Project Summary and Recommendations for Cities

Urban Mobility:

Preparing for the Future, Learning from the Past

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Introduction

Transport decisions, and their resulting impacts on land use patterns, fundamentally shape and define a city, both physically and through the daily living patterns of its citizens and visitors.

As policy priorities change, so do the types of measures that are introduced, with resulting shifts in travel behaviour and lifestyles.

What at one point in a city's history is often seen as the 'inevitable' need to adapt the urban fabric (sometimes in quite a brutal way) to accommodate the growing use of the motor car, may later be replaced by a focus on people movement and sustainable mobility, and a growing interest in urban quality and vitality – a city of places for people.

CREATE (Congestion Reduction in Europe: Advancing Transport Efficiency) charts these changes in policy priorities and travel behaviour through the experiences of five Western European capital cities over the last 50 years, noting the policy tensions and competing city visions, the triggers leading to change and the evolving governance arrangements that have facilitated, or sometimes retarded, such developments.

As policy priorities change, so do measures of success; in a car-focused city congestion is the dominant concern, but this becomes less important as more people travel by rail or on foot or by cycle, and when cities put a greater value on high quality places. Alongside this there have been technical changes, in the types of methods used to model behaviour and appraise schemes, and in the ways in which these tools are used.

This document provides an introduction to the CREATE project, focusing on findings and lessons of value to practitioners, and those developing or updating their Sustainable Urban Mobility Plans.

It is underpinned by extensive qualitative and quantitative research, which is fully documented in several deliverables (see page 58), and summarised in a series of Technical Notes. A more comprehensive set of Guidelines is also available.

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Foreword


Michael Cramer, MEP

Transport is responsible for 30% of all CO_2 emissions in the European Union, of which road transport accounts for 73%. While we have witnessed a drop in emissions in the industry (-36%) and housing (-23%) sectors since 1990, the transport sector has seen an increase of 25%, nullifying all efforts so far involving billions of Euros from taxpayers in other better performing sectors. Therefore, without a change of mobility we will not stop climate change. But that change is necessary so that our children and their children will be able to live healthily and sustainably on this planet.

With more than 75% of EU citizens living in urban areas, and this number increasing every year, cities are facing major challenges from road traffic such as congestion, pollution and noise, closely linked to the levels of car use in our cities.

In cities, transport is responsible for 40% of CO2 emissions, and if you look at all emissions, which are harmful to the climate, transport is responsible for 70% of all emissions in cities. But this presents a great opportunity: In German cities 90% of all distances made by car is less than 6 kilometres. These are journeys that are ideal for a modal shift to bus, tram, cycling and walking. In European cities – after the "Road map bicycle", which in 2015 was unanimously approved by all the EU transport ministers – it was agreed that more than 50% of all freight transport can be shifted to E-cargo bikes, which can transport up to 250kg. Imagine London, Berlin, Prague, Paris or Warsaw where 50% of trucks have disappeared without any financial repercussions for customers.

Starting with the Green Paper on Urban Mobility and the creation of the CIVITAS initiative more than a decade ago, the EU has long recognised the central role of cities in developing and implementing urban mobility solutions, and has supported cities in various ways. Projects like CREATE, funded under the Horizon 2020 framework, are crucial to providing guidance to cities on

how to tackle congestion, reduce car use in cities and plan positively for the future.

Looking at a half-century of evolution of transport policies in five Western European capital cities, CREATE has shown how changing policy priorities and supporting initiatives can lead to major reductions in car use. We have seen streets being transformed from traffic highways to providing important public spaces and centres for economic and social activity, enabling cities to provide attractive environments for citizens and visitors alike.

CREATE tackles issues raised in the triple EU mobility packages proposed by the European Commission. It has identified success factors and measures that encourage a shift away from the car (road mobility package), helped cities meet their air quality targets by developing guidance on how to reduce congestion (clean mobility package) and developed a vision of what the mobility of the future could look like (the third mobility package).

Together with cities, we are all fully committed to promoting sustainable urban transport as essential to a better quality of life for citizens. CREATE is a valuable project that will help cities to deliver on this.

In 1972 the very young Mayor of Munich, Hans-Jochen Vogel, pointed out: "The car is murdering our cities." Even if all cars are electric and all the power is dependent on renewables – which we are very far away from – the murdering of our cities will continue. Nobody wants to be a murderer of our cities. Therefore, we not only need a different technology, we also need a change of mobility.

In 2007 Hans-Jochen Vogel's successor, Christian Ude, commented at the Velocity conference in Munich, where the Bavarian car manufacturer BMW produces its automobiles, that in the future BMW should stand for "Biking, Metro, Walking". With this vision, which is supported by CREATE, we can save mobility and the climate.

What is CREATE?

CREATE is an EU Horizon 2020 and Civitas project that aims to cut road congestion in cities by encouraging a switch from cars to sustainable modes of transport.

In the past 50 - 60 years the project has studied how five cities in Western Europe – Berlin, Copenhagen, London, Paris and Vienna – have tackled growing car use and congestion. The lessons learned in these capitals has been used to support five growing urban economies: Amman, Jordan; Adana, Turkey; Bucharest, Romania; Skopje, Macedonia; and Tallinn, Estonia.

CREATE has carried out quantitative analysis of trends in car use and influencing factors, along with qualitative studies of governance facilitators and constraints. It has also looked at scheme funding, modelling and appraisal issues.

The project has identified future challenges and opportunities for urban mobility and produced a range of policy and technical documents.

Through its research, CREATE has developed a better understanding of: measuring congestion and network performance; changing urban transport policy priorities and their consequences; and the triggers for change and consequences of car use.

The project has sought to define future city challenges and successful delivery mechanisms as well as new ways of developing business models and applying techniques for forecasting and appraisal.

The CREATE partner cities

ADANA: the 2nd metro line is under construction

AMMAN: the population will double by 2025

BERLIN: almost 3,000 car sharing vehicles, including more than 400 electric vehicles are used

BUCHAREST: the public transport system is one of the largest in Europe

COPENHAGEN: cycling represents 45% of all commuter trips

LONDON: 26.1 million journeys per day

PARIS-ILE-DE_FRANCE: walking represents 39% of modal share

SKOPJE: walking and public transport are almost equal in modal share

TALLINN: since 2013, residents from the Estonian capital can travel for free

VIENNA: the capital city with the highest public transport usage in Europe

How do policy perspectives shape cities?

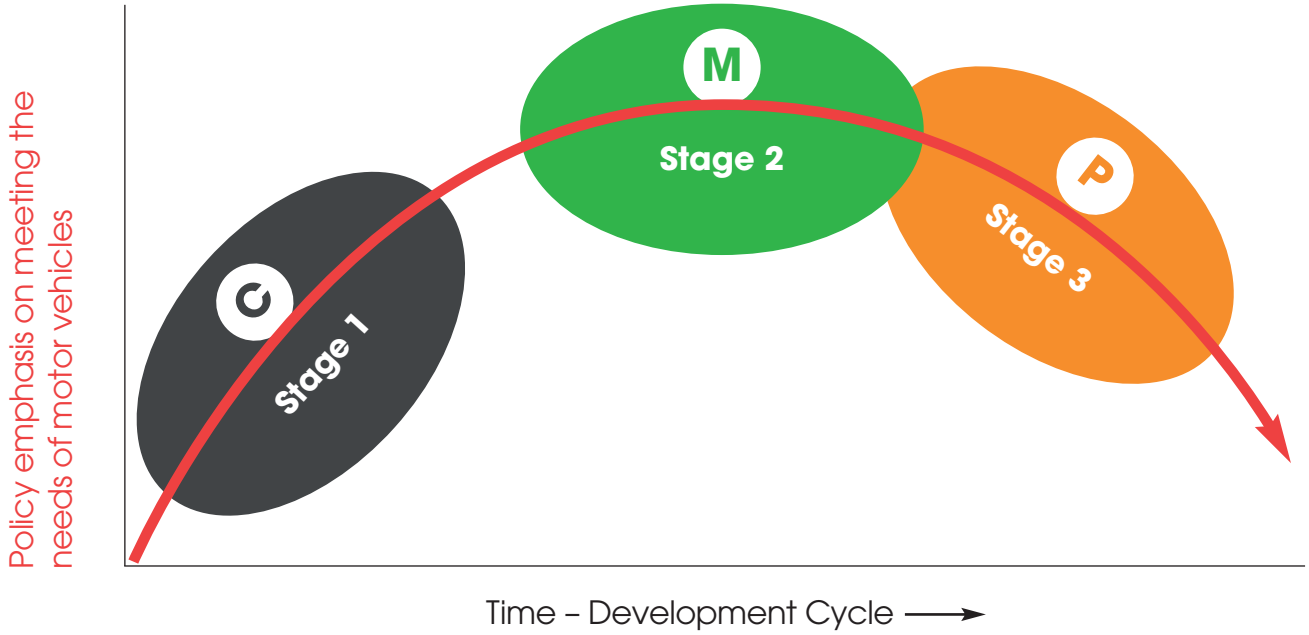
Over time, a city authority's perspective will determine which types of policy measures are introduced. And the measures implemented will impact on attitudes and behaviour, which in turn can influence levels of car use. Historically, we can identify three distinct policy perspectives.

- Road building
- Car parking
- Lower density
- Dispersion

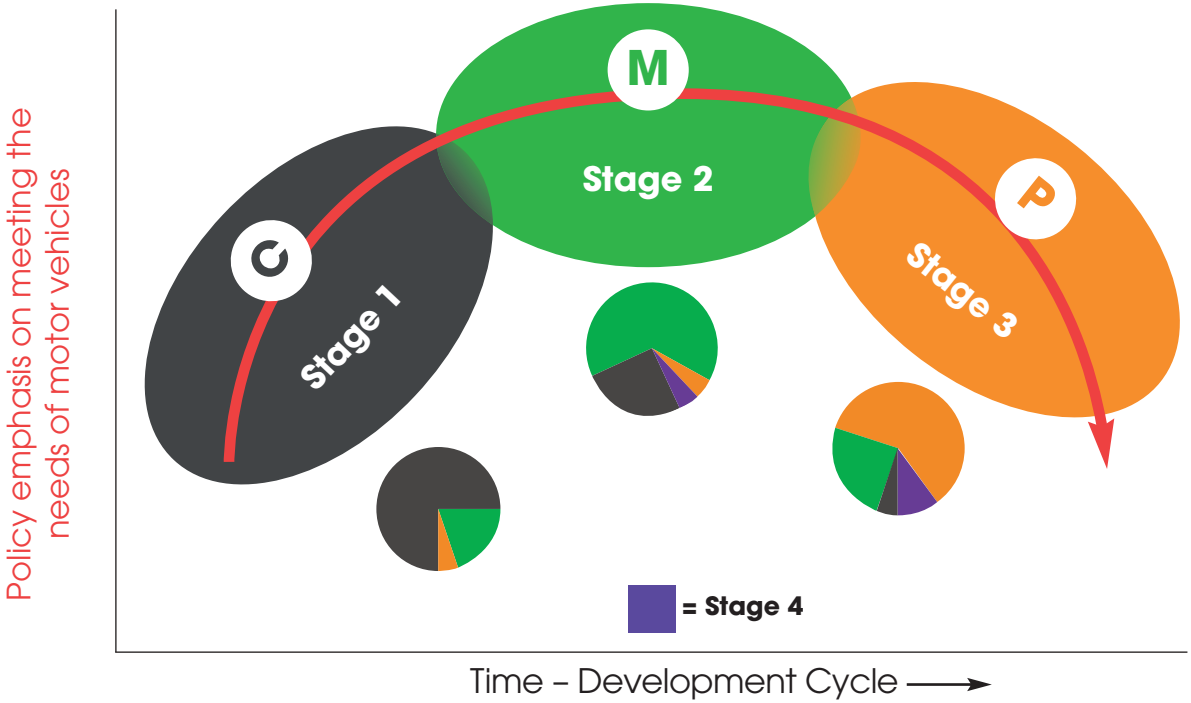
- Public transport
- Cycle networks
- Roadspace reallocation

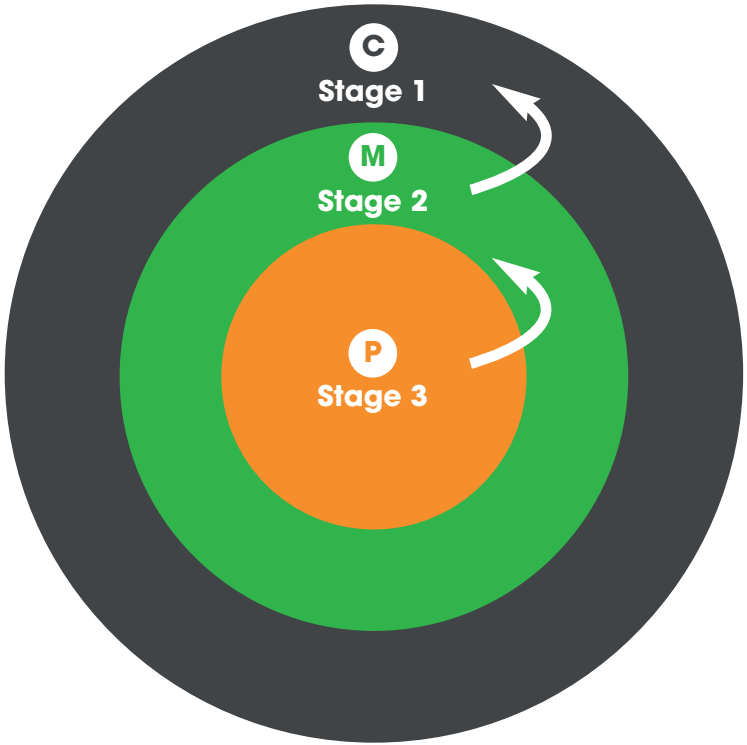
- Public realm
- Street activities
- Traffic restraint
- ToD/mixed use developments

In most Western European cities these perspectives have broadly followed sequentially, as a three-stage process, with the traffic restraint and street place-making elements in Stage 3 (P) depending on the provision of modal alternatives in Stage 2 (M). In some cases, however (e.g. Copenhagen) an interest in Place (P) proceeded a focus on sustainable mobility (M).



In practice, the shift from one stage to another is much less clear cut, with overlaps and sometimes short-term reversals of policy following an election. There may be elements of all three stages throughout a city's development, although the dominant perspective shifts. Elements of 'Stage 4' are already to be found in city policy debates.





In reality, the three stages co-exist in a city at the same point in time, but in different parts of the urban area. Stage 3 (P) policies are typically to be found in the central areas, where there are many historical buildings and high-quality public spaces, very good public transport, walking and cycling facilities are concentrated and the attractiveness of driving is limited. The inner-city areas also offer good modal alternatives based on a Stage 2 policy perspective (M), due to high land use density and diversity, and proximity to the central area. In the outer suburbs, with low density development, most trips may be made by car and pro-car (C) perspectives may dominate.

Over time, however, there is often a diffusion of perspective from the central areas outwards, so that Stage 3 (P) policies spread to inner areas and Stage 2 (M) policies to outer areas. In practice, there may be pockets of (P) policies in outer areas, in small towns that have become absorbed into the growing urban area.

A comprehensive, `place based' (P) city vision

- To CREATE mobility services that enable everyone to move freely and safely around the area without undue delay, mainly using sustainable modes of transport.
- To CREATE land use patterns that support high-frequency and high-quality public transport services on main corridors, and offer sufficient local diversity that residents can walk or cycle to access daily needs.
- To CREATE cities that are liveable and provide safe and attractive places (streets, interchanges, etc.) where people can take part in economic, social and community activities.
- To CREATE transport policies which actively contribute to the successful achievement of wider urban policy objectives, such as: regeneration, health and wellbeing, and community cohesion.
- To CREATE governance arrangements in each city which facilitate or support change, such as: knowledge and expertise, enforcement mechanisms, integrated transport planning, business models, etc.

Angers: The new Angers Loire Métropole in western France: putting people and place first

Contrast in policy measures: C –> P

The pictures show how this area of London has been transformed from a large traffic roundabout into a vibrant public space at the heart of the community, due to a shift in policy perspective and corresponding priorities.

London, Aldgate Square:

C Put in gyratory to increase road capacity (1960s)

Before

P Remove, to enhance place and provide new community heartland (2018)

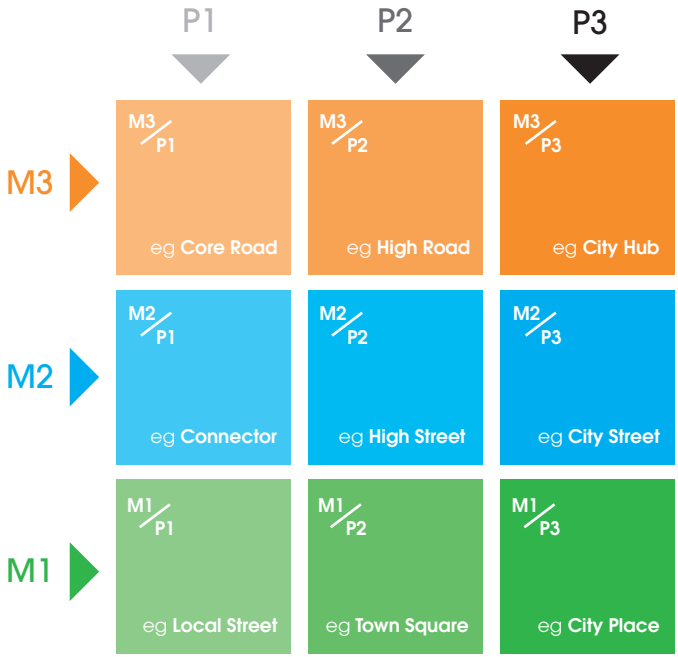
After

P: Requiring a new approach to street classification

In a car-oriented city (C), streets are seen mainly as roads for traffic movement, and are classified as such (e.g. primary distributor, collector). Under a city of places (P), streets are recognised as having two primary functions: Movement and Place.

The Movement dimension focuses on movement of people (M), on foot or cycle, in cars or using public transport. The Place dimension (P) reflects the importance of a street as a destination in its own right, due to the activities on or adjacent to the street, or the cultural or heritage significance of the buildings enclosing the street.

This figure shows the nine-category street classification recently introduced by Transport for London and adopted in the course of CREATE by Tallinn. This strongly affects how street performance is judged and how streets are designed.



What are the key triggers & drivers for change?

Triggers play a very important role in a city's transition from one policy perspective to another. They can be 'internal' to the city (IT), arising from the consequences of the current dominant policy perspective, or may originate from 'external' sources (ET), due to national or international economic and social factors. And they can either reinforce or counter each other.

In Oxford, for example, there was a proposal to build an inner ring road across Christchurch Meadow; this faced strong and sustained opposition and was ultimately defeated in the House of Lords. This paved the way for Oxford prioritising place and heritage, supported by the roll-out of park & ride, offering an alternative to car use.

However, the effectiveness of triggers in delivering change also depends on other factors associated with the governance arrangements in each city, and its ability to facilitate or support change. This includes elements such as the administrative structures, legislation, funding arrangements and enforcement – without effective enforcement mechanisms, it is not possible to introduce lanes for trams or buses, or parking regulations.

Internal triggers occur at points in time uniquely determined by the experiences of each city, as a reaction to the policy measures that have previously been introduced; whereas the external triggers usually occur in most places at the same point in time. This means that the external triggers will impact cities at different stages in their development – and so might reinforce a change in one case and hinder it in another.

Page 18 provides examples of typical internal and external triggers, while the figure on page 19 attempts to illustrate the concept more schematically.

Paris: Reducing capacity for car traffic, providing new tram and cycle routes and building a high-quality public realm

Examples of Internal and External Triggers

'Internal' triggers: stimulate shift in perspective

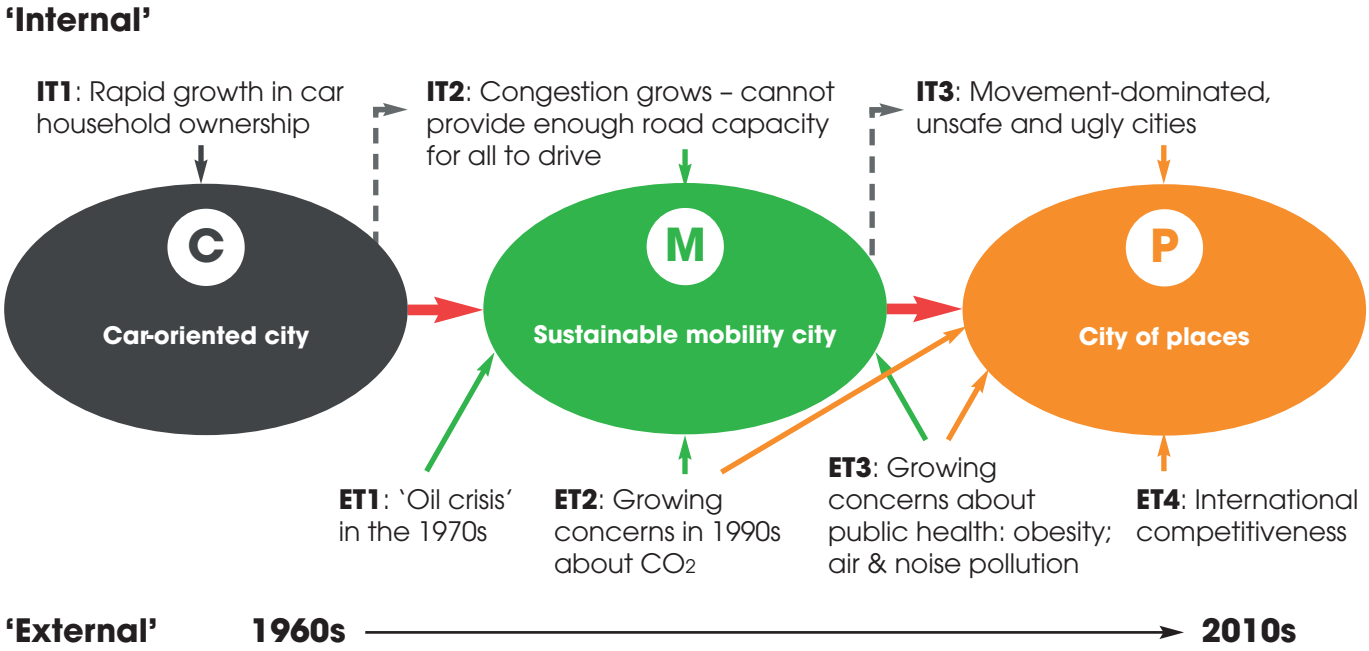
Each 'internal' trigger has a response that applies to C (car-oriented city), M (sustainable mobility city) and P (city of places):

- **IT1**: Rapid growth in car household ownership.
  C = Provide for private vehicle movement.
- **IT2**: Congestion grows – cannot provide enough road capacity for all to drive.
  M = Provide for more efficient person movement, promoting sustainable mobility.
- **IT3**: Movement-dominated, unsafe and ugly cities: 'reclaim the streets'.
  P = Recognise 'Place' component of transport infrastructure.

With 'external' triggers, there are wider contextual factors:

- **ET1**: The 'oil crisis' in the 1970s strengthened case to move away from car dependency C -> M.
- **ET2**: Growing concerns in 1990s about cutting CO2 emissions. Further promotion of non-car, sustainable modes, including support for electric vehicles C -> M.
- **ET3**: Growing concerns about public health: poor air quality and obesity.
  Encourage walking, cycling and neighbourhood planning -> M/P.
- **ET4**: International competitiveness based on high quality, accessible city environments.
  Strong focus on high quality city places and amenities -> P.

A typical sequence of triggers of change over a fifty-year period



What drives changing patterns of car use?

Over time car use cities in Western Europe steadily increased, before levelling off and then declining. There are several reasons for these trends. Key among them are:

- Changing demographics, employment and social patterns
- Technological change, for example due to the internet and the rise of Uber
- Changes in transport and land use policies such as rail investment in cities
- Aggregate capacity constraints on the road network

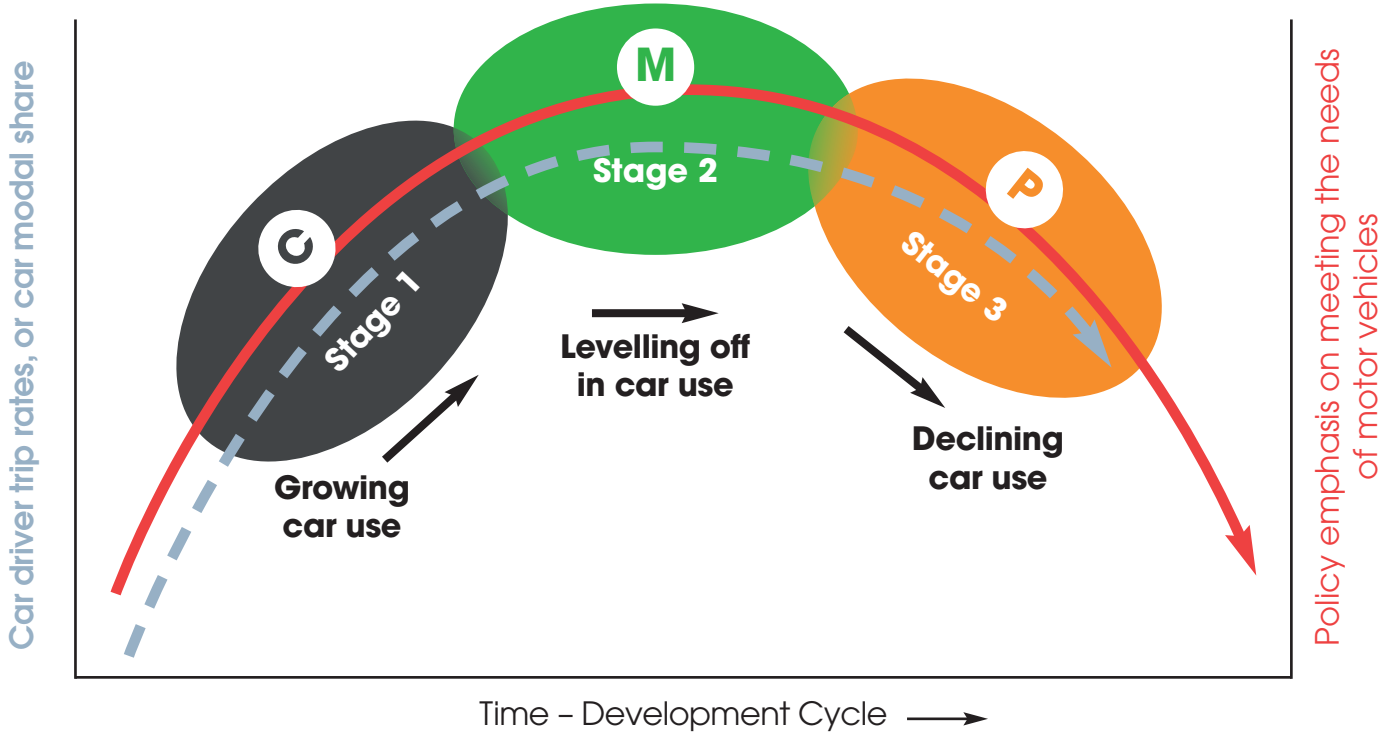
Changing car travel patterns

Car use is highest for mandatory trips, chiefly for work, business and education, as well as shopping and errands. 'Peak car' is mainly due to falls in these mandatory car driver trips. There has also been a fall in car driver trip rates among non-workers, though this has been offset by more car use among retired residents, especially women.

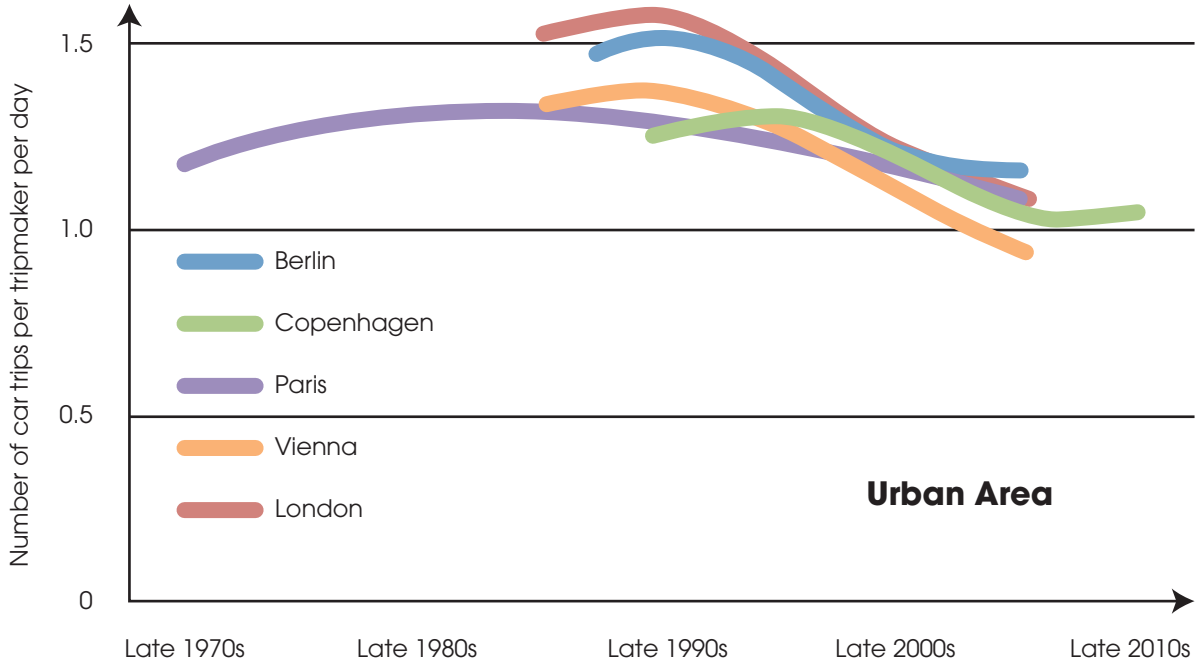
Meanwhile, falls in car use for working people has been due to both reductions in the overall trip numbers and a modal shift to alternative modes. Also significant is the generational effect, with a big drop in car use and less car access among young people. However, this has again been countered by higher car use and higher car access of retired people.

Car parking takes up substantial areas of space, which in Cities of Place (P) may be replaced by a public square

A 'U-shaped' trajectory of car use intensity linked to the different stages



Evidence of the 'U-shaped' curve in the five CREATE Western European cities, over time



Causes of declining car modal share

Structural

As car numbers and population densities have gone up in most cities, car use has become less attractive. Alongside this, a change in employment patterns means more temporary contracts, especially for young generations, as well as more part-time jobs, and more people in higher education, resulting in lower disposable incomes. Also, changing employment structures and sectors has led to new high skilled jobs, which tend to be located in higher density urban areas that are less suited to car access.

Another important factor has been the rise of new social/technical patterns and preferences, resulting in new patterns of daily activities (work, shopping, entertainment, leisure), which are increasingly based on 'virtual' rather than physical mobility, and more home deliveries.

Transport and land use policies

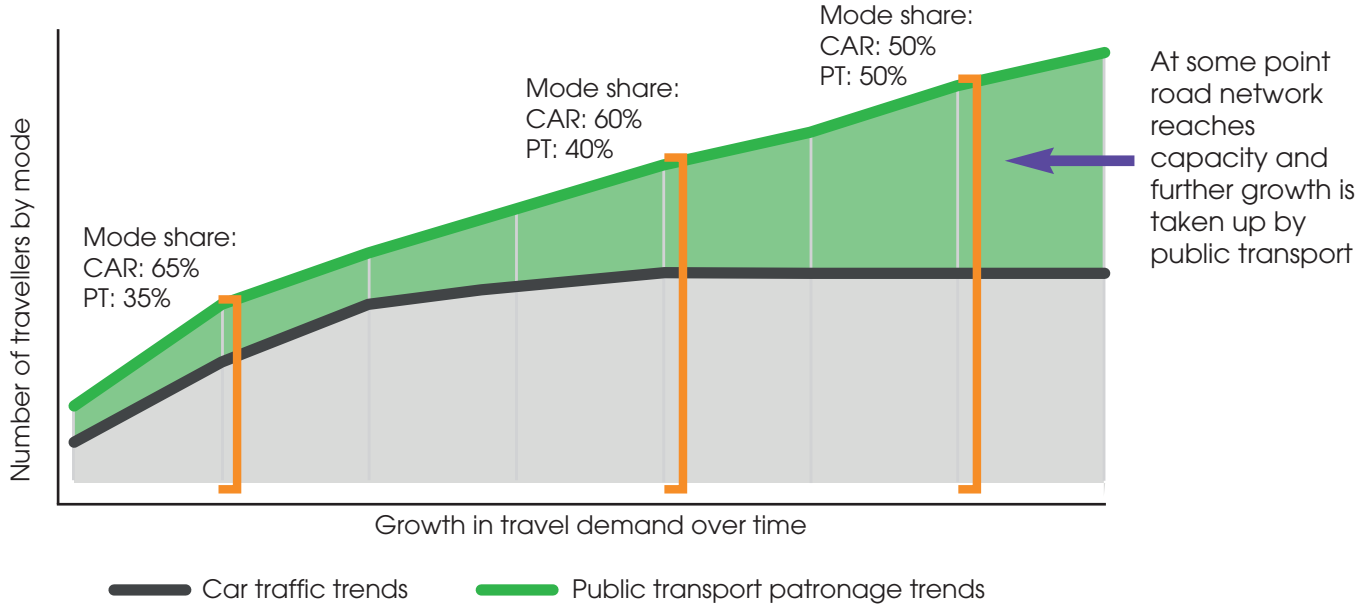
Investment in public transport infrastructure and services, walking and cycling infrastructure has encouraged a modal shift away from the car.

Cities are seeing a rising number of market-led alternatives to cars such as free-floating car sharing, Uber and electric bikes. These sustainable modes are appealing to the growing number of people living in higher density, mixed-use developments. Intensified parking management has also played a part, especially in inner-city areas through the spread of enforcement and increased parking fees.

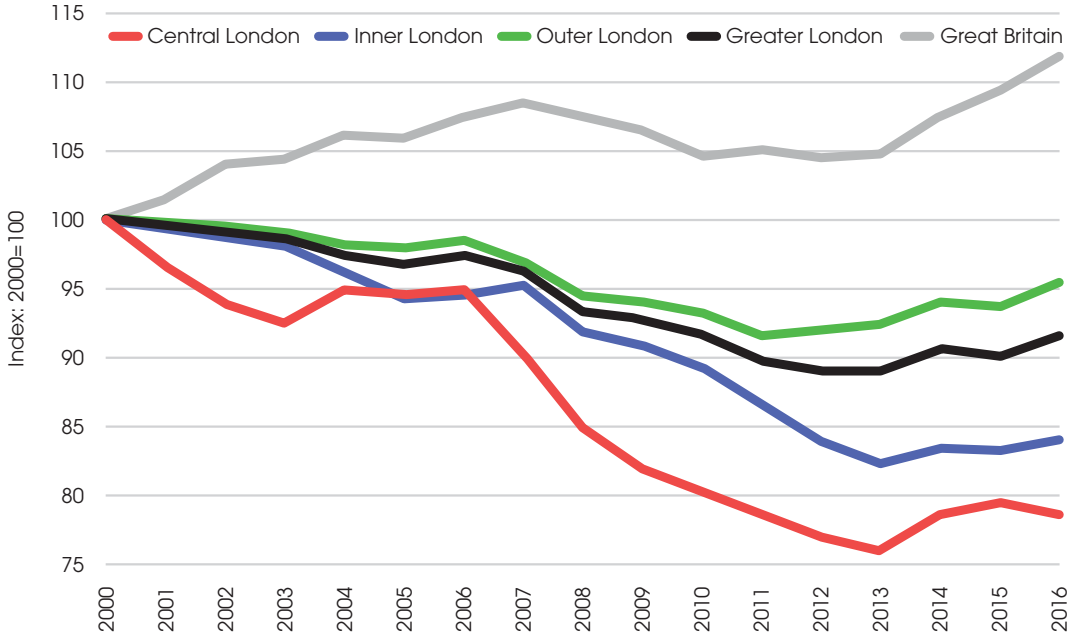
Meanwhile, road network capacity for cars has been reduced by the reallocation of space to public transport, cycling, walking and pocket parks as well as policies to charge directly for car use in cities.

Macro network capacity constraints

Evolution of car and public transport levels



In some cases, road capacity may not just reach saturation but may actually be reduced to reallocate space to reserved lanes for public transport, or to provide more public space. In Centrsl London, capacity has fallen by over 30%, with smaller reductions in Inner and Outer areas. This has resulted in absolute reductions in road traffic levels, as shown below.



Investment in cycling and walking infrastructure can encourage a modal shift away from the car

What are the conditions for policy evolution?

Not all cities will follow the Western European trajectory when it comes to car use and congestion. But what is clear is that certain conditions are required to enable the trajectory from car-based (C) to mobility (M) and place-based (P). In particular, cities require land use patterns and densities, along with street layouts, which make it feasible to provide attractive public transport alternatives to the car.

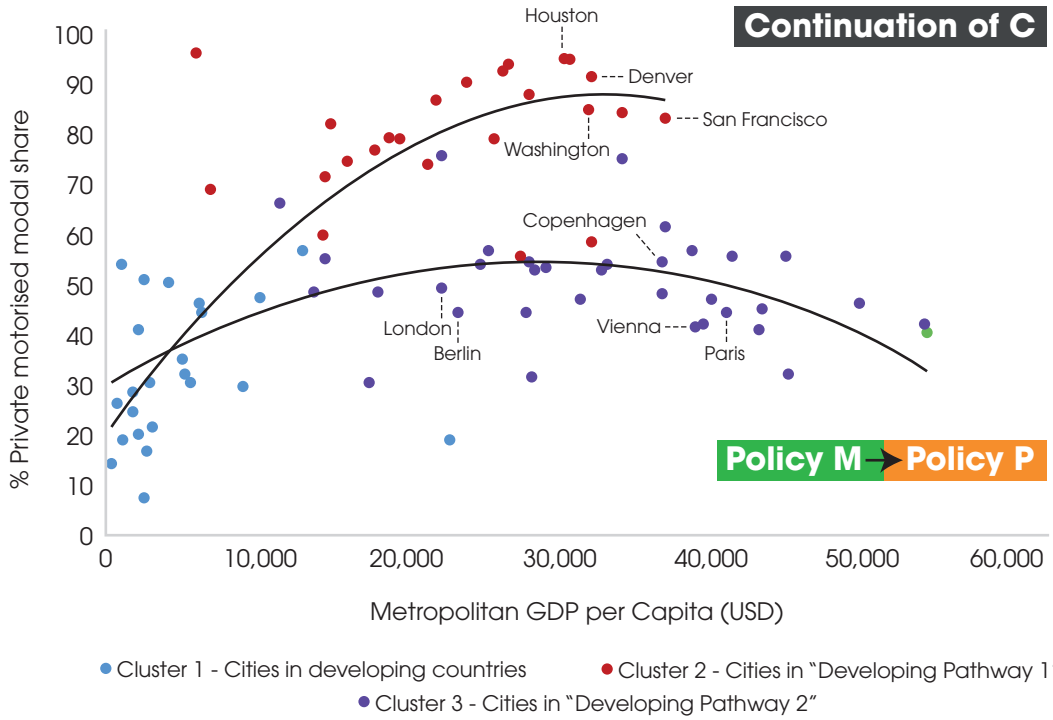
Is this 'C->P' evolution inevitable?

This three-stage process does not necessarily apply to all economically advanced cities. For example, many newer North American cities are still almost entirely car-based. Also, car use is much more dominant in suburban and rural areas.

The figure below (page 29) shows the different evolutionary paths taken by cities around the world. This is based on data **at one point in time** with cities described in terms of their metropolitan GDP per head (horizontal axis); the vertical axis shows the proportion of trips made by residents in a motorised private vehicle (e.g. car driver or passenger, motorcycle).

Below USD10,000, the proportion of motorised trips varies enormously, depending on cultural attitudes to use of motorcycles (cluster 1); but above this level in cities of increasing wealth, two distinct mobility patterns are evident. Cluster 2 shows a city grouping that increases its motorised mobility (mainly in private cars) with higher GDP levels; while Cluster 3 reproduces the temporal pattern shown on page 22: an initially increasing car modal share and then a decline with increasing wealth. In CREATE Stage 3, Western European cities are all in this group, with many North American cities clearly car-oriented.

Alternative city trajectories: poorer cities have scope to shape their future mobility patterns as their wealth increases



Source: analysis by Roger Teoh, MSc Dissertation Imperial/UCL 2016

UITP data 1995

Importance of pre-car city orientation

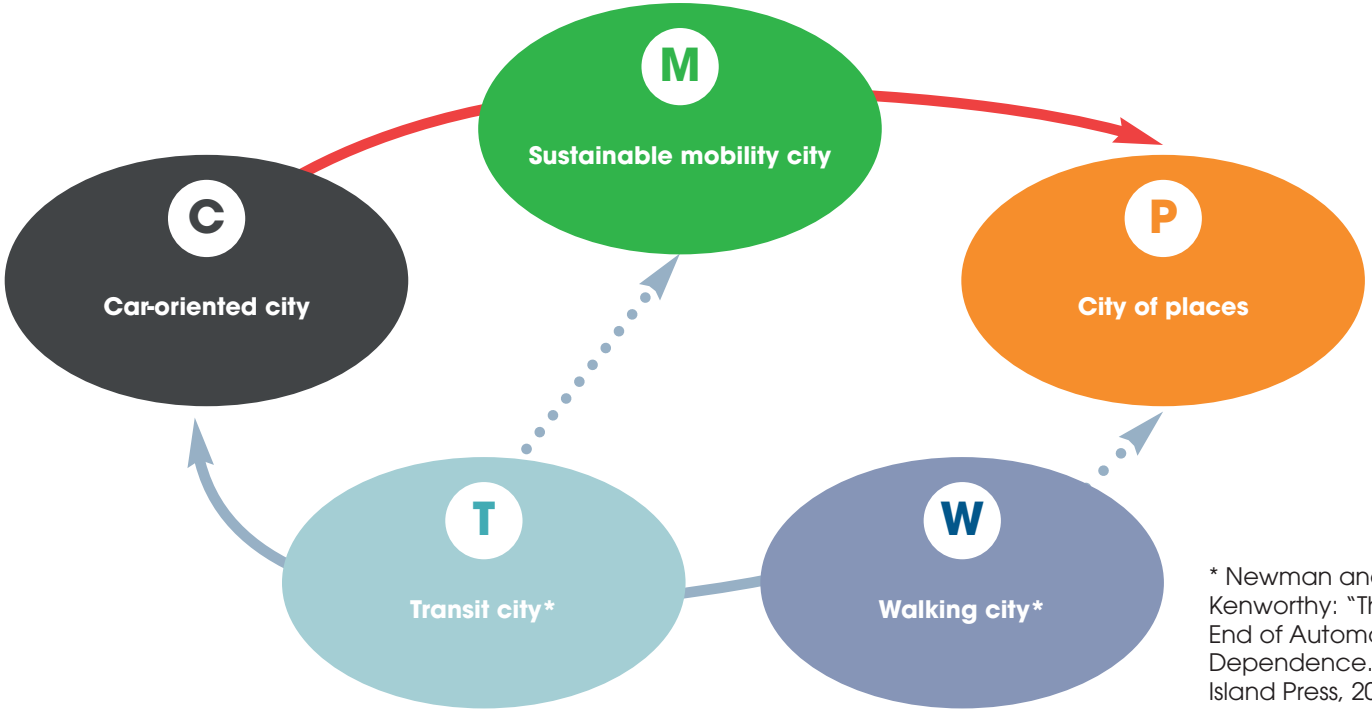
City of London: Like many older cities, the City of London's streets developed and expanded before the arrival of the car

Many older cities were substantial in size well before the arrival of the car. They developed when walking (W) and animal transport were the main modes of transport, and so were compact and mixed-use in nature. These older cities then expanded with new mass transit (T) systems – buses, trams and trains – along radial corridors.

Car-based road systems were then imposed onto this historic framework, making it relatively easy for these historic cities to move on to sustainable mobility (M) and then place-based (P) policies (page 31).

Building on heritage networks in older cities

The shift to (M) policy measures is helped by the previous patterns that resulted from the Transit city (T); and the Place-based policies (P) are easier to introduce in parts of the city that developed around walking (W) networks.



* Newman and Kenworthy: "The End of Automobile Dependence." Island Press, 2015

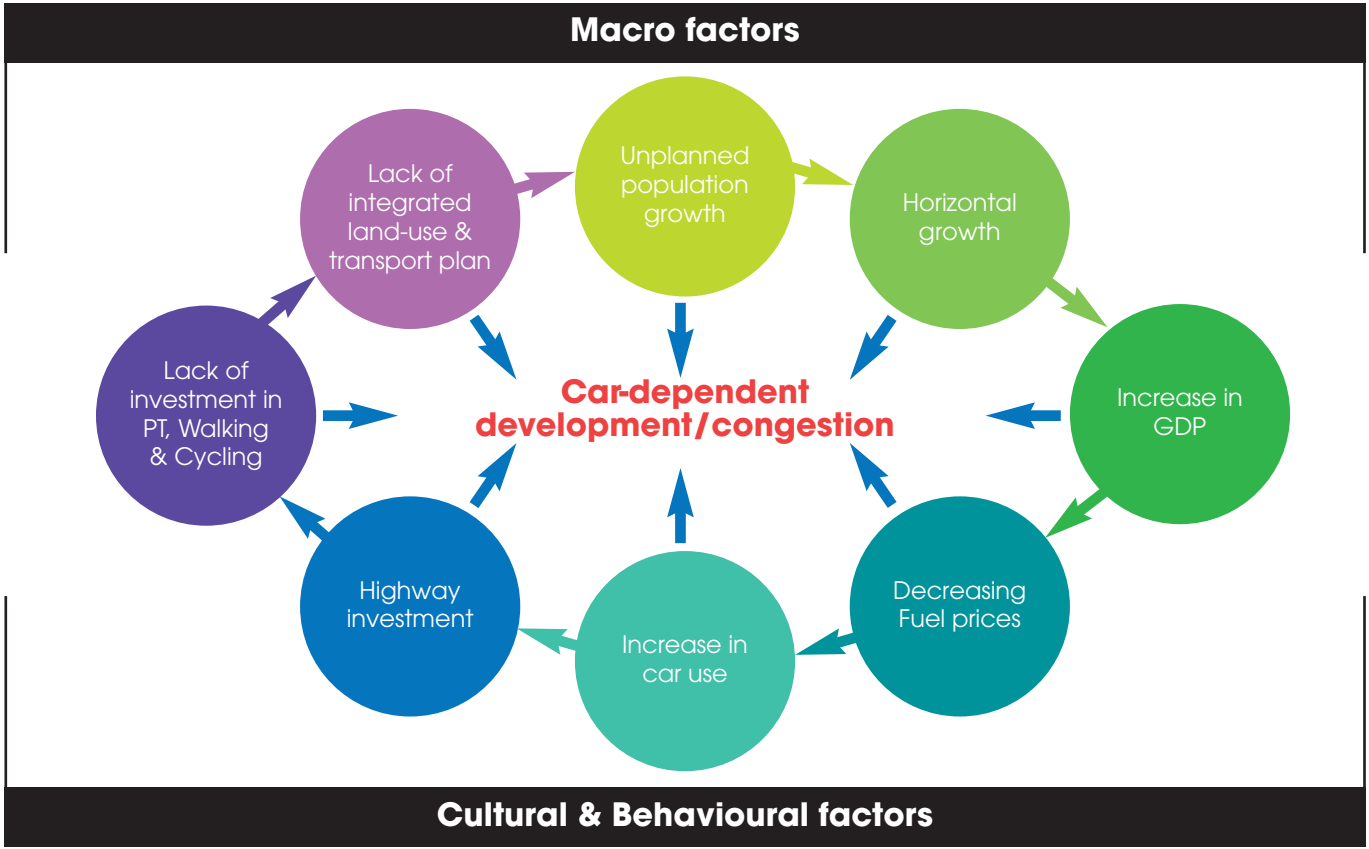
Factors contributing to growing car dependency and road congestion in cities experiencing rapid increases in car ownership

Research in CREATE undertaken in Adana, Amman, Bucharest, Skopje and Tallinn suggests that similar trends and patterns are operating in those cities. The figure below (page 33) illustrates some of the key factors that have contributed to car-dependent developments and growing road congestion. In most cases those factors are inter-connected and have occurred in parallel.

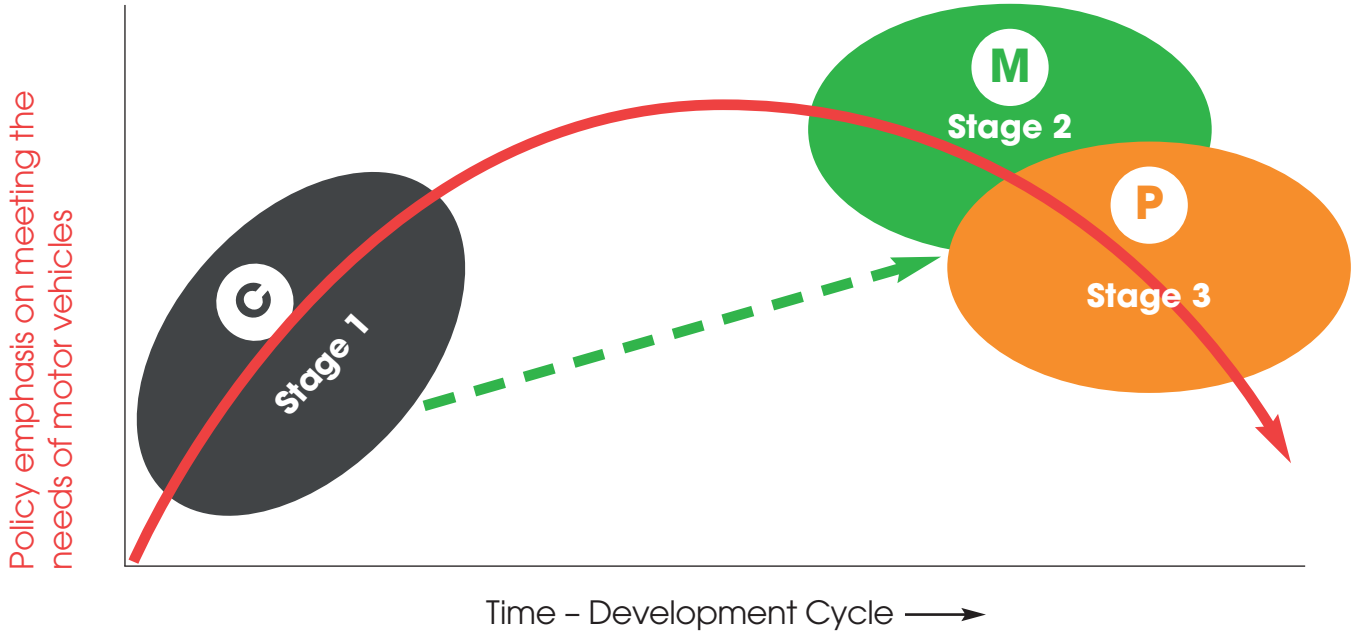
A rapid urban population growth and a lack of planning (land use and transport) at the metropolitan level has contributed to low density developments and urban sprawl, and a degree of car dependency. The combination of increasing GDP per capita and a decrease in fuel prices has also encouraged an increase in car-use. The availability of cheaper cars and new financial streams for their purchase has also been a contributing factor.

The focus on road infrastructure investment, and the lack of investment in public transport, walking and cycling has led to increased levels of car use and car dependency.

Various socio-cultural and macro factors have also reinforced these processes. One of the most prominent is the association between private car ownership and freedom and/or social status, which has led to high car ownership and car use levels. A macro factor often mentioned is the influence of international investments and trade agreements. For instance, the access to affordable second-hand cars was facilitated by trade deals with Western European countries; and investments in major urban highways were financially supported by international associations or neighbouring countries.


Macro factors
Lack of integrated land-use & transport plan
Unplanned population growth
Horizontal growth
Lack of investment in PT, Walking & Cycling
Car-dependent development/congestion
Increase in GDP
Highway investment
Increase in car use
Decreasing Fuel prices
Cultural & Behavioural factors

Can this evolutionary/learning process be short-circuited?



Road congestion in Amman

How do we shift from C to M/P policy perspectives?

So, how do cities make the transition from being car-based (C) to mobility (M) and place-based (P)? The key factor is a change in policy priorities, particularly in the light of negative impacts and public concerns about the consequences of current policy measures. This can lead to a change in how people think that urban streets should be used, perhaps encouraged by new financing opportunities (EU level, national level) that support a shift in policy perspective.

In the long term, Stage 1 (C) policies can be expensive when urban policy perspectives change; due to the huge cost of demolishing or burying roads and (re)building railway networks. Providing a high quality, public transport system (M) is not cheap, although it enables the limited urban space to be used much more efficiently and sustainably, and supports place-making aspirations (P).

But a successful shift in policy perspective imposes other requirements on cities. Adopting (M) and (P) policies will require capacity building and a re-focussing of funds; additional expertise in transport planning and operations (information, data analytics, planning & enforcement, etc.) and engagement with increasing range of stakeholders, including those from outside the transport profession.

Some cities may be locked into car-based patterns, at least in the short term. This could be for several reasons:

- Densities are too low for public transport, walking and cycling
- Land use patterns are too dispersed, and/or
- Traffic speeds are too high for other modes to compete (see page 45)

Institutional fragmentation may also serve as an obstacle, preventing co-ordinated action across the city. And there may be a lack of institutional capacity at local level, especially when policy priorities and enforcement capacities are defined at the national level, or influenced by industry.

Success factors contributing to a shift from C to M/P policies

The eight 'Ms' can help pave the way to a less car-dependent future:

- **Mood**
  Public, political and professional acceptability
- **Motivation**
  Triggers for change (e.g. deterioration)
- **Mass**
  Capacity building: deepen and broaden the skills base
- **Momentum**
  Building on success: pilots and policy 'windows'
- **Mechanisms**
  Engagement, enforcement, administration, delivery; co-operation and co-ordination
- **Measures**
  PT investment, reallocate road-space
- **Methods**
  Better forecasting and appraisal methods
- **Money**
  Funding mechanisms

What will the future city look like?

Cities are facing a wide range of challenges, ranging from population growth and economic restructuring, through to disruptive new technologies. To deal with these challenges, an enlarged policy perspective will be required. Taking advantage of 'big data' and 'smart city' initiatives, this new perspective can be characterised as the 'Integrated city'.

The Future City

There are five key factors that enable cities to move beyond car-dependency:

- Continued congestion and over-crowding
- Need for new and stronger measures – 'low hanging fruit' has been picked
- Cross-sector responsibilities of elected mayors, at metropolitan level
- Dealing with autonomous vehicles and other technological developments
- Pressures from 'Big data' and 'Smart City' initiatives

These factors can help lay the foundations for a new urban policy landscape. The key is to recognise interactions between transport and all sectors - and of travel as a 'derived demand' - with governance and administrative structures at metropolitan level, enabling some cross-sector planning. Support may come from new policy perspectives including new ways to involve and regulate private and citizen-led initiatives.

The Future City: the 'Integrated City'?

The Integrated City responds to demographic pressures and technological opportunities by taking a holistic, strategic and multi-agency approach to planning and operation, at a metropolitan level. Examples of this emerging perspective include Accessibility Planning, which focuses on optimising service delivery through well-designed land use patterns, transport networks and internet-based services; and MaaS (Mobility as a Service), which aims to provide a multi-modal platform for planning, booking and paying for door-to-door travel.

New technologies provide both opportunities and threats. The rapid growth in sensors and the IoT (internet of things), for example, enables the real-time monitoring and responsive management of a wide range of urban systems. While at the same time it makes cities more vulnerable to cyberattacks and any breakdown in electrical supplies and communication systems.

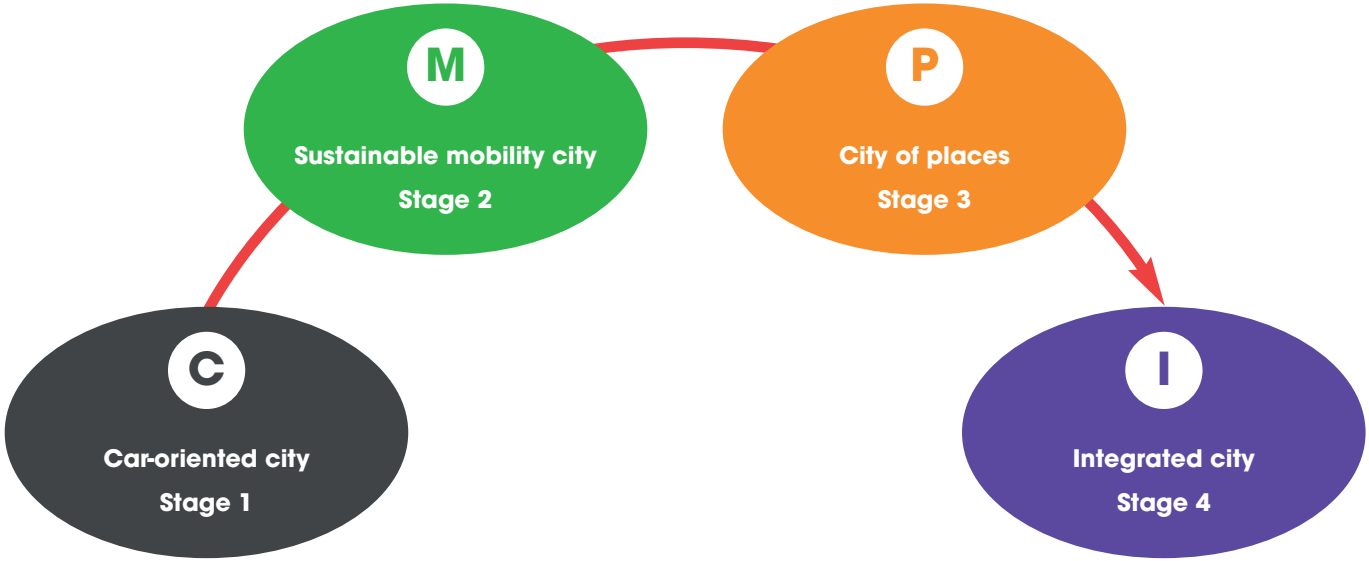
Supporting different city visions, based on:

- Sustainability
- Efficiency
- Equity
- Health and vitality
- Happiness

Academics can support the Integrated City, through research into socio-technical systems (showing how basic changes in consumption patterns occur through combinations of new technologies and evolving social and business practices); and activity-based analysis (which provides the opportunity to look at the cumulative impacts of developments in different sectors on daily behaviour and on overall resource use).

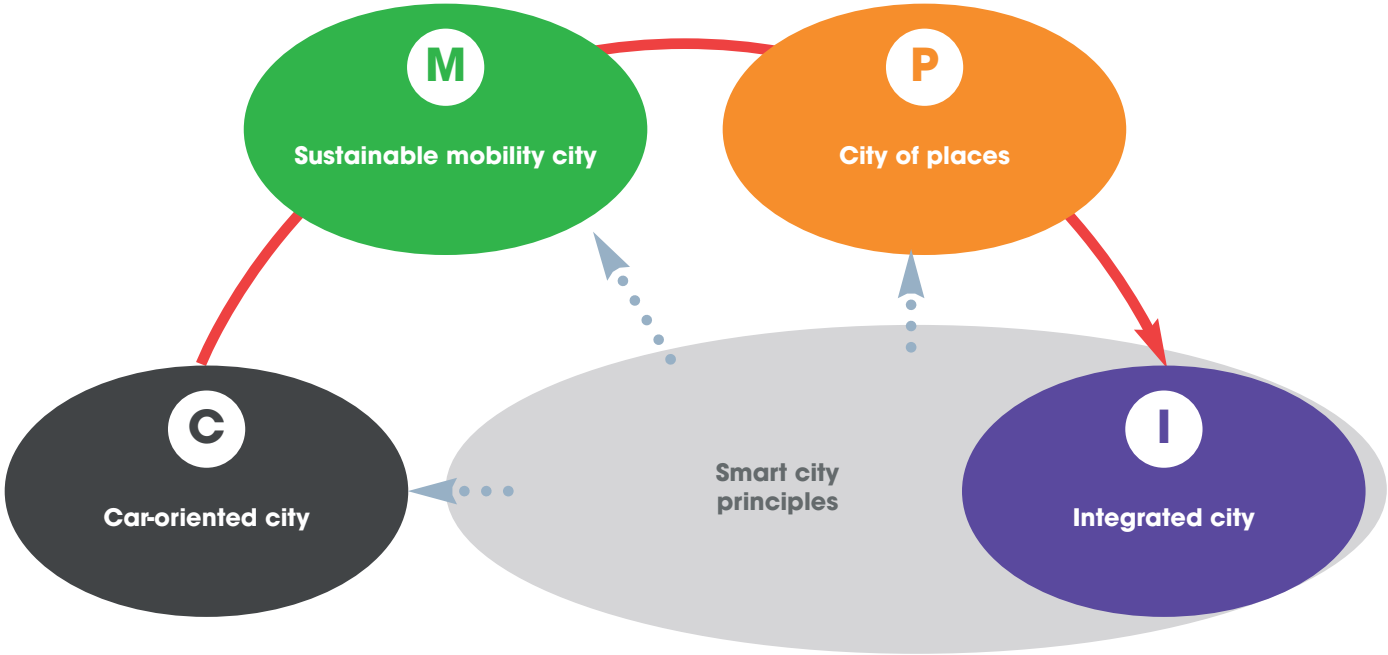
The Integrated City: the emerging 'Stage 4'?

Will cities now move beyond a focus on movement and place-making, to a more regional-level,comprehensive systems approach to urban planning and operation – assisted by private sector initiatives?

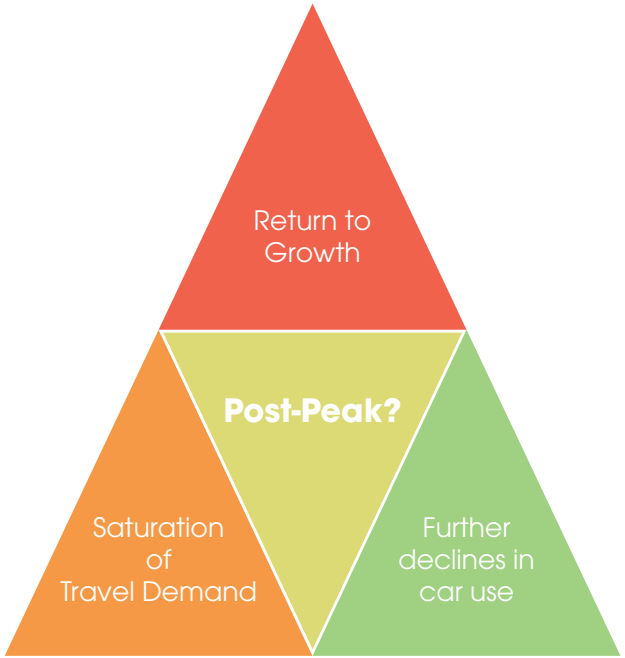


Opportunities to enhance other policy perspectives

Elements of the Integrated City approach, based on Smart City principles, can also increase the efficiency and effectiveness of the previous three policy perspectives.



What will happen to car use levels in the future?



In recent decades, car use per person has been falling in Western European cities that have embraced place-based (P), 'Stage 3' policies. But changing lifestyles and technological advances could shift the demand curve in different directions:

- We could witness further declines in car use, as more people choose to use enhanced public transport, or walk and cycle, or reduce their travel - shopping trips are falling sharply in some countries such as the UK. Autonomous vehicles might also be used as multi-passenger vehicles.
- Alternatively, we might have reached a saturation level in personal car use, with factors encouraging or discouraging car use balancing out across the population as a whole.
- A third possibility is that the autonomous vehicle will stimulate a growth in car-based travel, due to its comfort and convenience: trips could shift from other modes to the car, distances might become longer, and people might make more frequent journeys.

The Future AV City: Car 'Utopia' or 'Dystopia'?

Some predict that electric autonomous vehicles will be safe, clean, quiet, efficient users of road space, enabling productive travel time, and available to all population groups. But some of these developments may encourage a return to C-based policy perspectives:

- Mobility as a Service (MaaS) may encourage more vehicle-based door-to-door journeys, leading to reductions in walking and cycling and increasing obesity rates.
- AVs will make car use more attractive by reducing stress and making the journey to work a more relaxing experience. The rising popularity of AVs could increase demand for car carriageway space while the need for bus lanes, cycle lanes etc falls.
- There may be calls for segregated road space, with pedestrian guard-railing, to keep AVs moving in urban centres.
- The emergence of AVs could encourage longer commuting journeys and the decentralisation of cites, as the disutility of car travel drops dramatically: when the stress of driving is replaced by a relaxing environment where occupants can work, rest and play, then travel time and distances may become less of a material consideration.

In view of all these possibilities, it is vital that cities address these issues now, and play a proactive role in shaping their future development through aa clear and popular city vision – ensuring that they are '**technology-fed**' not '**technology-led**.

Is congestion in cities that important?

While congestion may dominate media debate and is an on-going concern for politicians, in practice is not necessarily that important. It is only one of several negative traffic impacts, alongside concerns about air pollution, road traffic injuries and deaths; as cities develop, it is seen as relatively less important. Besides which, it is hard to measure congestion unambiguously, and reliability is more important than speed for logistics companies.

Congestion and network performance

CREATE found that the assessment of congestion was very sensitive to the precise measurement used and depended on the local speed limit, the base reference speed, and whether it is vehicle or person based, etc.

City authorities face considerable pressure to 'do something' about congestion, usually from the more influential members of society. The instinctive reaction is to build more roads. But, taking into account the needs of the city as a whole, this is often not the best solution.

Most economically vibrant cities experience road congestion. But with good modal alternatives, fewer travellers are exposed to delays. Citizens and businesses are willing to make trade-offs between congestion and quality of life, accepting worse traffic conditions for a better environment. Cities are more disadvantaged by unreliable network performance than by low speeds, and the former can be addressed through new technology.

In cities with well-developed rail-based public transport systems, the average door-to door speed by car is very similar to that by rail, as shown below, so road speeds can increase with better rail services.

Average door-to-door speeds for London residents (kph), by main mode

	National Rail Overground	LU/DLR	Bus/tram	Taxi	Car driver	Car passenger	Cycle	Walk
2005/06	13.1	11.5	6.4	12.2	12.1	11.8	8.2	4.2
2006/07	13.5	10.8	6.2	12.7	12.7	12.4	9.4	3.8
2007/08	13.1	10.9	6.2	13.0	12.9	12.2	8.9	3.7
2008/09	12.8	11.0	5.9	11.5	12.8	12.2	9.5	3.2
2009/10	12.5	10.7	5.8	12.4	12.9	12.7	8.8	3.2
2010/11	13.1	11.0	6.0	12.6	13.0	12.5	8.6	3.3
2011/12	12.6	11.2	6.0	12.2	13.2	12.7	8.3	3.1
2012/13	12.5	11.0	6.0	12.7	13.2	12.8	9.1	3.2
2013/14	12.8	11.2	5.9	13.1	13.1	12.9	9.1	3.1
2014/15	12.5	11.6	6.0	13.1	13.0	12.7	8.9	3.2
2015/16	12.6	11.2	6.0	12.4	12.7	12.5	9.2	3.3
2016/17	12.1	11.3	6.1	13.7	12.4	11.9	9.0	3.7

Congestion indicators do not show the impact on travellers as a whole

Congestion indicators only take into account people using the general road network; as more travellers chose to use rail services, buses in segregated lanes, or protected cycling and walking networks, then the proportion of travellers affected by general road congestion declines. Indeed, where road-space has been reallocated from cars to sustainable modes, then a recorded increase in congestion may reflect a conscious policy decision to enhance conditions for other modes.

The table compares conventional congestion values with average delays when spread across all travellers – showing the much-reduced impact for travellers as a whole.

	INRIX indicators (2016)		**% of all trips made by car (driver or passenger)**	**Indicators adjusted for mode share of car users**	
	% of travel time the *average driver* spent in congestion	Average number of hours *car drivers* spent in congestion/year		% of travel time of the *average traveller* spent in congestion	Number of hours in congestion per year, averaged across *all travellers*
London	14%	73	34%	5%	25
Paris	12%	65	25%	3%	16
Berlin	8%	40	28%	2%	11
Vienna	7%	39	29%	2%	11
Copenhagen	4%	24	29%	1%	7

Tallinn: Reallocating space for bus lanes

How can new analytical approaches help?

Major transport investments and other policy initiatives generally rely on mathematical models to estimate future demand and economic business case procedures to justify funding.

These techniques were originally developed to design and justify C and M-type policies, and are not yet well adapted to the needs of cities taking a place-based (P) policy perspective.

Measures of 'success' depend on the policy perspective

Each policy perspective is adopted in order to deal with a particular set of perceived mobility-related problems, and introduces a targeted set of policy measures to address them. So, the 'success' of the C, M and P-type policies are each measured in a different way. These measures are used in business cases to obtain funding to implement the preferred policy packages.

As C and M policy perspectives have been in existence much longer than the P perspective, measures of success for P policies are generally much broader and less well developed. So, it can be much harder to make the economic case for investing in P policy measures. In the absence of economic values for place-based enhancements, the existing conditions overwhelmingly favour C-based policies – and make it very difficult to justify a reduction in road capacity. This means there can be a gap between what cities want to do – their vision for the future - and what they can easily justify to funding agencies (national governments, development banks, etc).

Examples of 'measures of success' associated with each policy perspective

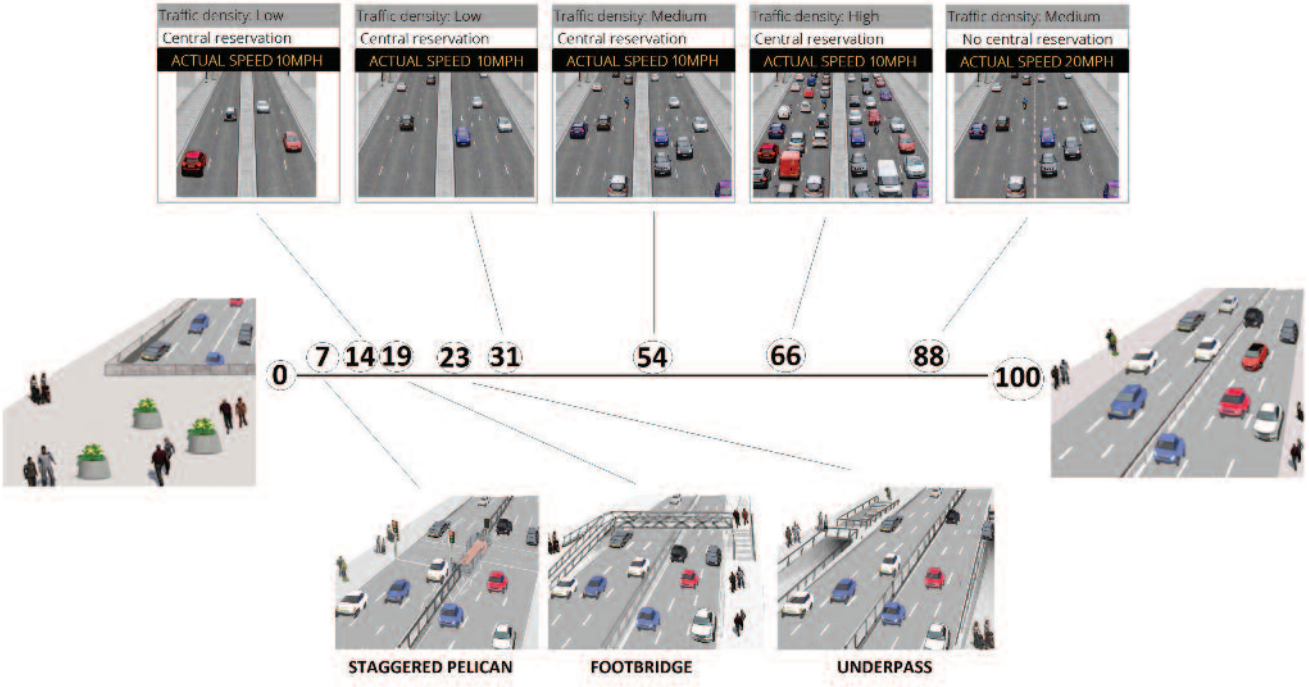
The table shows the distinct types of indicators that might be used to justify investment and measure success under the three policy perspectives.

C: car-based	M: SUM-based	P: place-based
Average network speeds	PT frequency and reliability	Time use in transport modes
Day-to-day variability	Access to bus stops and stations	Intensity of street activities
Vehicle congestion	Safety and security	Time spent in local area
Car parking availability	Seamless travel	Value of high quality public space
Road traffic accidents	PT modal split	Health of the population
Noise	Walking/cycling modal shares	Social interaction
Air pollution	Door-to-door travel times by mode	Social equity and inclusion
		Community severance

KEY: There are not yet well established means for measuring and valuing these benefits

Addressing one of the gaps in developing P-based indicators

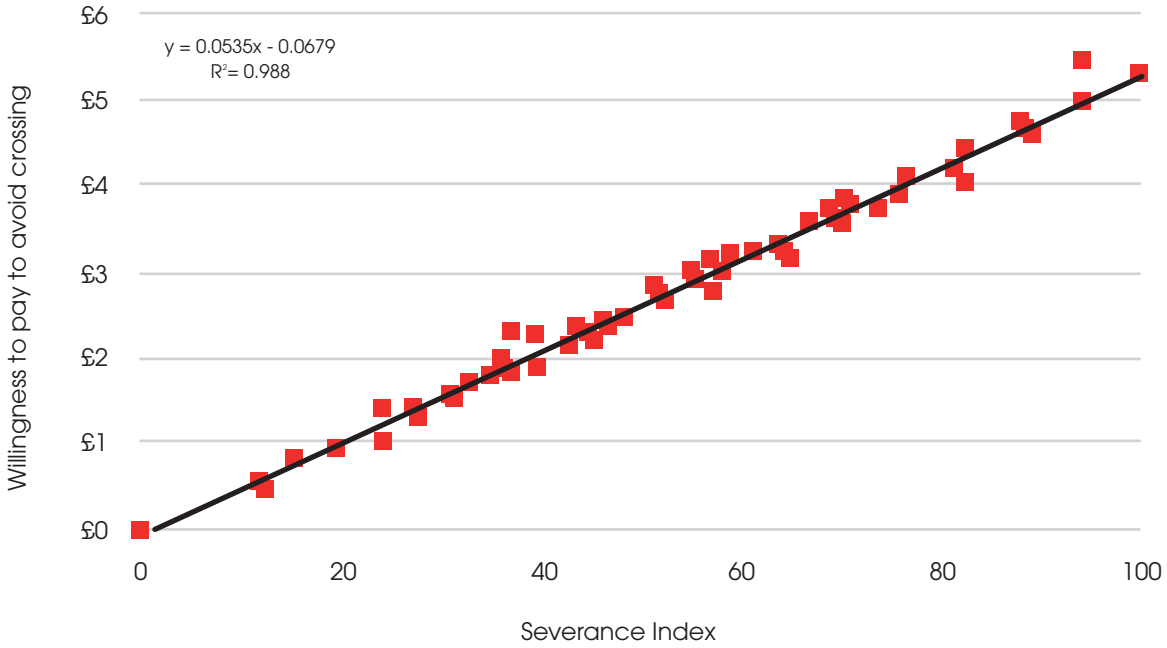
Creating a scale to measure the degree of severance caused by different road layouts and traffic levels (results based on surveys in two London neighbourhoods).



Estimates of 'willingness to pay' to avoid or reduce severance

Estimates for different road layouts and traffic levels – to be used in economic appraisals to justify investments in severance reduction measures.

Severance index vs. Willingness to pay (London)



Modelling for vision-led planning

Inverting the traditional role of forecasting models

C and M policy investments are largely based on model forecasts of future travel demand (`predict and provide'), which are used to achieve the desired outcome (e.g. a functioning car-oriented city). For example, forecasts seek to determine: how much road capacity is needed? what level of rail capacity do we need to provide? Here uncertainty in forecasting is `a problem', as it becomes uncertain as to what level of capacity to provide.

Policy P, meanwhile, starts with a much broader city vision that embraces mobility and the public realm. Here the aim of modelling is to identify policy packages that will deliver desired outcomes (`Vision & Validate'), that may be phased over time; and uses uncertainty to `stress test' packages to make them as robust as possible under different futures. This, in effect, turns the modelling process `on its head'.

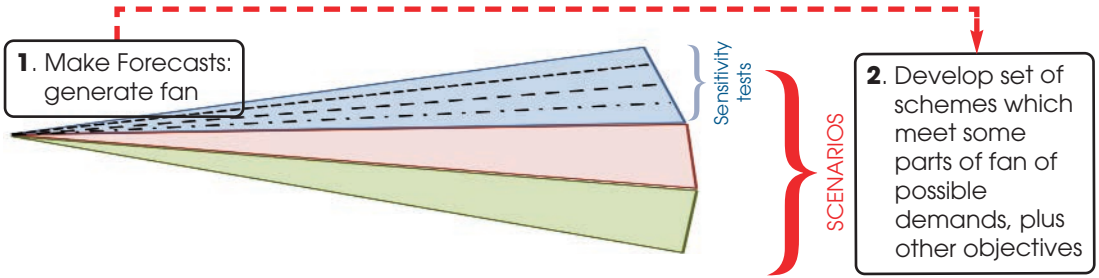
Exploring different futures through scenarios

Through developing very distinct scenarios (pictures of the future world), decision makers can become more confident about the robustness of the long-term vision they are seeking to achieve. Scenario planning has gradually gained in prominence as a methodical way of embracing uncertainty and `reframing strategy'. There are various other futures techniques available.

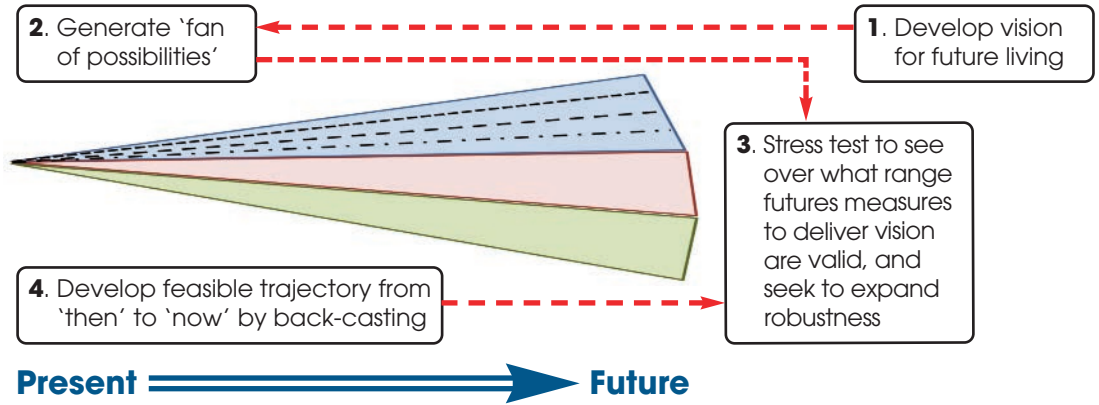
Decision makers can obtain two main benefits from carrying out methodical work designed to explore multiple possible futures: the process will help cities to accept the impossibility of predicting the future and so promote flexibility. And it will increase the chance that the chosen vision and associated strategies are robust against a number of possible futures.

Changing role of modelling when shifting from C (car-oriented) and M (sustainable mobility) to P (place-based) policies

C and M: 'Predict & Provide'



P: 'Vision & Validate'



Appraisal for vision-led planning

For many decades, traffic engineers and transport planners have viewed roads as being primarily for the movement of motor vehicles (C). A shift to sustainable mobility policies (M) puts greater emphasis on person rather than vehicle movement, but still views urban streets as first and foremost for movement.

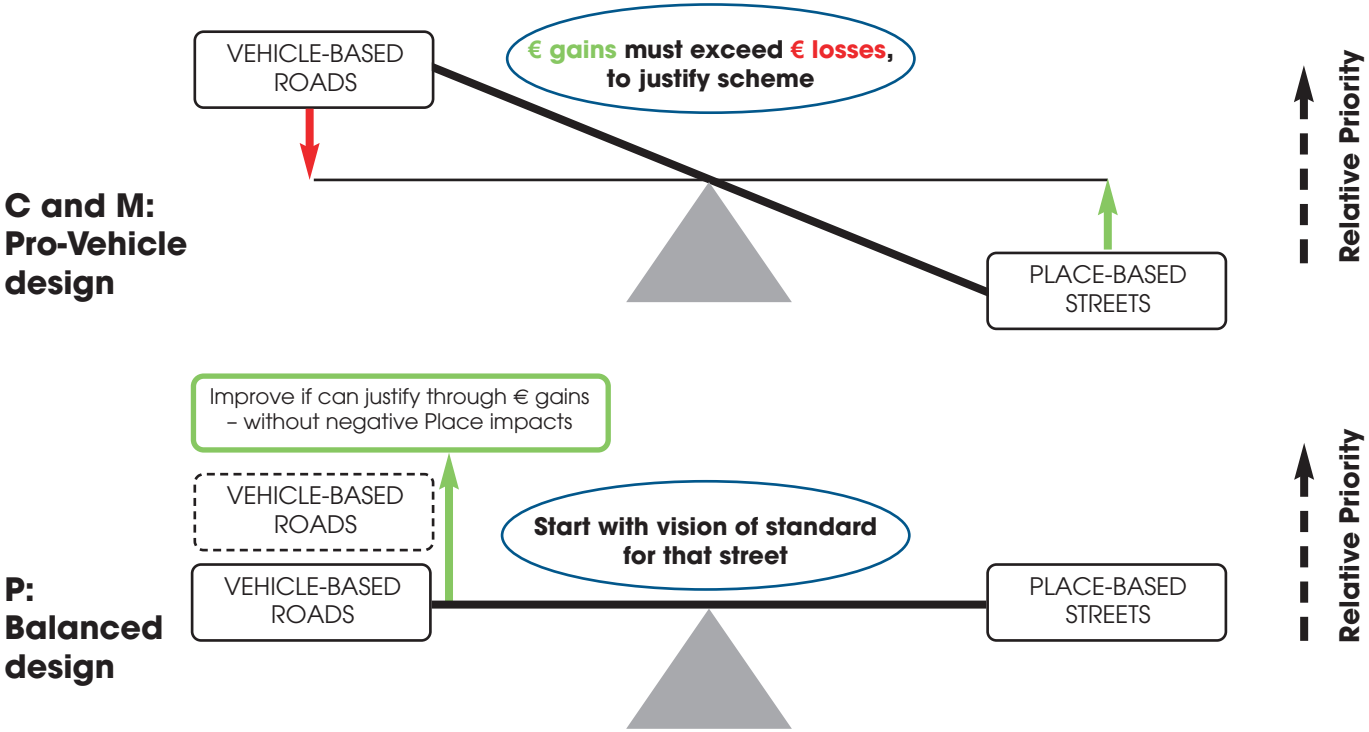
As a consequence, busier urban streets have been engineered to maximise Movement over Place (see page 15), resulting in a very 'un-level playing field', and unattractive street environments. Current applications of appraisal methods can make it difficult to redress this imbalance, as illustrated schematically in the upper figure below (page 55).

Conventional appraisal methods start from this very imbalanced situation, and require any proposals to improve Place conditions (P) to show that the benefits more than compensate for any losses to Movement. Current conditions (or a 'do minimum') form the basis for justifying change. As the valuation of Place benefits is in its infancy, this can be a very high hurdle to jump.

A more appropriate means of appraising schemes under a Place (P) policy perspective would be to start with the intended balance between Movement and Place and the appropriate design standard for that street type (see lower figure below). Appraisal might now be more focused on the most cost-effective way of delivering the intended outcome.

In many cases this would result in poorer conditions for Movement – correcting the historical imbalances – as is the case for the scheme illustrated on page 14. But, where a scheme could be designed that would increase Movement performance without any detriment to Place (e.g. through constructing a tunnel), then the conventional C-based valuations might be sufficient to justify such a scheme.

Changing application of appraisal when shifting from C (car-oriented) and M (sustainable mobility) to P (place-based) policies



Key recommendations for different groups

Recommendations for city politicians

- Broaden the debate about congestion:
  - Ensure it is carefully measured
  - Use wider indicators of urban mobility and city liveability
- Develop a wider city vision, in which sustainable transport plays a key role – this will encourage place-based thinking
- City shaping depends on a full integration of transport and land use planning, at the metropolitan level
- Foster cross-sector, multi-level governance, for more effective policy making and delivery
- For effective policy delivery, invest in institutional capacity: broader skills base, better enforcement, delivery capability, etc.
- Invest in enhanced data collection and data analytics, for a stronger evidence base
- Be bold: today's radical policy can become tomorrow's orthodoxy – but only with strong leadership
- Introduce trials and demonstrations – 'seeing is believing'
- Run awareness raising, marketing and behaviour change campaigns

Technical recommendations

- Ensure that key professional and technical groups are part of the planning and delivery teams
- Integrate transport and land use planning processes – and introduce policies as packages (e.g. reduce parking and road-space as metro line opens)
- Encourage stakeholder and citizen engagement, in policy development and delivery
- Give a higher priority to data collection and regular monitoring of system performance
- Make better use of data, to assess the scale of problems and to demonstrate impacts of schemes
- Measure key place-based indicators to assess the wider success of policies
- Use models to support strategy development which is designed to achieve the city vision
- Ensure that business cases reflect the full benefits of transport investment – not just the transport benefits – and take a balanced approach

List of key deliverables:

Deliverable No	Topic
D2.1	Urban congestion and network performance – a new understanding
D2.4	Stakeholder perspectives and needs assessment
D3.3	Quantitative analysis of travel trends: Western European cross-city comparisons
D3.4	Trends in traffic congestion: Western European cross-city comparisons
D4.3	Analysing historical transport policy developments: Western European cross-city comparisons
D4.5	Scope for accelerating urban mobility development processes in rapidly growing economies: cross-city comparisons
D5.2	Funding and financing sustainable mobility and liveability policies: are the current scheme appraisal procedures appropriate?
D5.3	CREATE guidelines: pathways to tackling congestion and reducing levels of car use in European cities
D6.2	Technological changes likely to affect cities and their transport systems
D6.4	How cities can work constructively in addressing the future – defining 'Stage 4'

Create Partners:

Particpant No	Participant Organisation Name	Country
(Coordinator)	University College London	UK
2	BOKU, Vienna, Institute for Transport Studies	Austria
3	EIP Bucharest	Romania
4	EUROCITIES ASBL	Belgium
5	Fondation Nationale des Sciences Politiques	France
6	IAU île-de-france	France
7	INRIX UK Ltd	UK
8	COWI	Denmark
9	Vectos UK	UK
10	City of Berlin	Germany
11	City of Copenhagen	Denmark
12	Transport for London	UK
13	Adana Metropolitan Municipality	Turkey
14	Greater Amman Municipality	Jordon
15	City of Bucharest	Romania
16	City of Skopje	Macedonia
17	City of Tallinn	Estonia
18	Technishe Universitaet Dresden	Germany

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