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The evolution of urban transport policy from car-based to people-based cities: is this development path universally applicable?

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Abstract

In many North-west European cities, and in a smaller number in North American and more advanced Asian cities, it is possible to identify an historical 40-60 year three-stage urban transport policy development path. Stage 1 is associated with a rapid growth in car ownership and use and the provision of high capacity urban roads and extensive car parking; stage 2 with a switch in emphasis to improving high-capacity public transport, in response to concerns about negative externalities; and stage 3 with an emphasis on urban liveability and quality of life, resulting in decreasing car use and space provision, and more use of sustainable transport modes. But this path has not been followed by all cities in developed countries. The objective of the paper is to consider cities which have followed this evolutionary path, to consider why other cities have not done so, and the implications for developing cities in China.

Keywords

- Urban transport policy development
- Western European cities
- Car dependence
- Sustainable transport
- Liveable cities

1. Introduction

While each city has inevitably followed its own transport policy development path, it is proposed that many North-West European cities – and some older North American cities – have followed similar development paths which have led to the current promotion of more sustainable transport policy outcomes, and along the way have been subject to several common influences and experiences. But that this path has not been followed by all economically advanced cities.

The paper first outlines a generalised conceptual model of an hypothesised three-stage 'urban transport policy development cycle', which attempts to capture the broad evolution of urban transport policy as it has affected person movement in many more economically advanced cities over the past 40-60 years, starting with the early post-war growth in car ownership and use. It summarises the main characteristics associated with each stage, shows how these have been related to different perspectives on the urban transport 'problem' and appropriate 'solutions', and have in turn led to different urban travel patterns. It then identifies some of the main triggers which have propelled cities long this common pathway.

It next presents some evidence in support of this simple characterisation of urban transport policy evolution, using London as a case study and showing the resulting impacts on patterns of travel behaviour, in particular car use.

However, it is evident that not all cities – or even all parts of one city - in a state of advanced motorisation have followed this path, and the paper next considers why this might be the case, and what are the key characteristics which have supported or inhibited moves towards more sustainable urban transport policies.

Finally, the paper considers whether this evolutionary model might be a suitable characterisation of likely policy trajectories for other parts of the world such as China, that are currently experiencing rapid motorisation. And whether, by learning from the insights offered by this three-stage model, these cities could compress the development cycle – speeding up the implementation of more sustainable transport policies, avoiding wasted investment in major roads-based infrastructure in core city areas, and preventing 'lock-in' to car dependent urban structures.

2. An hypothesised urban transport policy development cycle

It is proposed that the various historical developments in urban transport policy in many European (and some North American) cities with high levels of motorisation can be broadly characterised as a three-stage process, starting with the rapid growth in car ownership and the associated policy response to provide new infrastructure for car use, and ending with policies aimed at reducing car use and encouraging more sustainable travel patterns in high quality urban environments.

The concept is outlined diagrammatically in Figure 1. The horizontal axis provides a crude indication of elapsed time. In larger cities, such as London or Paris, the two end points would typically represent a 40-60 year time span, whereas in some small, historic towns with high quality heritage environments (e.g. Oxford: Dudley, 2003) this process has been compressed and experienced over 20-30 years. The left hand vertical axis (related to the blue dotted line) gives a broad indication of the degree of motorisation experienced by an urban area, measured in terms of car ownership (e.g. cars/1000 population) and car use (e.g. percentage car modal share among trips made by residents). The right hand vertical axis (associated with the red solid line) is more conceptual in nature and is intended to give an indication of the extent to which transport policy gives priority to meeting the needs of motor vehicles – particularly private cars.

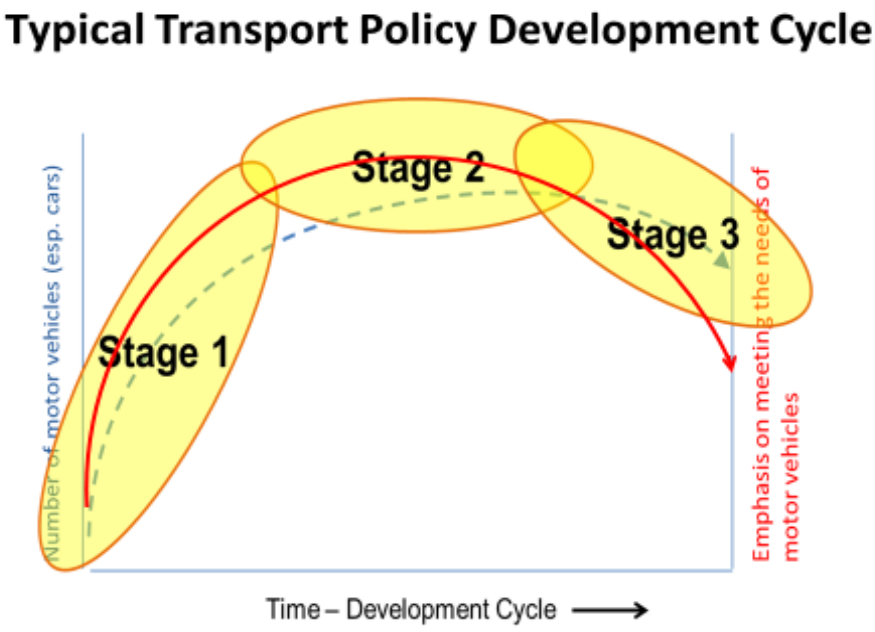


Figure 1: Characterisation of the urban transport policy development cycle

What this characterisation is suggesting is that in cities which have gone through this development process, car ownership and car use first rise rapidly, then level off and finally begin to fall as policies and external conditions change – in what is presented here as an idealised three-stage process.

At the outset, it is acknowledged that this model is a major simplification of urban transport policy as it has developed in any particular city, in at least three respects. First, in practice the process is not necessarily linear or sequential – and there may be several 'false starts' along the way. In London, for example, during the period of rapid growth in car ownership and use in the 1960s and 1970s which led to associated pressures for major road building - which is characterised here as 'Stage 1' thinking - there were voices who argued for what would now be recognised as 'Stage 3' sustainable transport policies; and London nearly introduced a congestion charging scheme in the 1970s at roughly the same time as the Area Licensing Scheme in Singapore (May, 1975); but in the end it was not politically acceptable until 2003 – nearly 30 years later..

Second, not all parts of a city region may be subject to the same set of policies at any given point in time; typically, city centres and inner city areas progress along the development path more rapidly than outer urban or peri-urban areas – which may still exhibit 'Stage 1' thinking. And third, the opportunity to progress through the three stages is partly influenced by the kind of urban structures in place preceding 'Stage 1'; this is considered further in section 4.

But, notwithstanding these caveats, this conceptualisation is offered as a heuristic for better understanding the development of urban transport policies. It is broadly consistent with the processes described in Acharya *et al* (2012), and has received positive feedback during academic and practitioner workshops in several countries, including China.

Each of the three stages is briefly discussed below.

2.1 Stage 1: accommodating traffic growth

The main features of 'Stage 1' are summarised in Figure 2.

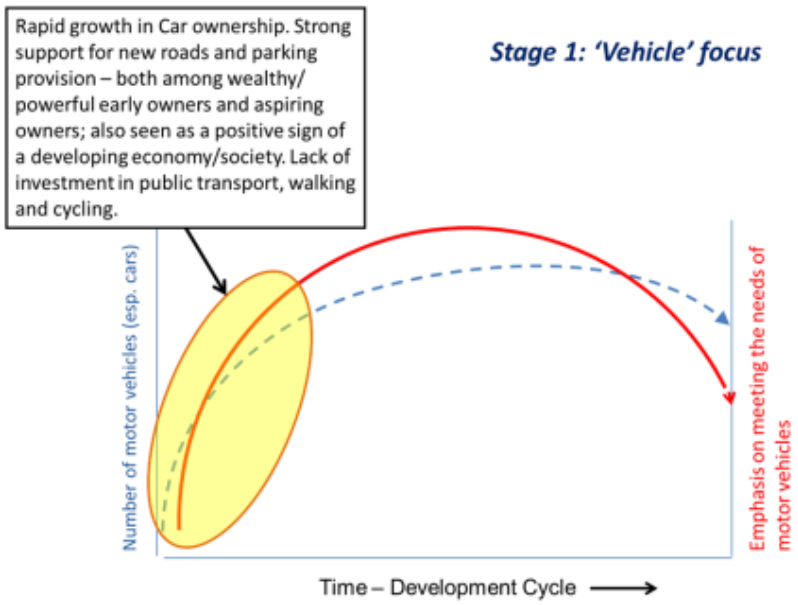


Figure 2: 'Stage 1' in the urban transport policy development cycle

The early stages of urban economic growth in the twentieth century have been associated with increases in personal incomes, which have resulted in a rapid increase in the levels of household car ownership and use. This, in turn, leads to a rapid overloading of the traditional urban road networks and strong political, business and public pressure to address the problem.

The policy priority is clearly identified as one of accommodating the increasing numbers of motor vehicles - meeting the need to cater for the 'inevitable' major growth in motor vehicle traffic, in order to avoid the city 'grinding to a halt', and undermining the economy of the city. The solution to this problem is seen very much in 'engineering' and scientific terms: as requiring investment in a major urban road building programme coupled with measures to maximise vehicle capacity on existing urban streets, and supported by large increases in parking provision, particularly at major trip attractions.

In the process, public transport investment may be cut back (and usage decline), and road space taken away from traditional economic and social street activities (e.g. market stalls), as well as from pedestrians and cyclists. Often too, in older cities extensive on-street tram systems installed in a pre-motorisation era are removed to provide more capacity for motor vehicles (for the extent of urban tram networks in Great Britain in the 1950s, see Garratt, 1995).

At this time there may be proposals to fundamentally reshape the structure of cities to improve movement efficiency and segregate motorised and non-motorised traffic, through constructing a hierarchy of motor vehicle-only roads, with the activities of the population confined to largely traffic-free living or environmental areas. Such measures are often accompanied by land use policies designed to rationalise the use of urban space, through the introduction of zoning policies (e.g. a housing zone, a retail zone, etc.) and non-traditional, low connectivity street patterns. Both sets of policies result in longer, more circuitous trips which are less amenable to walking and cycling, and may be difficult to serve by public transport. Many cities in this stage of development use the road layout of twentieth century North American suburban cities as their role model.

There are often few dissenting voices against this vehicle-dominated treatment of urban areas – at least for a while - for several reasons. In particular:

- This period is often associated with the development or expansion of a domestic motor industry, creating many well paid jobs which need to be supported through increasing domestic consumption.
- The 'early adopters' of the private car are mainly the rich and powerful in society, who have major political, legislative and funding influence.
- Poorer people, who are at this time unable to afford a car, are nevertheless often also supportive initially, as they aspire to car ownership in the future.
- Car ownership and use, and the construction of major highways is taken as a symbol of a city being 'progressive' and entering the 'modern world'.
- The people who are usually most affected by new highway construction, by being relocated or subject to environmental deterioration, are the lowest income communities who at that stage may be relatively poorly educated and have little political influence.

Quite soon, however, it becomes apparent that it is not practical to cater for unrestrained car use in larger urban areas with high to medium land development densities and traditional concentrations of trip attractions. It is evident that it is not possible to provide road sufficient capacity to keep up with the growing vehicle demand, and comprehensive transportation planning studies show that it would not be theoretically possible to provide a sufficiently dense, high capacity road network to accommodate unrestrained levels of car use, without destroying substantial parts of the urban fabric at a very high financial and environmental cost.

In practice too, extensive programmes of urban motorway construction often soon run into strong public opposition, as people see the consequences first hand, in terms of housing demolition, environmental degradation and severance.

At the same time, the practical aggregate consequences of encouraging high levels of car use begin to become apparent, in terms of growing traffic congestion – despite the hard won increases in capacity – and also through the resulting negative effects of traffic growth on air pollution, traffic accidents and – more recently – concerns about rising CO_2 emission levels.

In a study of 30 cities worldwide of over 1 million inhabitants as far back as the mid-1970s, Thomson (1978, pp. 58-59) found evidence of such symptoms emerging across a wide range of contexts:

> *"The universal similarity of the problem is remarkable, when one considers that some cities are much richer than others, some much older than others, some have extensive rail systems while others have none, some are of far greater density than others, some have enormous freeway networks while others have built no freeways at all. Yet, with few exceptions, all suffer from severe traffic congestion, parking difficulties, ailing public transport systems that are overcrowded during the rush hours and in financial difficulties, high accident rates, unsatisfactory conditions for pedestrians, and degradation of the urban environment through noise, pollution, danger and ugliness."*

Pucher *et al* (2007) report similar conditions among a range of Chinese and Indian cities in the 2000s. This leads to an apparent policy impasse: how to cope with the pressures for traffic growth, if major road building is no longer a practical – or an effective – option, and rising vehicle numbers are 'choking the roads' and damaging the environment of the city? The major policy breakthrough comes by redefining the problem – **through a major shift in policy focus** (Jones, 2012). Rather than catering for unlimited vehicle movement in urban areas, the primary objective switches to catering for person movement, through the improved provision of public transport. This, in principle, enables urban road traffic growth and the associated negative externalities to be contained, while increasing overall levels of urban mobility.

2.2 Stage 2: encouraging modal shift

The main features of 'Stage 2' are summarised in Figure 3.

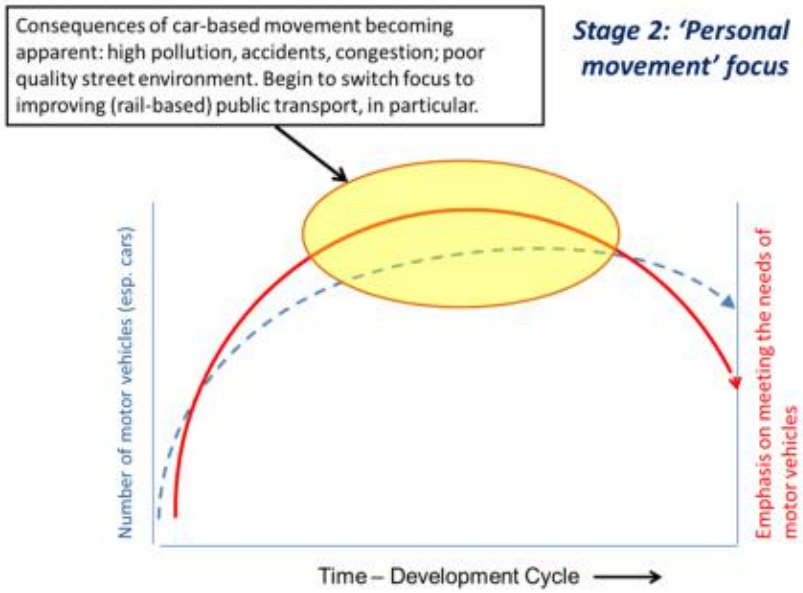


Figure 3: 'Stage 2' in the urban transport policy development cycle

Now the policy focus switches from one of accommodating as many motor vehicles as possible on the urban road network, to one of moving people from their origin to destination in the most efficient manner possible - so that the mode of transport used becomes of less importance. Since public transport systems (buses, trams, trains, underground) use the limited available urban space much more efficiently than private cars and can accommodate much higher numbers of people per unit area (both in terms of movement and parking), then the solution to the conundrum of how to cater for the rapid growth in vehicle demand in a physically constrained area is to seek to switch much of this growth to other forms of passenger transport.

So, efforts are made to increase the quantity and improve the quality of public transport services – which requires closer dialogue between public transport operators (whether publically or privately owned) and the city authorities. In practice, in the early stages of this policy transition it has often been articulated in relatively pro-car terms as accommodating as much movement as is manageable by car and then encouraging the rest to use other modes. Rail-based systems or segregated bus systems are generally preferred, as these can operate largely independently of the congested road network, and offer higher average speeds. Metro systems, in particular, can be built underground (or over-ground) and so provide a substantial increase in person movement capacity without curtailing surface road capacity, or causing severance.

In much of Western Europe and the larger cities in the USA and Canada – and more recently in cities such as Beijing and Lagos – there has been renewed interest and investment in rail-based public transport systems, while in South America the focus has been on building (cheaper) high capacity Bus Rapid Transit (BRT) systems (Moncada et al, 2016) due to greater funding constraints. This shift in

perspective from vehicle-based to person-based policy has often been coupled with some restrictions on car use, particularly through introducing parking controls in urban centres to control congestion and introducing vehicle access restrictions to counter high levels of air pollution, but without any major cutback in overall provision for car traffic. Growing car use is no longer seen as a benefit, to be encouraged, but neither is there major pressure to reign back on cars. Although in outer suburban and peri-urban areas, as noted earlier 'Stage 1' policies in support of car traffic growth may still prevail.

While from a utilitarian point of view this policy re-balancing may be relatively effective in keeping people moving in urban areas, many cities begin to recognise and react more strongly against the poor environmental quality associated with high traffic volumes, and start to want to manage down overall traffic levels – and, in particular, car use. There are often three factors at play here:

- A growing public health sensitivity to high levels of air and noise pollution, as evidence on the negative population health impacts starts to accumulate
- Increasing environmental concerns about transport generating unsustainable levels of CO_2 emissions; and
- A growing concern about the quality of the public realm – a desire to make cities attractive places in which to live and carry out business activities, including providing attractive street environments.

Some smaller historical towns which rely heavily on tourist income recognised the importance of retaining a high quality physical environment at an early stage in the process of motorisation, and so have made few attempts to accommodate large volumes of car traffic within their historic areas. In larger cities such concerns can take several decades to take firm root in urban transport policy discourses, but being a regionally or globally competitive city is now increasingly being associated with providing a high quality urban realm to support centres of economic, social and cultural activities. This has prompted a second major policy shift, with the objective of promoting 'liveable' cities.

2.3 Stage 3: promoting liveable cities

The main features of Stage 3 are summarised in Figure 4.

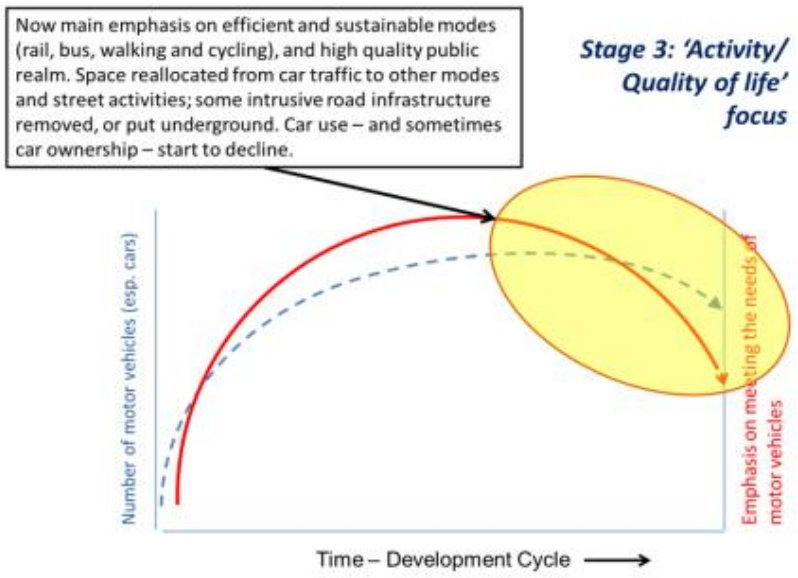


Figure 4: 'Stage 3' in the urban transport policy development cycle

At this stage there becomes a much greater business and policy focus on viewing cities as centres of human activity and on supporting policies which promote healthy lifestyles and a high quality of urban life. This is characterised in OECD (2015, Box 4.1) as a vision for 'Liveable metropolises in the 21st century'. From this perspective, it is meeting people's health and a wide variety of activity participation requirements – as residents, employers, visitors, etc. - which is of primary concern, and movement

starts to become of secondary importance - a means to an end, rather than an end in itself. By this stage there is a clear decoupling of car use and economic growth.

Within this re-framing of city policy, it becomes possible to raise questions about the need for physical mobility – can the internet substitute for physical movement, and can more activities be carried out close to home? And to consider the wider impacts of transport policies on people's daily lives. Just as with the transition from 'Stage 1' to 'Stage 2', at which point levels of vehicle traffic were no longer seen as the barometer of success, a move to 'Stage 3' no longer sees overall levels of mobility as such a core measure of performance. There is a greater interest in promoting accessibility.

Figure 5 gives an indication of the kinds of concerns and policy measures that are encouraged to deliver a 'Stage 3' outcome; note that the range of actors involved in delivering these measures is now much greater then when implementing 'Stage 1' policies. Various examples of successful 'Stage 3' European cities and the policy packages they have introduced are provided in Hall (2014).

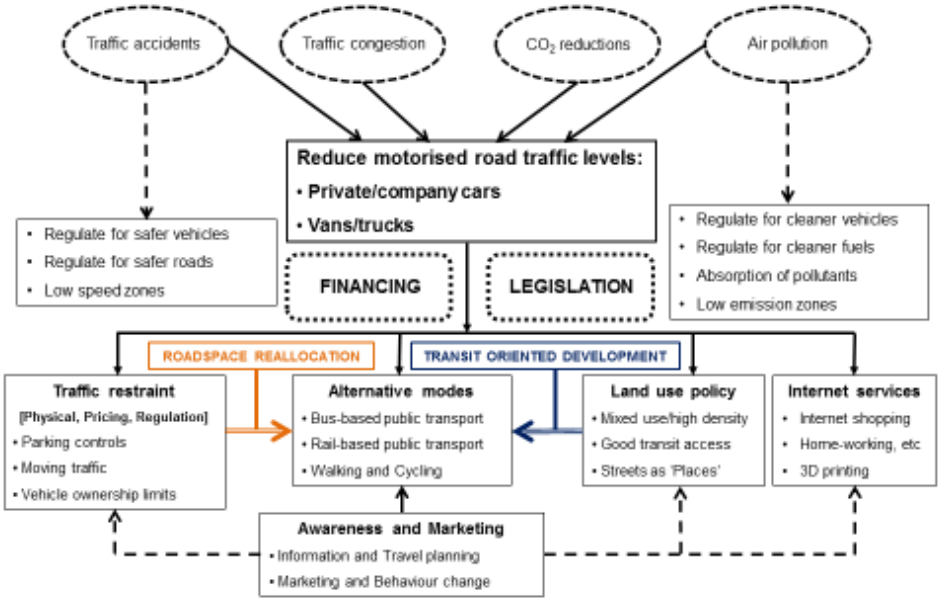


Figure 5: Components of a Comprehensive 'Stage 3' Policy Package

As part of further encouraging the development of attractive public transport services, there is now a greater recognition of the need to provide seamless, door-to-door transport (not just focussing on station-to-station movements); and a resurgence of interest in the role of cycling and walking in cities as offering sustainable and healthy modes of transport – they are no longer seen as residual modes that are the preserve of poor people. There is also strong interest in enhancing public spaces to create attractive 'places' and in providing footway space once again for traditional street activities (market stalls, sitting areas, etc.) – for what was often the first casualty in reallocating road space to increase motor traffic capacity in 'Stage 1'. The emphasis switches from engineering urban roads for vehicles to comprehensively designing urban streets for people.

At this stage active measures are now taken to reduce the volumes and dominance of motorised traffic, particularly private cars. The typical measures introduced as part of a 'Stage 3' city policy mix are multiple and wide ranging, and are likely to include:

- Cutting back on road space and capacity provision for cars and other motorised road traffic, by reallocating road space to sustainable transport modes
- In some cases, removing – at considerable expense – sections of the intrusive major road infrastructure which was constructed during 'Stage 1'
- Introducing measures to actively discourage car use, through policies such as congestion pricing, low emission zones, or more extensive and expensive on- and off-street parking controls
- Providing enhanced public transport services, with good local access arrangements

- Strong encouragement for increased walking and cycling, both through better facilities and improved information and marketing; and
- Promoting street activities and a high quality public realm.

On the ground, 'Stage 3' is often associated with relative and absolute reductions in urban car use (and sometimes car ownership); despite continuing increases in incomes, owning a car is no longer an important status symbol for many people.

3. Examples of the nature and effectiveness of policy shifts

This section provides some empirical evidence in support of the conceptual framework set out in section 2, by first using the evolution of transport policy in London as a case study (supplemented by other examples), and then presenting empirical evidence on the rise and subsequent fall in car use in some Western European cities which have now adopted a 'Stage 3' policy perspective and associated policy measures.

3.1 Policy developments in Greater London

Car ownership in Great Britain started to grow during the 1920s and 1930s, and some suburban arterial roads were built at that time without frontage access in anticipation of future increased traffic demand (e.g. A3 Kingston by-pass in London). During World War 2 the County of London Plan was prepared (London County Council, 1943), supported by senior figures such as Sir Herbert Alker Tripp, Assistant Commissioner of Police, Scotland Yard, London (Tripp, 1942), who advocated a more scientific approach to providing for motorised traffic. The London Plan proposed a major programme of road building to deal with traffic congestion and high accident rates.

But in the event, housing and industrial reconstruction was the priority in the early post-war period. It was only in the 1960s that the challenge of meeting the road infrastructure requirements of an increasingly car-based society started to be taken seriously, as car ownership began to grow rapidly. The national government commissioned a report called 'Traffic in Towns' (HMSO, 1963), which correctly forecast the likely growth in car ownership in the following decades and advocated the construction of a hierarchy of vehicle-only roads in urban areas (drawing on the earlier London and similar studies), with the activities of the population confined to largely traffic-free 'environmental areas' located in between the road networks.

3.1.1 'Stage 1' policies

In London, a major transport/land use study was carried out in the 1960s, which proposed four motorway standard concentric ring roads and several high capacity radial routes (GLC, 1969) to accommodate increases in car use. At that time, this was seen both as essential by many professionals 'to keep London moving', and as something to be welcomed as a sign of a building a post-war modern city largely based around the car. In parallel with this, measures were taken on the existing urban road network to increase road capacity for motor vehicles (Hart, 1976):

- London's extensive street tram system was removed, to reduce congestion for cars and to be replaced by a modern fleet of more flexible diesel buses.
- Urban clearways were introduced, banning stopping on major radial routes at peak periods, and
- In areas of more limited road space, one-way streets and large gyratory systems were introduced to increase capacity for road traffic.

Even at this time there were several writers who cautioned against proposals to accommodate large volumes of car traffic (e.g. Plowden, 1972; Thomson, 1969), but in the early days they were largely ignored by most professionals and the public.

However, within less than a decade attitudes began to change – both in London and nationally. As Starkie (1982, p. 92) noted: *"…by the mid-seventies the urban traffic policy that had applied for most of the previous decade had been stood on its head*". The urban population reacted against the environmental consequences of major road building projects, and the Treasury grew increasingly concerned about the costs of urban motorway construction.

At a technical level, the adoption of car-based strategies for larger cities was also being questioned on the grounds of efficiency and practicality. In London, even with the proposals for extensive motorway construction, the current traffic forecasting models were predicting unconstrained demand levels several times greater than the proposed capacity (Thomson, 1969). But, more significantly was the growing evidence that the planned capacity could not be delivered politically: the construction of the first section of one of the proposed motorways in inner London led to such a public outcry that the ruling Conservative administration in the Greater London Council was voted out in 1973, and the incoming labour administration promised an end to major motorway construction in London, under the slogan 'homes before roads'[1]. This abrupt change in policy was reinforced by the 'oil crisis' of 1973/74, when oil prices per barrel quadrupled as OPEC members restricted supply; and the wisdom of relying on car-based transport systems came into question.

Just as early signs of 'Stage 3' policies were being promoted by some writers in the 1970s (e.g. Bendixson, 1974), so some 'Stage 1' policy advocates were still active in the 1980s and 1990s. After the abolition of the Greater London Council in the 1980s by the UK Conservative government and the transfer of strategic transport responsibility to national government, Prime Minister Thatcher – who was no supporter of public transport – sought to make up for decades of under-investment in roads in London (which she saw as having held back the capital's economic development) by commissioning a series of major Road Assessment Studies costing £8m. These duly reported and proposed extensive new road construction – although not on the scale of the 1960s urban motorway proposals – and the recommendations were enthusiastically supported by the Transport Minister in the House of Commons. However, to the government's surprise, there was a major public outcry against the proposals and they were dropped after only a couple of weeks. By 1990 'Stage 1' policies for London's roads were finally dead, although pressure to upgrade the major radial roads under the control of the national Highways Agency continued until they were taken over by the Greater London Authority in 2000.

3.1.2 'Stage 2' policies

Although London already had an extensive public transport system, comprising comprehensive bus, underground and surface transport networks which were inherited from before the second world war, their upkeep and development had been largely neglected post war during the rush for road building in the 1960s. One exception was the construction of the Victoria Line between 1962 and 1969 (with the extension southwards to Brixton in 1972), which was designed to relieve the overcrowding on existing Central London underground lines, mainly inside what would have been the inner urban motorway box.

Once the motorway building programme had been scrapped, attention turned again to enhancing rail-based public transport systems in London, with proposals for several new underground lines, cross London rail links and surface rail enhancements. However, at this time London's population was in decline, particularly during the 1970s and 1980s – as was the case in many other Western European cities – so the urgency to act was reduced, and the only new section of underground line that was constructed (and opened in 1979) was the Jubilee Line across Central London, from Baker Street to Charing Cross. Efforts were made in the 1980s to encourage public transport use through fare reductions and the introduction of a zonal fare system and a travel card which introduced a daily cap on payments. These developments led to substantial increases in public transport use, aided by a demographic switch during the 1990s from an overall population decline to a sustained population growth.

The major political impetus for new railway construction in London in the 1980s and 1990s was in conjunction with major urban regeneration in the ex-docklands area of inner East London, which included the development of a second international financial centre at Canary Wharf. Between 1987 and 1999 three phases of the Docklands Light Railway were constructed primarily to serve this area, and since then further extensions have been built to serve regeneration areas further east. The success of the Canary Wharf development – now with over 100,000 employees – led to the construction of the Jubilee Line Extension, which opened in late 1999. These major developments are mainly rail rather than road served, in line with mainstream 'Stage 2' transport policy thinking.

[1] Note that similar changes in political opinion have been documented in other major cities; for example, in the USA in 1970 the mayor of Boston introduced a moratorium on all highway construction within an outer circumferential route – see Gakenheimer (1976).

While the DLR mainly serves new commercial and residential development areas, the continuing growth in London's population since the 1990s has resulted in major investments to provide additional movement capacity – in the form of rail services, with no significant increase in road capacity over this period (although local bus services have also been substantially increased). This has involved a combination of upgrades to existing Inner London mainly orbital railway lines, through the highly successful development of the Overground services in phases since 2007, and new cross-London orbital rail capacity, in the form of the north-south Thameslink network (due to fully open in 2018) and east-west Crossrail (in 2019). Already there are proposals to construct 'Crossrail 2', to cope with the accelerating growth in population and employment in London, both with the aim of relieving congested railway lines in South-west London and stimulating housing development in under-developed areas of North-east London.

Intellectually, the switch in policy emphasis from providing additional road capacity to enhancing rail provision was given a strong boost by the publication of the 'Downs-Thompson paradox', based on empirical research in London and Paris (Mogridge, 1990). This showed that average radial door-to-door speeds by car and rail are roughly the same, indicating paradoxically that the best way to maintain or increase average urban road network speeds is to raise average door-to-door speeds by rail – or by other sustainable transport modes. This observation has subsequently been substantiated in other cities by Newman and Kenworthy (1999); Table 1 shows recent figures for London.

Table 1. Average door to door speeds by main mode, all London residents
Source: Transport for London (in Jones, 2016)

	National Rail/Overground	Underground/DLR	Bus/tram	Car driver	Car passenger	Taxi	Cycle	Walk
2005/06	12.08	10.73	5.62	11.28	11.13	11.30	8.38	3.43
2006/07	12.53	10.52	5.96	12.14	11.90	10.27	10.02	3.42
2007/08	12.73	10.63	6.01	12.59	12.02	12.32	9.05	3.22
2008/09	12.38	10.77	5.68	11.90	12.09	11.33	9.63	3.00
2009/10	12.20	10.72	5.65	12.24	12.64	12.98	9.23	2.96
2010/11	12.88	11.08	5.78	11.97	12.37	12.53	9.17	3.05
2011/12	12.41	11.13	5.89	12.93	12.46	12.41	8.35	2.95
2012/13	12.26	11.12	5.77	13.18	12.92	12.67	9.19	2.92
2013/14	12.54	11.36	5.81	13.02	13.02	13.00	8.54	2.87
2014/15	12.17	11.62	5.94	12.83	12.73	13.65	9.13	2.95

However, this did not mean that the issue of road capacity in London was entirely ignored. Following the national government's U-turn on promoting new road construction after the Road Assessment Studies, there was strong political pressure nationally to do 'something' to reduce traffic congestion in London. This led to the appointment of a Traffic Director for London in 1991, whose was charged with creating a 'Red Route' network of key roads in London, on which further parking controls and other non-construction measures were to be introduced to facilitate the smooth movement of traffic on a strategic road network of roughly 550 km.

3.1.3 'Stage 3' policies

The political shift to 'Stage 3' policies in London broadly coincided with the establishment of the Greater London Assembly (GLA) in 2000 and the installation of a directly elected mayor for London – indeed, it is arguable that it would have been much more difficult to make this transition had London remained under central government control. Ken Livingston was elected mayor with a strong political mandate to improve sustainable transport provision and introduce a Central London congestion charging scheme, to reduce congestion and air pollution.

The GLA brought together strategic transport, land use and economic development planning policies, which has enabled a more integrated approach to planning than is generally possible elsewhere in Great Britain. Transport planning and its implementation has been taken forward, very successfully, by the then newly established body Transport for London, which commissions bus services from private companies on a regulated network and runs the London Underground and Overground networks (although not most of the suburban or national rail services).

Policy development in London now very much epitomises ‘Stage 3’ thinking and the kinds of associated policies. In particular:

- Further increases in rail-based public transport provision, with upgraded services, new lines and – in particular - much more attention given to access to rail stations and bus stops, and providing for door-to-door journeys.
- Improved bus services, with new routes, increased frequencies and new hybrid vehicles.
- Introduction of the Oyster card – a contactless smartcard – and cashless payment.
- Strong encouragement of walking and cycling, with improved pedestrian crossing facilities, new cycle lanes, cycle ‘super-highways’, a cycle hire scheme and strong promotional activities
- Increased footway space for street-based activities, and a major improvement in the quality of the urban realm.
- Schemes to reduce traffic dominance, through reduced speed limits and the introduction of ‘shared space’ schemes.
- Reallocating road space from cars to other road user groups, resulting in a substantial reduction in overall network capacity for general vehicle traffic.
- Downgrading or removal of some road schemes that were introduced during ‘Stage 1’ to increase road capacity, in particular the removal of gyratory schemes and one-way systems.

With regard to this latter point, in some cities the shift in policy emphasis to ‘Stage 3’ has led to the demolition of some of the elevated highways and multi-storey car parks that were constructed several decades earlier during the ‘Stage 1’ phase of urban transport development. ITDP and EMBARQ (2012) identify a number of freeway demolition examples, including:

- The Embarcadero, San Francisco, USA: built 1959, demolished 1990s
- Cheonggyecheon, Seoul, South Korea: built 1976, demolished 2003
- Harbor Drive, Portland, USA: built 1942, demolished 1974

Many smaller road demolition schemes have been carried out in cities such as Birmingham, in the English West Midlands, which during the 1960s constructed a grade-separated Inner Ring Road around the city centre, which cut off the centre from the surrounding areas and in time severely constricted the growth of the central area. There is now a major proposal to remove a major 8-lane road which skirts the western edge of the city centre, to improve the environment and create land for economic development (Birmingham City Council, 2014).

Moving to ‘Stage 3’ in London has led to a fundamental re-thinking of the functions of the city’s urban road network and the way in which it is used (TfL, 2013). In 2013 the Mayor of London set up a Roads Task Force (RTF), with representatives from a wide range of interest groups, to examine the future role of the road network in London, given that it carries 85% of person trips and virtually all freight movement, and has had very little attention or investment compared to rail. This was a politically ‘brave’ thing to do, as previous attempts to discuss this strategically in the 1960s and 1980s within a ‘Stage 1’ policy perspective, had ended in political failure – so discussing roads had been off the political agenda for nearly three decades.

However, set within a ‘Stage 3’ policy framework, the resulting dialogue has proved to be much more productive, positive and successful. In particular, it was recognised by the RTF that London’s network is trying – in many cases unsuccessfully - to serve three, partly conflicting objectives:

1. Provide a reliable network for essential road traffic
2. Encourage the safe use of more sustainable person transport – buses, cycling and walking
3. Support street-related activity and provide a high-quality public realm, given that roads represent 80% of London’s public spaces

In many cases the traditional road network cannot simultaneously accommodate all three requirements to a satisfactory level, so this leads to two strategic options:

- Cut back much further on road traffic levels through a much more extensive congestion charging scheme, or similar measures of traffic restraint, or/and

- Construct some new roads – but not to provide substantial new vehicle capacity but rather to shift motorised traffic away from sensitive parts of the road network, so that they can better meet objectives 2 and 3.

Both of these options are being further explored by TfL, with the general support of the wide range RTF members representing different interest groups. For example, studies are investigating opportunities to construct tunnels and 'fly-unders', to take traffic away from environmentally sensitive areas, or to deck over roads to provide additional public space.

As part of this dialogue, the RTF has recommended that London's roads be re-classified to reflect this broader understanding of their functions, by recognising that they have both a 'Movement' function (catering for movement by all modes of transport – not just motorised vehicles) and also an important 'Place' function – recognising them as an important part of urban public space, both as providing access to adjoining frontages (shops, houses, etc.) and as catering for on-street economic and social activities. It also preferred the term 'street' rather than 'road'.

This re-classification has been operationalised in the form of a 3 x 3 matrix of nine 'street family types', as shown in Figure 6, and is being implemented across the London street network, in conjunction with the 33 London Borough Councils. This is ensuring that the non-vehicular and non-movement street functions are now receiving much greater attention in street planning and design – very much in line with 'Stage 3', liveable cities, thinking – and is resulting in street layouts which are very different to those implemented during 'Stage 1', when there little consideration of walking and cycling and no recognition of the importance of 'place'.

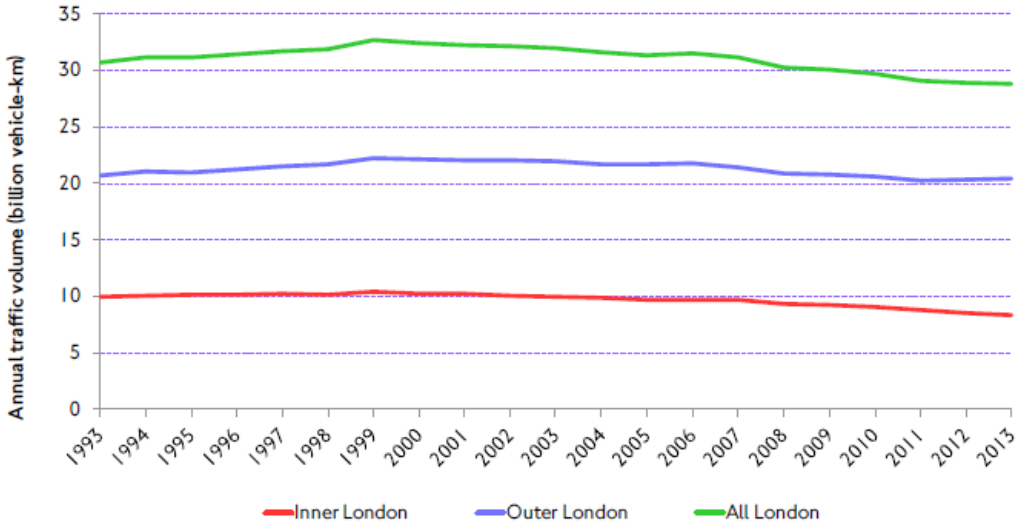
Figure 6: The new 'street types' classifaction being implemented across Greater London. Source: TfL (2015)

3.2 Empirical evidence of trends in car use and car ownership

These developments in transport policy thinking in London outlined above illustrate the practical manifestation of the conceptual red line shown in Figures 1 to 4 (i.e. an increasing, then decreasing, emphasis on catering for road traffic). There is also empirical evidence to support the hypothesised shape of the blue dotted line, both in London and elsewhere. In 1972 the car modal share of all trips made by London residents was 42%, on a rising trend. Between 1992 and 2002 this had stabilised at 46%; by 2012 this had dropped to 35%, on a falling trend - and by 2014 had further reduced to 32%.

This trend is also reflected in total traffic levels in London (see Figure 7). As can be seen, total road traffic in London peaked around 2000, and has been a general decline since then, despite population and employment increases.

Recent research carried out by Transport for London into the 'drivers of demand' (TfL, undated), has attempted to identify the major factors which account for the changing patterns of car use. The results are not conclusive, but the observed reductions in car use seem to be due to a mix of demographic changes (more younger people and migrants, who are more likely to be non-drivers), extensive restrictions on car ownership and use (high taxes on company car ownership, limited and expensive parking in inner city areas, and active traffic restraint), reductions in overall road capacity and major improvements to public transport, and walking and cycling provision.



Source: Department for Transport.

Figure 7: Overall traffic volumes in London – 1993 to 2013

London is by no means unique in this respect, as can be seen in Figure 8, where comparable figures are plotted for London and three other Western Eurpean capital cities – with data points being determined by the year in which household travel surveys were carried out in the respective cities. All show a declining share of residents' trips by car, in some cities starting as long ago as the early 1990s. A similar phenomenon can be found in other cities (Newman and Kenworthy, 2015).

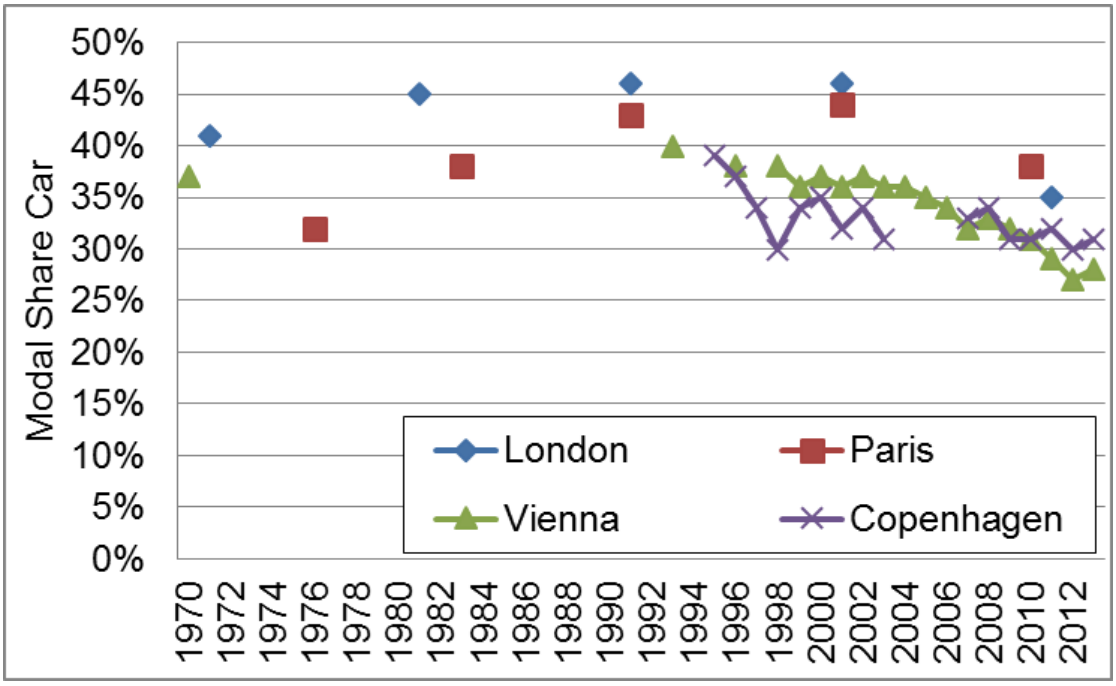


Figure 8: Changing car modal share over time (all trip purposes), in four Western European capital cities. Source: CREATE (2015)

This is one illustration of a broader phenomenon referred to as 'peak car', that has recently been observed in national travel data sets in several more economically advanced countries in North West Europe, as well as in Australia, Japan - and even the USA (see LeVine and Jones, 2012; Millard-Ball and Schipper, L., 2011; and OECD and ITF, 2013). So it might be that the urban transport policy development cycle has its counterpart, in some countries at least, at the national level.

Figure 9 is broadly comparable with Figure 8, showing car ownership rates in the same cities. Rates have started to decline in three of these cities (i.e. London, Paris and Vienna), but not in Copenhagen – so it is evident that reducing car driver modal share is not just the result of falling levels of car ownership.

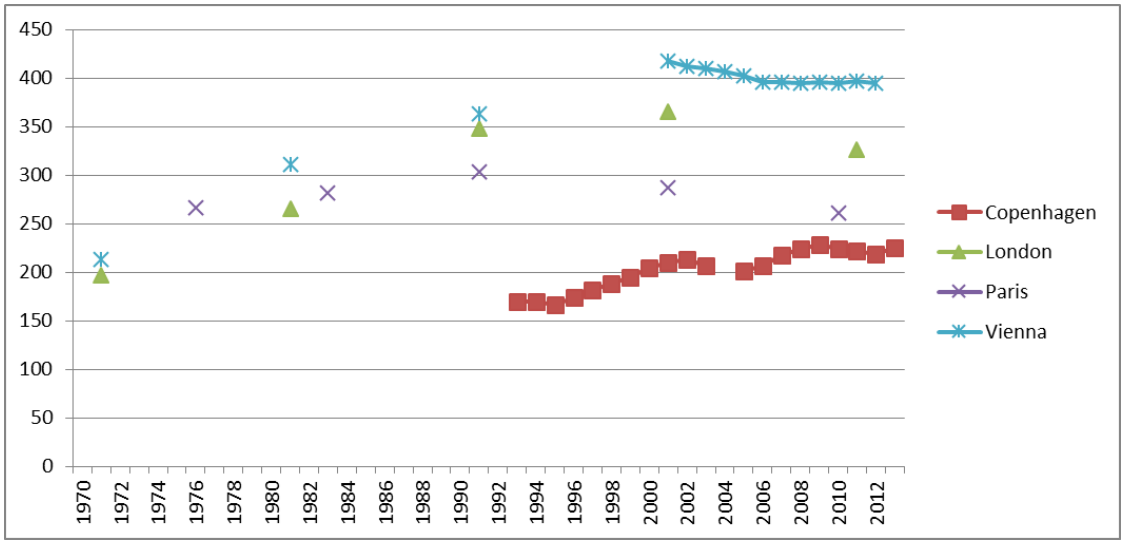


Figure 9: Changes in car ownership rates per 100 population over time, in four Western European capital cities. Source: CREATE (2015)

Thus, when cities are in the early stages of facing a rapid growth in car ownership and use, it seems to their populations and politicians that such growth is inevitable and that there are no options other than to substantially increase road capacity until potential demand is fully satisfied. However, with the benefit of hindsight, we can see that it has been possible in many prosperous cities through policy actions to achieve a levelling off in the growth of urban road traffic over time at well below 'saturation levels' - and in many cities to achieve a relative and absolute reduction in car use, at the benefit of an improved environment and public realm.

However, this is clearly not the case for all cities which have achieved high levels of motorisation, so why have some cities followed this three-stage process while others have remained with some variant of 'Stage 1'? This question is addressed in the next section.

4. Why have some cities not followed this path?

It is evident that car driver modal share has not peaked and then declined in all highly motorised cities, in the way shown in Figure 8. Among Australian capital cities, for example, the picture is mixed, according to the ABS census journey to work data (Mees and Groenhart, 2012). Car driver modal share has peaked and started to decline in Melbourne and in Perth, whereas in Adelaide, Brisbane, Canberra and Sydney it has flat lined, and in Hobart it is still slowly increasing. This seems to reflect a combination of geography, transport provision and strong policy initiatives to reduce car use in Melbourne and Perth. And of course, in some cities, residents might be quite content with conditions based around extensive car use.

In reviewing trends in North American commuting patterns between 2000 and 2009, Freemark (2010) notes a diverging trend:

> *"Automobile usage continues to decrease in the nation's older, densely developed cities: the places recording the largest declines in overall car share were, in order, Washington, New York,*

Boston, San Francisco, Seattle, Portland and Chicago. Those with the largest declines in non-automobile share were largely sprawling cities, including, in order, Columbus, Houston, Dallas/Fort Worth, Las Vegas and Nashville."

Looking at the generally higher levels of car use in the USA than in most other countries Wells (2012, pp. xxx and xxxi) describes much of the urban landscape as 'Car Country':

"….a shorthand label for places were car dependence is woven into the basic fabric of the landscape. …..Americans drive because in most places the built environment all but requires them to do so."

Younger cities which have grown mainly since the automobile age have developed extensive high capacity road networks and adopted lower density, zonal land use planning. They are clearly located in 'Stage 1' territory and are not endowed with a substantial pre-car land use and transport infrastructure legacy which would provide a basis for policy advance. So it is questionable whether such cities would be able to move to a 'Stage 2' or a 'Stage 3' configuration – even if they wanted to do so.

Thomson (1978), in his review of world cities nearly 40 years ago, concluded at that time that large cities were moving towards one of two types: dispersed and catering for full motorisation (e.g. Los Angeles) or denser with mixed use development, high quality public transport systems and walking and cycling networks. More recently, looking at cities in eastern Asia, Barter (2000) has similarly concluded that their development paths have either pushed them in the direction of 'auto cities' or 'transit cities' (with car restraint).

This suggests that there may be a crucial bifurcation point in the history of a city's development, at which time they become set on one path or the other – with major implications for the mobility patterns and lifestyles of future generations.

It appears that there is a set of pre-conditions which have to be met in order to make a successful transition from 'Stage 1' to 'Stage 2', where public transport services provide a competitive alternative for many car trips – and then potentially onwards to 'Stage 3'. Determining the details of these pre-conditions is an important area for future research, but in broad terms we can tentatively identify three core factors enabling cities to develop beyond 'Stage 1':

1. Land use patterns – a suitable 'urban fabric' (Newman and Kenworthy, 2015). A minimum land use density and a concentration of high attraction activities along corridors, sufficient to support attractive and financially viable public transport services; and enable access to local services on foot.
2. Comparable door-to-door speeds. A broad 'equilibrium' between average door-to-door speeds by car and by public transport (especially rail) - or locally walk/cycle – for a substantial proportion of daily journeys.
3. Strict limits on car use. Restrictions on car parking provision at major trip attractors, and a variety of fiscal, regulatory and physical measures to discourage private car use.

Condition 1 is naturally to be found in older cities that had already substantially developed along pre-car lines, where walk, cycle and public transport access to daily activities was an imperative.

Condition 2 is also common in such older cities, due to the low capacity of the road system and the often well-developed rail networks. But, ironically, it may be that, despite the congestion they suffer on a daily basis, the newer lower density car-based 'Stage 1' cities may nevertheless enjoy average door-to-door speeds by car that are too high for public transport or cycling to complete against – regardless of the suitability of the urban land use patterns.

Condition 3 is only likely to become politically feasible and behaviourally effective once conditions 1 and 2 have been met satisfactorily.

5. Implications for current 'Stage 1' cities

Most cities around the world are in 'Stage 1', grappling with issues associated with trying to cater for increasing levels of vehicle use, as personal vehicle ownership is now available to at least the wealthier

urban residents in most countries – and there are strong cultural aspirations to own and use these vehicles. Although, in some contexts, the demand for private vehicles is – at least initially – being met through ownership of motorcycles.

Some city professionals and politicians may aspire to move to 'Stage 3' as quickly as possible. While there is much to be learnt from the cities which have already passed along this development path about the kinds of policy measures that facilitate these transitions – and that might enable the typical 40-50 year cycle to be compressed - there are undoubtedly other kinds of more subjective underlying pre-conditions that need to be met in order to mimic this progression. In particular:

1. Suitable administrative and funding arrangements. 'Stage 2' – and particularly 'Stage 3' type policies – cannot be successfully introduced unless there is scope to plan and fund initiatives across modes and take into account Place-related requirements and issues such as public health costs and benefits. This requires comprehensive governance arrangements at the city region level, while mechanisms for funding rail-based public transport systems are a particular challenge in many less developed countries. One common problem - also to be found among existing 'Stage 3' cities such as London - is the inadequacy of existing public sector forecasting and appraisal methods that were essentially developed to make the case for 'Stage 1' road investments with the main objective of time-savings, to adequately capture the much wider benefits of 'Stage 3' investments (Jones, 2012).

2. Public acceptability. Sufficient numbers of the local population – and business and other stakeholders - are only likely to accept policies than do not give priority to motor vehicles once they observe and recognise the strong negative consequences of supporting increasing vehicle use – including worsening traffic congestion and public health. This may tie in with educational level and wealth; in cities such as Beijing, for example, pressure for a move to 'Stage 2' policies (an end to major road building and the construction of a 500km+ network of metro lines) has partly come from a growing articulate middle class, who are very concerned about the effect of poor air quality on their and their children's health. Growing environmental concerns about CO_2 may also be a factor here.

These issues also provide important subject areas for future research.

In practical terms, the main lessons for 'Stage 1' cities are that:

- If cities have aspirations to move eventually to 'Stage 3', then they should avoid the kinds of major road investment in environmentally or culturally sensitive areas that would be candidates for demolition under 'Stage 3'; and
- If they start to try and adapt their cities to accommodate as many motor vehicle as possible, by dispersing land use attractors and lowering densities to increase road network efficiency, then they will reach a point where they will become 'trapped' in this paradigm and physically unable to move into a 'Stage 2' and 'Stage 3' policy environment. For some such cities, it may already be too late, other than at a localised level (e.g. in the city 'centre').

However, even for cities with well-established 'Stage 1' transport and land use policies that have moved beyond the 'bifurcation point' identified in section 4, in the long run there may nevertheless be opportunities to start moving in the direction of a 'Stage 2' or 'Stage 3' city, through two mechanisms, affecting land use and transport provision, respectively.

On the land use front, by retrofitting low density residential areas to become 'transit oriented developments' (TODs), built at a higher density and incorporating mixed use developments. For example, in the USA the City of Carmel, Indiana, with around 80,000 residents provides an inspirational example, under the leadership of successive visionary mayors (Brainyard, 2012). In an effort extending over several decades, a sprawling suburb has been transformed into a community with a walkable central area and good walk and cycle access, with multi-storey apartments above shops and restaurants, several public buildings including a concert hall, and a very high quality public spaces and street environment. Now that this process is well advanced, the city is able to borrow money at

competitive rates to extend the area with evidence that land prices and property taxes will increase substantially as a result, and so pay back the loans[2].

Second, in relation to transport infrastructure, an opportunity to reconsider priorities may arise when major 'Stage 1' road construction becomes life expired and requires rebuilding or extensive reconstruction. This provides communities with the opportunity to consider whether to reinvest major sums in this infrastructure, or to provide instead for other forms of movement and a higher quality public realm. In some cases, earthquake damage has presented cities with this option, and also shown residents how well the city can survive without replacing the lost capacity (ITDP and EMBARQ (2012)).

Newman and Kenworthy (2015) note several such cases of urban retrofitting, where some of the more established car-oriented cities are beginning to move beyond 'automobile dependence'.

6. Conclusions

This paper sets out to stimulate debate about the nature of the evolution of urban transport policy and, in particular, the extent to which cities have a choice about whether to prioritise car use over wider liveability and sustainability objectives. The three-stage model in inevitably a simplification of processes that can be both 'sticky' and opaque, but this characterisation seems to have resonance with many urban professionals and politicians.

For larger cities in developing countries the three-stage model suggests that cities can go on to develop and grow in wealth without being car-dominated, although this may be difficult to anticipate while in the middle of 'Stage 1 and the associated mounting pressures to 'modernise' and accommodate car use as far as possible.

Clearly several factors contribute to these policy paradigm shifts. Changing public sentiment (e.g. against building urban motorways) can be an important factor, and timing ('policy windows') is also important. But sometimes individuals – mayors, ministers or charismatic campaigners – can have a decisive influence. Dudley and Richardson (2000, p. 229) reviewed over 50 years of British transport policy and concluded that:

> *"A key factor in understanding the paradox of the interrelationship between policy stability and change is to appreciate how new ideas may infiltrate and be absorbed, or even bypass, interests and institutions in order to transplant themselves and bring about a pragmatic shift in policy. In facilitating and executing the introduction of new ideas, it appears to be key individuals, acting in a variety of roles, who are primarily responsible for this task."*

This debate can be especially helpful in drawing attention to a potential bifurcation point and 'lock-in' conditions which 'Stage 1' cities might unwittingly find themselves drawn into, which thereafter makes it much more difficult to move into a 'Stage 2' or 'Stage 3' environment. Many Tier 2 and Tier 3 cities in China may be approaching this point. The ability to make such a transition is associated both with particular land use patterns and transport system characteristics, and governance and funding regimes which facilitate city wide decision making and funding across sectors.

In discussing these ideas with a range of cities, they have generally found this three-stage characterisation to be a helpful way of thinking strategically about transport policy trajectories and have raised the question of whether 'Stage 1' cities can speed up their transition to becoming 'Stage 2' and 'Stage 3' cites.

Clearly much caution is needed when transferring historical findings from mainly Western European cities to shaping prospective developments in 'Stage 1' cities in other parts of the world. There are important difference in culture, geography, climate, governance, etc. as well as in prevailing global trends (e.g. recent sharp reductions in oil prices now in contrast to rapid increases in the 1970s). Most of the current 'Stage 3' cities also benefited from having much of their land use structure and transport networks in place before the motorisation boom (during a 'Stage 0'?). So, in some ways they have

[2] For a detailed discussion of the benefits of 'smart-growth' policies, see Todman (2015); and for an example of the effectiveness of TOD policies in reducing car use, see Noland and DiPetrillo (2015).

reverted to pre-car priorities and been able to rely on that legacy of investment in infrastructure which younger cities that have largely grown in the car era do not have to draw upon.

Nevertheless, 'Stage 1' cities could at least avoid investing in major road infrastructure in central and inner city areas that would be an early casualty of any 'Stage 3' thinking. And, in principle, they could, start adopting 'Stage 3' policies, as encouraged by the European Commission in its advocacy of the introduction of 'SUMPS' (Sustainable Urban Mobility Plans) – see Wefering *et al* (2014). However, although such policy measures are available, for their implementation it is necessary to put in place appropriate legislative, funding and governance arrangements, which can take some time. In addition, there is a question of how quickly public opinion can make the journey from 'Stage 1' to 'Stage 3' – from a context where 'car is king' and public transport and (particularly) walking and cycling are the poor person's modes, to one where car use is seen as having negative consequences and a mode of last resort, and walking and cycling are regarded as positive choices. In Western Europe this journey has generally taken one to two generations – can it be done in less?

This paper inevitably raises more questions than it answers and identifies three major areas for further research:

1. Which policy measures contribute most to achieving 'Stage 2' and 'Stage 3' policy objectives and, in particular, the 'Stage 3' reductions in car modal share?
2. What are the main pre-conditions for a move from 'Stage 1' to 'Stage 2' and 'Stage 3', both in terms of triggers for change and the governance and other conditions which made it practical?
3. Are the technical forecasting and appraisal tools at our disposal, originally developed to address 'Stage 1' challenges, able to fully address the conditions and requirements associated with 'Stage 3' cities?

Some of these questions are being addressed in a recently funded EU Horizon 2020 project (CREATE, 2015), which is working with five Western European capital cities to explore their historical transition from 'Stage 1' to 'Stage 3', both in a technical sense and with regard to their changing political governance, funding and other arrangements. The project also includes five cities from Eastern Europe and the Euro-Med region, who are currently experiencing 'Stage 1' conditions and would like to explore a move to 'Stage 3'.

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