



JUNE 2015

# MOBILITY IN CITIES DATABASE

## SYNTHESIS REPORT

### INTRODUCTION

**After a period of erosion, public transport is on a growing trend again, particularly in developed economies, where urban sprawl tends to be slowing down. In developing and transition economies, urban mobility demand is pushed up by population and economic growth.<sup>1</sup> This puts public transport networks under pressure; furthermore the share of public transport tends to be declining in those cities, while car ownership is soaring. Overall, public transport growth is the strongest where efforts to increase its supply are matched by policies that manage private vehicle demand and increase urban density.**

This report provides information on the evolution of urban mobility patterns in the last 20 years, highlighting new trends and different trajectories for different groups of cities. In particular, it shows which policies underpin strong growth in the modal share of public transport and other sustainable modes. At the mid-term of the UITP strategy of doubling the market share of public transport by 2025, this report will provide support and inspiration to cities gearing themselves towards reaching this ambi-

### OVERALL URBAN MOBILITY TRENDS

#### URBAN DENSITY

In the second half of the twentieth century urban planning, particularly in developed countries, has focused on private cars as the primary means of transport for residents, leading to urban sprawl, characterised by a

tious objective. The report also highlights important relationships between the modal share of public transport and the characteristics of the urban transport system.

Data used in this report were collected for 60 metropolitan areas worldwide for the year 2012.<sup>2</sup> The database covers demography, the economy, urban structure, the number and use of private vehicles (including taxi), the road network, public transport networks (infrastructure and rolling stock, supply and demand, farebox revenue), and mobility patterns.

These data were compared to those collected for the years 1995 and 2001, in previous editions of the Mobility in Cities Database, when the same detailed definitions for data and metropolitan areas could be used.

The harmonisation of data between cities and through time was made difficult by the dispersion of sources, the diversity of methodologies, and the limited availability of data. Detailed common definitions were used to provide data of the best possible quality.

decrease in urban density and longer distances travelled. In the sampled cities within developed countries, this trend, which could be observed until the turn of the new millennium, appears to have been reversed. On average, density in developed cities dropped in 2001, compared with the 1995 figure, but has now increased again, the 2012 figure being on par with the corresponding 1995 value.

**Population density - Cities in developed countries**

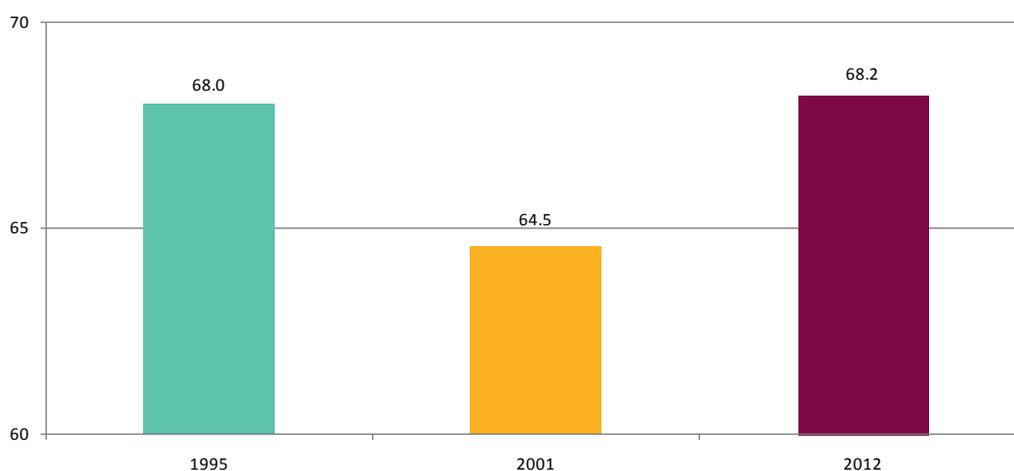


Fig. 1. Average urban density in developed cities – expressed in terms of inhabitants per urban hectare; 20 cities in sample.

<sup>1</sup> Cities in developed countries are those from OECD countries plus Hong Kong, Singapore and Dubai. The rest of the cities in the sample were grouped as ‘developing’.

<sup>2</sup> Larger cities are over-represented in the sample.

## URBAN DENSITY AND MODAL SPLIT

Urban residents' mobility choices are strongly linked with density. In denser areas there is a higher propensity to opt for modes other than private cars. The shorter trip distances associated with high density areas naturally lend themselves to more walking and cycling. Higher density areas also involve high concentration of activities, thereby allowing public transport to efficiently connect the locations where the origins or destinations of trips are concentrated.

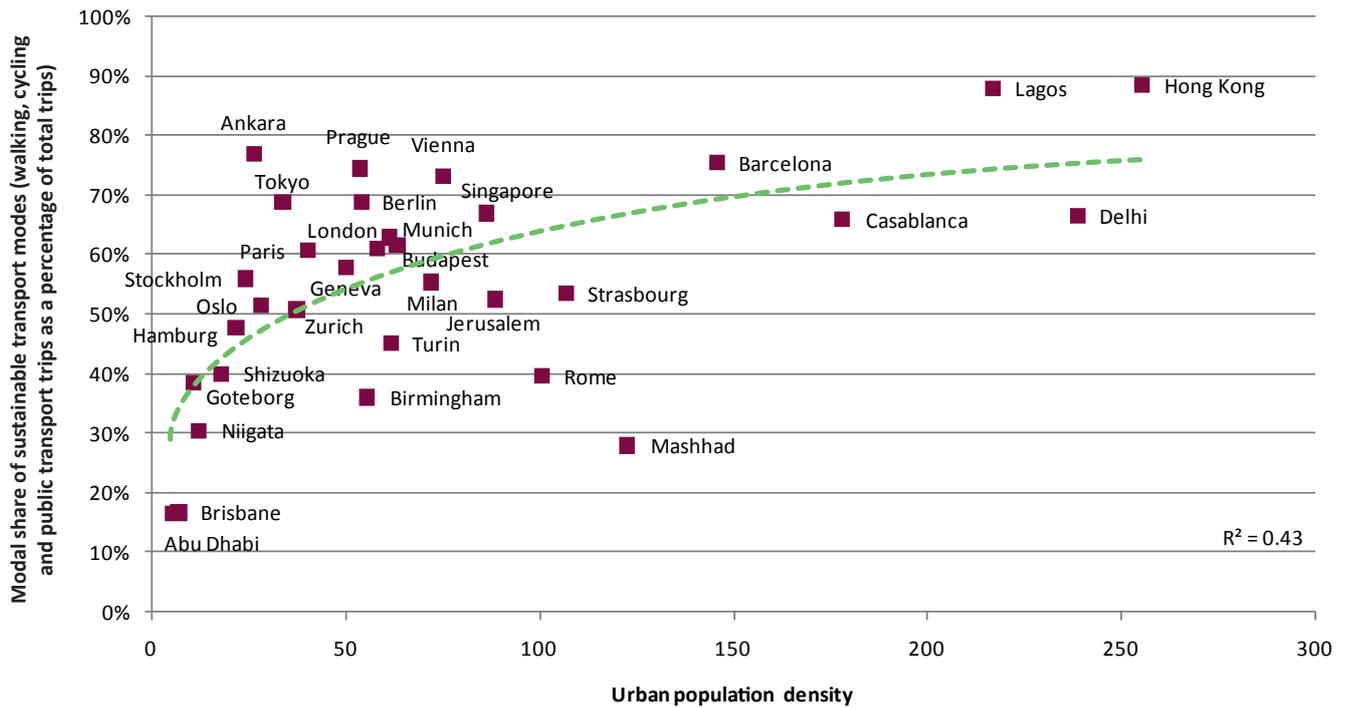


Fig. 2. Share of total daily trips undertaken by sustainable transport modes – walking, cycling and public transport – out of the total number of daily trips (vertical axis) explained by urban population density in metropolitan area (horizontal axis).

## MOTORISATION

The total number of cars owned by urban residents increased at a different pace around the world: in developed cities there was an average annual growth of 2.9% from 1995 to 2001 and only of 1.5% per year since 2001. In the developing cities considered, the total number of cars nearly quadrupled between 1995 and 2012 (at an annual growth rate of 8.3%) creating considerable pressure on urban transport infrastructure. While population increase plays a role in the growth in the number of cars, the comparison of motorisation rates shows different dynamics for cities in

developed and developing countries.

The rate of motorisation in developed cities has almost stopped growing between 2001 and 2012. Motorisation grew by an annual average of 2.3% between 1995 and 2001, while the annual average growth has been 0.5% after that. Cities in developing countries saw a strong increase in motorisation between 1995 and 2012 (4.6% average annual growth), but it must be said that developing cities still have a much lower motorisation rate.

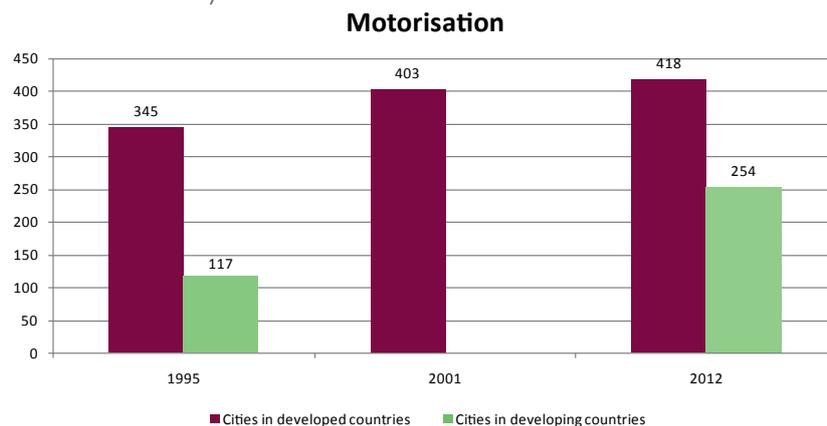


Fig. 3. Average rate of motorisation – expressed in registered cars per 1000 inhabitants – in 20 cities in developed countries and 5 cities in developing countries.

Furthermore, it is interesting to note a shift in the use of cars within cities in developed countries. Analysing data from city-wide mobility surveys, UITP calculated the average annual distance travelled in cars, whether as a driver or a passenger. The data refer to trips undertaken by residents within the area. Since 1995 we notice a consistent downward trend in distances travelled by private vehicles: the average distance travelled in cars

by each resident has decreased from 4,700 kilometres annually in 1995, to 4,400 in 2001 and 3,800 in 2012.

These developments would seem to suggest that the context is quite conducive to public transport growth in cities within developed economies, while being more challenging in those within developing economies.

## PUBLIC TRANSPORT SUPPLY

In developed cities, the total supply of public transport, expressed in vehicle x km, has increased by an average of 2.3% annually between 1995 and 2001 and by 1.2% per year since. In developing cities supply grew by an estimated 3.9% annually from 1995 to 2012 (see figure 4).

On average, the supply of public transport per urban resident has remained stable since 2001, at just over 100 vehicle x kilometres per inhabitant in cities within developed economies. Cities such as Beijing, Geneva, Madrid, Oslo, or London have increased supply at a higher rate than the population increase over the 2001-2012 period. Conversely, while

the total supply of public transport in Singapore increased significantly, by approximately 20%, it did not grow as fast as the population (+ 60%).

However, it must be noted that expressing public transport supply in terms of vehicle x kilometres, as done above, has the disadvantage of overlooking the replacement of older vehicles by newer ones of higher capacity. Analysing data on the number of place x kilometres provided by operators showed that cities such as Vienna, Geneva, Hong Kong, or Warsaw improved public transport supply in this way. On average, in the developed cities analysed supply expressed in place x kilometres increased at an annual rate of 1.8%, between 2001 and 2012, above the corresponding figure for vehicle x kilometres.

### Public transport supply in Vehicle x km

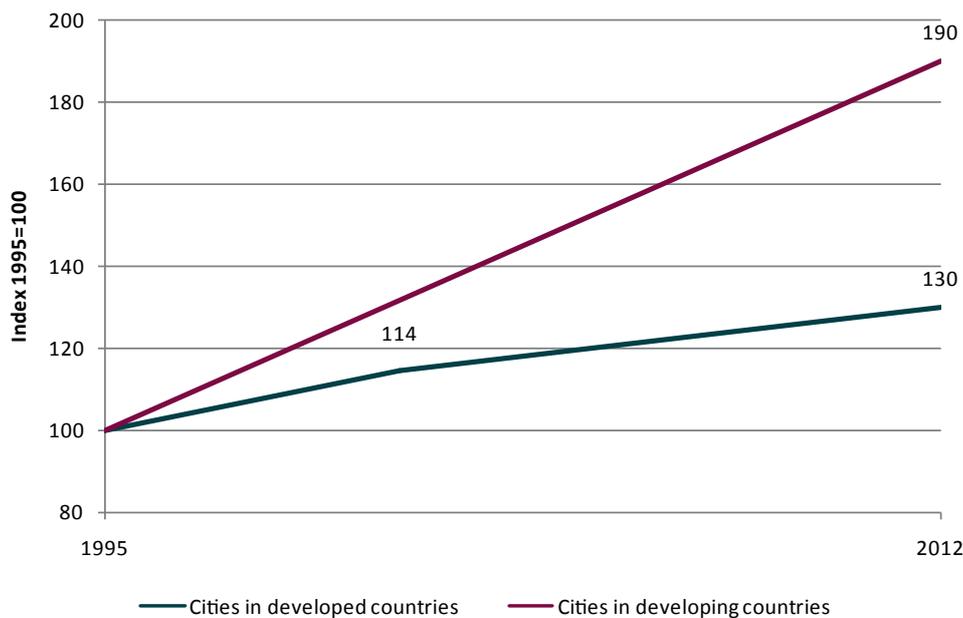


Fig. 4. Average evolution of public transport supply between 1995 and 2012 in 21 cities in developed countries and 4 cities in developing countries.

## PUBLIC TRANSPORT DEMAND

The total number of journeys<sup>3</sup> by public transport in developed cities has steadily increased at a rate of 1.5% per year up to 2001 and 1.6% per year afterwards. In developing cities, the corresponding average annual rate of growth in demand was 2.7%.

In cities in developed economies public transport demand per capita grew from an average of 395 trips per capita in 1995, to 414 in 2001 and it continued to grow afterwards, albeit at a slower pace, reaching an average of 419 journeys per inhabitant in 2012.

3 A public transport journey is defined as a boarding in a public transport vehicle.

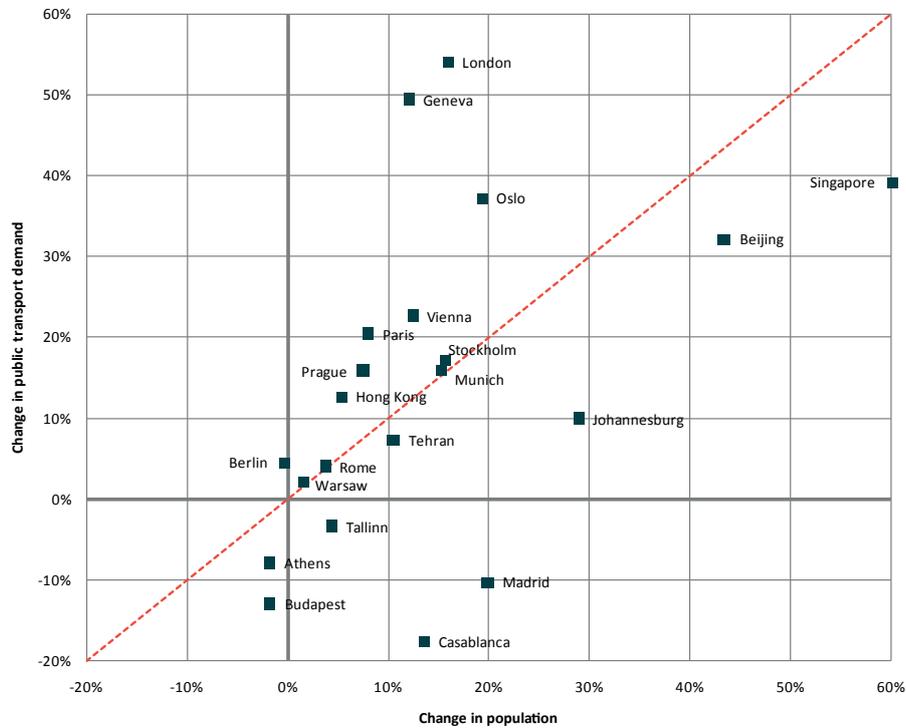


Fig. 5. Change in the number of metropolitan area residents between 2001 and 2012 (horizontal axis) and change in the number of total journeys undertaken by public transport between 2001 and 2012 (vertical axis). The dotted line shows equal changes in the two variables.

It is also expected that the number of journeys by public transport in a city varies with resident population. In the graph above the red line describes equal changes in public transport demand and resident population,

between 2001 and 2012. In cities plotted above the line, like Berlin, Hong Kong or Paris, the number of journeys by public transport increased at a faster pace than the resident population.

### MODAL SPLIT<sup>4</sup>

The share of public transport trips out of motorised and mechanised urban trips (referred in this document as the modal share of public transport) increased, on average, by about 20% between 2001 and 2012 in developed

cities. This is a reversal of the trend observed between 1995 and 2001, when the modal share of public transport had been slowly decreasing. By contrast, in developing cities, the modal share of public transport decreased, on average, by 33% between 1995 and 2012.

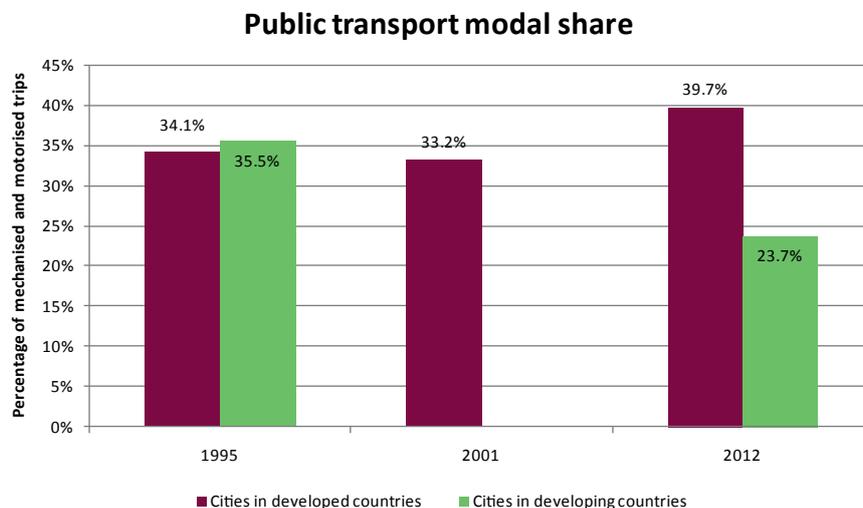


Fig. 6. Average public transport modal share in 2012 – calculated as the share of daily trips by public transport out of the total number of motorised and mechanised trips – in 16 cities in developed countries and 4 cities in developing countries.

<sup>4</sup> Mobility figures used by UITP consider each door-to-door movement as one trip. Each trip is assigned to a principal mode (walking, cycling, public transport, private motorised).

## MODAL CHOICE AND RELATIVE SPEED

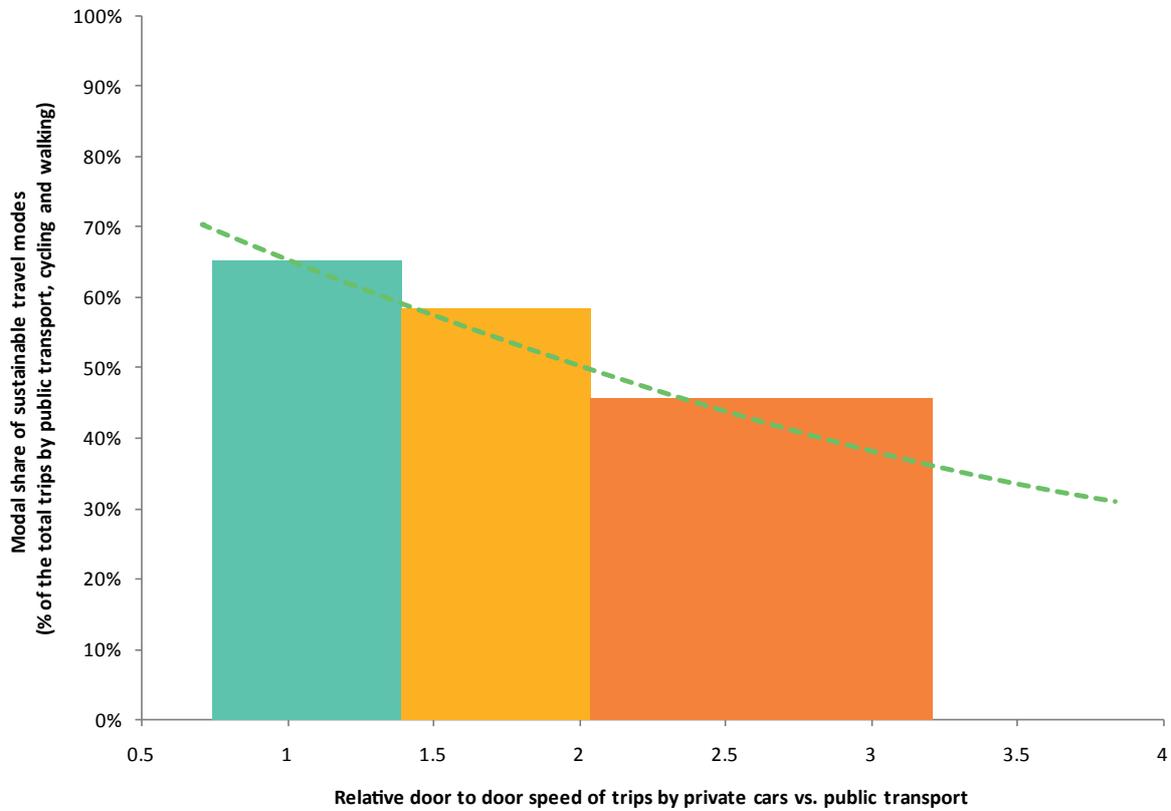


Fig. 7. Modal share of sustainable travel modes – calculated as the share of walking, cycling and public transport trips out of the total number of urban trips – as explained by the relative door-to-door speed of private cars and public transport.

Using data on the average lengths and durations of trips undertaken in metropolitan areas, UITP computed the average door-to-door speed of different transport modes, and investigated if the relative speed of the modes influences residents' modal choice. Door-to-door speed gives a more accurate representation of the traveller's experience as it also takes into account time spent while transferring on different public transport modes, as well as walking stages to or from the parking space or public stops. It is interesting to note that in five of the cities analysed the door-to-door speed of trips by public transport was better, or on par with that of trips by private car, while in an additional nine cities the ratio between door-to-door speeds is below 1.5. The graph suggests that when private and public motorised transport modes are comparable in terms of speed, urban residents are more likely to move away from private cars.

## EXPLORING URBAN MOBILITY TRAJECTORIES

The analysis of the database highlights different trajectories for different groups of cities. Each trajectory is associated with specific variations of urban density, motorisation, public transport supply - expressed in vehicle x km per inhabitant and distance travelled by private car - expressed in passenger x km per inhabitant. The description of these different trajectories sheds light on the adequate policy mix needed to reach the objective of increasing the modal share of public transport worldwide. Table 1 provides a synthesis of the groups of cities and their respective variations across the indicators considered.

## TRAJECTORY 1: ON TRACK FOR BETTER MOBILITY

In Vienna, Paris, London, Oslo, Prague and Geneva, the modal share of public transport increased by 20% or more between 2001 and 2012. In Vienna, following two decades of regular growth, the share of daily trips made by public transport reached 54% in 2012 – one of the highest in Europe. Another case in point is Prague, where a decline in public transport modal share was reversed.

Urban density increased in Vienna, London, Oslo and Prague between 1995 and 2012. The motorisation rate decreased in Vienna, London, Pa-



ris and Geneva between 2001 and 2012, marking a reversal of trend in all four cities. In London, Paris and Geneva, the motorisation rate was actually lower in 2012 than in 1995. For instance it fell to 307 cars per 1000 inhabitants in London. These cities implemented a range of traffic restriction measures in the past ten years (such as congestion charging in London or parking restrictions in Paris).

In this context, distances travelled by private car per person decreased by more than 30% in Vienna, Paris, London, Oslo, and Prague between 1995 and 2012.

Public transport supply (expressed in vehicle x km) per inhabitant increased in all six cities, including in those exhibiting strong population increases, such as London and Oslo. In these cities the volume of public transport supply increased by 37% between 1995 and 2012.

## TRAJECTORY 2: MAINTAINING THE STATUS QUO

In Berlin, Munich, Helsinki, and Barcelona, the modal share of public transport compared to that of private cars was broadly similar in 1995 and 2012, but the share of walking and cycling increased significantly. In Hamburg, Glasgow and Tokyo, the relative share of all modes was broadly similar in 1995 and 2012 – even though it fluctuated during this period.

The motorisation rate increased in all cities – except for Munich. Average distances travelled by private car per person increased everywhere, except for Tokyo. Tokyo reflects a general decrease in trip length as the population is growing faster in the central area - within 10 km of the city centre – than further out within the metropolitan area.

Public transport supply per inhabitant increased everywhere (except in Helsinki where its growth was not as fast as the population). This shows that the development of public transport supply alone may not be sufficient to increase the modal share of public transport, it must also be complemented by private vehicle demand management measures. Fur-

thermore, public transport must be integrated in urban planning and design policies aimed at maintaining urban density. Only by combining these measures in an integrated way can cities reap the full benefits of supply improvements.

## TRAJECTORY 3: UNDER PRESSURE

The modal share of public transport has decreased by 20% or more in Tehran, Casablanca, Johannesburg and Delhi between 1995 and 2012. It represents less than 30% of the trips in these cities, which are characterised by strong population growth and economic development.

In that economic context, motorisation is increasing very fast: it tripled in Delhi and quadrupled in Tehran between 1995 and 2012.

In these cities, the growth in public transport supply did not match the growth in population. Keeping the attractiveness of public transport thus requires massive investments.

## OTHER TRAJECTORIES

Quite a unique case, Hong Kong sees public transport having a dominant role (about 80% of trips in 2012). Public transport supply per inhabitant increased by more than 20% between 1995 and 2012.

In spite of a strong growth in motorisation (460 cars per 1000 inhabitants in 2012), the modal share of public transport in Dubai increased by 15% between 2001 and 2012, while public transport supply doubled during the same period.

The erosion of the modal share of public transport in Budapest (-40% between 1995 and 2012) is relatively typical of Eastern European cities. Public transport supply decreased by about 20% between 1995 and 2012 and motorisation is catching up with the level of other similar European cities.

Table 1: Summary of developments in selected cities across five indicators between 1995 and 2012: public transport modal share, urban density, motorisation rate, passenger x kilometres travelled by private cars per capita and public transport supply per capita.

City	Public transport modal share	Urban density	Motorisation rate	Passenger x km per inhabitant in private cars	Vehicle x km per inhabitant by public transport
<b>On track for better mobility</b>					
Vienna	Green	Green	Yellow	Orange	Green
Paris	Green	Yellow	Yellow	Orange	Green
London	Green	Yellow	Yellow	Orange	Green
Oslo	Green	Green	Green	Orange	Yellow
Prague	Green	Green	Grey	Orange	Green
Geneva	Green	Yellow	Yellow	Yellow	Green
<b>Maintaining the status quo</b>					
Barcelona	Green	Grey	Yellow	Yellow	Green
Berlin	Yellow	Yellow	Yellow	Yellow	Green
Munich	Yellow	Green	Yellow	Green	Green
Helsinki	Yellow	Grey	Green	Yellow	Yellow
Hamburg	Yellow	Yellow	Yellow	Yellow	Green
Glasgow	Yellow	Grey	Green	Grey	Orange
Tokyo	Yellow	Grey	Yellow	Orange	Yellow
<b>Under pressure</b>					
Tehran	Orange	Grey	Green	Green	Orange
Casablanca	Orange	Green	Green	Grey	Orange
Delhi	Orange	Green	Green	Orange	Grey
<b>Other trajectories</b>					
Hong Kong	Green	Orange	Green	Orange	Green
Budapest	Orange	Green	Green	Green	Yellow
Singapore	Green	Yellow	Yellow	Orange	Orange
Dubai	Green	Grey	Green	Orange	Green

The colours in each cell represent the evolution over the studied period according to the following scale:

- Growth above 10%
- Relative stability: the variation is between -10% and +10%
- Decrease by 10% or more
- Data not available, or not verified at the time of publication

## PUBLIC TRANSPORT AND USE OF URBAN SPACE FOR MOBILITY

It has been demonstrated that public transport enables a more efficient use of urban road space. Additionally, the graph below shows the relationship between public transport modal share and functional use of urbanised land within metropolitan areas. There is a negative relation between the two, as illustrated in the chart above: when public transport is more widely used – i.e. a higher modal share of trips – the percentage of the urban space serving the transport function is lower. Given that land is one of the scarcest resources in cities, aiming for a higher use of public transport could bring the added benefits of allowing urbanised space to serve other functions, which can in turn improve the liveability, or productivity of the metropolitan area.

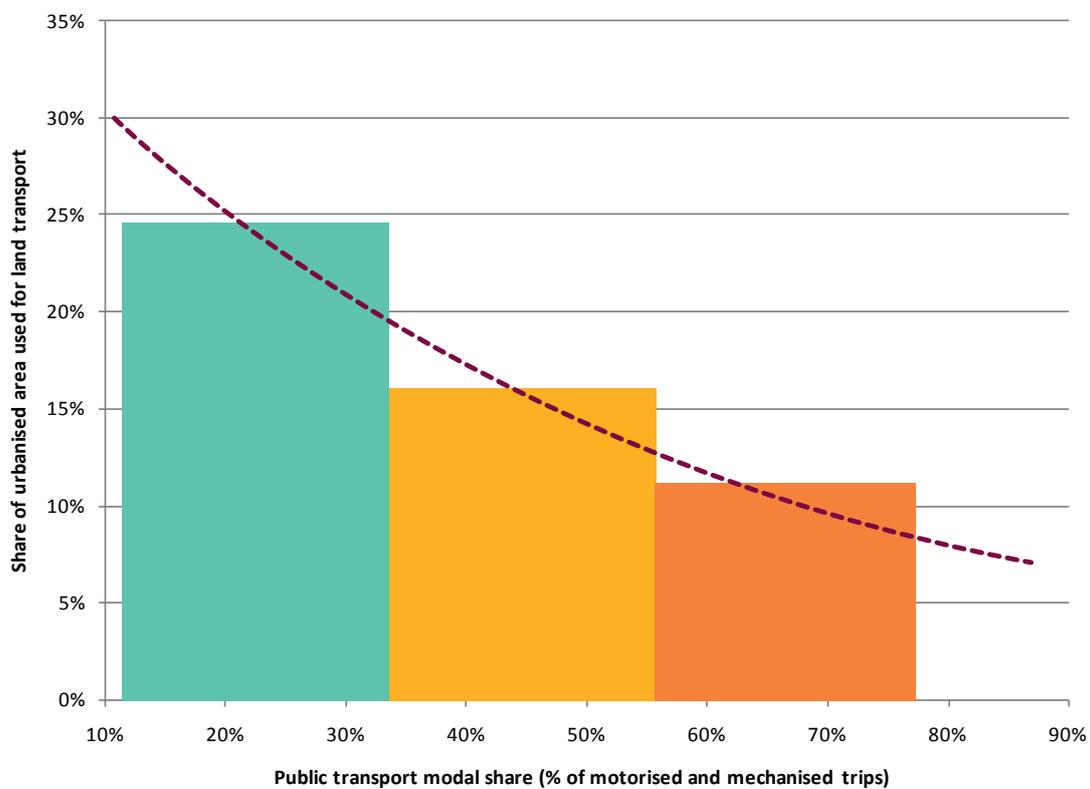


Fig. 8. The share of the urbanised area used for transport – calculated as the ratio between the urban surface used for land transport and the total urbanised surface – explained by the modal share of public transport – calculated as the share of trips undertaken by public transport out of the number of daily motorised and mechanised trips.

## CONCLUSION

The modal share of public transport is growing in cities which demonstrated a long term commitment not only to improving public transport supply, but also to managing demand for individual mobility and controlling urban sprawl.

Data presented in this report shows that reaching the objective of doubling the market share of public transport by 2025 would require increased efforts in terms of public transport supply improvements, private

vehicle demand management and integrated urban planning policies. This study also highlighted the need to improve the availability and comparability of urban transport data, and to develop new methodologies to better describe new mobility habits and intermodal travel.

The data gathered and quoted throughout this synthesis report will be released in electronic format.

**UITP wishes to thank its member organisations and contacts worldwide for their continuous support during this exercise.**

This is a publication of the International Association of Public Transport. UITP has over 1,400 member companies in 96 countries throughout the world and represents the interests of key players in this sector. Its membership includes transport authorities, operators, both private and public, in all modes of collective passenger transport, and the industry. UITP addresses the economic, technical, organisation and management aspects of passenger transport, as well as the development of policy for mobility and public transport world-wide.

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