidence from completed schemes. Models that integrate transport and land use are available, although not generally employed.

Modelling involves much uncertainty, many simplifying assumptions and limited data for calibration. Transport models cannot be independently validated. Given the considerable judgement involved in generating plausible outputs, it is not surprising that modelling is generally found to support the inclinations of the authorities that commission the studies. When such authorities are bidding for central government funds, other people's money, modelling will generally be found to support the bid.

A further difficulty with transport models is the routine assumption that the future will be like the past, with change driven only by exogenous parameters such as GDP growth, population growth, oil prices etc. But if the future is different from the past, as is indicated by the peak of car use in London (shown in Figure 2) and similar indications for Birmingham and Manchester (Metz, 2013), then forward looking relationships (elasticities) need to replace historic calibration data. This is difficult to achieve in practice. For example, the DfT's

National Transport Model has not yet recognised the emergence of peak car use in London and so forecasts substantial increases in car traffic in this city.

Conclusions

The transport system moves people and goods through space. New investment adds to this movement, the benefits being reflected substantially in changed spatial distribution, not reductions in travel time. The difficulties that the Commission is likely to experience in making recommendations for transport investment derive in part from shortcomings in existing methodologies, in particular that conventional economic appraisal is based on estimates of notional times savings and disregards the evidence for changed land use and real estate development as important benefits of investment. Moreover, conventional travel demand modelling and forecasting does not recognise important recent changes in behaviour, as reflected in the peak car phenomenon.

For its medium term work, the Commission might wish to review these methodological issues. More generally, there may be a role for the Commission to act in ways analogous to the Office for Budget Responsibility and the Committee on Climate Change, offering advice to national and local government on the merits of infrastructure investment based on independent analysis, both of methodologies and of substance.

In London, expected economic and population growth is the main determinant of future transport investment, which is therefore relatively unproblematic in principle. For the Northern cities, such growth is less obviously a given, and a desired role for transport investment is to foster growth. However, the prospects for speculative transport investments are uncertain. Hence to secure the benefits of transport investments, decisions should not be taken in isolation but as part of planned real estate developments involving both developers and planning authorities. Decisions on urban and regional rail investments seem more straightforward than for road investments, for which there is a good case for preferring cost-effective digital to costly civil engineering technologies.

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