

ABRIDGED EDITION



PLANNING AND DESIGN FOR SUSTAINABLE URBAN MOBILITY: POLICY DIRECTIONS

GLOBAL REPORT ON HUMAN SETTLEMENTS 2013



UN HABITAT
FOR A BETTER URBAN FUTURE

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SUSTAINABLE URBAN MOBILITY:
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SETTLEMENTS 2013

Abridged Edition

United Nations Human Settlements Programme

UN  HABITAT

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CONTENTS

Introduction	iv
Acknowledgements	vii
1 The Urban Mobility Challenge	1
2 The State of Urban Passenger Transport	6
3 Metro, Light Rail and BRT	13
4 Urban Goods Transport	20
5 Mobility and Urban Form	27
6 Equitable Access to Urban Mobility	36
7 Urban Mobility and the Environment	42
8 The Economics and Financing of Urban Mobility	48
9 Institutions and Governance for Urban Mobility	54
10 Toward Sustainable Urban Mobility	59
Selected References	65

INTRODUCTION

Urban transport systems worldwide are faced by a multitude of challenges. In most cities, the economic dimensions of such challenges tend to receive most attention. The traffic gridlocks experienced on city roads and highways have been the basis for the development of most urban transportation strategies and policies. The solution prescribed in most of these has been to build more infrastructures for cars, with a limited number of cities improving public transport systems in a sustainable manner.

However, the transportation sector is also responsible for a number of other challenges that do not necessarily get solved by the construction of new infrastructure. It is, for example, responsible for a large proportion of the greenhouse gas emissions that lead to climate change. Furthermore, road traffic accidents are among the main causes of premature deaths in most countries and cities. Likewise, the health effects of noise and air pollution caused by motorized vehicles are a major cause for concern. In some cities, the physical separation of residential areas from places of employment, markets, schools and health services force many urban residents to spend increasing amounts of time, and as much as a third (and sometimes even more) of their income, on public transport.

While those among the urban populace that have access to a private car, or can afford to make regular use of public transport, see traffic jams and congestion as a major concern; this is a marginal issue for people living in 'transport poverty'. Their only affordable option for urban transportation is their own feet. Persons with low household incomes – but also others, including many women, and vulnerable groups such as the young, the elderly, the disabled, and ethnic and other minorities – form the bulk of those characterized as living in transport poverty.

Thus, when the Secretary-General of the United Nations launched his 'Five-year action agenda' in January 2012, he identified sustainable transportation as one of the major building blocks of sustainable development. In particular, he stressed the need for urgent action to develop more sustainable urban 'transport systems that can address rising congestion and pollution'. He noted that action was required by a range of actors, including 'aviation, marine, ferry, rail, road and urban public transport providers, along with Governments and investors'.

Planning and Design for Sustainable Urban Mobility: Global Report on Human Settlements 2013 seeks to highlight the transportation challenges experienced in cities all over the world, and identifies examples of good practice from specific cities of how to address such challenges. The report also provides recommendations on how national, provincial and local governments and other stakeholders can develop more sustainable urban futures through improved planning and design of urban transport systems.

The report argues that the development of sustainable urban transport systems requires a conceptual leap. The purpose of 'transportation' and 'mobility' is to gain access to destinations, activities, services and goods. Thus, **access** is the ultimate objective of all transportation (save a small portion of recreational mobility). The construction of more roads for low-income cities and countries is paramount to create the conditions to design effective transport solutions. However, urban planning and design for these cities and others in the medium and high income brackets is crucial to reduce distances and increase accessibility to enhancing sustainable urban transport solutions. If city residents can achieve access without having to travel at all (for instance through telecommuting), through more efficient travel (online shopping or car-sharing), or by

travelling shorter distances, this will contribute to reducing some of the challenges currently posed by urban transport. Thus, urban planning and design should focus on how to bring people and places together, by creating cities that focus on accessibility, rather than simply increasing the length of urban transport infrastructure or increasing the movement of people or goods.

The issue of urban form and functionality of the city is therefore a major focus of this report. Not only should urban planning focus on increased population densities; cities should also encourage the development of mixed-use areas. This implies a shift away from strict zoning regulations that have led to a physical separation of activities and functions, and thus an increased need for travel. Instead, cities should be built around the concept of ‘streets’, which can serve as the focus for building liveable communities. Cities should therefore encourage mixed land-use, both in terms of functions (i.e. residential, commercial, manufacturing, service functions and recreational) and in terms of social composition (i.e. with neighbourhoods containing a mixture of different income and social groups).

Such developments also have the potential to make better use of existing transport infrastructure. Most of today’s cities have been built as ‘zoned’ cities, which tends to make rather inefficient use of their infrastructure; as ‘everyone’ is travelling in the same direction at the same time. In such cities, each morning is characterized by (often severe) traffic jams on roads and congestion on public transport services leading from residential areas to places of work. At the same time, however, the roads, buses and trains going in the opposite direction are empty. In the afternoon the situation is the opposite. Thus, the infrastructure in such cities is operating at half capacity only, despite congestion. In contrast, in cities characterized by ‘mixed land-use’ (such as Stockholm, Sweden), traffic flows are multidirectional – thus making more efficient use of the infrastructure – as residential areas and places of work are more evenly distributed across the urban landscape.

Furthermore, the report argues with strong empirical information that increased sustainability of urban passenger transport systems can be achieved through modal shifts – by increasing the modal share of public transport and non-motorized transport modes (walking and bicycling), and by reducing private motorized transport. Again, an enhanced focus on urban planning and design is required, to ensure that cities are built to encourage environmentally sustainable transportation modes. While encouraging a shift to non-motorized transport modes, however, the report acknowledges that such modes are best suited for local travel and that motorized transport (in particular public transport) has an important role while travelling longer distances. However, in many (if not most) countries there is a considerable stigma against public transport. The private car is often seen as the most desirable travel option. There is thus a need to enhance the **acceptability** of public transport systems. More needs to be done to increase reliability and efficiency of public transport services and to make these services more secure and safe.

The report also notes that most trips involve a combination of several modes of transport. Thus, modal integration is stressed as a major component of any urban mobility strategy. For example, the construction of a high-capacity public transport system needs to be integrated with other forms of public transport, as well as with other modes. Such integration with various ‘feeder services’ is crucial to ensure that metros, light rail and bus rapid transit (BRT) systems can fully utilize their potential as a ‘high-capacity’ public transport modes. It is therefore essential that planners take into account how users (or goods) travel the ‘last (or first) mile’ of any trip. By way of an example, it is not much use to live ‘within walking distance’ of a metro (or BRT) station, if this implies crossing a busy eight-lane highway without a pedestrian crossing, or if one is unable to walk to the station (due to disability, or lack of personal security). Likewise, it is unlikely that urban residents will make use of metros (and BRTs), if the nearest station is located beyond walking distance, and there is no public transport ‘feeder’ services providing access to these stations or no secure parking options for private vehicles near the stations.

Yet, it is important to note that considerable investments are still required in urban transportation infrastructure in most cities, and particularly in developing countries. City authorities should ensure that such investments are made where they are most needed. They should also make sure that they are commensurate with their financial, institutional and technical capacities. In many cities of developing countries, large proportions of the population cannot afford to pay the fare required to use public transport, or to buy a bicycle. Others

may find these modes of transport affordable, but choose not to use them as they find the safety and security of public transport to be inadequate (due to sexual harassment or other forms of criminal behaviour), and/or the roads to be unsafe for bicycle use or walking (due to lack of appropriate infrastructure). Investment in infrastructure for non-motorized transport or affordable (and acceptable) public transport systems is a more equitable (and sustainable) use of scarce funds.

However, many cities and metropolitan areas, all around the world, experience considerable institutional, regulatory and governance problems when trying to address urban mobility challenges. In many cases national, regional and local institutions may be missing or their responsibilities may be overlapping, and even in conflict with each other. To address such concerns, the report notes that it is essential that all stakeholders in urban transport – including all levels of government, transport providers and operators, the private sector, and civil society (including transport users) – are engaged in the governance and development of urban mobility systems.

To ensure effective integration of transportation and urban development policies, it is essential that urban transportation and land-use policies are fully integrated. Such integration is required at all geographic scales. At the micro level, much is to be gained from advancing the model of ‘complete streets’; an acknowledgement that streets serve numerous purposes, not just moving cars and trucks. At the macro level, there is considerable scope for cross-subsidies between different parts of the urban mobility system, including through value-capture mechanisms which ensure that increased land and property values (generated by the development of high-capacity public transport systems) benefits the city at large, and the wider metropolitan region, rather than private sector actors alone.

Planning and Design for Sustainable Urban Mobility: Global Report on Human Settlements 2013 is released at a time when the challenges of urban transportation demands are greater than ever. This is particularly the case in developing countries where populations (and the number of motorized vehicles) are growing at rates where urban infrastructure investments are unable to keep pace. I believe this report will serve as a starting point to guide local authorities and other stakeholders to address the challenges faced by urban transportation systems all over the world. The report provides some thought-provoking insights on how to build the cities of the future in such a manner that the ultimate goal of urban transport – namely enhanced access to destinations, activities, services and goods – takes precedence over ever-increasing calls for increased urban mobility.



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- I The HS-Net Advisory Board consists of experienced researchers in the human settlements field, selected to represent the various geographical regions of the world. The primary role of the Advisory Board is to advise UN-Habitat on the substantive content and organization of the *Global Report on Human Settlements*.

THE URBAN MOBILITY CHALLENGE

Mobility flows are a key dynamic of urbanization, with the associated infrastructure invariably constituting the backbone of urban form. Yet, despite the increasing level of urban mobility worldwide, many of the world's cities face unprecedented challenges to urban mobility systems, particularly in developing countries.

This report examines the state of urban mobility in different parts of the world in light of these challenges. It explores the linkages between urban form and mobility systems, with a view to determining the essential conditions for promoting the sustainable movement of people and goods in urban settings.

ACCESSIBILITY IS AT THE CORE OF URBAN MOBILITY

A major point of departure for this report is that the prevailing challenges of urban mobility are consequences of the preoccupation with the means of mobility rather than its end – which is the **realization of accessibility**. It urges urban planners and decision-makers to move away from a 'transport bias' in urban mobility planning, towards a focus on the human right to equitable access to opportunities. Thus, the report calls for a paradigm shift in transport policy, emphasizing the need to reduce the global preoccupation with mobility enhancement and infrastructure expansion.

The accessibility focus for sustainable mobility also entails paying due consideration to the built form of the city, particularly the optimization of urban density and the fostering of a sense of place. Further, it enhances economies of agglomeration, and encourages non-motorized mobility. The backbone of accessibility-based urban mobility is public transport, particularly well-integrated high-capacity public transport systems.

THE TRANSPORT BIAS OF MOBILITY

Globally, the transport bias of urban mobility is demonstrated by the dominance of motorization, particularly private cars as the preferred means of mobility. In 2005, nearly half of all urban trips were made by private motorized modes, primarily due to the meteoric increase in the number of motor vehicles. By 2035, the number of light-duty motor vehicles – cars, SUVs, light trucks and mini-vans – is projected to reach nearly 1.6 billion (see Figure 1). Moreover, a redistribution of the 'global travel pie' is unfolding as developing countries are responsible for this increase.

The high rates of car ownership have been favoured by heavy investments in road infrastructure, sprawling urban forms and increased per capita incomes. Consequently, global motorization has led to increased energy use and carbon emissions worldwide. Rapid motorization is further compounded

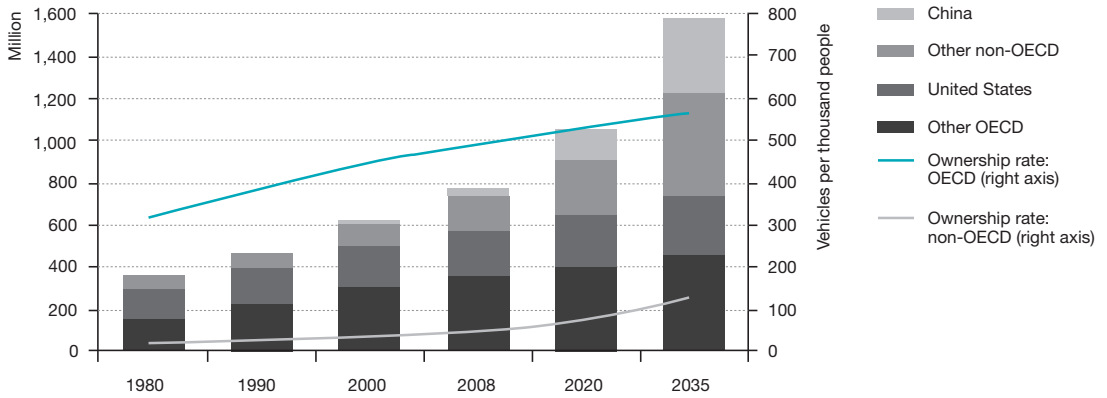


Figure 1
Passenger light-duty vehicle fleet and ownership rates by region (1980–2035)

Source: IEA, 2010.



Residents in many cities all around the world have to cope with inadequate transport infrastructure (Kathmandu, Nepal)

Source: © Hung Chung Chih / Shutterstock



Multi-lane freeways, flyovers and tunnels encourage private motorization, urban sprawl and fragmentation of the urban fabric (Oakland, California, US)

Source: © Mark Downey / Alamy

by expanding globalization, rising trade flows and incomes, leading to an enhanced demand for personal mobility. A number of other factors – such as economic policies that maintain fuel subsidies and planning practices that incentivize suburban residential developments, large malls and retail centres with extensive parking – also play a role in increasing motorization.

The fragmentation and sectoralization of the management of urban development in many parts of the world is also reinforcing the dominance of the traditional ‘transport bias’ in urban mobility systems. The poor linkage between land-use planning and transport planning has encouraged the tendency towards increased transport investments.

TRENDS AND CONDITIONS IN TRANSPORT-ORIENTED MOBILITY SYSTEMS

The role of **public transport** in cities varies widely, accounting for 45 per cent of urban trips in some cities of Eastern Europe and Asia, 10–20 per cent in much of Western Europe and Latin America, and less than 5 per cent in North America and Sub-Saharan Africa. In most of Sub-Saharan Africa, and poorer parts of South and South-Eastern Asia, government-sponsored public transport services are either inadequate or non-existent. Despite growing concerns over energy supplies, climate change and access for the poor, public transport’s modal share of trips is expected to decline over the next decade in all world regions.

Worldwide, the **informal transport sector** provides much-needed (and much-valued) mobility, particularly for the poor. The lack of affordable and

accessible public transport systems in developing countries has led to the proliferation of informal operators, such as private microbus and minibus services. In some settings, informal carriers are the only forms of public transport available.

Non-motorized transportation is often the dominant mode of urban mobility when public transport services are poor and incomes are low. In 2005, about 37 per cent of urban trips worldwide were made by foot or bicycle, the two major modes of urban non-motorized transport. In African cities, walking accounts for 30–35 per cent of all trips while in South Asia's densest, most congested cities, more than half of all passenger and goods trips are by foot, bicycle or rickshaw. Evidence suggests that non-motorized transport is an important component in poorer and smaller cities, capturing as much as 90 per cent of all person-trips.

Traffic congestion is an undesirable by-product of widespread mobility in cities worldwide, and a

major factor in restricting access in cities. It has extensive impacts on the urban quality of life, consumption of fossil fuels, air pollution, and economic growth and prosperity. Studies from the 1990s estimated that traffic congestion lowered the gross domestic product of cities by some 3–6 per cent.

SUSTAINABILITY CHALLENGES OF URBAN MOBILITY

A sustainable urban mobility system is one that satisfies current mobility needs of cities without compromising the ability of future generations to meet their own needs. Neglecting **the connection between land-use and mobility** has created the urban sprawl evidenced in most cities today. Differences in the urban form – emerging either from



Motorized vehicles are a major contributor to air and noise pollution, as well as emissions that cause climate change (Kano, Nigeria)

Source: © Danita Delimont / Alamy

a haphazard process of locating settlements and activities, or from strategically planned intervention – can create big differences in mobility systems. Key considerations include the pattern of street arrangement, the length of blocks, and the relationship of buildings to pathways, stations and central places.

Urban transport is **socially sustainable** when mobility benefits are equally and fairly distributed, with few if any inequalities in access to transport infrastructure and services based on income, social and physical differences. Social sustainability is rooted in the principle of accessibility, wherein equality exists among all groups in terms of access to basic goods, services and activities, and to enable people to participate in civic life.

Many of the **environmental challenges** in the urban transport sector are rooted in its reliance on non-renewable fossil fuels. Increasing greenhouse gas emissions and global temperatures underscore the urgency of weaning the transport sector from its dependency on oil and automobility. The urban transport sector is also a major source of air and noise pollution, with serious public health impacts.

The urban transport sector is **economically sustainable** when resources are efficiently used and distributed, maximizing the benefits and minimizing the external costs of mobility. Urban transport infrastructure is expensive. Accordingly, crafting reliable and equitable funding programmes for transport infrastructure that reward efficient and sustainable behaviour remains a challenge. Public transport systems face serious fiscal challenges as, almost universally, they rely on public subsidies.

Translating visions and plans for sustainable urban mobility depends on the presence of supportive

and nurturing **governance**, including sound institutional and regulatory structures. The lack of adequate institutional capacity – whether in the form of a trained and educated civil-service talent pool, or a transparent and largely corruption-free procurement process for providing transport infrastructure and services – poses immense challenges in advancing sustainable urban transport. Institutional fragmentation undermines the ability to coordinate urban transportation services. In addition, bloated bureaucracies are notorious for waste and delays in the deployment of urban transport projects. Lack of capacity for strategic planning and coordination is another major problem worldwide.

ORGANIZATION OF THE REPORT

This report is organized as follows:

- Chapters 2, 3, and 4 review global conditions and trends in passenger and goods transport.
- Chapter 5 looks at the linkages between urban form and mobility.
- Chapters 6, 7, 8, and 9 describe policy responses to the urban mobility crisis by focusing on the social, environmental, economic and institutional dimensions of sustainability.
- Chapter 10 summarizes the key findings of the report, focusing on broad practices, policy, and strategy recommendations aimed at sustainable urban mobility.

THE STATE OF URBAN PASSENGER TRANSPORT

Urban transport trends and conditions indicate that cities remain inaccessible for many urban residents in spatial/physical or socio-economic terms. This chapter provides an overview of the state of urban passenger transport globally, focusing on four key modes of transport: non-motorized transport, formal public transport, informal (motorized) transport and private motorized transport.

NON-MOTORIZED TRANSPORT

Non-motorized transport, and particularly walking, is the principal means of transportation in most cities of developing countries (see Figure 2). This is largely

not by choice, but rather driven by the lack of affordable and accessible alternatives, with most pedestrians belonging to lower income groups.

Cycling caters for the mobility needs of numerous urban dwellers in the cities of developing countries, especially in Asia. Recently, however, there has been a decline in cycling in some Asian cities, due to rising incomes and concomitant motorization, including changing social perceptions, which tend to view cycling as a means of transport for the poor.

Bicycle ownership is high in developed countries, particularly in Western European countries such as the Netherlands, Denmark and Germany. This has been attributed to the transport and land-use policies introduced since the mid-1970s in these countries in favour of non-motorized and public transport facilities.

User benefits:	Increased user convenience, comfort, safety, accessibility and enjoyment as well as savings from reduced vehicle ownership and use.
Equity objectives:	Benefits economically, socially or physically disadvantaged people.
Congestion reduction:	Reduced traffic congestion from private cars on congested roadways.
Roadway and parking cost savings:	Reduced roadway and parking construction, maintenance and operating costs.
Energy conservation:	Economic and environmental benefits from reduced energy consumption.
Pollution reduction:	Economic and environmental benefits from reduced air, noise and water pollution.
Land-use impacts:	Encourages more accessible, compact, mixed, infill development (smart growth).
Improved productivity:	Increased economic productivity by improving accessibility and reducing costs.

Source: Adapted from Litman, 2013.

Table 1

Non-motorized transport benefits

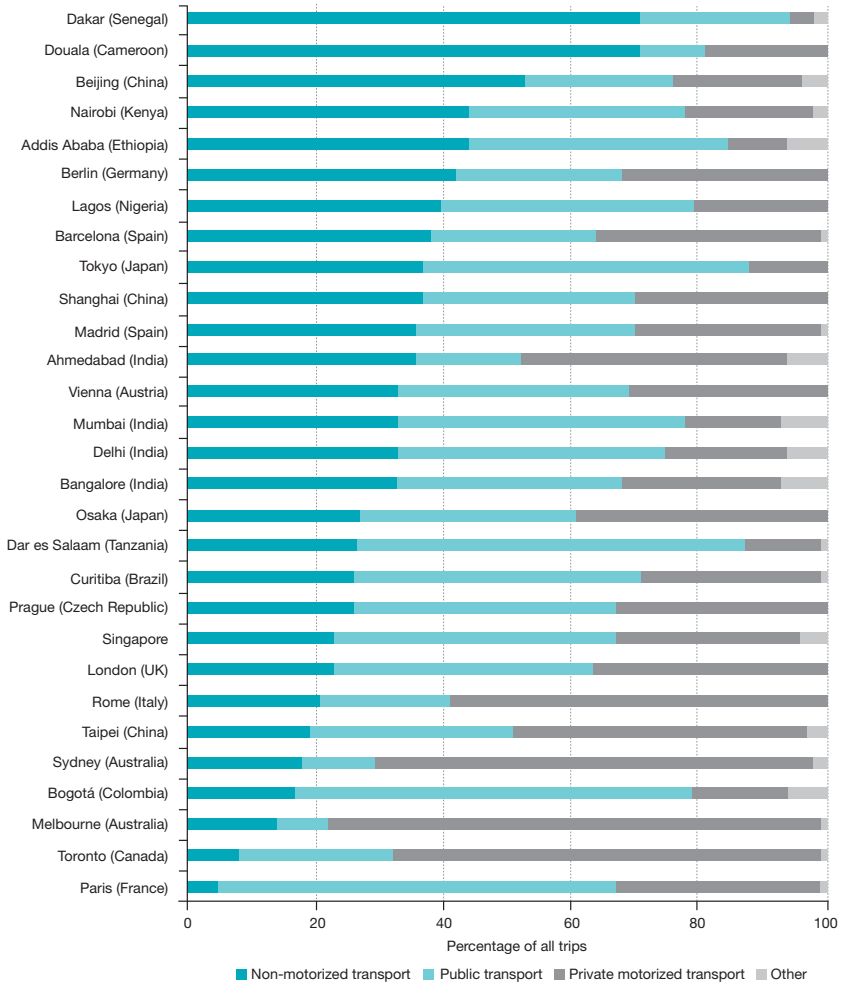


Figure 2
Urban travel modal shares in selected cities

Most cities of developing countries have poor quality infrastructure for non-motorized transport. Poor lighting, absence of footpaths and overcrowding make walking unsafe in these countries. Public expenditures tend to focus on provision of infrastructure for the small minority that can afford to own a private car, in effect subsidizing the wealthiest road users.

In developed countries, pedestrian infrastructure has rapidly improved in recent decades, with a number of Western European cities investing heavily in pedestrian areas and dedicated lanes. In contrast,

investments to improve infrastructure for walking and cycling in the US have been limited.

A major advantage of non-motorized transport is that it reduces energy consumption, greenhouse gas emissions and pollution, as it does not rely on fossil fuels (see Table 1). Furthermore, such transport modes require significantly less road and parking space, and enable the preservation of natural habitats and open spaces. Cycling and walking can also directly provide the daily physical activity required for a healthy life style.

FORMAL PUBLIC TRANSPORT

The modal share of public transport has decreased or stagnated in most cities of developing countries, and few efficient formal public transport systems remain. Typically, public transport is operated by a growing number of entrepreneurial individuals or small/medium-sized companies, but with low investment and minimal public support. Public transport in these cities has been characterized by weak regulation, scarcity of supply, poor quality, and the predominance of informal sector operators.

Some encouraging trends have, however, been observed. In Africa, bus rapid transit (BRT) systems have been introduced in Lagos and Johannesburg, generating substantial benefits for residents. Also notable are China's growing investments in metro and BRT systems, servicing millions of passengers in urban areas. A growing number of urban BRT systems

in Brazil, Chile, Ecuador, Peru and Venezuela have also expanded public transport services significantly.

In developed countries, most cities are maintaining or increasing the market share of formal public transport. In North America and Western Europe, the annual number of public transport passengers has been increasing since the 1960s and 1970s, despite rising car ownership and suburban sprawl. In terms of the regulatory aspects of public transport provision, since the 1980s there has been a shift from publicly owned provision to a privately-owned market-driven approach.

Globally, there has been a lack of adequate investment in public transport. In most developing countries, urban public transport infrastructure is far from adequate and in poor condition. Also, previously subsidized public transport services have been scaled back or discontinued amidst policies of liberalization and economic reform in some developing countries. The provision of public transport infrastructure is comparatively better in cities in some key emerging



Rail-based transportation systems carry significant numbers of poor people, particularly in large cities (Mumbai, India)

Source: © dbimages / Alamy



Walking accounts for the largest proportion of trips taken, although not of distance travelled, in most societies, rich or poor (Nairobi, Kenya)

Source: © John Warburton-Lee Photography / Alamy

markets, such as South Africa and Brazil. In contrast, many cities of developed countries have seen investment and improving services, increasingly through public-private partnerships.

The value of expanding public transport services to enhance accessible mobility in cities is unquestionable. The economic benefits of public transport investment include both direct job creation and indirect support of manufacturing, construction and other economic activities. Furthermore, public transport moves more people with fewer vehicles, less energy, and less space consumption. In social terms, access to jobs, education, health services and other facilities – all of which are central to social inclusion – is increased by public transport provision.

Projections of future population growth and motorization amidst a lack of road capacity, suggest that if public transport does not double its modal share, many cities may well grind to a halt. Urban planning and land-use policies – together with

transport demand and fiscal measures – can encourage a shift in transport behaviour towards public transport. However, investments in public transport should focus on the qualitative factors of these modes – such as convenience, comfort, security, safety and prestige – as these are valued more highly than is assumed by a conventional focus on quantitative factors such as speed and price.

INFORMAL TRANSPORT

Informal transport is firmly entrenched in the cities of developing countries, often accounting for over half of all motorized trips. In Africa, private carriers dominate, mainly minibuses and shared taxis with schedules and fares varying with demand, routes being semi-fixed and stopping points unregulated. The lower investments required from operators of

informal transport services are a key incentive for entry into this sector. Informal transport is a predominant mode in most of Latin America, with the proliferation of vans and minibuses encouraged by a lowering of import tariffs and the inability of public transport to meet transport demand. Because of rapid motorization, however, informal carriers are increasingly viewed as major contributors to worsening traffic congestion.

Generally, the role of informal transport appears to decline as cities in developing countries become wealthier. This inverse relationship between wealth and informal transport often prompts public authorities to ban the latter in the hope of conveying a modern image. Many cities in developed countries also have informal transport services often as niche markets for immigrants from countries with a legacy of informal transport.

Informal transport offers distinct service advantages, and in most developing countries – where formal public transport is limited or non-existent – it is often the only dependable service available. With fewer passengers per vehicle, informal transport is more frequent, flexible and adaptive, suited to lower density settings, serves polycentric trip patterns, penetrates the narrow streets of low-cost neighbourhoods, and better negotiates congested traffic; and is thus quicker. Vehicles used for informal

transport can also be more energy efficient, owing to higher load factors.

Driven by profit, operators respond quickly to market trends, and economize on costs. Importantly also, the informal sector is a significant gateway to employment for many recent immigrants, making up an estimated 15 per cent of total employment in poor countries. However, safety is one of the numerous disadvantages of this mode, with accidents occurring because of poor (or lack of) driver training, inappropriate vehicles and poor maintenance. Informal operators rarely insure vehicles (or passengers), thus further aggravating accident impacts.

In environmental terms, informal transport vehicles are significant atmospheric polluters due to two-stroke engines, excessive oil mixtures, low-grade fuels, and poorly maintained engines. Since most service providers are not fully licensed, they must often pay bribes, making corruption rife within the informal transport sector.

PRIVATE MOTORIZED TRANSPORT

The growth of private motorized transport during the twentieth century had major impacts on the growth and development of cities all over the world. In 2010

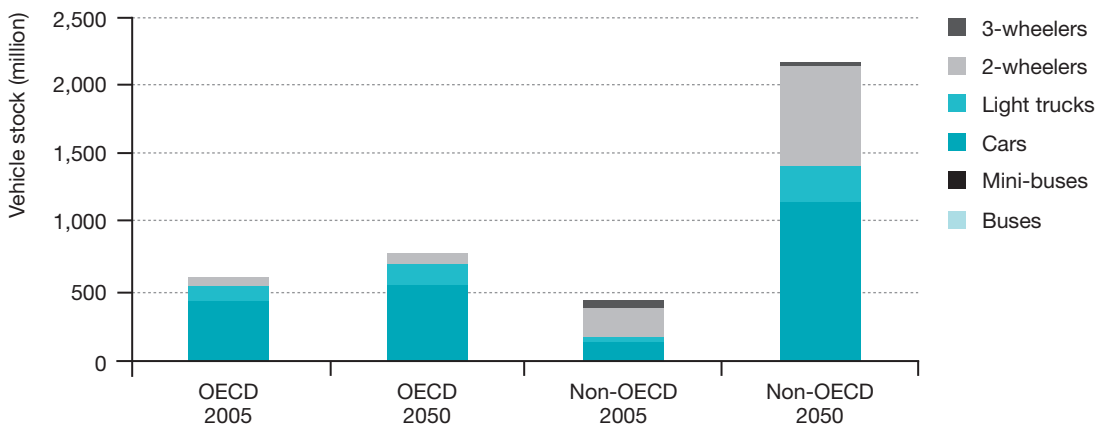


Figure 3

Total stock of motor vehicles, OECD and non-OECD countries

Source: IEA, 2009.



The perceived advantages of convenience, privacy and status continue to make the private car an attractive means of urban transport (São Paulo, Brazil)

Source: © Andre M. Chang / Alamy

there were 825 million passenger cars globally. Of these, close to 70 per cent were in developed (including transitional) countries, whilst only 30 per cent were in developing countries, mainly in Asia. The number of light-duty motor vehicles – cars, SUVs, light trucks and mini-vans – is projected to increase to nearly 1.6 billion by 2035 and more than 2.1 billion by 2050 (see Figure 3).

Globally, the number of new cars sold annually increased from 39 million in the 1990s to nearly 63 million in 2012, with Asia accounting for 40 per cent of global sales in 2012. The rapidly growing economies of Asia and South America are expected to continue driving massive future growth in new-car sales.

Since 1990, vehicle ownership growth rates have declined in a number of European countries, such as Germany, France, Italy, and also in Japan.

In countries with high car ownership evidence suggests that travel distances may have peaked, so that further increases in gross domestic product are unlikely to lead to increased travel distances. In countries with economies in transition, car ownership rates have doubled in just a decade (1990–2000).

Whilst car ownership in developing countries remains significantly lower than in developed countries, ownership in emerging economies is higher than in most developed countries. With most of the current and future growth in population and urbanization taking place in developing countries, the potential for further motorization is substantial.

Globally, the provision of road space and parking for vehicles varies considerably, partly reflecting different strategies adopted by cities towards private motorized travel. A key objective of urban transport investment in many developing countries has been

to increase road space for motorized transport. Yet new road infrastructure tends to generate additional traffic. There is need to move away from simply predicting growth in motorization, in order to provide additional infrastructure and move towards demand management within the framework of an overall strategy for sustainability.

The perceived advantages of convenience, privacy and status continue to make the private car an attractive means of urban transport. Moreover, the private motorized transport industry generates numerous economic benefits, including direct employment in manufacturing, indirect employment in infrastructure and services (fuel stations, maintenance, second hand markets, policing, emergency services), and major investments in urban areas (road construction). Overall, the automotive industry supports around 5 per cent of the total global workforce.

However, a considerable range of externalities arise from increased motorization in cities, thus dwarfing its benefits. Being heavily dependent on oil, one of the most significant impacts of private motorized transport is on the environment, health and safety. A further externality of private motorized transport is traffic congestion, which imposes significant costs on economic efficiency through reduced productivity.

INTERMODALITY IN URBAN TRANSPORT

Modal integration is also an essential prerequisite for urban accessibility. The four modes of urban transport discussed in this chapter are highly complementary in that urban trips are often multi-modal.

While the critical importance of intermodality in enabling accessibility in cities is recognized, interventions designed to enhance integration vary across countries. Cities in Western Europe have taken the lead in facilitating modal integration, especially between public and non-motorized transport. However, modal integration has been given minimal consideration in cities of developing countries. In these cities, although not by design, informal and non-motorized modes do serve as an important gap filler by feeding other transport modes.

Several attempts to facilitate intermodality between non-motorized and public transport in cities have focused on integrating cycling. The contribution of walking as a feeder to public transport systems has also been emphasized, especially in cities of developing countries.

METRO, LIGHT RAIL AND BRT

The main high-capacity public transport options – metro, light rail and bus rapid transit (BRT) – offer solutions for improving urban mobility, quality of life and the environment in both developed and developing countries, providing a competitive alternative to private cars. These systems are strategic in shaping urban form, promoting higher densities, including mixed and accessible land use.

MAIN CHARACTERISTICS OF METRO, LIGHT RAIL AND BRT SYSTEMS

The introduction of metro, light rail and/or BRT can provide important benefits to a city: it can improve the efficiency of the urban economy by reducing travel cost and time; it can increase the level of city-centre activity, thereby enhancing agglomeration economies which are crucial for the prosperity of urban areas; and it can reduce road congestion. In cities where these modes are dominant, the access to opportunities and services is improved, benefiting the urban poor in a number of ways.

Metro is an urban electric transport system using rail tracks, exhibiting high capacity and a high frequency of service. With metros, a carrying capacity of more than 30,000 passengers per hour per direction is possible. Accordingly, metro systems require huge investment, and are often implemented as the preferred option of large cities where demand justifies that high capital cost.

Light rail can be described as an electric railborne transport, which can be developed in stages to increase capacity and speed. The general term ‘light rail’ covers those systems whose role and performance lie between a conventional bus service and a metro. Therefore, they are flexible and expandable. Given the relatively high cost of light rail systems, they are often found in wealthy cities, and in proximity to high-income developments.

BRT is a bus-based mode of public transport operating on exclusive right-of-way lanes at the surface level. It is considered a high quality customer-oriented public transport that is fast, safe, comfortable, reliable and cost-effective. The best BRT systems flexibly combine stations, bus services, busways and information technologies into an integrated system with a strong identity.

The main physical characteristics of metro, light rail and BRT systems are outlined in Table 2. Capacity, commercial speed and cost are the key variables for evaluating high-capacity public transport systems.

NATIONAL POLICIES TOWARD HIGH-CAPACITY PUBLIC TRANSPORT IN DEVELOPING COUNTRIES

Rail-based public transport systems have been a natural part of the development of urban

Component	Metro	Light rail	BRT
Running ways	Rail tracks	Rail tracks	Roadway
Type of right of way	Underground/elevated/at-grade	Usually at-grade – some applications elevated or underground (tunnel)	Usually at-grade – some applications elevated or underground (tunnel)
Segregation from the rest of the traffic	Total segregation (no interference)	Usually longitudinal segregation (at grade intersections) – some applications with full segregation	Usually longitudinal segregation (at grade intersections) – some applications with full segregation
Type of vehicles	Trains (multi-car)	Trains (two to three cars) or single cars	Buses
Type of propulsion	Electric	Electric (few applications diesel)	Usually internal combustion engine (diesel, CNG) – some applications with hybrid transmission (diesel/CNG-electric) or electric trolleybuses
Stations	Level boarding	Level boarding or stairs	Level boarding
Payment collection	Off-board	Usually off-board	Off-board
Information technology systems	Signalling, control, user information, advanced ticketing (magnetic/electronic cards)	Signalling, control, user information, advanced ticketing (magnetic/electronic cards)	Control, user information, advanced ticketing (electronic cards)
Service plan	Simple; trains stopping at every station between terminals; few applications with express services or short loops	Simple; trains stopping at every station between terminals	From simple to very complex; combined services to multiple lines; express, local – some combined with direct services outside the corridor
User information	Very clear signage, static maps and dynamic systems	Very clear signage, static maps and dynamic systems	Very clear signage, static maps and dynamic systems
Image	Modern and attractive	Modern and attractive	Advanced as compared with standard buses

Note: Characteristics for high performance metro, light rail and BRT; CNG = compressed natural gas.

Source: Fouracre et al., 2003; Vuchic, 2007; Federal Transit Administration, 2009.

Table 2

Main physical characteristics of metro, light rail and BRT

infrastructure in developed countries. In the last 15 years, several cities in developing countries have started implementing BRT systems, with some initiating or expanding light rail and metros. Furthermore, national governments are co-financing public transport infrastructure in order to support the large proportion of the population now living in urban areas. The report elaborates the following examples:

- **China**, which has initiated demonstration projects in thirty selected cities.
- **India**, where encouraged by Delhi's success, six other Indian cities have metro systems under construction, while metro systems in another eleven cities are in various planning stages.
- **Brazil**, where every city with more than 20,000 inhabitants (i.e. some 1,600 cities) is required to

develop a mobility master plan linked to its urban development plans. Thirty-one cities in Brazil currently have BRT systems or busways.

- **Mexico**, where since 2008 a federal programme for public transport has given financial support to eleven BRT systems and one suburban rail system. Furthermore, pipeline projects in thirty-four cities are also earmarked for such funding.
- **Kenya**, where in 2012 the government, supported by the World Bank, launched an urban transport improvement project to support the development of selected high-capacity public transport corridors.
- **Morocco**, which has light rail systems in the cities of Casablanca and Rabat-Salé.
- **Nigeria**, where in Lagos a BRT system is being implemented.



Metros provide cities with the means to move large numbers of people, while consuming fewer resources (Hong Kong, China)

Source: © Evgenia Bolyukh / Shutterstock

- **South Africa**, where there is a national commitment that by 2020, most city residents are to be no more than 500 metres away from a BRT station.

METRO SYSTEMS AROUND THE WORLD

The world market for railway infrastructure and equipment has been growing at 3.2 per cent a year,

and is set to grow at around 2.7 per cent annually, until 2017. Spending on metro rail systems should grow faster still, at perhaps 6–8 per cent. Currently, 187 cities have the metro system as part of their public transport system (see Figure 4).

A comparison between metro systems worldwide reveals the following trends:

- A majority of these cities have very large populations.
- Urban areas with metro systems have often

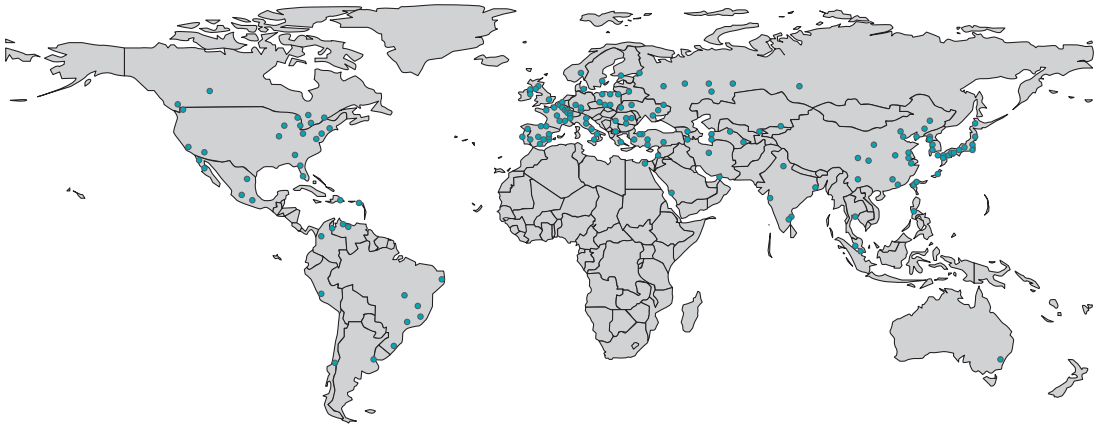


Figure 4

Metro systems around the world

Source: Based on data from <http://mic-ro.com/metro/table.html>, last accessed 5 June 2013.

extended or grown beyond their established boundaries, engulfing surrounding areas and adjacent towns and sometimes expanding into different provinces. This implies that the governance of metro systems must go beyond the traditional city limits.

- Many of the cities with metro systems are either capital cities or large cities. Capital cities account for nine of the sixteen cities with the world's largest metro systems and 27 per cent of all cities with metros.

LIGHT RAIL SYSTEMS AROUND THE WORLD

Light rail systems have proliferated in both developed and developing countries in the last two decades, with many cities in Asia, Africa and Latin America re-introducing light rail systems. Currently, there are approximately 400 light rail and tram systems in operation worldwide, while construction of additional systems is on-going in sixty cities.

The growing popularity of light rail systems can be attributed to their ability to provide significant transport capacity without the expense and density needed for metro systems. However, many light rail systems are challenged by ageing or obsolete assets.

As a result, transport authorities in many cities are rejuvenating their existing light rail infrastructure or constructing completely new systems.

BRT SYSTEMS AROUND THE WORLD

Compared to metro and light rail systems, BRT is a relatively recent phenomenon, starting with the implementation of the first busway in Curitiba (Brazil) in the early 1970s. As of mid-2013, there were 156 cities worldwide with BRT and bus corridors, most of them implemented in the last decade (see Figure 5).

Since BRT and metro systems are both rapid public transport systems, a comparison of their growth and performance is inevitable. However, BRT systems are not yet comparable to metro systems in terms of their total track length and daily demand. The longest metro system (Beijing) is 3.3 times longer than the longest BRT system (Jakarta), while the most popular (in terms of daily ridership) (London) carries four times more passengers than the most used BRT (São Paulo).

Recently, African cities have made remarkable strides in developing BRT as part of their public transport systems. In 2008, Lagos launched a 'BRT

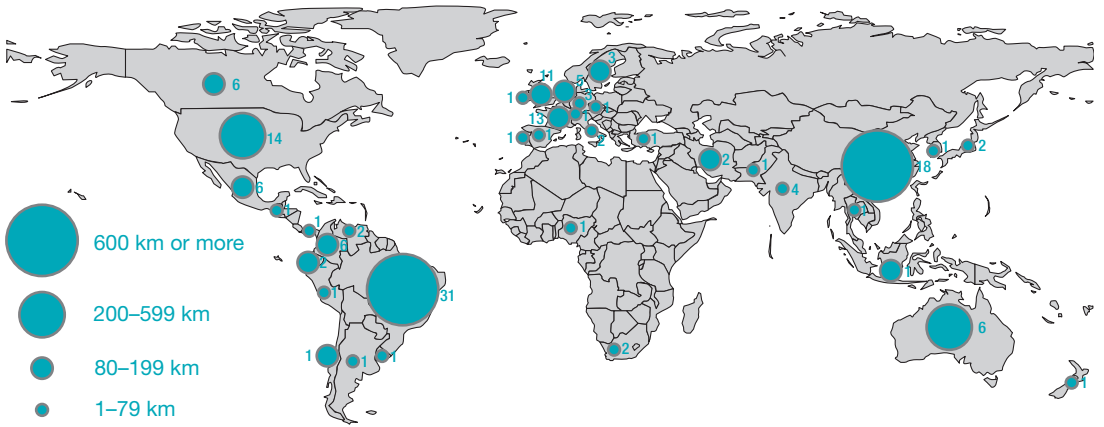


Figure 5

BRT systems around the world (mid-2013) (number of cities and system lengths)

Source: Based on data from <http://mic-ro.com/metro/table.html>, last accessed 5 June 2013.



Road-based public transport systems can offer efficient and effective access to urban activities (Bogotá, Colombia)

Source: © Jeremy Pembrey / Alamy

lite' corridor (a high-quality system that is affordable in the local context, while retaining as many of the desirable BRT characteristics as possible). With the impetus from the 2010 World Cup, three South African cities (Johannesburg, Cape Town and Port Elizabeth) have initiated BRT lines.

MAIN CHALLENGES FACING HIGH-CAPACITY PUBLIC TRANSPORT SYSTEMS

Despite their growth, high-capacity public transport systems still face a number of challenges, especially in developing countries. These include: integration within the public transport system; integration with other elements of the transport system; integration with the built environment; quality of service; lack of finance and institutions.

Integration within the public transport system and with other modes of transport occurs at three levels: physical, operational and fare integration. Physical integration allows for direct connections from one service to another, usually including transfer facilities and terminals. It is also important to provide adequate connectivity with other components of the urban transport system, such as walking, biking, taxis, informal transport services, cars and motorcycles. Further, adequate space is needed at important integration points, particularly in the periphery of cities, to ensure that different types of users are able to connect to the public transport system, and avoid using cars to go to the city centre.

Accessible development suited for public transport (also known as transit-oriented development) involves merging complementary land use and planning with high-capacity public transport systems. This encourages compact, pedestrian and public-transport-friendly environments that are integrated



A mixture of high-capacity public transport options and exclusive rights-of-way improve the efficiency of public transport systems (Hong Kong, China)

Source: © ChameleonsEye / Shutterstock

into the surrounding area. **Integrating public transport systems and the built environment** makes both the public transport system and the city successful. High density (combined with disincentives to private car ownership and use) increases ridership, while public transport provides opportunities for dense, accessible, mixed-use urban environments. Consequently, shorter trips can be completed on foot or bicycle.

Quality of service involves several elements, including: travel time, reliability, safety and security, comfort and user information. The most advanced public transport systems in the world include all these dimensions of quality. Many advanced systems in developing countries have high quality services, but may not include the first and last leg of the trip (i.e. walking to and from the station). ‘Universal design’ – which is an important aspect of inclusive public transport systems – is often overlooked. In cities of developing countries, reliability is not commonly measured, and hence not managed. Typically, light rail and BRT systems in these cities observe train or bus ‘bunching’ (i.e. two or three vehicles arriving simultaneously at the stage, and gaps between vehicles). This reduces the systems’ capacity and causes high occupancy for some vehicles, while others have excess space.

The availability of **finance** is essential for efficient urban mobility systems. Conversely, the

absence of finance can constrain the ability of relevant authorities to implement sustainable high-capacity public transport options. A variety of financial risks can occur when investing, expanding, and maintaining metros, light rail or BRT systems, which require large amounts of funding. Accordingly, the following issues need to be considered:

- The financial risks in public transport project development, i.e. the tendency to underestimate time and cost (leading to costly overruns for both), and overestimate demand during the decision-making process.
- Funding for capital investments in high-capacity public transport requires the participation of all levels of government.
- Public transport subsidies are efficient and socially worthwhile, as public transport involves several positive externalities (air quality, climate change, road safety, physical activity).

Urban transport involves multiple **institutions** and levels of government which are not always well coordinated, resulting in the lack of integration among public transport components, other transport modes, and the built environment. This is further exacerbated by the lack of technical and managerial capacity.

URBAN GOODS TRANSPORT

Goods transport is a fundamental component of the urban environment, an issue which until recently was neglected in the planning process. The challenge is to balance the need to ensuring efficiency of goods transport, whilst minimizing externalities such as congestion, the emission of pollutants, noise and accidents. This is especially so when considering the close interactions between urban land-use, urban form and goods transport within an increasingly contested landscape.

Urban goods transport is concerned with establishing an effective interface between the regional or global realms of freight transport and the last mile of urban freight distribution. This last mile requires a shift to different distribution strategies more suitable to an urban context, often resulting in congestion, delays and additional costs proportionally higher than the distance concerned.

URBAN GOODS TRANSPORT: KEY COMPONENTS AND ACTORS

Urban goods transport, as it relates to cities and their populations, is the set of all activities ensuring that their material demands are satisfied. The focus is on the city as a place of production, distribution and consumption of material goods, but also the handling of waste as an outcome of these activities.

While the functions of production (e.g. manufacturing) and consumption (e.g. retailing) remain prominent forms of urban goods transport, globalization has enabled the expansion of the distribution sector as a more prevalent element of the urban landscape, with facilities such as terminals and distribution centres. City logistics have experienced significant changes, particularly with the concept of lean management, where demand-based supply chain management has enabled a better management of inventories and less storage requirements.

It is increasingly recognized that the metropolitan area should also be considered as a freight planning unit. Still, the focus on urban goods transport remains limited, partially due to an enduring bias in urban planning concerning freight issues. Of particular relevance is containerization, which has shaped transportation systems in a fundamental way, by providing a load unit that can be handled almost everywhere, by a variety of modes.

A city is provisioned by hundreds of supply chains servicing numerous economic sectors including grocery stores, retail, restaurants, office supplies, raw materials, and parts (for manufacturing), construction materials and wastes. There are three main components of city logistics; the modes that carry the freight, the infrastructures supporting freight flows and the operations related to their organization and management (see Figure 6).

City logistics, as a 'last mile' distributional strategy, can take many forms depending on the

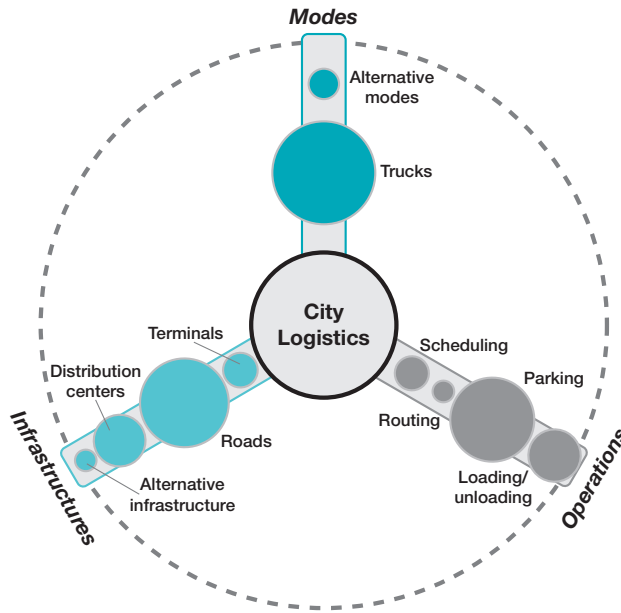


Figure 6
 Components of city logistics and their relative importance



Freight vehicles are responsible for 10–15 per cent of vehicle-kilometres travelled in cities

Source: © Rouzes / iStockphoto

concerned supply chains, including the urban setting in which it takes place. It involves two main functional classes: the first concerning consumer-related distribution and the second concerning producer-related distribution.

There are four general stakeholder groups that are shaping urban freight distribution: cargo owners (e.g. retailers, manufacturers, wholesalers); residents; distributors (mostly carriers, third party logistics companies and freight forwarders); and planners and regulators.

Planners and regulators try to set rules under which urban freight distribution takes place, aiming to satisfy their constituents, including their commercial, transport and distribution interests. However, when challenges in city logistics requiring an intervention from either a public or private stakeholder emerge, the relationships between stakeholders are likely to change, which can lead to four possible outcomes:

- 1 **Conflicts.** Due to the scarcity of space, as well as the density and the complexity of the urban landscape, conflicts between stakeholders are common.
- 2 **Cooperation.** Usually achieved when additional mitigation strategies are added to a project (change in design) or to modes of operation. Public–private partnerships are examples where private goals and public interests can be mitigated.
- 3 **Competition.** Freight forwarders compete to attract and retain customers over their freight distribution services. Commercial and residential developers are also competing within the land-use zoning framework for real estate projects.
- 4 **Coopetition.** A specific form of collaboration between private stakeholders, particularly when a stakeholder is unable to individually address an issue or is incited to do so by regulation.

TRENDS AND CONDITIONS OF URBAN GOODS TRANSPORT

Cities are concomitantly areas of production, distribution and consumption. The growth in global trade reflects growing levels of production and

consumption taking place in urban areas. The city is also increasingly transnational. Gateway cities often fulfil the material requirements of whole regions by being a point of freight transit and distribution to service inland destinations.

The material intensiveness of urban freight distribution depends on local economic, geographic and cultural characteristics. Cities in developed countries with high standards of living are coping with a high intensity of urban goods transport. In Europe, for instance, a high-income city generates about one delivery or pick-up per job per week, 300–400 truck trips per 1,000 people per day, and 30–50 tonnes of goods per person per year.

Interestingly, conditions in which urban goods transport takes place in developing countries show an impressive diversity. Accordingly, it is not surprising to find state-of-the-art transport facilities such as port terminals, airports and distribution centres. This aspect of city logistics is therefore on par with those of developed countries. However, in addition to formal goods transport, an informal sector provides crucial city logistics services to lower-income groups in developing countries (see Box 1).

GOODS TRANSPORT IN AN URBAN CONTEXT

No city is alike with respect to the nature and challenges of its city logistics. In addition to broader factors shaping the conditions of urban goods transport such as geographical settings, history, levels of economic development and government policies, the urban context shapes goods transport trends in specific ways.

Urban density is closely associated with patterns of goods transport. While cities in developing countries tend to have higher densities than cities in developed countries, higher income levels in developed countries increase the generation of freight per density level. High-density areas are associated with high absolute consumption levels, but they can also result in congestion. Still, high density provides additional opportunities to consolidate deliveries and use alternative modes. Further, the distribution of density in relation to the street layout, or urban spatial structure, also influences goods transport.



Freight distribution centres are an essential component of sustainable cities (Johor Bahru, Malaysia)

Source: © Alessandro / UN-Habitat

Box I Non-motorized informal goods transport in Asia and Africa

In Delhi, motorized tricycles haul small loads requiring frequent delivery stops, and handle around 60 per cent of intra-city goods movement, transporting as much as a 5-tonne truck in a day via multiple trips. As well as courier services, deliveries of groceries, furniture, electronics, etc., are increasingly made by auto-rickshaws, vans and tricycles, whilst larger informal carriers – such as shared taxis, minibuses, and light vans – are used for longer distances. In South Asia, trip chains involve intermodal connections between micro-vehicles and large-load haulers at railway stations, bus depots, distribution centres, etc. Although efficient and affordable, the limited income earned by indigenous goods haulers undermines capital investment in more efficient vehicles. Access to credit can thus be an

important factor for improving city logistics in developing economies.

Non-motorized transport is also frequently used for goods delivery in many cities of developing countries, due to it being cheap and readily available. In Mumbai, about 200,000 *tiffin* lunch boxes are delivered daily by a combination of non-motorized means, thereby generating employment for those involved. Forms of non-motorized transport for goods in African cities include three-wheel platform rickshaws (*gudrum matatu* in Dar es Salaam), waste cart pushers (*kayabola* in Accra), and animal drawn carts in South African low-income townships for waste picking, scrap metal haulage and coal delivery.

The urban land-use structure relates to the organization of economic activities, and impacts upon goods transport. A decentralized and dispersed land-use structure is associated with a disorganized urban goods transport system, as it becomes problematic to reconcile origins and destinations in urban interactions. For instance, delivering the same quantity of goods in a decentralized and dispersed land-use setting generally involves longer trips and more frequent stops than in a centralized and clustered setting.

Freight distribution, as an activity fundamental to urban life, consumes a substantial amount of space in urban areas and competes with other activities for the use of land and infrastructure. The land used for freight infrastructure can be particularly extensive in metropolitan areas that are points of convergence for global material flows, and involve several stakeholders. However, the amount of land devoted to freight is not necessarily related to the size or the level of consumption in a city.

Intermodal transportation places tremendous pressure on the land in metropolitan areas, particularly those with **container terminals and their ancillary facilities**. Container port terminal facilities occupy prime waterfront real estate, which is a scarce resource in coastal areas.

Distribution facilities consume a lot of space, as a wide array of added value activities are performed on a one-floor design, including consolidation and deconsolidation, cross-docking and storage. The spatial distribution of industrial, commercial and logistics

facilities has a direct impact on the number of vehicle-kilometres, and the average trip length necessary to reach stores, industries and households.

Another key trend is **logistics sprawl**, or the spatial de-concentration of logistics facilities in metropolitan areas. It generates demands for land to support urban goods distribution while also impacting the patterns and modes of commuting. Due to their low density and suburban settings, logistics zones are generally not well serviced by public transport and contribute to automobile dependency.

CHALLENGES OF URBAN GOODS TRANSPORT

The diffusion of modern freight distribution systems on the urban landscape generates environmental and social externalities, ranging from vehicle emissions, accidents and congestion to logistics sprawl. Addressing these externalities represents a set of environmental, economic, social and institutional challenges (see Table 3).

EXISTING POLICY RESPONSES

Urbanization and its associated growth in material consumption have reached a point where a more concerted approach to freight distribution is advo-

Challenges	Dimensions
Environmental challenges	Mitigate environmental externalities (emissions, noise). Reverse logistic flows (waste and recycling).
Economic challenges	Capacity of urban freight transport systems (congestion). Lower driving speeds and frequent disruptions (reliability). Distribution sprawl (space consumption). E-commerce (home deliveries).
Social and institutional challenges	Health and safety (accidents, hazardous materials). Passenger/freight interferences (conflicts). Access (allowable vehicles, streets and delivery hours). Zoning (land use, logistics zones, urban freight distribution centres).

Table 3

Key challenges in urban goods transport



Freight transport plays an essential role in the daily lives of all urban residents (New York, US)

Source: © Sam Dao / Alamy

Strategy	Advantages	Drawbacks
Rationalization of deliveries		
Night deliveries	Less traffic congestion and faster deliveries. No conflicts with commuting.	Organization of labour and work shifts. Potential disruptions to communities and family household dynamics (due to noise and night work).
Extended delivery windows	More delivery options and fewer impacts during peak hours.	Organization of labour and work shifts.
Freight facilities		
Urban freight distribution centres	Better usage of delivery assets. Less traffic congestion.	Additional costs and potential delays due to consolidation. May not well service consignee delivery requirements (e.g. time).
Local freight stations	Less delivery parking. A single consolidation/deconsolidation location.	Deliveries from freight station to consignee. Management costs for the freight station.
Designated delivery parking areas	Better access to consignees. Less disruptive deliveries.	Fewer parking spaces for passenger vehicles.
Modal adaptation		
Adapted vehicles	Less impact on local traffic congestion. Easier to find a parking spot. Environmentally friendly vehicles.	More journeys for shipments larger than the load unit. Additional costs.

Table 4

Main city logistics policies

cated. This requires an understanding of the key challenges in urban freight distribution and the dissemination of practices and methods, notably data collection, to enhance urban mobility and sustainability. Urban areas are constrained by and subject to a complex regulatory framework. Opportunities for collaboration between different stakeholders exist,

as space for urban logistics is a fundamental element of urban planning.

In many developing countries, the lack of resources often hinders adequate policy responses. Still, an array of policies have been considered to mitigate urban freight distribution problems, most of which are related to traffic congestion (see Table 4).

MOBILITY AND URBAN FORM

Heightened concerns over climate change, rising gasoline prices, traffic congestion and social exclusion have sparked renewed interest in exploring the link between mobility and urban form. Despite this, most cities, particularly in developing countries and emerging economies, continue to prioritize motorized transport and related urban infrastructure.

There is a wide variety of urban forms, defined by land use and transportation systems that are not conducive to the provision of 'efficient' forms of urban mobility. There can be little doubt that designing neighbourhoods, cities and regions in a way that can reduce private car dependency, promote healthier, more sustainable urban forms and a variety of travel solutions can make the city more accessible to all.

Accessibility lies at the core of achieving an urban form that is environmentally sustainable, socially equitable and inclusive. Sustainable mobility is an outcome of how cities and neighbourhoods are designed and take form, but it also shapes the urban form itself. A reinvigorated notion of urban planning, solid institutions and governing structures is therefore required.

DECENTRALIZATION, CAR DEPENDENCE AND TRAVEL

The dispersal of growth from the urban centre is a worldwide phenomenon. Dispersal, as a form of decentralization, at least when it is poorly planned, lies at the heart of unfolding patterns of urban

development that are environmentally, socially and economically unsustainable.

While rising affluence and modernization have fuelled the dispersal of cities worldwide, socio-cultural factors have also played a role. As in China, the transition to free-market economies has accelerated suburban growth throughout Eastern Europe. In India, planning policies suppress permissible densities to decongest central cities, and have been blamed for inducing sprawl in recent decades. Easy-to-obtain credit for low-income housing has triggered an explosive growth in low-cost but isolated residential enclaves on the outskirts of many Mexican cities.

Urban sprawl is increasingly prevalent in developing countries, and is blamed for consuming scarce agricultural lands and dramatically increasing municipal costs for infrastructure and service delivery. Class and income disparities are deeply embedded in the spatial arrangements and mobility challenges of many cities of developing countries. In developed countries, suburban living, associated with the lowering of population and employment densities, has contributed to rising motorization rates and the environmental problems related to car dependency.

The internal combustion engine car technology developed rapidly during the twentieth century, leading to the advent of the automobile city. The automobile city allowed development to fill in the wedges between radial corridors of the streetcar city and metropolitan boundaries, to extend outward four to five times. As many cities worldwide continue to experience sprawl, built-up densities become lower.

**Transport-related energy consumption
Gigajoules per capita per year**

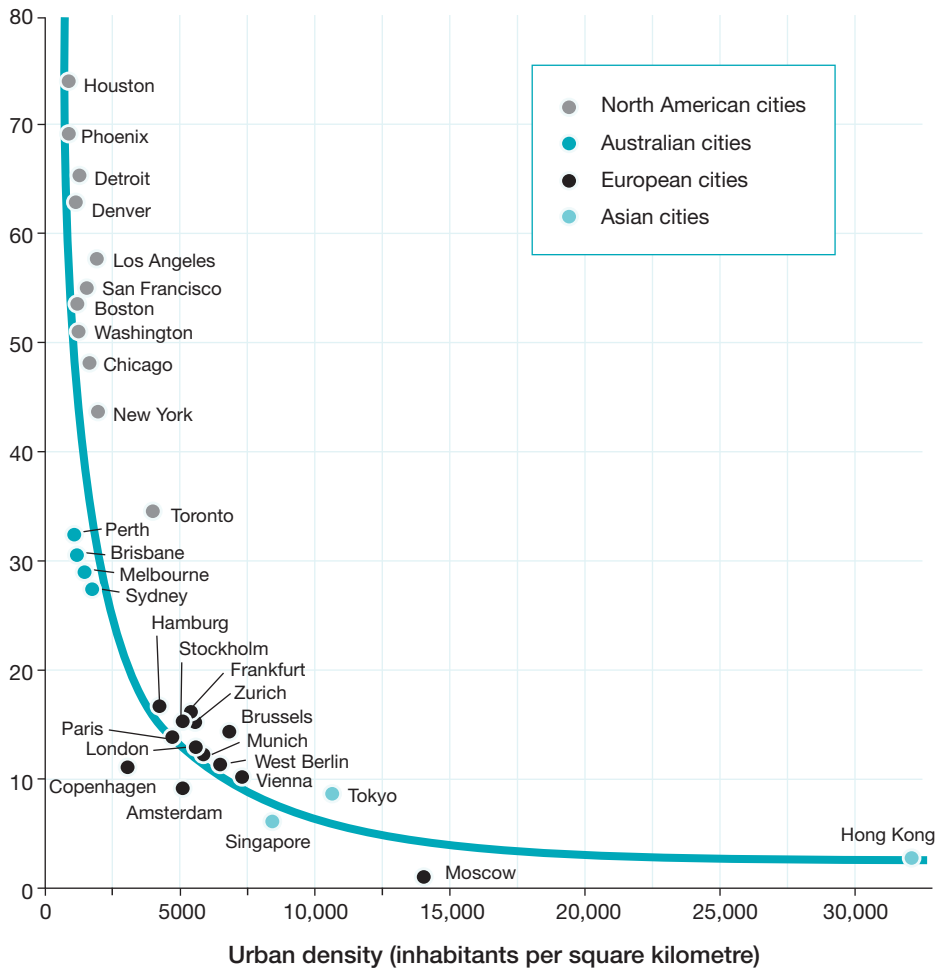


Figure 7

Influences of urban densities on transport-related energy consumption (1989)

Source: Newman and Kenworthy, 1989.

Urban densities strongly influence travel. A 1989 cross-sectional comparison of thirty-two cities showed that transport-related energy consumption declines precipitously with urban densities (see Figure 7). Follow-up studies of 37 cities in 1999 found similar results: low-density cities averaged considerably higher vehicle-kilometres travelled per capita than high-density ones.

In most instances, density is a necessary, though not a sufficient condition for moderating private car use and fuel consumption. Once certain density levels are reached the rate of drop-off tapers, offering a useful policy guide to the association between mobility and urban form. For example, Hong Kong style high-rise densities are not needed for major declines in energy consumption and motorized

movements to be achieved. Rather, going from very low-density sprawl (e.g. the suburbs of car-oriented Houston) to modest densities of town houses and duplexes, produces the biggest declines in transport-sector energy consumption and vehicle-kilometres travelled.

Density is but one element of urban form that influences travel. The spatial distribution of population and employment densities is also important. Where people live, work, shop, and socialize sets the stage for travel by defining the location of trip origins and destinations, and thus the length of trips and the energy they consume.

A mono-centric urban form, wherein the vast majority of jobs and commercial activities are concentrated in the city centre and most households reside on the periphery, mainly produces radial trips. But while the convergence of vehicles near the centre often gives rise to extreme road congestion, it also allows for heavily patronized radial public transport

networks to thrive. A multi-centred or polycentric form results in more dispersed, lateral and cross-town travel patterns, which generally favour flexible forms of mobility, like private cars.

Urban land coverage also influences travel. Redirecting growth to the periphery might lessen city-centre traffic congestion at the expense of longer-distance trips, which are more dependent on motorized transport (including two- and three-wheelers).

The larger the city, the greater its complexity and the potential to influence future traffic conditions, particularly if not well managed. Larger cities have significantly higher average urban densities than smaller cities and thus higher traffic densities (e.g. vehicles travelling roads per square kilometre).

While urban agglomeration allows for job specialization, efficient market transactions and knowledge spillovers, if concentrated growth is not well planned – such as the integration of urban



Denser forms of development reduce travel distances, use less energy, and support more efficient urban mobility systems (Zoetermeer, the Netherlands)

Source: © Frans Lemmens / Alamy

growth with metro investments – the resulting economic benefits tend to be eroded. Agglomeration diseconomies – i.e. the inefficiency and loss resulting from poorly planned concentrations – is expressed in the form of lost labour productivity from extreme traffic congestion, increasing air pollution and an overall decline in the quality of urban living.

URBAN DENSITIES AND PUBLIC TRANSPORT THRESHOLDS

High densities are essential for sustaining cost-effective public transport services. Rail, with its high up-front capital costs and economies of scale, needs to attain a threshold density of trips in order to cost less than accommodating the same trips by car or bus. Since rail-based public transport needs high passenger volumes to be cost-effective, it also needs high concentrations of people and jobs around stations.

Public transport that is cost-effective can only be achieved through high urban densities and a large share of jobs and retail activities concentrated in the urban core (e.g. Shanghai), or in polycentric cities with multidirectional travel patterns (e.g. Stockholm). The reliance of public transport on urban density has prompted efforts to define the minimum density thresholds required to support successful public transport services.

However, as there are many city features that influence public transport ridership, some observers have cautioned against a fixation on density. Walkability and the land-use mixes of neighbourhoods that surround stations are also important to viable public transport services. If people cannot safely and conveniently walk the half-kilometre to or from a station, chances are they will not use public transport.

PLANNING THE ACCESSIBLE CITY

Coordinating and integrating urban transport and land development is imperative for creating sustainable urban futures. Notably, the design and layout of a city strongly influences travel demand. Simultaneously, transportation infrastructure is an essential feature that shapes the city. Thus, the coordination and integration of transport planning and development, as well as spatial planning and development, is key (see Box 2).

The coordinated planning of urban mobility and land development starts with a collective vision of the future city, shared by city government and civil society. Local authorities can utilize a range of tools to influence urban growth, such as land-use regulations, infrastructure investments, tax policies (e.g. enterprise districts), and land purchases (e.g. green belts). However, experience shows that transportation investments are one of the most important.

Box 2 'Compact cities' or 'smart growth'

'Compact cities' or 'smart growth' describes urban development that is compact, resource-efficient, and less dependent on the use of private cars. As an antidote to sprawl, these terms aim to reduce the municipal fiscal burden of accommodating new growth, while promoting walking and cycling, historical preservation, mixed-income housing that helps reduce social and class segregation, and diversity of housing and mobility choices that appeal to a range of lifestyle preferences. Ten accepted principles which define such developments are:

- 1 mixed-land uses;
- 2 compact building design;
- 3 a range of housing opportunities and choices;
- 4 walkable neighbourhoods;
- 5 distinctive, attractive communities with a strong sense of place;
- 6 preservation of open space, farmland, natural beauty, and critical environmental areas;
- 7 development directed towards existing communities;
- 8 a variety of transportation choices;
- 9 development decisions that are predictable, fair, and cost effective; and
- 10 community and stakeholder collaboration in development decisions.



Urban developments should focus on human-centred, walkable, mixed-use communities, with moderate to high residential densities (Rio de Janeiro, Brazil)

Source: © Yadid Levy / Alamy

Planning the accessible city also involves increasing the percentage of urban land allocated to streets, to enhance connectivity. The overall connectivity of the city can be measured by proxy, by comparing the ratio of urban land allocated to streets with the total land area of the city. While it is important for cities to invest in streets, it should be noted, however, that having a high percentage of urban land allocated to streets is only the first step in making a city more accessible. There is, in addition, a need to take into account the efficiency of the street system and its adaptability to essential urban mobility modes such as high-capacity public transport systems, walking and cycling.

Integrated mobility planning and urban growth needs to occur at multiple spatial scales – e.g. the region as a whole, districts and corridors, as well as neighbourhoods. Spatial harmonization between these three levels can be crucial to the successful integration of transportation and urban development.

BUILT ENVIRONMENTS AND TRAVEL AT THE NEIGHBOURHOOD SCALE

Analysts often express features of built environments along five core dimensions, or the ‘5 Ds’: Density, Diversity, Design, Destination accessibility, and Distance to transit (see Box 3). These 5 Ds strongly influence travel demand – notably, the number of trips made, the modes chosen and the distances travelled – and are evident in many contexts and settings. Both singularly and collectively, the 5 Ds affect vehicle-kilometres travelled per capita.

A recent analysis in North America concluded that ‘destination accessibility’ is the most important land use factor that strongly influences travel. On average, a doubling of access to destinations is associated with a 20 per cent decline in vehicle-kilometres travelled. Other attributes which influence

Box 3 The five Ds of built environments that influence travel

- **Density** gauges how many people, workers, or built structures occupy a specified land area, such as gross hectares or residentially zoned land.
- **Diversity** reflects the mix of land uses and the degree to which they are spatially balanced (e.g. jobs–housing balance), as well as the variety of housing types and mobility options (e.g. bikeways and motorways).
- **Design** captures elements, like street layout and network characteristics that influence the likelihood of walking or biking – e.g. pedestrian- and bike-friendliness. Street networks vary from dense urban grids of highly interconnected, straight streets, to sparse suburban networks of curving streets forming loops and ‘lollipops’.
- **Destination accessibility** measures ease of access to trip destinations, such as the number of jobs or other attractions that can be reached within 30 minutes travel time.
- **Distance to transit** is usually measured as the shortest street routes from the residences or workplaces in an area to the nearest rail station or bus stop.

These are not separate dimensions and indeed are often co-dependent. Having high-rise housing and office towers will yield few mobility benefits if the two activities are far from each other. A diversity of uses and improved accessibility to destinations from home or work are needed if denser development is to translate into more pedestrian and transit trips.

travel include urban design (e.g. street connectivity and safe, complete sidewalk provisions) and well-sited pedestrian routes.

Globally, various neighbourhood designs and retrofits are being introduced to reduce the need for travel by private cars and invite more sustainable forms of mobility. Among these are traditional neighbourhoods, also known as new urbanism; transit-oriented development (TOD); and car-restricted districts.

Before the advent of the private car, **traditional neighbourhoods** were compact and highly walkable. Daily walks, e.g. to shops, restaurants or schools which were no more than five minutes away were characteristic of the pre-automobile era. In the early 1980s, an urban design movement known as the ‘new urbanism’ was developed in the US. In contrast to the sameness and sterility of suburban sprawl, the new urbanism emphasized the fine details of what makes communities enjoyable, distinctive, and functional.

Transit-oriented development (TOD) is traditional or new urbanism development that is physically oriented to a public transport station. Increasingly, TOD is globally recognized as a viable model for shaping urban growth. TOD is most fully developed in Europe, and in particular Scandinavia.

Many European cities have brought liveability and pedestrian safety to the forefront of trans-

portation planning. Initiatives have sought to tame and reduce dependence on the private car. **Traffic calming** is one such example, pioneered by Dutch planners who have added speed humps, realigned roads, necked down intersections, and planted trees and flowerpots in the middle of streets to slow down traffic. With traffic calming, the street becomes an extension of a neighbourhood’s liveable space – a place to walk, chat and play. Car passage becomes secondary. An even bolder policy has been the outright **banning of cars** from the core of traditional neighbourhoods and districts, complemented by an upgrading and beautification of pedestrian spaces. Illustrative examples from developed countries can be found in Bremen, Bologna, Siena and Bruges, as well as substantial portions of university towns like Groningen, Delft, Oxford, Cambridge, Freiburg and Münster. Extended pedestrian-only shopping streets and promenades have also gained popularity, such as Copenhagen’s Strøget.

Similarly, multi-block car-free streets and enhanced pedestrian zones also exist in some cities of developing countries, such as Curitiba. While implementation of these plans has considerable positive outcomes, consideration needs to be given to ensuring that high-quality and frequent public transport services are in place to absorb displaced car traffic.



The local street has the potential to be a community centre, the place where people meet (Hamburg, Germany)

Source: © Yadid Levy / Alamy

CORRIDOR CONTEXTS

Transport corridors represent the spatial context in which significant challenges are often faced in coordinating transportation and land development across multiple jurisdictions. They are also where ‘access management’ – trading off the mobility versus site-access functions of roads – can pose significant policy challenges, particularly in fast-growing cities and regions. If well planned and designed, corridors also present a spatial context for designing a network of TODs.

Transportation corridors function to move people and goods, but often face intense development pressures, which over time can erode their mobility function, particularly in the cities of developing countries. New roadways open up access to new territories, spawning building construction and land development, and thus more traffic. Effectively, the roadway’s role and function transforms – from one

of providing **mobility** to providing **site access**. The two roles are in conflict, with the problem accentuated when different institutions control infrastructure and land development along the corridor. If a national government or state builds a new road to improve cross-city traffic flows, local governments take advantage of the added capacity by allowing new development – a means to grow the local economy and generate property tax income.

Some cities have directed land uses that are scattered throughout suburbia – e.g. housing, offices, shops, restaurants, strip malls – to **corridors served by public transport**. Scandinavian cities such as Stockholm, Helsinki and Copenhagen have created networks of linked TODs – that is, public transport oriented corridors. The mobility and environmental benefits from Curitiba’s three-plus decades of integrated development along public transport corridors is well celebrated.

REGIONAL CONTEXTS

For centuries cities have grown and spilled beyond their walls and jurisdiction boundaries. However, the development of city clusters and large urban agglomerations is more recent. Many countries, especially China, have adopted new towns as the preferred planning approach previously adopted by European and US cities. Many other cities in developing countries have also adopted new town approaches to regional development based on clusters.

Some megacities have become so large that some countries have moved to planning ‘supracities’. These are network cities with populations of over 40 million. In 2010, the Guangdong Provincial Government in China announced it was planning to create the world’s biggest ‘megacity’ by merging nine cities into a mega-region metropolis.

Increasingly, cities of different sizes have started merging and forming new spatial configurations that take three principal forms, namely: mega-regions, urban corridors and city-regions. Connectivity and regional transport are crucial for the development of these large agglomerations.

IMPACTS OF TRANSPORTATION INVESTMENTS ON URBAN FORM

Just as urban form and land-use patterns shape transportation, transportation investments shape urban form. The opening of a new road or public transport line influences the locations, intensities, types of development, and the value of land. Accordingly, the changes in accessibility drive the urban form and land-use changes, following transportation infrastructure investments. Matching the infrastructure hardware with supportive policy software is essential, if hoped-for land-use outcomes are to follow.

Historically, urban rail systems, like metros and light rail, are potential city-shapers. They define the growth spines and axes of cities, leading to higher density concentrations of industries, offices, and businesses along rail-served corridors. They also spur sub-centring and decentralization, and are contingent on levels of proactiveness in encouraging new

Box 4 Prerequisites for urban form changes

- Proactive planning is necessary if decentralized growth is to take the form of sub-centres;
- Other pro-development measures must accompany public transport investments;
- Public transport service incentives and private car disincentives (‘equalizers’) help in inducing station-area land-use changes);
- Network effects matter.

development and minimizing the growth-restricting impacts of onerous regulations. In cities such as Toronto, Portland and Munich, for example, the new rail systems have attracted significant shares of new developments to station areas.

Public transport investments in rail-based services exert their strongest spatial influence in large, congested cities. While most empirical knowledge is drawn from developed countries, theory suggests that the city-shaping impacts of new rail investments in developing countries might be stronger. Global experiences show that a number of preconditions are necessary for urban public transport investments to spawn sustainable urban form outcomes (see Box 4).

Accessibility benefits conferred by rail systems get capitalized into land prices. Higher values of rail-served parcels exert market pressures to intensify land development. **Land value appreciation** presents an opportunity to recapture the value created by public investments in public transport. The resulting ‘win-win’ situation leads to financially viable investments and an intimate connection between rail systems and nearby real estate development that attracts tenants, new investors and public transport riders. Public transport joint developments (e.g. the leasing of air rights above metro stations to private developers) are another way to financially capitalize on the accessibility benefits conferred by public rail investments.

Conventional wisdom holds that traditional bus services have imperceptible influences on urban form and land-use patterns because, in contrast to many rail systems, they fail to deliver appreciable accessibility benefits. An exception, however, is BRT, where



Under the right conditions, railways and bus-ways can spur central city redevelopment (Moscow, Russia)

Source: © Martin Roemers / Panos

buses are provided with an exclusive, dedicated lane, which significantly improves the quality of service. Thus, it is not public transport ‘hardware’ – i.e. steel-wheel trains or rubber-tyre buses – that unleashes land-use changes, but rather the quality of service and more specifically, the comparative travel-time savings of taking public transport vis-à-vis the private car. Significant land price increases have been recorded near BRT stops in Bogotá, Seoul, Brisbane and Los Angeles.

Motorways generally exert stronger influences on urban form than public transport lines. However, the impact of new roads varies considerably. In poorer countries, road investments generate new economic growth, opening access to new markets and expanding trade sheds. Developed countries, on the other hand, experience impacts that are largely redistributive, hence shifting growth that might otherwise occur in some settings to newly served highway settings.

EQUITABLE ACCESS TO URBAN MOBILITY

Urban mobility systems aim to provide access to basic goods, services and activities to enable people to participate in civic life. In reality, people do not have equal access to urban opportunities. The unequal access *per se* is not necessarily problematic, however, the distribution of impacts (benefits, disadvantages and costs) can be considered ‘unfair’, thus becoming an issue of social equity.

Investments in transport infrastructure do little to alleviate the mobility difficulties of the poor, vulnerable and disadvantaged groups if the services provided are unaffordable or physically inaccessible. This chapter focuses on aspects of urban mobility that relate to providing affordable access to opportunities, minimizing social exclusion, and improving the quality of life for all.

The most critical challenge is the heterogeneity of urban populations and the spatial dispersion of social and economic activities. Meeting the mobility

needs of all requires the provision of adequate public transport, and appropriate infrastructure for non-motorized transport. Furthermore, improved urban planning, new technologies and infrastructure measures are needed where affordability is an important aspect of equitable access.

AFFORDABLE URBAN MOBILITY

Transport must be affordable for the majority of the urban population, and in particular for those who have no other way of travelling to access basic goods, services and activities. Constrained mobility is an important element of the social exclusion that defines urban poverty. Improved transport connections can help in tackling social exclusion through addressing

Box 5 Understanding the parameters of urban transport

- **Affordability** refers to the extent to which the financial cost of journeys puts an individual or household in the position of having to make sacrifices to travel, or to the extent to which they can afford to travel when they want to.
- **Availability** refers to route possibilities, timings and frequency.
- **Accessibility** describes the ease with which all passengers can use public transport. It also includes

ease of finding out about travel possibilities, i.e. the information function.

- **Acceptability** is another important quality of public transport, either because of the transport, or the standards of the traveller. For example, travellers may be deterred from using public transport due to lack of personal security.

Source: Carruthers et al., 2005.



In developing countries the vast majority of people have limited access to affordable motorized transport (Nairobi, Kenya)

Source: © Julius Mwelu / UN-Habitat

barriers posed by the accessibility, availability, acceptability and affordability of the urban mobility system (see Box 5).

The access and mobility of the urban poor is constrained by city planning, socio-economic characteristics, transport facilities and the availability of services. The poor are increasingly concentrated on the periphery of urban areas, and consequently they travel longer distances and their need for affordable transport is increased. From Delhi to Shanghai, and Brussels to New York, the provision of economical and convenient ‘last mile connectivity’ – i.e. from the trip ends to the point of accessing public transport systems – remains a major issue of concern. Evidence suggests that any deficiencies in public transport will have a greater impact on the urban poor. High transport costs force the poor to carefully prioritize their mobility needs and expenditure.

In recent years, ambitious policy responses have been introduced by planners and policymakers to address the challenges outlined above. Achieving

transport affordability objectives requires actions that support non-motorized transport, reduce the financial costs of transport services, and increase transportation affordability through improved land-use accessibility.

Non-motorized transport can be stimulated by a policy package consisting of investment in facilities, improved transportation networks, and awareness campaigns, as well as disincentives for the use of private motorized vehicles. Combining public transport and cycling can provide a high level of affordable mobility. Most cities in developing countries are high-density, thus suitable for policies promoting non-motorized transport. Travel demand management has a key role to play in this context. The private sector could be a key partner in supply side interventions to increase bicycle ownership and use through the promotion of micro-credit programmes and cycling education. Awareness campaigns and political commitment can bring about a shift in public attitudes towards non-motorized transport, as well as enhanced social inclusion.

Public transport fares should be set at rates that allow commuters to use it. In developing countries, fares are often set above competitive equilibrium levels. A delicate balance must be struck between the consumer's convenience and willingness to pay, and the operator's need to balance its budgets (or to make a profit, in the case of private sector operators). **Transport subsidy** is an important policy option for ensuring equitable transport access for all. However, poorly targeted subsidies may result in the rich deriving a disproportionate benefit compared to the poor.

Transport affordability can also be increased by **improving land-use accessibility**. Accessibility planning offers a new way to ensure urban residents reach the services and facilities they need by walking, cycling and public transport. Integrated land-use and travel demand management measures enhance accessibility and lead to improved affordability. Public

support for suitable low-cost housing near large employment centres, or public transport, is a fundamental aspect of land-use planning. Linking urban mobility systems and housing policy also makes good financial sense. Together, transportation and housing make up half or more of household consumption expenditure. To the degree that less is spent on transport, more income is freed up for housing consumption.

VULNERABLE AND DISADVANTAGED GROUPS AND URBAN MOBILITY

Vulnerable and disadvantaged groups – women, ethnic minorities, the elderly, the disabled, children, etc. – stand to gain important social benefits from improved urban mobility networks, technologies and



Segregated public transport services may be necessary in many countries to cater for the distinct needs of women (Tokyo, Japan)

Source: © Islemount Images / Alamy



Although 'universal design' standards address the needs of people with disabilities, it is a comprehensive concept that can benefit all users

Source: © Jeff Greenberg / Alamy

facilities, as improved access and mobility reduce isolation, vulnerability and dependency. However, transport networks will need to cater to their particular needs if they are to access the benefits.

Worldwide, societies are **gendered**, in that men and women often play different roles. There is a strong case for mainstreaming gender concerns in the working ethos of urban transport organizations. In developed countries, women's commuting patterns are often different from men's, particularly if married with children. On average, women are more likely to be working in part-time and lower-wage jobs than men, contributing further to women's increased expenditure in terms of time spent travelling. Whether in urban or peri-urban areas, women tend to make more trips, although over shorter distances than men. High costs of public transport can make access to such services particularly prohibitive for women, when it comes to reaching places of work, education or basic services. Additionally, significant

levels of sexual harassment of women on urban public transport systems are frequently reported globally.

The mobility needs of **children and youth** are primarily related to their need to access educational facilities, childcare and related services. Accordingly, children's travel needs can have a significant impact on household travel patterns, due to the largely car-dependent nature of those needs. In developing countries, the major cause of drop-outs in primary schools is the distance that children have to walk to reach their schools. Other factors which contribute to irregular school attendance include the risk of sexual assault.

More than 1 billion people in the world have some form of **disability**. People with disabilities often find transport to be limited, unaffordable or inaccessible, frequently citing the lack of adequate transport as a barrier to accessing health care. Future trends show that disability will become an even

Box 6 Convention on the Rights of Persons with Disabilities (Article 9, paragraph 1)

'To enable persons with disabilities to live independently and participate fully in all aspects of life, States Parties shall take appropriate measures to ensure persons with disabilities access, on an equal basis with others, the physical environment, transportation, . . . and other facilities and services open to the public . . . These measures, which shall include

the identification and elimination of obstacles and barriers to accessibility, shall apply to, inter alia: (a) Buildings, roads, transportation and other indoor and outdoor facilities, including schools, housing, medical facilities and workplaces.'

Source: www.un.org/disabilities/documents/convention/convoptprot-e.pdf, last accessed 25 March 2013.

greater concern, due to ageing populations and the higher risk of disability in older people, including the global increase in chronic health conditions such as diabetes, cardiovascular disease, cancer and mental health disorders. Consequently, many who are accustomed to driving will have to stop due to age-related disabilities.

A wide range of **policy options** and initiatives exist, which focus on improving mobility for the urban poor and enhancing accessibility for vulnerable and disadvantaged groups. Cities at various levels of development can draw on such experiences for further development of sustainable transport systems. The actual design of the policy or practice will have to be modified to meet the specific circumstances of each city. Gender-sensitive design, infrastructure and services are important and need to be mainstreamed. Further, strategies that improve pedestrian safety and increase accessibility should also be considered. Worldwide, many countries are introducing legislation that requires transport services to be made more accessible, to conform to international law (see Box 6).

SAFETY AND SECURITY IN URBAN MOBILITY SYSTEMS

Safety and security are essential ingredients of sustainable urban mobility systems. It is important to guarantee the safety of vehicular traffic and pedestrians. The security of all transport users has to be ensured to make a transportation system sustainable. In many countries, national security is an urgent priority, due to the numerous terror attacks against urban infrastructure during the last two decades.

Road traffic accidents are the ninth leading cause of death worldwide; accounting for 2.2 per cent of all deaths, or 1.2 million deaths per year. The average road traffic fatality rate of developing countries (about 20 per year per 100,000 population) is nearly twice that of developed countries. The predominance of vulnerable road user casualties in Asian and African countries can be attributed to the abundance of vehicles and non-motorized transport, including a lack of segregated facilities in the road network. Poor enforcement of traffic safety regulations due to inadequate resources, administrative problems and corruption, exacerbate the situation further.

Reducing the risk of traffic accidents in urban areas requires action on a combination of fronts. Successful policies and interventions to reduce the risk of traffic accidents combine legislation, engineering, enforcement and education measures. An estimated 96 per cent of countries have a national policy prohibiting drinking and driving, to include speed limits and public information campaigns. Similarly, many countries have made improvements in infrastructure design and vehicle characteristics (e.g. seat belt use). In developing countries, simple, low-cost interventions such as speed bumps have had a significant impact on pedestrian road safety. Other effective interventions include integrated land-use and transport planning for optimized traffic flow, and the promotion of public and non-motorized transportation.

Globally, **security risks and fear of crime** while engaged in transportation activities have skyrocketed. Public transport systems are inherently vulnerable to terrorist attacks as they concentrate large numbers of people on a predictable basis, and often have a minimum of security controls present.



Traffic accidents are one of the leading causes of deaths in cities (Lebanon)

Source: © JORDI CAMÍ / Alamy

While the most dramatic attacks have occurred mostly on major systems in major cities, this does not mean that local bus services or smaller cities are safe from attack. Crimes ostensibly unrelated to the use of public transport – such as being robbed or killed while waiting at a bus stop – discourage many people from using public transport. In many countries widespread sexual harassment on and around public transport facilities, inadequate street lighting and poor design of public transport, are also deterrents.

Since the 1980s, transport planners have recognized the importance of **personal security for transportation users**, especially women. Similarly, many European cities are limiting through-traffic on streets to protect children, the elderly, and disabled

people through the judicious use of speed bumps and winding thoroughfares. The integration of safety concerns within transportation systems such as environmental design is also increasingly evident. Environmental design plays an important role in reducing crime in public transport, which includes strategic policing, strict maintenance procedures, and ‘zero tolerance’ policies in enforcing rules and regulations. The emergence of low-cost open-source mapping tools, widespread cellular network coverage, declining costs of mobile phone hardware, and increasing internet use by public agencies have resulted in unprecedented opportunities to support transport planning and management in developing countries.

URBAN MOBILITY AND THE ENVIRONMENT

The environmental consequences of increased motorization are cause for major concern – both locally and globally – as the transport sector is one of the major contributors to greenhouse gas emissions, the major cause of climate change. Urban mobility will always use resources and generate externalities, but its impact on the urban environment can be substantially reduced, so that it remains within acceptable limits and makes a strong contribution to other aspects of sustainability, including intergenerational concerns. Urban density reduces the overall spatial footprint of development and allows for greater preservation of natural areas.

ENVIRONMENTAL CHALLENGES IN URBAN MOBILITY SYSTEMS

Environmental concerns have, over the last few decades, become central to urban mobility planning. Yet, in practice, developmental objectives seem to take priority over environmental concerns. There is an urgent need to find the means by which both developmental and environmental concerns can be addressed at the same time, in mutually supporting ways.

Motorized urban transport relies almost entirely (95 per cent) on oil-based products for its energy supply, primarily in the form of petrol and diesel. The shift in urban transport technology towards motorization has led to a significant increase in the

global consumption of such oil-based products. The transport sector accounts for about 22 per cent of global energy use. The bulk of this is accounted for by passenger transport, while the rest is consumed by freight transport.

The **dependence on an oil-based energy supply** means that there has been a direct correspondence between the amount of energy used in the transport sector and the emissions of carbon dioxide (CO₂), the main transport-related greenhouse gas. Given the considerable growth in urban travel demand globally, mitigation technologies and practices are urgently required to achieve a significant global reduction in carbon-based energy use for urban transport. In the longer term, and irrespective of the wider environmental impacts, the transport sector needs to diversify its sources of energy and to decarbonize the sources of fuel used.

Cities are more efficient in their use of energy for transport than less densely populated locations, as more efficient public transport can replace the need to use private cars, and because distances are shorter. There is thus a significant potential to reduce energy use (and thus greenhouse gas emissions) by encouraging more people to use public transport.

Globally, the **CO₂ emissions from the transport sector** have increased by 85 per cent from 1973 to 2007. However, the CO₂ emissions from transportation are much lower in developing than in developed countries. The emissions in most of Asia and Africa, for example, are about a third or a quarter of the global average, with the exception of the

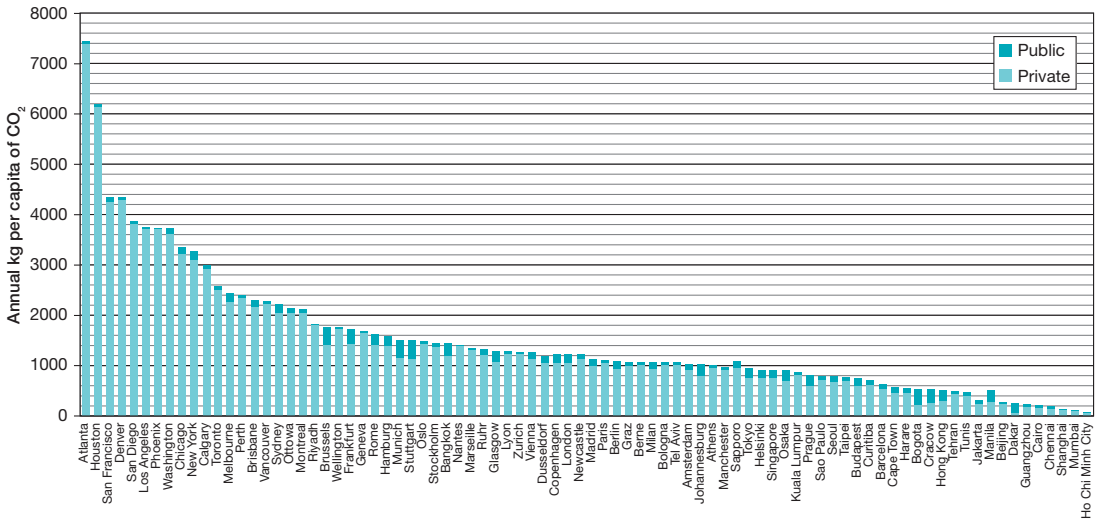


Figure 8
Per capita emissions of CO₂ from passenger transport in 84 cities (1995)

Source: Kenworthy, 2003, p. 18.

Middle East, where transportation emissions per capita are similar to those in Europe.

Road freight accounts for about 25 per cent of global transport-related CO₂ emissions, while emissions from rail transport are insignificant. A total of 52 per cent of CO₂ emissions are being produced from passenger road transport. Worldwide, more energy (and CO₂ emissions) per capita is used in private than in public transport; in Africa the ratio is three to one, while it is fifty to one in the US. Figure 8 shows variations in CO₂ emissions from passenger transport across cities in various parts of the world. In most cities, the emissions from public transport are insignificant compared to those from private motorized transport.

Nearly one-half of the world’s cities are located on the coast or along major rivers. These locations have in the past been subject to occasional flooding, but these risks have increased as a result of frequent storm surges and high winds, accentuated by **global warming and sea level rise**. Transport is central to the functioning of cities, and therefore the immediate need for cities to take action to protect the existing transport infrastructure from the impacts of climate change is critical.

The increased motorization of urban transport is also causing serious challenges to **human health**:

- **Air and noise pollution:** Trucks and other freight carriers emit disproportionate amounts of pollutants in cities. Prolonged exposure to noise can lead to anxiety, depression and insomnia.
- **Human health and physical activity:** There is

Box 7 A successful bicycle sharing system: Changwon, Republic of Korea

Changwon is working towards becoming Korea’s leading ‘eco-rich city’, by improving the quality of life through sustainable mobility and non-motorized transportation. As a part of this effort, the ‘Nubija’ bicycle sharing system was introduced on 22 October 2008, with 20 parking stations (where bikes can be checked out and returned) and 430 bicycles. By 2011, there were 163 parking stations (with 3,300 bicycles). At that time, membership of the scheme had reached 76,579, who ride an average of 4,396 kilometres per day. In 2012, the number of parking stations had reached 230.



Telecommuting (i.e. working from home) reduces the need for physical travel

Source: © Blend Images / Alamy

growing evidence of the links between physical inactivity and obesity, and their impacts on the risk of diabetes, heart disease, colon cancer, strokes and breast cancer.

- **Community severance, open spaces and mental health:** Community severance divides and fragments communities, forming a barrier so that people cannot cross the road or rail track. Research indicates that job satisfaction and commitment declines with increased road commuting distance (but not with public transit use), and that perceived traffic stress is associated with both lower general health status and depression.

REDUCING THE NUMBER OF MOTORIZED TRIPS

There are many opportunities to reduce the need for motorized travel by walking or cycling. More imaginative innovations are the cycle hire schemes that are now a feature of many cities (see Box 7),

where old technology (the bicycle) has been matched up with the new technology (smartcards), so that bikes can be used on demand, either free for an initial period or for a reasonable charge.

The most effective way of reducing the number of trips (at least in theory) is that a specific trip is no longer made, as it has been replaced by a non-travel activity or substituted by technology, for example internet shopping, teleworking and teleconferencing.

REDUCING TRAVEL DISTANCES IN CITIES

Urban planning has a major role to play in organizing spatial activities in cities so that they are in close proximity to their users. If travel distances are reduced then accessibility is improved as activities can be undertaken with less travel. Further, if travel distances are short, then it becomes more attractive to walk or cycle – particularly if space is allocated for



Non-motorized transport modes play an important role in many cities (Old Delhi, India)

Source: © Robin Laurance / Alamy

exclusive rights of way – and use public transport, thus reducing energy use and the environmental impacts of transport. The arguments for high urban densities are strong on both transport and land take, hence cities should be encouraged to build upwards (higher buildings) and not outwards (suburban sprawl).

CHANGING THE MODAL SPLIT

Transport policy has often been strongly orientated towards maintaining and increasing levels of public transport use. However, success has been limited due to increases in incomes and growing urban populations. There are three basic groups of strategies that can be used to encourage modal shift to more energy-efficient forms of transport, namely:

- 1 **Regulatory measures** can place limitations on the numbers of vehicles on the road at any given time

or day. Limitations can also be placed on the number of new vehicles that can be registered in the city.

- 2 **Pricing measures** include electronic road pricing, congestion charging or cordon pricing and parking pricing to reflect the value of the space used.
- 3 **Investments in public transport and public transport infrastructure** are central to ensure that priority is given to this transport mode, which allows the greatest number of people to be carried most efficiently.

TECHNOLOGICAL INNOVATION AND VEHICLE EFFICIENCY

There are technological and other policy responses related to increasing the efficiency of motorized vehicles and the use of the best available

technology. This implies that the use of carbon-based fuels should be substantially reduced and cleaner low-carbon fuels should replace them for all forms of motorized transport. Efficiency gains must be set against the growth in traffic, as this often outweighs those gains. Rapid urbanization in many developing countries thus presents an opportunity to invest in the low-carbon city transport system of the future ('leapfrogging').

The scale of any emission reduction is dependent on a set of factors such as the **efficiency and age of the vehicle stock**, the distance driven by each vehicle, and the tendency to buy larger and heavier vehicles. The introduction of new technologies does not, however, lead to immediate cuts in emissions. The average age of vehicles in developed countries is lower than in developing countries, where the average age of vehicles can be more than 15 years, with exceptions like Brazil, India and China, which have their own car manufacturing industry.

The emission of pollutants from motorized vehicles is related to three main factors: The quality of the fuel, the fuel efficiency of the vehicle stock, and the capture of pollutants before they escape from the vehicle. Many governments are now setting more challenging mandatory **targets for fuel efficiency** in new vehicles, and this single action will substantially reduce CO₂ and other emissions from the transport sector. Despite the clear intentions to reduce key emissions from vehicles, in practice it will take 10–15 years to work its way through the entire vehicle stock in developed countries. In developing countries, with considerably older vehicle stocks, it will take even longer.

While searching for **alternative fuels**, it is important to recognize that both petrol and diesel have very high energy densities, thus, alternatives should have a high energy output and must be produced cleanly and cheaply, and in sufficient quantities.

The range of technological solutions that can be used to address the issues of improved vehicle efficiencies and reduced levels of CO₂ emissions are extensive. Underlying all strategies, however, is the importance of **vehicle occupancy** (freight and passenger), which is illustrated by the efficiency figures. Fully laden vehicles (public and private, freight and passenger) are far more efficient than empty ones.



Electric or hybrid cars are a feasible solution to reduce the carbon footprint of private motorized transport

Source: © guynamedjames / Shutterstock

THE COMPOSITE SOLUTION

Most cases of successful implementation involve a package of policy measures. Such 'packages' are more likely to gain public acceptance and promote overall welfare gains to society. The packaging process requires a deep and holistic appreciation of policy subsystems, together with a structured approach, if its benefits are to be genuinely realized.

In order to achieve the European Union target of zero carbon emissions from transport in cities by 2050, some communities have started moving towards the 'car-free city'. One such community is Vauban, Germany, which was constructed on a scale that facilitates movement by local public transport, walking and cycling (see Box 8). Vauban offers one example of how many of the different elements outlined in this chapter can be brought together into

Box 8 Car-free living: Vauban, Germany

Vauban is a small community of 5,500 inhabitants and 600 jobs, 4 kilometres south of the town centre of Freiburg. It was started in 1998 as 'a sustainable model district' on the site of a former military base. Although the Vauban community itself is small, it is mixed, with considerable levels of involvement of the local people, who help to decide priorities and alternatives (the Forum Vauban). The guiding mobility principle has been to try to reduce car use, giving residents the flexibility to use a car where necessary. This is matched by high quality public transport, walking and cycling facilities.

Within Vauban, movement is mainly by foot and bicycle, and there is a tram link to Freiburg (2006). Cycling is the main mode of transport for most trips and activities, including commuting and shopping. The town is laid out linearly along the tracks, so that all homes are within easy walking distance of a tram stop. The speed limit on the district's main road is 30 kilometres per hour, while in the residential area, cars should not drive faster than 'walking

speed' (5 kilometres per hour). About 70 per cent of the households have chosen to live without a private car (2009), and the level of car ownership (and use) has continued to fall.

The transport network in Vauban adopts a complex combination grid, with three types of streets: collector roads, local streets and pedestrian/bicycle paths. Most local streets are crescents and *culs-de-sac*. While they are discontinuous for cars, they connect to a network of pedestrian and bike paths which permeate the entire neighbourhood.

Most of Vauban's residential streets lack parking spaces. Vehicles are allowed to drive in these streets (at walking pace) to pick up and deliver, but are not allowed to park; enforcement is based on social consensus. Each year, households are required to sign a declaration indicating whether they own a car. If they do, they must buy a space in one of the multi-storey car parks on the periphery (at an annual cost of €18,000 in 2008).

a coherent set of proposals. Based on this experience it seems that urban residents can live in a car-free environment, provided that the right transport links are established, there are local facilities and services, and there are sufficient reasons for not owning a car (e.g. limited and costly parking).

FUNDING MECHANISMS FOR ENVIRONMENTALLY SUSTAINABLE URBAN MOBILITY SYSTEMS

There are global financial options that are directly related to environmental sustainability. So far, the

mechanisms devised to address such funding have not been effectively used in cities or in the transport sector. Out of the 6,660 'clean development mechanism' projects registered by 1 April 2013, only twenty-eight were related to transport. The clean development mechanism is one of the flexible mechanisms under the Kyoto Protocol.

There are also considerable overlaps between many general development programmes – funded through official development assistance – and global public goods programmes, including climate change mitigation strategies, such as public sector investments in clean transportation.

THE ECONOMICS AND FINANCING OF URBAN MOBILITY

In economic terms, the various modes of urban mobility are both complementary and competitive. They are complementary because residents typically avail themselves of more than one travel mode as they go about the daily activities of urban life. Simultaneously, these modal alternatives often compete for passengers. If sustainable transport systems are to evolve out of such complex systems, it is going to require an understanding of the incentives and disincentives faced by buyers and sellers of transport services.

The ways that urban transport options emerge and evolve depend heavily upon the costs of different transport options and the ways in which these costs are financed: either directly in fares, indirectly through taxes and fees or absorbed as pollution, climate change, congestion, road traffic deaths and injuries, or other social costs. Thus, this chapter reviews the economics and financing of urban mobility in light of its impacts on the ways the choices are made to explicitly pay for, or implicitly absorb, the costs. Finance systems can encourage (or discourage) the alignment of economic, environmental and social goals. There is thus a need to move away from an economics of mobility towards an economics of access.

THE ECONOMIC AND FINANCIAL CHALLENGES OF URBAN MOBILITY

The global dominance of the private car as the preferred means of urban transport is setting urbanization on a collision course with pressing equity and environmental concerns. Data on the relationship between rising income levels and rising rates of car ownership are strongly positive: as income rises, car ownership increases. Although the relationship between income levels and car ownership is relatively weak in countries with high incomes, it is strong among low-income countries. As the majority of the world's population live in low-income countries, an overall increase in income in these countries could have a significant impact on car ownership. The central challenge is to ensure that financing for public and non-motorized transport infrastructure and service delivery is at least comparable to efforts for accommodating the car. To do less is to virtually ensure that public transport remains an inferior choice.

Despite its relatively low cost, infrastructure for **non-motorized transport** (pedestrian bridges, paths, sidewalks and crossings) is sorely lacking in many urban areas, making it an unsafe and often inconvenient mode of travel. Non-motorized transport is often completely ignored or allocated an insufficient budget – particularly in developing countries – because it is not ‘revenue-generating’; thus, private investors and



A multi-modal regional transport system facilitates an easy distribution of costs and revenues across modes (London, UK)

Source: © Peter Stroh / Alamy

international lending agencies are not keen to provide finance, while the cost is, in many cases, beyond city capabilities.

Public transport can provide excellent access within urban areas when it is affordable to the user, frequent, predictable, safe and integrated within a comprehensive network. However, it often entails high capital and operating costs compared with private cars. To make a comparison between the real cost of public vs. private motorized transport, it is essential that the full cost include social costs, local pollution and global greenhouse gas emissions as well as the economic cost of congestion.

While capital costs for rail-based public transport range widely, they are consistently higher than for other modes. It has been estimated that the total per kilometre capital cost for metros generally ranges between US\$50 million and US\$150 million (2002 US\$ values). BRT capital costs (i.e. stations and

dedicated lanes) are considerably lower and the systems are built faster than rail. However, BRT does generally entail higher maintenance and operation costs than rail.

Public transport is primarily financed through fares, subsidies, and value-capture arrangements. **Fares** are perhaps the most contested component of public transport financing (see Box 9). International aid and/or broader-based **subsidies** must be sought to support public transport systems. Strong regulatory and governing institutions are necessary to collect and distribute funds for public transport at a large scale.

Informal motorized transport can operate much like public transport from the user's perspective, but is usually managed by private, for-profit companies or individuals. Each informal transport system may have its own fare structure which is not integrated with the rest of the public transport

Box 9 Public transport cost recovery from fares

Generally, fare-box recovery is adequate to support the public transport system only in places where density of use is high, public transport runs on exclusive rights of way and where affluent users prefer public transport to private cars. Two types of situation fit this scenario:

- Certain Asian cities; such as Hong Kong, Singapore, Tokyo, Osaka and Taipei. The fare box recovery ratio in Hong Kong in 2007 was 149 per cent.
- High-speed rail lines that connect major airports to city centres, such as the Heathrow Express in London, the Arlanda Express in Stockholm, the Brussels Airport

train, the Schipol–Amsterdam train and the Shanghai Maglev.

For European cities, the modal fare box recovery ratios are in the range of 30–50 per cent. The fare box recovery ratios in North American cities with high density and strong fixed rail systems are comparable to those in Europe. However, in the lower density North American cities the rates go down to as little as 9 per cent. In Burkina Faso, the public–private bus system, SOTRACO, covers 59 per cent of operating costs from fare revenues.

system. Uncompensated social costs subsidize the financial viability for informal sector transport providers.

Private motorized transport is often the most expensive mode for the traveller. There is a choke point of congestion when each private vehicle reduces space and diminishes the quality and speed of the trip for all other vehicles. Depending on system design, private vehicles can also interfere with the operation of public transportation.

ECONOMIC VALUE OF THE TRANSPORT SECTOR

Urban transportation is a vital urban public service and an integral input into the economic life of its city-region. While the overall size of the transport sector varies from economy to economy, it tends to account for a small but significant proportion of the gross domestic product – between 3 and 8 per cent in the countries of Asia and the Pacific. The demand for transport is what economists call a derived demand – a demand generated in pursuit of another goal. Urban transport is also a major source of employment.

In most cities of Sub-Saharan Africa, employment in the informal urban transport industry is a mainstay of the local urban economy. In Kenya, some 40,000 *matatus* (mini-vans) provide 80,000 direct and 80,000 indirect jobs, mostly in urban areas. The transport sector also often creates higher overall levels of income. Worldwide, it has been estimated that every

US\$1 of value created by public transport is linked to the further value creation of US\$4.

FROM ECONOMICS OF MOBILITY TOWARDS ECONOMICS OF ACCESS

One of the most powerful justifications for the disproportionate funding of private motorized transport is that it saves time. If the value of the benefits (i.e. the time savings) exceeds the cost of the project, it is deemed worthwhile. It is from this insight that modern cost–benefit analysis for transport decision-making evolved. It is, however, important to rethink this approach, to evaluate ‘the value of access’ as distinct from the hypothesized benefit of ‘time saved’ when considering transport investments.

To the extent that transport improves the ability of an urban area to maximize the agglomerative benefits of access – i.e. the economies of market density and supplier density – it adds significant value to the local economy. A working definition of the benefits of agglomeration would be the increase in individual per worker productivity that results from improved access.

An economic analysis of sustainable urban mobility must consider the complex nature of mobility as both a private and public economic good. The working formulation for an economics of sustainable urban mobility is one in which the planning and policy target is maximum access and minimal mobility. Mobility serves as the means to access these goods.

Increasingly, car users in most countries do not pay a high enough price to cover the full cost to society of this travel mode. This implies that the society at large is in effect subsidizing private motorized transport (through the costs of addressing economic, social and environmental externalities). Policy solutions to correct this inefficiency call for 'getting prices right'. In order to develop urban public transport systems that are of sufficient quality and quantity, and that also reduce environmental and social equity problems, policymakers must confront the reality that user charges will never be sufficient.

THE PERENNIAL FINANCIAL PROBLEM: COSTS EXCEED REVENUES

As noted in Box 8.1, there are only a handful of instances where fares represent both full cost

recovery and sufficient profit to permit a private market to sustainably meet the needs of passenger travel. Policymakers have attempted to 'solve' the cash flow problem through fare increases and competitive tendering. These solutions typically fall short, and the starting point for confronting the financial challenge is to recognize that **if urban public transport is to generate its valuable public goods benefits (i.e. to promote access), revenue sources beyond the fare box are needed.**

Travellers in developing countries pay high transport prices relative to their income; the amount paid is insufficient, relative to the revenue sums required at full cost recovery. Poor quality transportation entails high costs that are often not distributed equally across the city or within households. These income constraints limit the amount of revenue that users can contribute to the costs of maintaining the urban transport system. Attempts to resolve revenue shortfalls by increasing the costs of populations that are already paying a fare that severely taxes their



Hong Kong, China, has one of the world's few self-financing public transport systems, thanks to efficient use of value capture

Source: © CoverSpot Photography / Alamy



Park and ride schemes, combined with road pricing, can encourage a modal shift towards public transport

Source: © Kevin Britland / Alamy

ability to pay is clearly an extremely inequitable approach, and is thus not likely to succeed.

Furthermore, the value of urban transport is directly related to its quality as an integrated system, distinct from a collection of independent modal options and specific routes. The financial danger is that in a quest for saving money, specific routes are at times valued on an individual basis and not as part of a system. **The public goods value of access derives from the existence of entire urban transport systems.**

EXPANDING THE FINANCIAL OPTIONS FOR PUBLIC AND NON-MOTORIZED TRANSPORT

In what direction should the public sector proceed in order to expand financial support for urban public

and non-motorized transport beyond user-generated revenues? This section outlines the possible approaches.

Typically, governments meet the funding gap for urban transport via allocations from general tax receipts, the so called **general revenue model**. To the extent that governments treat public transport as just one among many public services such as police protection and education, this arrangement can work well. One of the weaknesses of this financial source is its political vulnerability (i.e. changing political climates).

There are also a number of **other allocations from public funds** to urban transport (which are in effect cross-subsidies to public and non-motorized transport), including, *inter alia*: various forms of road pricing, parking fees, advertising, sales taxes, taxes on fuels and vehicle ownership, employer contributions and grants from international funding agencies. However, the allocation of such public funding is frequently exposed to political considerations, and

may get diverted to other purposes, particularly during periods of economic austerity or changes in leadership.

Since direct public funding is politically vulnerable, it is preferable to directly link publicly sponsored forms of financial support to the benefits urban mobility bestows upon indirect beneficiaries. It is within that context that location-based taxes and assessments to support transport services have become popularly labelled as **value capture** systems. Experiences from Hong Kong and Bogotá show the importance of creating an agency that is capable of bridging the land use and transport divide. Tax-increment financing also works according to the same principle: when a site's value increases due to the implementation of new transport infrastructure, the government can anticipate an additional increment in real estate taxes, and can borrow against this anticipated tax revenue to finance implementation of the transport infrastructure. Value capture approaches work best in cities where there is initially low per capita car use and where the population is growing.

A wide range of **other public-private partnership models** have been used to finance urban transport systems. Such partnerships run across a continuum of contractual arrangements ranging from

traditional forms of government procurement to total private ownership of publicly used infrastructure. One powerful motivation for public partners to engage in such partnerships is to pass the risks of construction and maintenance off to the private party. However, as the investment involves vital elements of public infrastructure, the public partner can never walk away. Consequently, and regardless of contractual arrangements, the risk often remains with the public sector, which is often forced to buy out the private partner, at great cost to the public treasury.

In practice, finance for most urban transport systems is typically a **combination of sources** that resemble value capture in some aspects and general revenue funding approaches in others. The specific financial structure of any particular system will depend greatly on the historic context in which it operates, including the norms and values.

City experiences demonstrate the importance of inter-governmental cooperation and the need for a clear local public authority over the operation of public transport systems. Overall, there is need to ensure that – as a general rule of thumb – operating costs are tied to fares. However, capital costs need a broader source of revenues – a source that relates to the broader access values that the system creates.

INSTITUTIONS AND GOVERNANCE FOR URBAN MOBILITY

The challenges of urban mobility systems can only be addressed if they are seen as **political** challenges; requiring political consultation, decision and implementation, as opposed to seeing them as purely technical challenges requiring the ‘right’ technical solutions. Therefore, urban governance and related institutional and regulatory frameworks are at the heart of developing sustainable urban mobility systems and are critical to how well (and how fast) urban transport infrastructure and services are planned, appraised, delivered and operated.

No matter how good the policy recommendations, their implementation is dependent upon how fit-for-purpose these institutional and governance frameworks are to direct, manage, resource and deliver them. In many cities, formal institutions which affect the transport sector frequently operate in a less than desirable manner, particularly in developing countries.

UNDERSTANDING INSTITUTIONAL AND GOVERNANCE FRAMEWORKS FOR URBAN MOBILITY

The interaction of the institutional structure and agency actors is characterized by both formal

dimensions (i.e. rules and laws) and informal dimensions (i.e. customs and traditions), which impact relations between different branches of government. Even in the well-ordered cities of many developed countries, the informal sector and non-governmental organizations play an increasingly important role in facilitating and encouraging sustainable urban mobility.

The practice of policymaking and planning for urban mobility generally rests with institutions at the level of an urban area. However, as this may not coincide with the administrative boundary of the dominant city, organizations at a national (and sometimes regional/provincial) government level also set frameworks that can significantly influence policies that are (and are not) adopted. This is particularly the case with respect to land use, emissions, climate change, safety and finance. Coordination between the two levels of government is often not easy and frequently unequal.

CONDITIONS AND TRENDS

The policy and planning challenges of urban mobility in developing countries and in countries with economies in transition differ significantly from those found in urban areas of developed countries. Generally, the resources (human, technical and financial) and institutional frameworks at the disposal of policymakers and planners in such cities are less



Consultations with all stakeholders are an essential component of the realization of effective urban mobility systems

Source: © Alfredo Caliz / Panos

well developed. The report focuses on selected regional conditions and trends of institutional developments and governance, and their underlying influences.

In most of **Africa** poor coordination between the numerous institutions in urban transport prevails. This has led to problems in developing unified and integrated urban mobility policies. Generally, too many ministries are involved in urban transport issues, combined with widespread underfunding and absence of decentralization in the transport sector.

The institutional and governance frameworks in the field of urban land-use and transport in **Latin America and the Caribbean** are strongly influenced by developed countries (particularly North America). The major new institutional initiatives in the region relate to efforts to formalize and improve public transport services through the introduction of new BRT systems and metro extensions.

The institutional and governance structures for urban transport in **Western Asia** are as diverse

as the different governance systems found there. Notwithstanding, a decentralized model of urban transport governance appears to be emerging throughout the region, as a result of recent reforms related to rapid urbanization. Many oil-rich countries have developed urban transportation systems similar to those in developed countries. This has been accompanied by the establishment of some well-resourced, sophisticated new institutional and government frameworks for urban mobility. In contrast, Yemen, which has inadequately developed institutions for urban mobility, is more akin to those of the poorer parts of South Asia or Sub-Saharan Africa.

The institutional frameworks for urban transport and land-use development in the cities of **South Asia** generally exhibit a strong multi-tier set of national, regional and local government, plus quasi-governmental institutions, accompanied by a significant growth of private sector transport operators and investors (see Box 10). The lateral links between the institutions – in functional and geographical terms –

Box 10 Typical challenges of urban transport institutions in South Asia

- **Under-resourced institutions**, lacking in overall capacity to plan, execute, maintain and deliver affordable and sustainable urban transport.
- **Fragmented policy formulation and implementation**, with lack of co-operation among multiple ministries and transport agencies.
- **Lack of finances** for transport infrastructure and public transport services; resulting in extensive institutional and governmental support, concessions and subsidies.
- **Insufficient financial procedures** and accounting/audit systems.
- **Bureaucratic procedural constraints** that impede the delivery of urban transport infrastructure and services.
- **Inadequate legal and enforcement frameworks** and capacities needed for urban transport and land-use developments.
- **Absence of comprehensive information systems**, disclosures and public participation, leading to corruptive practices.

are typically poor compared to their vertical institutional links. However, several Indian cities have set up unified metropolitan traffic and transport authorities.

South-Eastern Asia presents a mixed picture in terms of institutional development and governance for urban transport. This is due to the different forms and levels of governments that prevail, different colonial histories, and subsequent evolution of their political processes. It is common however, that many of the responsibilities related to urban movement in the region are entrusted to a range of different national ministries.

In **Eastern Asia**, the influence of the strong institutional and governance frameworks for urban mobility in Hong Kong and Singapore has been particularly noticeable in mainland China. Accordingly, strong political support for key urban transportation projects has helped achieve some aspects of long-term policymaking and planning in China. However, in some instances, tensions exist between central and local interests, as well as between public and private sector interests. Occasionally, these have prevented the emergence of an integrated institutional approach to land-use and transport development.

CHALLENGES, UNDERLYING INFLUENCES AND RELATED POLICY RESPONSES

The report organizes the main challenges and underlying influences related to urban transport institutions and governance in four main categories,

as outlined below. The main report presents a selection of innovative and successful institutional and governance interventions to address most of these challenges.

Adaptation challenges

There is a slow-growing acceptance among governments (and stakeholders) of the need to change institutions and governance, if sustainable mobility goals are to be delivered. The increased globalization and politicization of the environmental debate brings challenges that can have major local manifestations. Negative manifestations generate tensions, which have influenced the thinking of many urban mobility stakeholders, as well as those engaged in urban land-use policy and planning. Due to the resistance to change within many institutions, addressing these challenges typically requires strong political leadership.

There is increasing recognition that the integration of land-use and transport planning is necessary to ensure the efficiency of urban mobility systems.

Administrative and governance challenges

During the last two decades, democratization, privatization and decentralization have been the three main challenges to the institutional changes occurring in Eastern Europe. For example, complications have occurred when rail- and road-based transport services extend well beyond city boundaries into their hinterland as inter-city carriers for passengers and goods.

Changes in organizational arrangements of agencies are frequently made to address urban mobility challenges, particularly when a new administration comes to power, either at the national or municipal level. These changes, however, have too often acquired a reputation for doing little more than ‘moving the boxes around’ on an organizational chart, and renaming them.

Of all challenges confronted by efforts to promote integrated urban land-use and mobility planning, perhaps the most corrosive is a bias against integrated planning and management.

Mobility policy, plan-making, management and regulatory challenges

The mainstreaming of the mobility needs of the socially and economically disadvantaged is a major challenge, and includes gender concerns, as well as the needs of the disabled, the elderly, children and youth. The challenges relate to their dependence on non-motorized movement, their restricted access to motorized public and private transport, their vulnerability to traffic accidents, and other safety and security concerns.

The issue of how best to plan, manage, operate and regulate urban public transport is a major international challenge, especially where non-nationalized

models of public transport governance exist. Some stakeholders advocate that these enterprises must over time be transformed into self-sustaining businesses operating on commercial lines. Other stakeholders, however, do not consider it desirable (or inevitable) that public transport should always be commercially operated, and look to a more welfare-orientated approach instead.

Freight movement is critical to the economies of all cities. There is thus an ongoing call for increased private investments to address the needs of freight movement, in terms of infrastructure and operations. Although globally significant, such investment is particularly important for cities with major ports and/or airline hubs in developing countries, and countries with economies in transition, where globalization has opened up many new opportunities. In order to address such challenges, the City of Paris has employed an explicit transport policy for freight since the early 2000s, and has promoted a charter for freight movement (see Box 11).

Challenges of multi-modal integration are exceedingly important with respect to provision of efficient public transport and freight movement. A common challenge for urban institutions is the integration of the planning, management and operation of railways with road-based public transport services and other traffic.

Box 11 The Freight Charter, Paris, France

In 2002, a consultation brought together the deputy mayor and the various freight transport stakeholders – as well as rail operators, energy providers and other public agencies – with a view to informing each other of their respective challenges and priorities. In 2006, as a result of these consultations, a Freight Charter was signed by all parties. While not a legally binding document, it identified commitments made. The most salient of the conclusions of this charter were that it:

- Declared that consultation helped defuse conflicts before they break out, between parties that (previously) usually never met.
- Introduced enforcement of truck access and delivery regulations.
- Highlighted the land scarcity for logistics activities, especially in the inner suburbs.
- Suggested that experimenting with new forms of city logistics organizations is an effective way of spreading new ideas.
- Concluded that the relevant jurisdiction for policies is regional rather than local, given that freight flows traverse all local boundaries.



Strong political leadership is a critical element for successful urban transport reforms (Enrique Peñalosa, Bogotá, Colombia)

Source: © Holcim Foundation

Inter-agency collaboration among the organizations responsible for the planning, management and operation of various urban modes of transport – and the city planning organizations responsible for land developments – is also essential. Finally, there is a clear need to mainstream environmental concerns in institutional and governance frameworks for urban mobility.

Resourcing and capacity-building challenges

Perhaps the most pervasive challenge for urban transport institutions globally, is the lack of sustained funding for transportation infrastructure and services – not least for the institutional infrastructure. Combined with a poor understanding of urban economics and the complex interplay between infra-

structure investment, land-use planning and the value that the ‘public good’ of efficient mobility can provide, these challenges can pose ‘wicked problems’, i.e. problems that are difficult (or impossible) to resolve on account of their incomplete, contradictory and changing features.

The development of information and communications technologies enhances the performance of urban transportation systems. These tools, however, are often poorly understood and/or present numerous technological and funding challenges (especially initially) to many conventional civic institutions, particularly in developing countries.

Institutional capacity-building and training of staff in the urban transport sector is critical, as it seeks to address local issues, and enhances global information and communications technologies that facilitate knowledge-sharing and lesson-learning.

TOWARD SUSTAINABLE URBAN MOBILITY

Global trends, such as rapid urbanization and motorization, pose tremendous challenges to urban mobility and accessibility. Yet, the changing context within which these are occurring, and the experience this is generating, present new opportunities for advancing innovative policies and programmes for sustainable development. The crux of this chapter is an elucidation of the concrete ramifications pertaining to the shift from focusing on improving the efficiency of urban transportation to enhancing accessibility in the city as a whole.

It is appropriate, first, to revisit some of the dysfunctional trends that were highlighted in the preliminary chapters and which necessitate the paradigmatic shift reiterated throughout this report. Indeed, the most prominent trend emerging from Chapters 2–4 is the increasing difficulty in accessing places, opportunities and services worldwide. Owing to urban sprawl, distances between functional destinations have become longer, widespread congestion has increased travel time, and high capital and operating expenses have led to increasing costs of accessibility. Consequently, a number of social groups are structurally discouraged from accessing many parts of the cities where they live, and are therefore deprived of the full benefits offered by urbanization. Furthermore, poor accessibility has reduced the efficiency and functionality of many cities.

Another trend highlighted in this report is the steady increase in the share of private motorized transport, including the extremely high motorization rates in developing countries. Apart from the inherent

inequity associated with private motorized transport, the negative externalities it generates are quite substantial.

The configuration of cities in terms of form, structure and function has been highly influenced by the dominance of private transport infrastructure, facilities and services. The embedded imperative of private motorization as the dominant mobility mode has dictated the layout and design of streets and neighbourhoods, dispersion of densities and location of functions. Perpetuation of this model has generated a self-replicating crisis of urban accessibility.

Simultaneously, in most cities, the neglect of urban freight distribution and management of freight transport – both in land-use and transport planning – tends to make goods transportation a major impediment to sustainable urban mobility and to accessing the city. The management principles and norms guiding planning, design and delivery exacerbate the situation further. Moreover, the regulatory instruments are not fully compatible with the demands of sustainability.

In megacities of developing countries where the mobility demand on major corridors is appropriately high, metros remain the only economically and environmentally viable public transport system. For cities which do not have the passenger threshold required for metros and/or the economic capacity to invest in them, BRT has become a viable option, at least in the short and medium term.

The report acknowledges the critical importance of accessibility for enhancing the economies of

agglomeration and urbanization. It underlines that urban mobility and accessibility are key for promoting sustainable urban development. Consequently, there is an urgent need to reframe urban mobility policies and practices in order to address these shortcomings.

POLICIES AND PRACTICES FOR REFRAMING URBAN MOBILITY

This report advocates for a paradigm shift in addressing urban mobility. It emphasizes the multi-dimensional nature of sustainable urban mobility, in terms of both policy and operational implications. It also summarizes some of the key attributes for a recalibration of how cities are designed and planned, and how urban transport services are organized and delivered in the quest for more sustainable mobility systems.

Urban mobility is finely woven into the spatial, social, economic, political, and environmental fabric of cities. Only by recognizing the systemic nature of problems (mispricing leads to over-consumption of roads in peak periods; sprawling settlement patterns render public transport systems ineffectual; urban design for machines creates cities for cars rather than people) can significant headway be made in charting a sustainable mobility future. There is thus an urgent need for **holistic and systemic thinking and action**.

It is essential to recognize travel as a 'derived demand', i.e. **transport is a means, not an end**. This realization envisages cities, neighbourhoods, regions and mobility systems as tools that promote desired societal outcomes – such as liveability and affordable access – with transport playing a supportive role. Operationally, this can take the form of compact, mixed-use communities that dramatically shorten trip distances and improve pedestrian and bicycling infrastructure.

Accessible cities not only put places (e.g. homes and workplaces, or 'trip origins and destinations') closer to each other, but also provide safe and efficient pedestrian and cycling corridors and affordable, high-quality public transport options. Accessible cities are inclusive, resourceful and pro-poor. Urban mobility policies should thus place **priority on accessibility rather than transport**.

POLICY AND OPERATIONAL ENTRY POINTS

From the above normative framework, the final section of this report presents six policy and operational areas that can be developed to suit different settings, and through which accessibility-based sustainable mobility can be achieved. The overall logic of these lies in their strategic linkage and their cumulative potential for triggering policy and operational change.

Enhancing the linkage between land use and transport

There is a disconnect between the essence of land-use and the logic of transport. This connection needs to be re-established for sustainable urban mobility to be achieved; and it can only be effectively initiated at the highest level – through national urban policy initiatives. When properly articulated, national urban policy offers the most authoritative instrument for elevating the linkage between land-use and transport planning (beyond the bureaucratic and political compromises often reached).

The key challenge is therefore not merely to overcome the separate handling of transport and land-use planning; or even to ensuring a juxtaposition of the two. Rather, it is to foster an organic integration of the entire continuum of multi-modal mobility within a holistic and sustainable land-use system where dynamic synergies are harnessed, interconnections are promoted and functionality optimized. The comprehensive integration of land-use and transport needs to be thematically cross-cutting and multi-sectoral, reflecting the co-dependence of urban systems.

Revitalizing urban planning and transport engineering designs

The linkage between urban form and transport is realized through the optimization of density, and enhanced proximity and co-location, as well as improvements in the functionality and inclusiveness of places and facilities. Density can be optimized through the use of regulatory instruments (such as zoning laws), the application of locational incentives



High-capacity public transport systems, and a focus on inter-modality, are essential components of a sustainable urban mobility system (London, UK)

Source: © Yon Marsh / Alamy

(such as infrastructural investments), and design interventions. Compact configurations complemented by transport-oriented development minimize private motorization, while making it viable for cities to invest in different modes of public transportation.

The planned optimization of density advocated in this report enables the attainment of economies of scale, making it viable to provide a range of facilities at the least cost. The compactness engendered allows for more public space while also exerting a minimum impact on the environment. Coupled with appropriate design, it encourages non-motorized and public transportation, fosters conviviality and strengthens a sense of place.

A related attribute is the need to ensure diversity and mixed-use neighbourhoods. Mixed-land use promotes non-motorized transport by increasing proximity and reducing the need to travel.

Realigning transport infrastructure investment and development

Gradual steps should be taken to correct the current imbalance in funding and investments between private and public modes of transport. More public resources need to be allocated to facilities which cater to the needs of the majority of people in both developed and developing countries. It is particularly important that cities investing in metro, light rail and high-end BRT systems direct larger shares of future growth to public transport corridors.

The urban transport sector needs to be treated as an integrated whole, through systems of financing and pricing. Dedicated, long-term funding is also essential to allow strategic, forward-looking planning, such as preserving rights of way for future infrastructure investments.



Non-motorized transport is environmentally sustainable and well suited for making short trips in most cities (London, UK)

Source: © Alex Segre / Alamy

Among other financing sources, the option of value capture is highly recommended as a complement to public funding. Through recouping the increase of value in adjacent land and converting it into public finance for reinvestment in urban mobility systems, the linkage between land-use and transport is reinforced.

Owing to the financial constraints of local governments and increased interest by private investors, the global urban transport sector has witnessed a surge in other forms of public–private partnership. Public–private partnerships have the potential to inject efficiencies in the urban transport sector and also stimulate innovations, like market-based pricing and automated toll collection. However, this report also highlights some of the potential dangers related to the use of public–private partnerships in urban mobility projects, such as the financial risks, which tend to be carried by the public rather than by the private sector partners involved.

Integrating urban transport facilities and service operations

Properly designed transport systems also contribute to business expansion, increased economic output and employment generation. Indeed, mobility is a necessary (though not a sufficient) precondition for economic growth and expansion. Efficiency must underpin management, operational and system design practices throughout the urban transport sector.

Progressive projects and programmes – such as green transport-oriented development and ‘complete streets’ – do not suddenly appear, but begin with thoughtful plans and visions. Transport planning needs to be well integrated with land-use planning at all levels of government. Through both carrots (e.g. financial aid) and sticks (e.g. regulatory requirements), national governments are uniquely positioned to encourage state/provincial, regional and local institutions to link transport investment and urban

development strategies in master plans, zoning practices and infrastructure design standards.

Streamlining urban institutions and governance framework

Innovative ideas and policies geared towards sustainable mobility require strong institutional and governance structures to oversee their successful implementation. Political will, sound leadership, transparency and accountability are essential in building public trust. The planning institutions are vital to the entire process, as these are capable of creating compelling visions of urban futures. Moreover, participatory mechanisms must be in place to ensure that planning and investment decisions are socially inclusive and representative of all segments of society. Technology itself can be an enabler of more

grass-roots and inclusive policymaking in urban transport. Social media, for example, allow like-minded individuals to coalesce and shape public discourse.

Responsibilities for the urban transport sector are being decentralized across the world. It is essential that human and financial resources are made available for the successful handover of functions and investment responsibilities from central to local governments.

The development of fully integrated and sustainable multi-modal urban transportation systems requires robust regional governance structures, which gives rise to inter-municipal cooperation. While most of the innovations introduced in urban transport will come from local and regional actors, higher levels of government also have a crucial role to play. National urban transport policies that promote integrated



Dedicated non-motorized transport infrastructure is required to improve the safety of all road users (Amsterdam, the Netherlands)

Source: © Charlie Knight / Alamy

planning and provide capital loans and technical assistance can help smaller cities develop sustainable mobility systems.

There is also a need to inject efficiencies, accountability and transparency in the urban transport decision-making process. This requires the development and institutionalization of planning processes and evaluation approaches that are based on objective measures of performance and tied to well-articulated goals and hoped-for outcomes.

Readjusting legal and regulatory instruments

The aforementioned interventions call for changes in the management of space, the built form, the engineering of transport systems, and social behaviour, as well as in the institutional and financing arrangements related to urban development. These elements are built upon the legacy of a legal foundation that has

perpetuated mobility systems, which this report has found to be severely wanting. Any transformation would therefore entail major reform in the legal and regulatory framework relating to urban management. For example, the ordinances guiding the planning process have to be amended from land-use segregation and rigid zoning, towards fostering mixed-use and compactness. The same applies to building codes and standards, mandates and the authority allocated to different institutions, as well as to sanctions directed at reducing negative externalities.

While significant progress has been achieved in some cities, in terms of incorporating the necessary laws and regulations for realizing some of the above objectives, much remains to be done. The dire need for fostering inclusiveness and environmental protection not only calls for the enactment of a comprehensive set of statutes, but also requires the consolidation of enforcement capacity, to ensure that the laws and regulations are abided by.

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PLANNING AND DESIGN FOR SUSTAINABLE URBAN MOBILITY: POLICY DIRECTIONS

GLOBAL REPORT ON HUMAN SETTLEMENTS 2013

Urban transport systems worldwide are faced by a multitude of challenges. Among the most visible of these are the traffic gridlocks experienced on city roads and highways all over the world. The prescribed solution to transport problems in most cities has thus been to build more infrastructures for cars, with a limited number of cities improving public transport systems in a sustainable manner. However, a number of challenges faced by urban transport systems – such as greenhouse gas emissions, noise and air pollution and road traffic accidents – do not necessarily get solved by the construction of new infrastructure.

Planning and Design for Sustainable Urban Mobility argues that the development of sustainable urban transport systems requires a conceptual leap. The purpose of 'transportation' and 'mobility' is to gain access to destinations, activities, services and goods. Thus, access is the ultimate objective of transportation. As a result, urban planning and design should focus on how to bring people and places together, by creating cities that focus on

accessibility, rather than simply increasing the length of urban transport infrastructure or increasing the movement of people or goods. Urban form and the functionality of the city are therefore a major focus of this report, which highlights the importance of integrated land-use and transport planning.

This new report of the United Nations Human Settlements Programme (UN-Habitat), the world's leading authority on urban issues, provides some thought-provoking insights and policy recommendations on how to plan and design sustainable urban mobility systems. *The Global Report on Human Settlements* is the most authoritative and up-to-date global assessment of human settlements conditions and trends. Preceding issues of the report have addressed such topics as *Cities in a Globalizing World*, *The Challenge of Slums*, *Financing Urban Shelter*, *Enhancing Urban Safety and Security*, *Planning Sustainable Cities* and *Cities and Climate Change*.



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