Future of Cities: beyond Peak Car

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Key points

Successful cities are characterised by growing populations; they are where people are attracted to work, study and live. As population density increases, agglomeration effects contribute to economic productivity and to similar cultural and social benefits.

Increasing population density precludes enlarging the road network to accommodate a growth in car-based mobility. Instead, rail systems must be expanded to provide fast and reliable travel for those who work in the city, so the share of journeys undertaken by car declines.

In London, car use peaked at 50 per cent of all trips in around 1990. It has now fallen to 37 per cent and should fall further to 27 per cent by the middle of the century, on the basis of current projections and policies. This will make a significant contribution to mitigating transport greenhouse gas emissions.

Introduction

The pattern of human habitation has been shaped by the development of transport systems, which in turn have depended on the evolution of transport technologies. The crucial factor has been the increase in speed made possible by harnessing fossil fuel energy. Two hundred years ago, nearly all travel was on foot, which meant that most people had to live close to where they worked, and so they had limited choices of dwellings, markets, schools and other facilities. Rising incomes made possible the widespread adoption of successive technological innovations – bicycles, buses, trams, trains, motorised two-wheelers and cars - that permit faster travel and hence access to a wider geographical area than is possible on foot.

Peter Hall (1994) described how, for each successive development of transport technology, there was a corresponding kind of city, but the relationship was mutual in that the previous growth of the city shaped and constrained the subsequent transport options. Newman and Kenworthy (2007) distinguished between different classes of city according to population density. 'Walking cities' were the major urban form for 8,000 years and substantial parts of the central areas of many major cities retain this character: dense mixed-use areas no more than 5km across. 'Transit cities' developed from 1850 to 1950 based on trams, buses and trains, allowing spreading from dense centres 20-30km along rail corridors. 'Automobile cities' (which developed from the 1950s onwards) could spread further at low density to 50-80km in size. Newman and Kenworthy found

that constant average travel time of about an hour a day was consistent with these developments, as new technologies allowed faster travel.

Thus investments in a succession of new transport technologies that allow higher speeds of travel have permitted greater access within the time available for travel, and this in turn has offered increased opportunities and choices of employment, residence, shopping, leisure and educational facilities, and so forth, within cities, their suburbs and beyond. But this increased dispersion has come at the cost of increased energy consumption and greenhouse gas emissions.

Transport accounts for over 60 per cent of global oil consumption and about a quarter of energy-related CO_2 emissions. Transport has been seen as more problematic than other areas of the economy as regards reducing greenhouse gas emissions. Most emphasis has been on new technologies, in particular electric propulsion, where the present state of battery technology limits widespread adoption.

There is, however, emerging evidence that the growth of car travel may be less than hitherto supposed on account of global urbanisation at population densities that limit car use. UK travel and transport statistics are exceptionally extensive, which permit us to track developments over time. London in particular can be used as a case study to exemplify changes in travel patterns as a consequence of population growth at increasing density. We see a marked shift away from car use in London, as a result of policies that respond to population growth by investing in public transport, especially rail, and by measures to constrain car use. This shift away from car use will help significantly to mitigate greenhouse gas emissions from surface transport.

Cessation of growth of travel

There is evidence that the average annual distance travelled by car has ceased to grow in most of the developed economies, starting well before the recession, and may be declining in some cases, a phenomenon known as 'Peak Car' (Le Vine and Jones, 2012; Goodwin and Van Dender, 2013; Metz, 2013, 2014). A number of explanations have been proposed for this phenomenon, which are not mutually exclusive and which include: a decline in the proportion of younger people holding driving licences, company car taxation reform, travel demand saturation, a shift away from car use in urban areas, and technological factors constraining faster travel.

The annual National Travel Survey has tracked the key trends in England over a 40-year period for personal travel by all modes of transport (other than international aviation). The average trip rate has remained broadly unchanged at about 1000 journeys per person per year, while average travel time has stayed at about 370 hours a year or about an hour a day, a general finding for settled populations. What has changed over the period is the average distance travelled, which has increased from 4500 miles a year in the early 1970s to about 7000 miles by the mid-1990s, the result of investment in more and better cars and roads, and also in railway improvements. These investments allowed people to travel faster and hence further in the unchanged time utilised for travel.

However, the average distance travelled in Britain ceased to grow around 1995, since when it has remained broadly unchanged (NTS 2014). Since household incomes continued to grow over most of the subsequent period, the historic relationship between travel and income no longer applies. Almost 80 per cent of current total annual distance travelled is by car, hence the cessation of growth of travel is consistent with the cessation of growth of per capita car use, the Peak Car phenomenon.

Travel in London

The cessation of growth of per capita car use means that demographic factors are now the main future determinants of travel demand, in particular population growth and the location of additional inhabitants, whether on greenfield sites or urban brownfield and infill developments. Because the road capacity of cities is limited, car use is constrained, despite the growth of both population and incomes.

London, a city with a historic centre and mature suburbs, has virtually no greenfield sites likely to obtain planning consent for building but has considerable brownfield land. London has not attempted to increase road capacity in recent years, and indeed has allocated more road space to bus and cycle lanes and pedestrians, with the result that both car traffic and trips have declined somewhat. Because the population has been growing, the share of all journeys taken by car has declined (currently 37 per cent, down from a peak of 50 per cent around 1990) while use of public transport has increased correspondingly (TfL, 2014). Walking trips have changed little while cycling is growing, but from a low base.

On the present central case projection, London's population, at present 8.6m, is expected to grow to 11.3m by 2050 (Mayor, 2014). To cope with this growth, investments have been made in the public transport system and further substantial investments are planned in additional rail capacity, but it is not intended significantly to increase road capacity. On this basis, I expect car use in London to decline to about 27 per cent of all trips, which would be less than half the level of car use in Britain as a whole (Metz, 2015).

An estimate of the share of journeys made by car in London between 1950 and 2050 is shown in Figure 1, which exemplifies the concept of 'Peak Car in the Big City'. There is evidence that car use in Birmingham's and Manchester's city centres is declining. There is also evidence for declining car use per capita in the main Australian cities since 2003-04 and a rise in public transport use. Comparable data is difficult to locate for large cities in other countries, although anecdotal evidence suggests similar developments may be occurring.

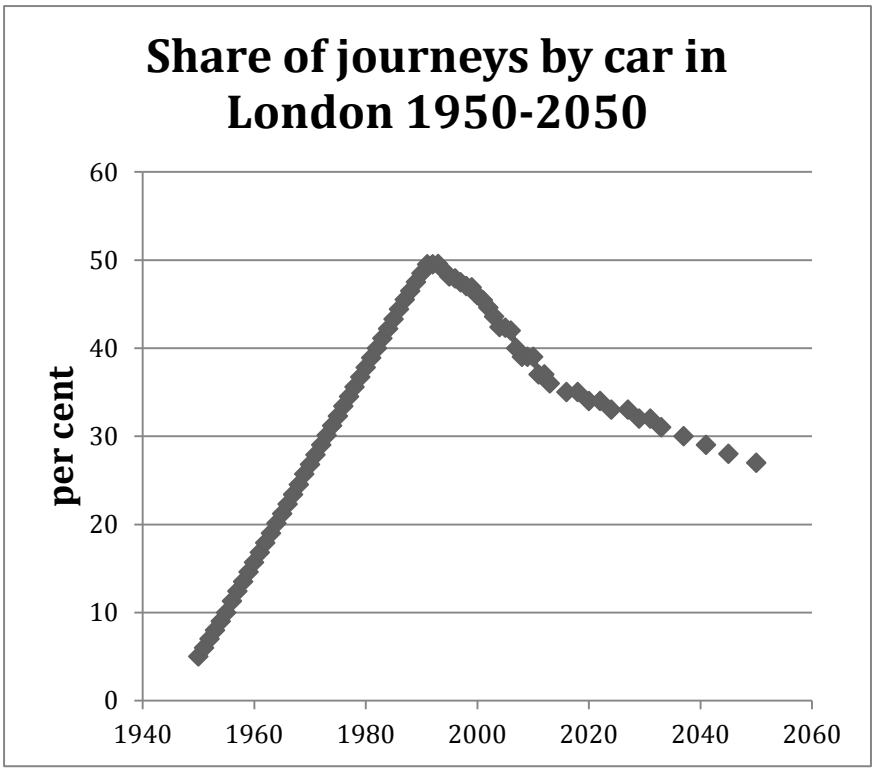

Figure 1: Share of journeys by car in London, 1950-2050. Taken from Metz (2015).

Travel in big cities

The global population is expected to increase from the present 7.0 billion, of whom half live in urban areas, to 9.3 billion by 2050 on the UN's Medium Variant case. Population growth is mainly becoming an urban phenomenon concentrated in the developing world, resulting in larger cities. At present some 40 per cent of the world's urban population resides in cities of one million or more, projected to increase to 47 per cent by 2025.

It is generally assumed that car ownership in the developing economies will increase as incomes rise, following a trajectory similar to that of the developed economies. However, population growth and urbanisation mean that higher density cities are likely to become more prevalent, where the car is less useful. Accordingly, there is the possibility that developing cities with relatively low car ownership at present could avoid the pronounced peak in car use as seen in London, moving instead directly to a more sustainable level of car use, avoiding unnecessary investment in vehicles and undesirable emissions of greenhouse gases and pollutants.

My proposition is that for a medium-density city of around 10m people, limiting car share to less than 30 per cent of journeys will allow the travel needs of the population to be met without excessive traffic congestion and with substantially lower greenhouse gas emissions. Experience in London suggests that the key policy requirement to achieve such an outcome is investment in rail systems. Constraints on car use are also needed to avoid congestion that detracts from the efficient functioning of essential urban road traffic.

Rail routes—whether under- or over-ground, classic heavy rail or light rail metros or trams—serve to move commuters to and from work in central business districts as well as provide for work journeys, speedily and reliably. There is currently a major revival of urban rail underway, associated with the peaking of car use (Newman, Kenworthy, and Glazebrook, 2013). Because rail is relatively expensive, Bus Rapid Transit (buses operating on dedicated routes that are not impeded by road traffic, Cervero, 2013) is a lower cost alternative. Rail can attract business and professional people out of their cars for work journeys because it is faster and more reliable than the car on congested roads. For example, the new financial centre at Canary Wharf in London's former docks now accommodates 100,000 well-paid employees, most of whom use new rail routes to get to work. It is much harder to attract such people onto buses that are no faster than car travel and often uncomfortably crowded.

Because there is no limit on the numbers or types of vehicles that can use roads, they tend to be congested at times of peak use in dense urban areas. A successful city needs a street network that gives priority to those functions for which rail is not an alternative: buses, taxis, vehicles for goods delivery, and construction and emergency vehicles. The simplest means for achieving this is to control on-street parking during working hours, whether by prohibition or charging, since car trips are not made without the assurance of parking at both ends. Traffic management techniques using coordinated traffic signals are a valuable additional measure for limiting congestion (Emmerson, 2014). Both parking control and traffic management can be introduced incrementally, according to need, with the feasible aim of reducing systemic traffic congestion to an acceptable minimum, so that gridlock is avoided. London also employs congestion charging, a form of road pricing, to manage demand for vehicle use in a central zone. However, such schemes require political consent to introduce, often difficult to obtain, and involve substantial operating and enforcement costs, and hence seem unlikely to be widely adopted.

Cycling is an important mode in some successful developed cities, which can relieve crowding on public transport and may allow some deferral of investment in expensive new rail routes. Cycling is growing in London, with trips almost doubling since 2000, albeit from a low base (2 per cent of all trips), with plans for substantial investment in cycle routes (Mayor, 2013). Cycling is an important mode in low-income cities, to be replaced as incomes rise successively by motorised two-wheelers and then by cars. However, cycling can be revived and can make an important contribution if promoted through the introduction of cycle lanes and low cost bike hire schemes The southern Chinese city of Hangzhou is reported to have the largest public bicycle rental scheme in the world (Shaheen and Guzman, 2011).

Greenhouse gas emissions from urban transport

Given the expected growth of urban populations noted above, the contribution of urban transport to greenhouse gas emissions is set to increase and accordingly the possibilities for mitigation are being addressed. The main measures comprise improved operational efficiency, promoting low carbon technologies, and improving the attractiveness of walking, cycling and public transport.

While technological and behavioural changes have attracted most attention as ways to mitigate transport greenhouse gas emissions, much depends on how cities respond to growing populations - whether by building upwards at higher densities, as is common in China, or by spreading out at low densities. In the past, densities of cities have tended to decline as incomes have risen and people have sought better quality living in new suburbs. The 1990 Green Paper of the European Commission recommended urban strategies that emphasise mixed use and denser development that would be more likely to result in people living closer to working places and the services they require, such that the car could then become an option rather than a necessity. Critics questioned the feasibility of this approach, arguing that it was naive to attempt to reverse the deep-seated counter-urbanisation trend, which had been the dominant urban force since 1945 in most Western countries.

However, recent experience in Britain suggests that this counter-urbanisation trend can reverse as people see the attractions of city living (Headicar, 2013). Thus the population of London fell from 8.6m in 1940 to a minimum of 6.7m in the late 1980s, as people left an overcrowded and damaged city. However, the tide turned and the number of inhabitants recently returned to 8.6m and is projected on a central case to reach 11.3m by 2050. More generally, the importance of cities for economic activity is increasingly recognised (Florida, 2005; Glaeser, 2011). If urban population density increases, catchment areas shrink, whether for schools or supermarkets, which in turn makes the slow modes of cycling and walking potentially more practicable. Improving the pedestrian environment to enhance the quality of city life facilitates walking. Quality urban life attracts young people seeking economic and cultural opportunities, who see fewer attractions in the car. Creation of car-free public spaces facilitates high quality urban life which fosters creativity and agglomeration benefits.

To the extent that growth of urban populations leads to increasing densities, this may be expected to inhibit the increase in car use that would otherwise take place, a possibility that needs to be taken into account in projections of transport sector greenhouse gas emissions.

The implications of cessation of growth of per capita travel demand and car use for UK transport sector carbon emissions can be considered by reference to the online 2050 Calculator issued by the Department for Energy and Climate Change to explore possible approaches to meeting the target set in law to reduce UK greenhouse gas emissions by at least 80 per cent by 2050. For each sector of the energy economy, four trajectories are considered, reflecting increasing efforts to reduce emissions. For domestic passenger transport, the least ambitious case ('Level 1', consistent with current plans) assumes a 9 per cent increase in average distance travelled by 2050, with little change in mode share. The most ambitious trajectory for travel demand ('Level 4') assumes the same per capita distance travelled in 2050 as today, with a reduction in private vehicle use from 83 per cent of total distance travelled in 2007 to 62 per cent in 2050. However, although Level 4 supposes strong policy interventions (details not specified), the outcome is in fact consistent with a continuation of the trends discussed above: a continued absence of growth of per capita travel nationally, with growth of the urban population in London and other large cities resulting in a shift away from

car use. So Level 4 outcomes may be achievable with no additional policy intervention.

The impact on greenhouse gas emissions depends also on the uptake of zero emission technologies and improvements to the fuel economy of conventional vehicles. For cautious assumptions in this regard, the reduction in transport energy use by 2050 from Level 4 travel demand behaviour is estimated from the Calculator as 60 per cent, compared with 45 per cent for Level 1 behaviour, a significant additional decrease which contributes usefully to the overall target of an 80 per cent reduction in greenhouse gas emissions by 2050 against a 1990 baseline. Moreover, adding the strong policy interventions envisaged with Level 4 could achieve an outcome close to this target.

Future of urban transport

Trends in travel patterns depend on changes in individual behaviour, and on demographic and technological developments. A key change in behaviour in the developed economies has been the end of the historic relationship whereby growing incomes led to increasing distance travelled. The pattern of individual travel in the UK has been broadly stable on average over the past twenty years. This means that future demand is driven by population growth, and the pattern of the demand growth is driven by whether the additional inhabitants are housed on greenfield sites or within urban areas. The revival of cities as sources of economic dynamism, as well as of places of cultural and social vibrancy, serves to constrain car use and enhance sustainability.

Transport technologies change very slowly and incrementally. The first mass produced motorcar, the Model T Ford, took to the road a century ago but is little different in form from the modern car, albeit the latter is vastly improved, incrementally. Modern trains still utilise steel-wheel-on-steel-rail with track gauge unchanged since the nineteenth century. Extensive efforts are underway to introduce electric propulsion to road transport, to reduce greenhouse gas emissions. At present battery technology is the limiting factor. But electric vehicles will not change the fundamental feature of the road system, which is that it is open to all and so tends to be congested in and near urban areas at times of peak demand. There is much current excitement about the prospects for driverless cars. But these are essentially taxis with robot drivers. Taxis are useful and we would make more use of them if they were cheaper, which they might be if robots replaced human drivers. But the impact on traffic congestion is not likely to be significant – it could go either way, depending on whether or not increased demand outweighs increased efficiency.

The crucial technological distinction for surface transport has always been between the open road and the closed railway. In densely populated cities, rail in all its forms competes effectively with the car on congested roads, particularly for work journeys. Changes are likely to be incremental, increasingly brought about by developments in digital technologies, including those apps that facilitate easier use of public transport. More generally, the mobile internet assists city living by the urban young, for whom the car is not part of the lifestyle. The retreat of the car removes an impediment to interactions between people that give rise to agglomeration benefits – economic, social and cultural.

A combination of behavioural, demographic and technological changes is contributing to a marked shift away from the car in London, a successful city. The peak of car use is well behind us, with a marked fall from 50 per cent of all trips in around 1990, when the population was at a minimum following half a century of decline, to 37 per cent currently, and projected to fall further to 27 per cent on current policies, as the population grows to 11.3m by mid-century.

The peak of car use in London, as shown in Figure 1, reflects a transition that can be described in a number of ways:

- from travel demand driven by growing incomes, to population increase as the main determinant;
- from the twentieth century in which growing prosperity was associated with growing car ownership, to the twenty-first century in which growing prosperity is associated with decreasing car use in successful cities; and
- from the era of steadily increasing travel, starting in the 1830s with the coming of the railway as the energy of fossil fuels was harnessed to allow faster movement than walking pace, an era now ended as we have run out of technologies that allow safe and sustainable travel at yet higher speeds.

The transition shown in Figure 1 is one that it would have been hardly possible to forecast in advance. A transport planner, thinking in the 1980s about future travel patterns in London, would have predicted continued growth of car use, albeit saturating at some point in the future, consistent with a continuing decline in the population of the city. An econometric model based on past trends would generate the same kind of projection. However, such models cannot take account of the kind of behavioural changes that underlies the Peak Car phenomenon, at least until well after they have occurred. Hence reliance on such models for planning is problematic.

The shift away from car use seen in London also reflects the outcome of key investment decisions - to expand rail transport rather than to increase road capacity for car traffic. Population growth prompts a range of policy and investment responses. In the case of London, plans are being developed for substantial investment in rail transport. The main aims are to reduce overcrowding on existing rail routes, to accommodate the expected growth of passenger numbers, and to make land accessible for residential and commercial property development. Such rail investment will contribute to the shift away from car use and thus to mitigating transport greenhouse gas emissions, although this is not the main purpose. It may generally be the case that such indirect approaches to greenhouse gas reduction are more cost-effective and publicly acceptable than direct approaches such as subsidising electric vehicles.

Conclusion

Population growth and increasing population density in big cities is a current trend that prompts helpful policy responses that in turn reduce greenhouse gas emissions to a significant extent. Successful big cities have growing populations, because people are attracted to work, study and live there. City authorities recognise the difficulties and disadvantages of expanding the road network to accommodate more vehicles and so they invest in alternative modes, particularly

rail which can provide fast and reliable travel. The share of journeys by car therefore declines.

More than one billion motor vehicles populate the earth today. There could be two billion by as early as 2020, assuming continued rapid growth of ownership in the developing economies (Sperling and Gordon, 2009) . However, given the urbanisation of populations, the economic attractions of denser cities, unavoidable constraints on car use in dense urban areas, and the possibilities for alternative modes of travel that allow cities like London to prosper, such growth may not be inevitable. Car use in a large city may be only half that in a country as a whole.

The key policy interventions for ensuring efficient travel for the growing populations of successful cities are a rail and/or Bus Rapid Transit network to get business people out of their cars for work journeys, and constraints on car use to avoid congestion that impedes essential urban road traffic. For cities in developing countries with low car use at present, the Peak Car experience may be avoided and a more sustainable outcome achieved. The future growth of transport sector greenhouse gas emissions could therefore be significantly lower than is generally projected.

References

Cervero, R. (2013). Linking Urban Transport and Land Use in Developing Countries. Journal of Transport and Land Use, 6(1), 7-24.

Emmerson, G. (2014). Maximising the use of the road network in London. In *Moving Cities: the future of urban travel*. [S. Glaister and E. Box(eds)]. London: RAC Foundation.

Florida, R. (2005). *Cities and the Creative Class*. Abingdon: Routledge.

Glaeser, E. (2011). *Triumph of the City*. London: Macmillan.

Goodwin, P. and Van Dender, K. (2013). 'Peak Car' – Themes and Issues, *Transport Reviews*, 33(3), 243-254.

Hall, P. (1994). Squaring the circle: can we resolve the Clarkian paradox?, Environment and Planning B: Planning and Design, 21, S79-S94.

Headicar, P. (2013). The Changing Spatial Distribution of the Population in England: its Nature and Significance for 'Peak Car'. *Transport Reviews*, 33(3), 310-324.

Le Vine, S. and Jones, P. (2012). *On the Move: making sense of car and train travel trends in Britain*. London: RAC Foundation.

Mayor (2013). The Mayor's vision for cycling in London. London: Greater London Authority

Mayor (2014). London Infrastructure Plan 2050: a Consultation. London: Greater London Authority.

Metz, D. (2013). Peak Car and Beyond: the Fourth Era of Travel, *Transport Reviews*, 33(3), 255-270.

Metz, D. (2014). *Peak Car: the Future of Travel*. London: Landor LINKS.

Metz, D. (2015). Peak Car in the Big City: Reducing London's greenhouse gas emissions, *Case Studies in Transport Policy, [available online].*

Newman, P. and Kenworthy. J., (2007). Greening urban transportation, in State of the World 2007: Our Urban Future, Worldwatch Institute, Earthscan, London.

Newman, P., Kenworthy, J. and Glazebrook, G. (2013). Peak Car Use and the Rise of Global Rail: why this is happening and what it means for large and small cities. *Journal of Transportation Technologies,* 3(4), 272-287.

NTS (2014). National Travel Survey. London: Department for Transport. Table NTS00101.

Shaheen, S. and Guzman, S. (2011). Worldwide Bikesharing, *Access No. 39,* University of California Transportation Centre.

Sperling, D. and Gordon, D. (2009). *Two Billion Cars*. Oxford: Oxford University Press.

TfL (2014). Travel in London, Report 7. London: Transport for London.