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Sustainable urban mobility solutions for Asia, Latin America and the Mediterranean region

Book Chapter

Sustainable Urban Mobility Pathways

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Sustainable urban mobility solutions for Asia, Latin America and the Mediterranean region

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Abstract

Cities around the world strive to establish sustainable urban transport systems in order to provide efficient and safe mobility services for their citizens with minimum environmental and social impacts. With often-limited opportunities to build new infrastructure, cities aim to increase the efficiency and capacity of their existing transport systems by deploying innovative, sustainable and technically advanced solutions.

The successful transfer and implementation of urban mobility solutions between global regions proves to be particularly challenging considering that socio-economic conditions and the respective policy frameworks differ substantially. A number of projects have successfully demonstrated the transfer of selected solutions between leading and take-up cities. Such paradigms actually confirm the high value of collaborative learning and exchanging experiences within different cultures and planning practices.

Cities, regions and countries around the world often share similar urban mobility challenges with some cities being more or less progressive than others. While there are advantages to sharing best-practices, examples and lessons learnt, it is of significant benefit to city officials and other relevant stakeholders to have a robust methodology in place, which they can follow to implement and harmonise successful urban mobility policies, measures and technologies.

Urban mobility proves to be strongly influenced by a spectrum of economic, social and political factors indicating the need for analysing the conditions, trends and implications of sustainable urban mobility solutions in each of the different Mediterranean, Latin-American and Asian countries. This chapter, summarises the conditions, trends and implications of sustainable urban mobility solutions China, India, Brasil, Mexico, Turkey, Israel and Morocco.

Key words: sustainable mobility, policy, Asia, Africa, Latin America

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Sustainable urban mobility solutions for Asia, Latin America and the Mediterranean region

This chapter presents the urban mobility challenges in **Brazil, Mexico, China, India and the Mediterranean region** (including Morocco, Israel and Turkey). It share insights gained from research and interviews with city officials from these countries, and proposes successful sustainable urban mobility initiatives that can be implemented in these countries.

The applicability and potential of the identified solutions in different cities and world regions depend on the local and national framework conditions, such as socio-economic aspects, legal frameworks and individual cultural aspects e.g. attitudes towards enforcement and control – what is accepted in one cultural context may not be accepted in another. Also city-specific aspects are of great importance, e.g. spatial structure and land-use patterns or characteristics of mobility (modal split etc.). The city partnerships included reciprocal visits, trainings and stakeholders workshops.

This section focuses on a selected number of cities from the partner regions and includes a general description of the urban mobility situation in each country, and the specific insights related to a select number of cities, is based on this thorough and methodological fieldwork and the feedback received from city officials. All partner cities are characterised by rapid rates of urbanisation, the consequent growth of informal settlements, urban sprawl and a declining share of public transport usage. There are increasing rates of car ownership, worsening safety and air quality conditions and challenges for urban accessibility. Based the **SOLUTIONS** project and the Urban Electric Mobility Initiative cities have selected a number of measures to move towards a sustainable urban mobility development that is in line with the New Urban Agenda and a 1.5 degree stabilisation pathway. This chapter presents profiles of countries, outlines the policy drivers and barriers to implementing sustainable urban mobility measures, the recommendations of the SOLUTIONS experts, and the solutions that would best tackle their problems.

Brazil' urban mobility SOLUTIONS

Country profile

Population: 206.1 million (2014) °

Area: 8,515,770 km².

Belo Horizonte

Belo Horizonte, the capital of the state of Minas Gerais, is the third largest metropolitan area in Brazil, with a population of over 2.4 million, with 5.7 million in the official metropolitan area. It is surrounded by the Serra do Curral mountain range.

In terms of air quality, since 2001 Belo Horizonte monitors the percentage of days with good air quality: days with good air quality decreased from 93.5% in 2001 to 66.6% in 2011. Because of this worsening, Belo Horizonte has made a commitment to reduce its emissions by 20% for 2030.

São José dos Campos

São José dos Campos, in the Metropolitan Area of Vale do Paraíba, located between the two most active production and consumption regions in the country: São Paulo and Rio de Janeiro, has a population over 600,000 people distributed over 353,9 km². It is the most important aerospace industry centre in Latin-America, containing many important research and educational institutions, as well as technology enterprises.

Needs, gaps and priorities

Brazil is Latin America's largest economy and home of the greatest biodiversity on the planet. Brazil faces environmental and social challenges driven by economic development and high level of urbanisation. A growing middle class increased Brazil's energy-related emissions by more than 21% from 2005-2010. Already, 85% of the country's citizens reside in cities, with all net population growth expected to occur in cities over the next 30 years.

Brazil, the largest and most populated country in Latin-America, has seen a significant growth in its cities in the last decades. Due to the challenges related to this, a National Policy of Urban Mobility was adopted in 2012. The main objective of this policy is to provide a more efficient mobility system, while improving air quality, reducing congestion and reducing deaths and injuries caused by transport crashes. To deliver on this objective the development of SUMP's has become mandatory for large and medium-sized cities (more than 20,000 inhabitants), with a clear objective to build more connected, inclusive and sustainable cities. The SUMP's developed by the municipalities must establish goals and guidelines to improve public transport, city logistics, and foster non-motorised mobility.

Belo Horizonte

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In terms of air quality, since 2001 Belo Horizonte monitors the percentage of days with good air quality. days with 'good air quality' decreased from 93.5% in 2001 to 66.6% in 2011. Because of this worsening, Belo Horizonte has made a commitment to reduce its emissions by 20% by 2030. As part of the SOLUTIONS project, Belo Horizonte is developing implementation plans for non-motorised transport (NMT), low speed urban roads (Zones 30), and urban logistics solutions.

The Municipal Authority for Urban Policies is responsible for planning and managing urban projects like public infrastructure, housing, pavements, sanitation and transport. BHTRANS (Empresa de Transportes e Trânsito de Belo Horizonte), a public entity, is responsible, under a mandate from the Municipal Authority, for urban transportation and traffic management for the whole city. BHTRANS plans, organises, guides, coordinates, executes, delegates and controls the delivery of public services related to urban transportation and road traffic, according to federal and state legislation, as well as contributes for Belo Horizonte's urban planning.

Belo Horizonte has an innovative Sustainable Urban Mobility Plan, called PlanMob-BH, with comprehensive measures including TOD, BRT and bike solutions. The city created an Urban Mobility Observatory and a Mobility Council, two important tools of social control that are responsible for providing information and collecting civil society demands for improving mobility. By implementing a BRT system, Belo Horizonte also took the opportunity to revitalise the downtown area, creating pedestrianised streets and giving the space back to people from cars. PlanMob-BH also proposed the development of a Bikeway Network.

São José dos Campos

The city of São José dos Campos, in the Metropolitan Area of Vale do Paraíba, with a population over 600,000, is the most important aerospace centre in Latin-America, containing important research and educational institutions, as well as technology enterprises.

São José dos Campos is currently developing solutions for public transport and integrated planning. Urban & transport planning in São José dos Campos is done by the municipality, which is currently developing a SUMP, established previously as a mandatory instrument to receive financial aid for projects. The city will soon be receiving funding from the Federal Program to Accelerate Growth (PAC).

As a part of the Solutions project in 2014, a set of meetings with technicians, operators and project managers helped identify opportunities and difficulties faced by the teams who are proposing the development of a BRT as part of the solutions on public transport and integrated

planning. Several of these measures are currently pursued further in São José dos Campos with support from the project.

Policy barriers and drivers

Due to the fact that SUMP's are already mandatory planning instruments for cities in Brazil, there is an enormous transferability potential between leading cities and training cities. But in order to make this happen in a proper manner, a need to strengthen the technical capacity at the municipal level has been identified.

SUMP's can significantly contribute to a better and more sustainable urban transport system in Latin-American cities, but experience shows that – given the local conditions – success may be more achievable if the various mobility-related stakeholders (operators, providers, and users) are involved in the planning process. Citizen engagement is a key component of sound sustainable urban mobility planning. This is one of the relevant topics where some cities in Brazil have conducted best practices.

As CO₂ emission reductions are an important objective for large and medium-sized cities, there is an interest on clean vehicles, with emphasis on biofuel, more infrastructure for cyclists and pedestrians, and on public transport (especially for bus priority and BRT). Belo Horizonte already has a continuously growing bike sharing system called Bike-BH, with plans to have a total of 40 stations with 400 bikes. Currently, Belo Horizonte has a network of a total of 72 km of protected bicycle lanes. PlanMob-BH intends to add 308 km more bicycle lanes to the networks by 2030. Belo Horizonte has already pedestrianised 2 streets in the central city. The new infrastructure also includes bicycle lanes and a terminal of BRT MOVE. There is a clear opportunity to replicate this measure in other areas of the city, and in other cities in Brazil.

In 2014 Belo Horizonte approved the implementation of a Zone 30, which was supported by the SOLUTIONS project and the partner city Bremen. Part of this implementation action is a regulation to limit speed in dedicated areas to a maximum of 30 km/h, which is supported by a number of traffic calming measures. The implementation of this measure will be a pilot-project part of the program PEDALA-BH and is aimed to be integrated into the cycling strategy and the network planned in PlanMob-BH.

Since Brazil has regions with rapid growth and often unplanned urban development, such as both Belo Horizonte and São José dos Campos, a comprehensive SUMP approach can significantly contribute to a better and more sustainable urban transport system in these cities. With regard to urban logistics, national and regional conditions are very favourable for the development of a Municipal Policy for Urban Logistics. The main players are the local government and the freight carriers, who will have to cooperate on relevant measures.

Regarding financial resources, currently there is a lack of funding to deliver an origin-destination survey of freight transport, that is fundamental in order to elaborate a comprehensive policy for urban logistics.

Recommendations and solutions

For both Belo Horizonte and São José dos Campos, more sustainable transport planning in the cities may be achieved by implementing a SUMP, currently being elaborated. Also, better coordination and integration between different public transport modes has been recommended, in order to achieve a better inclusion of needs of different user groups.

Zone 30 projects (like the one already in implementation, as a pilot-project, in Belo Horizonte) may be pivotal in these efforts, as well as the development and implementation of other proposals for cycling networks (depending on budget availability), like bicycle sharing systems. It is also important to induce a mode shift towards NMT and public transport, which

would imply the need of a higher quality service, in terms of reliability, safety, security, time-saving and customer-driven public transport systems (such as BRT). Solutions which have been identified to be highly applicable for cities in Brazil are shown below. Most of them are already being implemented or have been in the past.

Solution
Public transport
Mass transit systems (BRT in particular)
Bus priority measures
Bike-sharing and public bicycles
Transport infrastructure
Dedicated bus lanes
Innovative and safe cycling infrastructure
Intermodal interchanges
Pedestrianising city centres and streets
City logistics
Vehicle and operation restrictions on time, weight and size (off-hour deliveries in particular and night-time parking lots)
Low Emission Zones
Forums, portals, labels and training
Urban Consolidation Centres
Pick-up point networks
Integrated planning/SUMPs
Stakeholder participation and citizen engagement
SUMP monitoring and evaluation

Mexico's urban mobility SOLUTIONS

Country profile

Population: 125.4 million (2014) ¹⁰

Area: 1,964,375 km².

León

León is the fifth largest city in Mexico, with a population of nearly 1.4 million people, distributed over 198 km². Regional and national planning for the last 20 years have consolidated the economic dynamic of the municipality, by exploiting its geographical location along the industrial corridor linking Aguascalientes, León, Guanajuato, Silao, Irapuato, Celaya, Salamanca and Queretaro.

Despite the city of Leon being the first in Mexico to create an Integrated Transport System, with 5 BRT lines and a series of complimentary routes, the city continues its efforts to strengthen its public transport, as the same time as it consolidates a non-motorised transport strategy. For almost two thirds of trips in the city, public transport or though non-motorised modes are used.

La Laguna Metropolitan Zone (ZML)

ZML contains four municipalities: Matamoros and Torreón, from the state of Coahuila, and Lerdo and Gómez Palacios, in Durango. This urban area had population growth of 1.9% from 2000 to 2010, when it reached 1.2m inhabitants. The city's public transport routes have an average speed of around 15 km/h, and an average commute time over 30 minutes, considered unsatisfactory for a mid-size city

Durango

The capital of the state of Durango covers an area of 94 km², with over 580,000 inhabitants. It has a historical centre, with narrow streets, poor road pavement quality and lack of main road axis to structure the urban development. Durango lacks an efficient road network, together with a poor transport service. Only 39% of Durango's population use public transport, mainly old and polluting buses of over 10 years of age. The city also lacks non-motorised strategies that led to a high motorisation, resulting in high traffic congestion for a mid-size city.

Needs, gaps and priorities

Mexico, the second most populated country in Latin-America, has experienced largely unplanned growth over the last decades, and an increasing modal share for private transport. Over the last three decades, housing policy took step back: the need to address the lack of housing led developers to create disconnected, disperse and distant cities, taking advantage of the low cost of land outside the boundaries of the consolidated urban network. A lack of coordination between transport and urban development planning has resulted in disorganised growth which now needs to be addressed.

In recent years, Mexico has taken significant steps towards the modernisation of public transportation in its main cities. The implementation of Bus Rapid Transit systems (BRT) in some cities, alongside the creation of professional operating companies (which, in many cases, are previous private operators) has not only meant a change in standards regarding how the transportation service is provided, but also meant a structural change in the way mass transportation services are planned, managed and operated in Mexican cities. Nevertheless, these systems coexist with thousands of obsolete, uncomfortable, unsafe and highly polluting vehicles; a result of an owner-operated and fragmented model of operation.

The main problem in Mexican cities is the number of private cars increasing at an annual rate of 4%. If this rate continues, in 2030, cities like León would have about 1 million private vehicles, worsening congestion problems, and its air quality. This scenario applies mostly to cities in the northern part of the country, where motorisation rates are higher and there is still a leading toward private-car-oriented policies.

Policy barriers and drivers

Several important steps towards sustainable mobility have been taken in Mexico in recent years, such as the creation of a Federal Program for the Support of Mass Transport (PROTRAM), which has pushed forward the modernisation of urban transportation in the country's main cities. Furthermore, the National Strategy for Sustainable Urban Mobility promoted by the Agriculture, Territory and Urban Development Ministry (SEDATU) offers the possibility of linking policies and sustainable mobility programs with urban development strategies. This drives to develop integrated public transport systems and represents a radical change in the way Mexican cities move and built.

Part of the requirements established by PROTRAM for cities to qualify for funding is a SUMP. Cities have advanced on this task, but a series of shortcomings have been identified, such as strengthening the institutional capacity on technical issues to elaborate, implement, evaluate, analyse and monitor a SUMP.

In some cities, autonomous municipal planning agencies (IMPLAN) have been created to address the lack of continuous development plans, as well as the need of a technically solid institution which is above the political cycle. This has been shown to be good practice in the cities where an IMPLAN operates, providing comprehensive development plans with a long term vision, and structuring land use exploitation in an orderly manner.

One of the most important components yet to be enhanced is institutional arrangements, for example, by creating financially and institutionally solid transport agencies in charge of planning, regulating, operating and monitoring public transport. The transition is not an easy one: for this to happen, the creation of institutional and ad-hoc legal frameworks is required, as well as the establishment of financing mechanisms to guarantee the stability of transit systems, while keeping high service quality levels.

At the same time, as stated before, the short administration period of the municipalities requires a very agile execution of projects, as most decision-makers are replaced after each election (depending on the political scenario). In order to tackle this situation, the state administrations (with six-year terms) typically need to lead and coordinate with the municipal actors to conclude long-term mobility projects. This situation applies to most Mexican cities (León is one exception), where planning, execution and coordination of transport relies on the state.

The state of Durango, for example, leads two projects - one for the capital city of Durango and one for the ZML. In the case of the capital city, their SUMP aimed to increase the productivity and quality of public transport, and restructure its routes, while reorienting the urban development to a more sustainable model. Crucially, the Federal Government supports the project, making it more feasible due to the financial implications of federal support.

ZML has a significant interest in developing a BRT system for the Laguna corridor (LC). As mentioned before, it is composed by municipalities of two different states. Therefore, the biggest barrier is to find a solution for the compliant with acceptable different legal and political systems, pending, as well as the verification of the definitive operational scheme.

In terms of finance, for example, in both of the SOLUTIONS cities (León and Durango, and most other Mexican cities) - public transport receives no subsidies. As such, all operational costs must be recovered from fares. This makes it very difficult for owner-operated bus service providers to generate sufficient funding to renew, improve or upgrade the bus fleet. This fact is linked to another fact that the current institutional and legal frameworks of most of the states is built for owner-operated buses. There is a general institutional issue in most of the metropolitan areas, including Mexico City, where territorial borders and institutional responsibilities represent a clear disruption for urban travel. This has even led to the discussion around the creation of Metropolitan governments in order to properly manage different services, such the distribution of water, solid waste disposal, public security, the police force, or mobility planning.

Solutions and recommendations

A large number of cities are already evaluating the transformation of Public Transport using PROTRAM's financial support, yet a step back needs to be taken; while it is widely recommended to strengthen the institutional and legal frameworks to provide high quality public transport service. This needs to be followed by solid financial schemes in order to ensure that investments on public transport are financially sustainable. In this regard, as part of the Solutions project, one of the needs identified by Leon which could not be addressed due to the timeline of the project was Curitiba's experience and knowledge on subsidy schemes, which would not put the municipality's financial situation in jeopardy.

As previously stated, the short period of the municipal administration may be the main barrier to address, as this may lead to the design and implementation of immediate but not effective, car-oriented solutions, which – in the worst case – has even resulted in the increase of private car usage, therefore worsening the mobility patterns in Mexican cities. In this regard, it is highly recommended to continue strengthening agencies such as IMPLAN, which have shown to be quite successful at providing long term planning instruments in order to consolidate urban development and transport planning in a comprehensive manner. As seen in the Solutions project, the feasibility and applicability of mobility solutions relies, to a significant degree, on

technically competent planning agencies which can put together long term plans such as SUMP.

As stated before, it was not possible to accomplish the implementation of a solution in Leon, as the political scenario shifted many times, by which priorities initially established were modified twice. These modifications could not be properly adapted into the cycle of the Solutions timeline.

However, due to the fact that air quality in Leon has worsened in recent years, one of the recommendations given by the SOLUTIONS team was to evaluate switching to more energy efficient and cleaner fuels, to be used in public transport (currently most buses run on EURO IV ULSD technology) as well as considering electric vehicles for logistics. This should be supported by financial incentives, as electric vehicles represent unacceptably high investment costs in most Latin-American. On this last issue, it is important to note that logistic vehicles in Mexico are regulated at the federal level.

Durango, one of the SOLUTIONS training cities, is currently improving its SUMP, which could over the years be implemented with solutions such as non-motorised transport, bike sharing systems and public transport solutions (with BRT lines possibly being one of them). Some of the other Solutions which can be implemented in Mexican cities, depending on local conditions are:

Solution
Public transport
Mass transit systems (BRT in particular)
ITS for Public Transport
Electric and hybrid vehicles
Integrated fare systems
Bike-sharing and public bicycles
Transport infrastructure
Dedicated bus lanes
Innovative and safe cycling infrastructure
Intermodal interchanges
Pedestrianizing city centres and streets
City logistics
Vehicle and operation restrictions on time, weight and size (off-hour deliveries in particular and night-time parking lots)
Low Emission Zones
Forums, portals, labels and training
Urban Consolidation Centres
Pick-up point networks
Integrated planning/SUMPs
Stakeholder participation and citizen engagement
SUMP monitoring and evaluation

Conclusions

The main problem to address in Latin American cities are the rapidly growing demand of privately owned vehicles, commonly linked to urban development which is disconnected, disperse and distant from the consolidated urban areas.

Newly incorporated policies in Mexico and Brazil include the elaboration of Sustainable Urban Mobility Plans that will define the way cities configure to prioritise public transport combined with non-motorised transport and freight solutions, which can improve urban mobility. In order

to do so, some of the areas of opportunities or overcoming barriers in the Solutions take-up or training cities are:

- **Strengthening processes.** In the cases of both Mexico and Brazil, federal financial support is provided in order to implement sustainable urban mobility solutions. This process needs to be in continuous improvement, in order to set standards, that provide guidance and monitor implementations in cities.
- **Strengthening capacity.** One of the identified needs within municipalities is the continuous capacity building processes to push the elaboration, implementation and evaluation of mobility solutions by planning agencies. This issue responds to the fact that in some cases, the technical agencies are newly staffed in every new administration. This can also be solved by creating autonomous municipal agencies with overlapping administrations.
- **Strengthening Institutions.** Having strong agencies in charge of planning, operating and monitoring urban mobility would lead cities to be able to manage urban mobility in a more orderly manner.

Therefore, the **Solutions** project led take-up and training cities to live and experiment the implemented solutions, strengthening knowledge through the exchange of techniques, processes, ideas but most importantly, from lessons learned through various mistakes.

China's urban mobility SOLUTIONS

Profile

Population: 1.364 billion (2014)¹¹

Area: 9,596,961km²

The third largest country in the World, and the most populated, China has seen a rise in its population density and urban population. There's also a shift from China's traditionally more sustainable mobility patterns and modal shares, towards a rapid road infrastructure expansion induces additional motorized transport demand. Several large Chinese cities were involved in the SOLUTIONS project, namely Beijing, Foshan, Hangzhou, Harbin, Shanghai, and Zhongshan.

Air quality is of significant concern amongst Chinese officials. The general public is also showing growing interest in air quality issues, partly due to extreme situations in major cities (especially Beijing), but also by recent revelations of food and water quality standard compromises. National and local authorities are at pains to ensure local air pollutant emissions reduction efforts are being pursued. Some 200 Chinese cities are investigating the potential Low Emission Zones. Congestion and air quality are already significant issues in many Chinese cities and are at the top of the agenda for most city officials working on urban mobility. As a result, many Chinese cities have already invested substantially in traffic infrastructure, and there has been significant investment in transport infrastructure hardware, although Chinese citizens are still strongly influenced by the media and her/his perception of global models and success; many aspire to purchase their own car.

The realization is growing that the demand-driven approach to transport planning will not deliver sustainable mobility and that more innovative solutions are needed. There is a growing recognition that focusing on rapid road infrastructure expansion induces additional motorized transport demand, significantly shifting away from China's traditionally much more sustainable mobility patterns and modal shares. This has been identified as an expensive approach which also results in increased energy consumption in the Chinese transport sector. Furthermore, the strategy increases travel costs and greenhouse gas emissions, results in deteriorated air quality and to increased social costs from accidents.

Policy barriers and drivers

Air quality being the greatest issue, in the Chinese workshop discussion on clean vehicles had an important role, and focused on electric cars and two-wheelers – predominantly battery electric vehicles (BEV) and plug-in electric hybrid vehicles (PHEV) – along with the adoption of various other fuel options, such as CNG, LNG and biofuels. China has a strong interest in electric mobility and is already the world's largest producer of electric two-wheelers.

There is rapidly growing interest in the development of infrastructure and systems for sustainable transport modes such as walking and cycling, as shown by some of the workshop presentations. China traditionally had a very high modal share of cycling; the current challenge is to maintain or regain this share. To facilitate this, accessible and safe cycling infrastructure and supporting measures are required. With increasing motorized transport, safety issues associated with cycling also increase.

Providing and/or improving the attractiveness of modal alternatives – such as public transport, walking and cycling – is paramount in achieving high modal shares for these modes, limiting road-transport demand, and thus improving the transport system's overall sustainability. Ensuring slow but free flowing traffic using ITS, combined with other demand management measures is an area of mutual interest for the EU and China.

Another measure discussed, both for improving attractiveness of several modal alternatives and to regain the very high share of cycling, was bike sharing. Based on European concepts, many Chinese cities are establishing systems within a very short time-frame, yet at very high level of quality and quantity. A number of cities in China such as Zhongshan, Hangzhou, and the workshop's host city Foshan, have implemented bike-sharing schemes based on the Parisian model.

Several Chinese researchers and city officials mentioned a growing interest in Light Rail (LRT) technologies as logical next step from Bus Rapid Transit (BRT); some of the key infrastructure, such as a dedicated line and high-capacity stations, is already in place as part of the BRT system. However, operational funding of these systems has been identified as a key problem for public transport services in Chinese cities. The infrastructure cost itself is seen as less problematic, as loans from domestic banks are readily available and land sales provide a sizeable income for infrastructure investment. The exchange between cities in Europe and China could cover not only technology and policy issues, but also operational and funding structures.

Since a systemic approach to mobility policy and planning is gaining recognition amongst Chinese mayors, the Sustainable Urban Mobility Plan (SUMP) concept presented in the workshop was well received; a number of Chinese researchers and city officials acknowledged the need to adopt a more participatory planning approach and emphasized the opportunity for knowledge exchange between Europe and China in this area.

Recommendations and solutions

China has significant potential to reduce the vehicle fleet energy consumption using existing technologies. One example is electrification to allow more efficiency gains, in particular optimized logistics, consolidation centres and last-mile distribution using low-emission vehicles. Another one is non-motorized transport from a variety of perspectives, including both soft (e.g. awareness raising and driving behaviour/attitudes) and hard measures (e.g. infrastructure design), although more research is required.

BRT is well adapted to large, dense cities where high levels of usage can be achieved. Experience with such systems from the UK and France is available and could be transferred to China after adaptation to Chinese conditions. Public transport, in particular BRT, will be a key topic in the exchange between Asian, European and Latin American cities.

To improve the attractiveness of modal alternatives as well as to reduce energy consumption, it is important that traffic management systems are complemented by measures such as congestion charging, parking policies, and additional travel demand management and energy efficiency improvement measures. Such measures could include improvements to the public transport system as a reliable and affordable alternative to cars, coupled with measures targeting the car-fleet's efficiency, as well as traffic management systems and road-user charging schemes. Using IT systems, such as public transport traffic light priority, smart-card ticketing, parking management, car and bike sharing, the preferred transport modes can be made more attractive and efficient.

Vehicle-fleet energy efficiency can also be improved by fostering technology adoption and policy tools. Local solutions, such as the plate quotas from Beijing and Shanghai, and national and supra-national measures from Europe, such as registration taxes and fee-bate schemes, are also promising.

There are a number of resources regarding the design and implementation of sustainable mobility measures available to city officials. In Europe, platforms such as the Transport Research & Innovation Portal (TRIP), ELTIS or CIVITAS are very popular for knowledge exchange. Chinese cities have already contributed to ELTIS by translating European experiences and by submitting Chinese experiences to the portal. SOLUTIONS will facilitate the continuation of this exchange.

Similar approaches could be used to further tap Chinese knowledge and experience and use it to support intra-Chinese exchange, but also to allow European cities to further learn from China. While these knowledge platforms only provide a high level assessment of the measure and its implementation, this already provides some very valuable insights. The adaptation of policies to the specific conditions in a city is the next necessary step toward fostering adoption. For research and exchange funding, more definite discussions with Chinese counterparts about existing programs and their structures would be very important. As a next step, harmonization of these programs with Horizon 2020 and most likely vice-versa, would be very desirable. Also, harmonization of factors such as evaluation of proposals and reciprocity would be very helpful if joint collaboration is to remain at the same quality as current FP7 projects in cooperation with Chinese partners and even more so if research cooperation is to be intensified.

Table 1 Summary of recommendations for China

Cooperation area	Recommendations
Clean vehicles	Short term: exploit potential of current technologies, including alternative fuels. Wheel-to-wheel emissions should be taken into account Medium to long term: expand vehicle electrification. Develop common standards for batteries and charging infrastructure Focus on fostering technology adoption and policy tools to encourage vehicle-fleet energy efficiency improvement, examples from Europe and China
Network management and road-user charging	RUC/traffic management systems should be introduced as part of a comprehensive system, including improving other modes' attractiveness Assess the success and transferability of traffic management systems and road user charging schemes, and examine measures that can be locally implemented
Public transport	Examine both the successes and the failures of BRTs to understand BRT's transferability

	Exchange knowledge on technology and policy issues, and operational and funding structures Feasibility study for a Chinese city, including implementation and operation aspects
Non-motorized transport	Dialogue on the technical and economic feasibility, and the specifications of the enabling policy and funding environment to increase the introduction of non-motorized transport infrastructure and services Link into European knowledge of interchange design Non-motorized transport is included in the transferability analysis: it is likely that walking and cycling will play a role
Integrated planning and sustainable urban mobility plans	Knowledge exchange on Sustainable Urban Mobility Plans (SUMP), including local capacity building Examine the transferability of the SUMP concept Facilitate knowledge transfer from leading European cities to cities in Asia and Latin America

India's urban mobility SOLUTIONS

Profile

Population: 1.295billion (2014)¹²

Area: 3,287,590 km²

The second most populated country in the world, India has one of the largest urban systems in the world including some of the world's most populated cities. Kochi, one of the major ports in India, is the second most important port city on the western coast of India (the first being Mumbai). It is located in the Ernakulum district of the central region of the State of Kerala, along the Arabian Sea and Vembanad Estuary. The city is well connected to other parts of the country with air, road, rail, and waterway connections. The port has influenced location of number of large-scale industries around the city.

The population of Kochi urban agglomeration (UA) witnessed a rapid population growth over the past 30 years, and grew 38% from 2001 to 2011. The city of Kochi comprises an area of 95 km² (municipal limits), 331 km² UA, and the densest part of the city is along major arterial roads, but Kochi has grown in largely unplanned fashion, with major growth along the key arterial highways towards the east.

While historically Kochi mainly depended on walking, cycling and inland water transport, and the central part of Kochi has a dense fabric of streets where walking is still prevalent, the outward expansion of the city has led to an increase in travel distances and higher demand for motorized mobility. The usage of personal vehicles is expanding rapidly with declining use of public transport and increasing income levels – Kochi has experienced a 12.2% decadal growth in vehicular ownership from 2002 to 2012, where work and education trips comprise 73% of total trips made in the city. Although public transport users and pedestrians account for 60% of all trips in Kochi, there are few dedicated pedestrian facilities in the city and a complete absence of cycling facilities. Most of the roads in the city have no defined footpaths. Wherever footpaths are present, they are either poorly maintained or encroached upon by parked vehicles.

People are often forced to walk on the carriageway on narrow roads immediately next to motorized vehicles, risking their safety.

The increase in capacity and improvement in quality of the transport system has not been compatible with transport demand, which is always increasing the need for both for vehicular movement and parking, and it is difficult to depend only on road based and private car based transport options and solutions. The rate of growth in private vehicle ownership, combined with the inadequate road network is unsustainable, and with this increase in dependency on private vehicles, traffic flow on most of the road network in Kochi has been experiencing delays, which in turn had impacted on fuel economy of public and private vehicles.

With the increasing demand for road space and narrow road widths, Kochi UA is in a difficult position in developing cost-effective transport infrastructure.

Public transport demand is largely met in Kochi by buses followed by ferries and auto-rickshaws. Bus transport plays a vital role in meeting the travel needs of city population. However, the existing public transport system has insufficient capacity for the interurban and suburban routes, as a result of the unhindered development of vast areas as urban extensions, unscientific planning in urban infrastructure development, absence of proper linkage of various forms of transportation. Furthermore, the absence of bus bays and supporting infrastructure also causes haphazard stopping of buses which is a concern for passengers and on-going traffic. Likewise, as for other cities in India, planning, implementation and maintenance of transport facilities at city level in Kochi involves multiple agencies. The local governments in Kerala state enjoy some degree of autonomy and have direct control over the developments, however larger infrastructure projects are usually controlled by the state or national government. While 64% of the land use apportionment to roads is for local streets which are to be maintained by Kochi Corporation, the rest of them lie in the remit of various other departments like the public works department, national highways, and Greater Kochi development authority.

The state government has approved a Metro Rail project for Kochi in July 2012, together with integrated water transport, with the Kochi Metro Rail Corporation (KMRL) being set up for its implementation. The KMRL acts as the umbrella transport authority (UMTA) for the city, coordinating all transport improvement projects in the city. The metro rail project is funded through a sovereign loan by the AFD (French Development Bank), while the integrated water transport project is funded by the KFW (German Development Bank).

Policy barriers and drivers

Planning reforms at city level are mainly developed under master planning process; the city development plan, revised every 5 years, outlines the structure for various projects to be planned and implemented. Individual detailed project reports are mandatory for prioritized projects.

Key barriers to any strategy are finance, public acceptability and concerns of the public. National government lead urban development schemes have been supporting governments to improve their infrastructure through participatory funding.

Urban transport in Kochi is fragmented, with different departments to be involved in a single urban transport project, and the coordination between departments further delays the planning and implementation process. However, in case of Kochi, the Kochi KMRL acts as a unified metropolitan transport authority (UMTA), minimising institutional barriers.

Temperatures in Kochi vary from various seasons, however humidity can have a negative impact on the usage of non-motorized transportation (NMT). As such, transport infrastructure should include green cover and shade where possible to protect people from sunlight and humidity.

Kochi's recent selection as a 'Smart City' by the national government as part of their smart city mission scheme could provide support to sustainable mobility in the city. As part of the

application, Kochi has included major components of NMT network and bike sharing in selected areas of the city and has also proposed development of the Vytilla Mobility Hub that will connect the metro corridor with the proposed water transport network to facilitate interchange and better mobility across the city.

Solutions and recommendations

Based on an assessment of high priority transportation needs, insight gained through meetings with diverse group of stakeholders and timely inputs from various cluster partners as part of project, the project team developed a comprehensive set of transport strategies for Kochi. The proposed strategies and measures address Kochi's overall goal to establish a more balanced multi-modal transportation network, and are intended to help Kochi move toward and retain the share of public transport, walking and improve facilities for cycling and other sustainable transport modes, and complement the city's ongoing efforts to improve its transport system.

They can be summarized with this storyline:

1. The major emphasis should be reducing the burden imposed by private vehicles
2. High priority for public transport projects, local funding availability for all such modes
3. Imposing curbs on vehicles entering central roads, provide dense public transport network and create walkable and barrier free public spaces
4. Parking management through dynamic pricing complemented with better public transport to provide a viable door to door option
5. Understand and facilitate alternative last mile options, such as bike sharing and clean technology IPT modes.
6. Regular update of transport studies to understand developments in travel demand
7. Adopt an integrated approach to land use and transport planning
8. Capacity building of municipal officials and other involved departments on urban transport issues

A clear implementation direction and policy approach is required to take up the measures proposed under the project. The key steps proposed to support the further engagement and implementation process are:

- Carry out further engagement with the municipal corporation, KMRL officials and other stakeholders that can be included in the process
- Provide technical assistance for implementation support to the municipal corporation and KMRL if they agree to take up any pilot demonstrations of proposed measures which can be taken as separate component
- Support can be extended to gaining support from potential funders to develop terms of reference to implement prioritized measures such as bike sharing, on-street parking management and clean vehicles.
- Facilitate further interaction with leading city (Hangzhou).

Conclusions

As discussed earlier in this section, the mobility challenges faced by cities in China and India, ranging from difficulties in the development of cost-effective transport infrastructure to health hazards due the environmental deterioration caused by vehicular demand for urban roads, have made sustainable transport solutions desirable. In addition to improvements to public transport systems and improving the modal share of walking or cycling, these cities reflect a consensual need to restrict the entry of motor vehicles on their busiest or central thoroughfares.

The implementation of sustainable transport objectives has, in some cases, been constrained by public concerns, institutional structures or finance. Cities in China and India need proven

methods to address these and thus meet their mobility challenges. SOLUTIONS has worked towards addressing these challenges by assessing solutions from elsewhere – primarily Europe, Asia and Latin America – for use in regional settings.

The recommendations listed in SOLUTIONS Asia part are an emphasis on the role of public transport and other sustainable solutions in, initially mitigating detrimental effects of motorized transport and, improving the liveability of a city. The ready availability of solutions proven in other parts of the world make them ideal for a seamless transfer and to positively impact cities facing mobility challenges. In assessing transferability and enabling necessary change, SOLUTIONS is working towards a vision where the futures of Indian and Chinese cities are secured by sustainable mobility.

Urban mobility needs, policy barriers and uptake of sustainable solutions in Mediterranean partner countries

Introduction

This **SOLUTIONS in the Mediterranean region** presents the key findings from the assessment of urban mobility conditions in the selected Mediterranean partner countries and, in more detail, in **Israel, Morocco and Turkey**. After identifying and analysing a set of innovative and sustainable urban mobility solutions, clustered in the six thematic areas listed above, **SOLUTIONS** conducted a series of personal interviews and local workshops in the aforementioned countries. These facilitated an interactive and constructive dialogue with local city officials for identifying the main urban mobility needs, gaps and priorities of several Mediterranean cities.

SOLUTIONS, however, considered only four of the six thematic clusters for the Mediterranean region. The ‘Network and mobility management’ and ‘Clean vehicles’ themes were not taken into account due to their low transferability potential considering the main urban mobility characteristics of the Mediterranean region. The local workshops discussed and evaluated local and national policy frameworks, identified the main policy barriers and drivers, and provided targeted recommendations to be put forward in local agendas to facilitate the uptake of innovative and sustainable urban mobility solutions that best fit local conditions and targets. Following the conclusion of the workshops and the analysis of their main findings, a final Mediterranean event identified common urban mobility needs, gaps and priorities for the Mediterranean region - outlined at the last section of this section.

The Mediterranean region

SOLUTIONS targeted a number of cities from the selected countries in Mediterranean regions - **Israel, Morocco and Turkey**. Following activities were carried out within the project in the selected countries:

- a. Analysed their urban mobility conditions
- b. Identified their main urban mobility needs, gaps and priorities
- c. Presented to city officials experiences from the implementation of selected urban mobility solutions in Europe, and
- d. Analysed local and national policy frameworks to inform the evaluation of the transferability of solutions that best fit local conditions and the interests of local authorities.

In order to gain insight on urban mobility in the cities in the selected countries, following methodology was applied (Figure 1):

- Developed a dedicated questionnaire used as the basis for personal interviews with city officials in **Israel, Morocco and Turkey**
- Organised three local workshops in **Turkey** (Kocaeli), **Morocco** (Casablanca) and **Israel** (Tel-Aviv). The workshops' main aim was to, (a) further discuss and elaborate on the issues raised by the interviewees, (b) present best practices of urban mobility solutions in Europe, (c) identify and prioritise promising solutions considering local needs, gaps and priorities and (d) evaluate local, regional and national policy frameworks.
- Organised a final Mediterranean event in **Turkey** (Istanbul) where participants presented and validated the findings from the local workshops. This enabled **SOLUTIONS** to draft a set of common priorities for the Mediterranean region and build a common understanding of the region's urban mobility conditions.

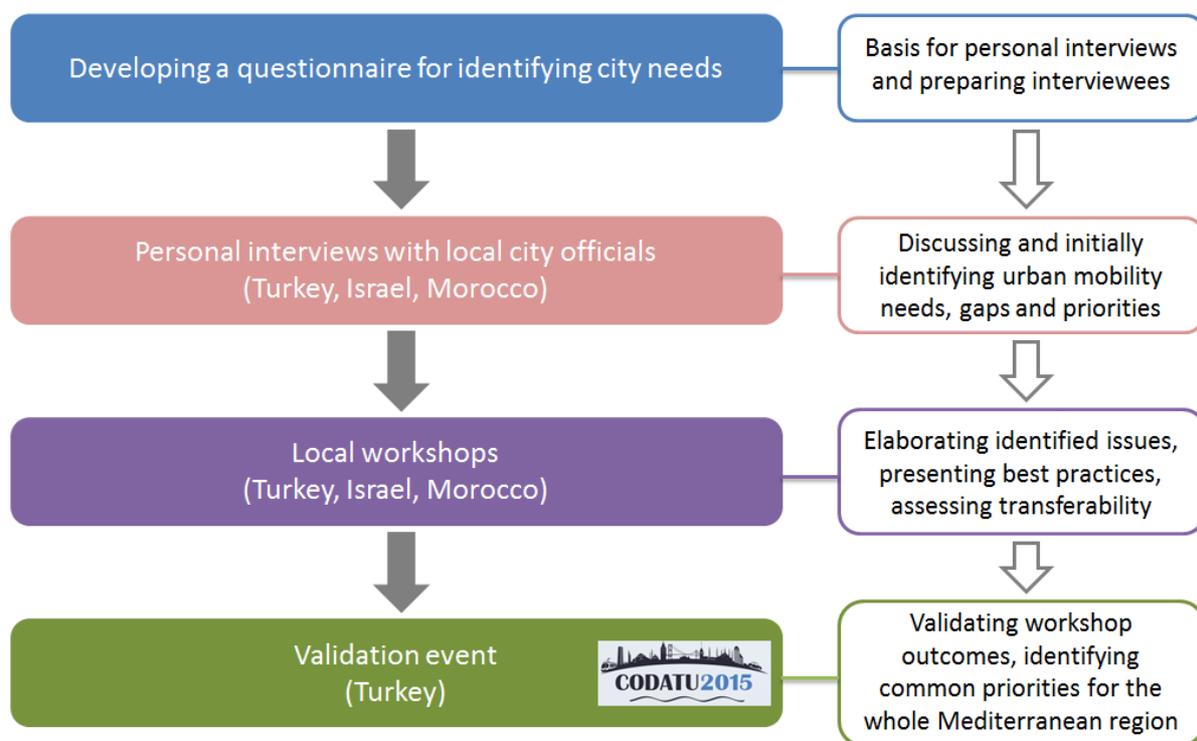


Figure 1 - The methodological approach followed for the SOLUTIONS Mediterranean activities

Building upon the findings of the local workshops and other events, a country/city profile on urban mobility was formed along with the analysis of needs, gaps and priorities of urban mobility solutions. The study on main policy drivers and barriers for implementing the selected urban mobility solutions was also carried out and finally recommendations on how to transfer the solutions in each local setting, indicating references to best-practice real-world examples was provided. They are shortly described below:

Israel's urban mobility SOLUTIONS

Country profile

Population: 8.216 million (2014) ²

Area: 22,072 km²

Jerusalem

Within approximately 1.5 million people in Jerusalem's metropolitan area, 800,000 live in the city. Due to its hilly topography, the infrastructure for train was not built in the city for many years. Lately, Jerusalem has two train stations and is the only Israeli city with an intra-city Light Rail Transit (LRT) system. A central bus station serves as the main departure point for passengers who are visiting other parts of the country and also as a main transfer point for buses operating within the city.

Tel Aviv

The Tel Aviv metropolis, with 3.5 million people, is one of the most populated area in Israel. Around 1 million people and 500,000 vehicles enter the city daily. Private cars (52%) are used for the majority of trips into and within the city, while public transport (23%), walking (16%) and cycling (9%) present significantly lower shares. Four train stations connect the Tel Aviv metropolitan area with other Israeli cities, while one central bus station acts as the main departure point for buses operating within the metropolis and the whole country. To address the congestion in its major arteries, the city introduced a bike-sharing system and green routes for promoting walking. An LRT system is currently under construction. The flat landscape of the metropolitan area and the city, and the fact that a large percentage of urban trips are shorter than 5 km, favour the use of sustainable transport such as walking and cycling over private cars.

Haifa

Haifa's metropolitan area has about 1 million people. It is a hilly coastal city with many steep paths and steps for pedestrians. Haifa developed its city centre around the port, which remains busy and generates many traffic problems. Haifa Bay has been the traditional centre of Israel's heavy and petrochemical industries, including oil refineries. This makes it a significant source of air pollution, and heavily affects the quality of urban life. There are four train stations and two central bus stations in the city. Haifa developed the first Bus Rapid Transit (BRT) system in Israel, the Carmel Tunnels, which cross the city from north to south and vice versa and recently established low-emission zones.

Needs, gaps and priorities

Israel's high population density, with over 370 people per km², has a great impact on its transport system. The Ministry of Transport & Road Safety is responsible for the country's transport system. The country has four metropolitan hubs: Jerusalem, the capital; Tel Aviv, the country's economic powerhouse; Haifa in the north; and Beer Sheva in the south. The National Public Transport Authority bears the main responsibility for public transport, though it has delegated some responsibilities to local transport authorities. Despite the limited control they have, the latter act as the main stakeholders.

To address traffic congestion, which many Israeli cities experience, a number of local and national actions have been undertaken to improve the public transport system, to enhance existing transport infrastructure, to address the negative impacts of urban freight operations and to achieve a more holistic and integrated approach to urban planning. More specifically, the country's first LRT and BRT systems are operational in Jerusalem and Haifa, respectively. Additional lines in these cities and new lines in other cities (e.g. LRT in Tel Aviv and BRT in Netanya) are currently in various stages of planning and implementation. Prioritising public transport vehicles is an integral part of the aforementioned systems, while implementing a

nationwide integrated fare system is encouraging an increase in the share of public transport. There is a greater focus on improving the efficiency of urban freight operations, as cities increasingly understand their negative impacts. Outside Tel Aviv, Israeli cities do not follow holistic approaches to urban transport planning, but other cities are adopting elements of the Sustainable Urban Mobility Plan (SUMP) process while updating their municipal master plans. Within this process, some municipalities are also involving relevant stakeholders and are introducing monitoring and evaluation measures, which are mandatory for a SUMP.

Policy barriers and drivers

Introducing sustainable urban mobility solutions in Israel is often challenging. Some of the main difficulties are related to the division of responsibilities between the National Public Transport Authority and the various local transport authorities. To this end, there is a real need for a more coherent national transport policy, although some policy goals have already been defined, in line with the sustainable transport agenda, for certain areas such as the strategic road network, public transport and walking and cycling. Public transport policy is highly centralised with several regulations (e.g. for buses, trains, etc.) formulated at a national level. Local authorities are responsible for taking policy-related decisions on several aspects, some of which are relevant to the transport sector.

Most Israeli local authorities do not have any strategic plan analysing how they expect urban mobility to evolve (thus setting the necessary actions to be taken in order to accommodate future transport demand) or if they have such plans, they lack detail. Only a few authorities, such as Tel Aviv, have well-established programmes facilitating the development of such detailed strategic documents. However, their ability to impose changes on the transport system is quite limited.

Local authorities cannot take transport-related decisions across a wider area or a major transport corridor, which extend beyond their jurisdiction. Made at a national level, these decisions often cause conflicts between the national transport authority and the local authorities affected by the respective decision. Governance on responsibilities between the national transport authority and local municipalities, and within local municipalities, is not appropriate. In most cases, several organisations share responsibilities; there is an extra challenge in reaching consensus and implementing a transport policy. The time it takes politicians to ensure the cooperation of all relevant stakeholders delays large-scale projects, which imposes a significant negative impact on traffic and commercial activities.

Another challenge that most cities face worldwide relates to checks and balances designed to ensure they efficiently implement policies. Large-scale transport projects also often take long to complete because of the short periods (2-3 years) for government officials, compared to mayors who serve for longer. Furthermore, the **absence of regional bodies** to manage transport in metropolitan areas also imposes a number of challenges. In fact, Tel Aviv has carefully considered introducing such a regional body for many years but due to a number of political issues, it has not materialised yet. Only in some cities, such as Haifa, have the responsibilities of municipal traffic management centres that have been extended to also cover satellite towns and metropolitan areas.

Despite the aforementioned challenges, some policy drivers have facilitated the implementation of sustainable urban mobility solutions in Israel. More specifically, in 2011, the Ministry of Transport & Road Safety and the Ministry of Finance jointly invited medium-sized cities (between 70,000-250,000 inhabitants) to submit proposals for developing sustainable urban transport systems. They designed the competitive process in such a way that only one municipality could receive funding to implement its proposal. However, the process encouraged many Israeli cities to develop sustainable mobility plans that would efficiently integrate their different urban transport modes. So, despite being unsuccessful in being funded,

many cities used their proposals as foundations to search for other funding opportunities, and as such was a good starting point for local authorities requiring further support in advancing the development of their plans.

Israeli citizens can also drive policy to a certain extent. Indeed, the interest of Tel Aviv’s residents in physical exercise contributed towards promoting the city’s bike-sharing system. Furthermore, residents understood that developing a sustainable urban transport system requires giving priority to public transport. They welcomed the proposal of providing priority to buses on the city’s main roads. Such an increased understanding of the need to improve the city’s urban transport system also led the residents of Jerusalem to favour the construction of a new tramline.

Recommendations and solutions

Existing efforts to improving and better coordinate national transport policy should continue, particularly as, due to the limited land and road space and the density of residential areas, local municipalities need to take unpopular actions for promoting sustainable urban mobility.

One possible measure that can stimulate a positive change towards sustainable urban mobility is to provide tax support to municipalities and a policy encouraging the transition from private cars to public transport. The process of clearly defining the distribution of responsibilities among Israeli local authorities and the national transport authority should continue and extend so that all relevant issues can be efficiently resolved. They should also consider transport in metropolitan areas as a whole and further explore establishing regional and metropolitan transport authorities with powers over public transport, rail and arterial roads - as is the case in many European cities.

Israeli city officials identified a number of promising solutions best fitting their cities, thus presenting the largest transferability potential and expected benefits: additional mass transport systems, prioritising public transport vehicles at intersections, constructing additional bus lanes, cycle and walking paths and intermodal interchanges. The increased understanding of the negative implications of urban freight operations led city officials to consider a number of different solutions to minimise the negative impacts. A more holistic approach towards urban planning and the development of SUMP’s is also an emerging need for Israeli cities that are interested in learning from Europe.

Specific, transferrable measures that Israeli cities can consider implementing in order to tackle their urban mobility problems are in the table below:

Solution
Public transport
Mass transit systems (BRT in particular)
Bus priority measures
Bike-sharing and public bicycles
Transport infrastructure
Dedicated bus lanes
Innovative and safe cycling infrastructure
Intermodal interchanges
Pedestrianising city centres and streets
City logistics
Vehicle and operation restrictions on time, weight and size (off-hour deliveries in particular and night-time parking lots)
Low Emission Zones
Forums, portals, labels and training
Urban Consolidation Centres

Pick-up point networks
Integrated planning / SUMP s
Stakeholder participation and citizen engagement
SUMP monitoring and evaluation

Morocco's urban mobility SOLUTIONS

Country profile

Population: 33.92 million (2014) ³

Area: 446,550 km².

Grand Casablanca

The Grand Casablanca region, which includes the city of Casablanca, is located in the northwest centre of Morocco. The region covers 1615 km² and homes approximately 4 million people, of whom 92% live in urban areas. Grand Casablanca's road network is 573 km, of which 512 km is paved. Transport infrastructure is well developed including a rapid transit system connecting Casablanca to the airport, a 31 km tramway connecting the eastern suburbs to the city centre (serving about 150,000 travellers per day), and a bus network. The transport sector is a major source of greenhouse gas emissions, accounting for approximately 15% of total emissions in Morocco. Established in 2008, the region's public transport authority was dissolved in 2015 due to institutional issues and the complexity in coordinating the cooperation with the different entities involved in urban transport.

Marrakech

Marrakech is located in the centre of Morocco at the foot of the Atlas Mountains. It has approximately 980,548 people (2014⁴) spread over 230 km². The city is divided into two distinct parts: the Medina, or historic town, and the new city. In recent years, the city expanded in the periphery, resulting in the creation of two satellite cities, Tamansourt and Shwider.

Rabat

Rabat is the capital of Morocco and of the Rabat-Salé-Zemmour-Zaer region. It has a population of 577,827 (2014⁴). The transport network consists of buses, a tramway, and a railway line equipped with an electrified double track, connecting Rabat with Salé and Casablanca. The majority of commuters between Rabat and Casablanca use a fast train

shuttle (TNR) which runs every 30 min to 1 hour. Rabat has two stations: Rabat City and the Agdal. People living in cities that are more distant generally use their personal vehicles in order to reach the urban network.

Needs, gaps and priorities

The transport sector plays a major socio-economic role in Morocco. It represents 6% of the country's GDP and 9% of the tertiary sector. It is also responsible for employing 80% of the workforce, and accounts for 34% of national energy consumption. Furthermore, the tax revenue from the transport sector constitutes 15% of the state budget.

Road transport is predominant within Morocco, responsible for 90% for domestic trips and 75% of goods transport on the 60,000 km road network. The country is still constructing expressways, with 1,014 km built by 2015. Morocco is also extending its 2,120 km rail network with four high-speed lines that will connect major Moroccan cities. The first line between Casablanca and Tangiers will be completed in 2018 and the others will follow until 2030.

In Casablanca, transport infrastructure has not developed as desired, failing to cope with the daily demand of citizens. The urban public transport system, which mainly consists of buses, trams, trains, and big taxis operating on certain routes, is poor, mainly due to the significant imbalance between transport supply and demand, and the low level of education of professional drivers. The high number of taxis further supports this imbalance. City officials acknowledge that developing the appropriate transport infrastructure is an important priority and will enhance the accessibility of all citizens to the urban public transport system.

District municipalities are responsible for implementing projects focusing mainly on improving public spaces (e.g. new designs) while Casablanca is currently working on the development of an urban transport plan according to the concept and vision of a Sustainable Urban Mobility Plan (SUMP). This is a good basis for integrated urban transport planning, and addresses several challenges and sets specific targets. To this end, sharing knowledge and exchanging experiences of the development of SUMPs in Europe is much needed and will provide significant benefit to the city officials.

Policy barriers and drivers

The economic development of Morocco is quite limited with government structures often being poor throughout the country. Public transport and cycling are associated with a low social status while the public regard private cars as more prestigious. Religious constraints generally exclude women from cycling or using scooters and motorcycles (with the exception of Marrakech).

The Ministry of Transport is responsible for funding the majority of transport projects and provides policy directions. However, targeted policies towards sustainable urban transport are still quite limited with current urban transport plans (PDUs) covering broader transport planning. There is also no appropriate framework for adopting an integrated policy, as most existing regulatory frameworks are piecemeal. Local involvement exists to a certain extent, as in the case of Marrakech, where the municipality has enforced local regulations. In all cases, however, citizens are not involved in the implementation process of transport projects.

Positively, there are indications that existing transport policies encourage the reduction of car use. Rabat, for example, has introduced increases in parking charges, encouraging the use of public transport, and built a tramway to increase accessibility in public transport, thus relieving the already congested road network especially during peak hours.

As mentioned before, some Moroccan cities such as Casablanca have drafted urban transport plans that provide an overview of urban mobility measures and can enhance transport safety and tackling traffic congestion efficiently. Such measures include:

- a. further developing the public transport system

- b. promoting sustainable transport modes (walking and cycling)
- c. efficiently developing and operating road networks
- d. optimising the urban freight transport system
- e. establishing an integrated pricing and ticketing scheme covering all urban trips
- f. providing incentives to private companies and public authorities for promoting car-pooling and public transport to their staff
- g. involving the public in the consultation process of transport projects, and
- h. improving the monitoring and evaluation process of the implemented measures.

Solutions and recommendations

In the short term, the city of Casablanca should enhance its existing urban transport system by efficiently managing all available transport options including the big white taxis, which often operate in a similar way to buses (i.e. on specific routes). It can reach this goal by introducing access restrictions for big taxis and discouraging the use of small taxis by providing priority to buses, developing efficient intermodal interchanges and improving the infrastructure for pedestrians. Introducing new public transport modes and appropriate policies can efficiently reshape the urban transport system in Moroccan cities. Developing the relevant transport infrastructure and prioritising public transport vehicles will greatly enhance accessibility to public transport for all citizens and result in higher quality services.

Providing targeted incentives for promoting the wider use of rail is also important, including the development plan for a suburban rail network. Completing Casablanca’s tramline and the planned construction of two more lines will result in a significant model shift towards public transport. Considering the lack of a coherent urban transport policy, Morocco should also develop efficient mechanisms for ensuring the active cooperation of all relevant stakeholders in the urban transport planning process. The need to address social exclusion is a very important driver for improving the public transport system. Specific, transferrable measures that Moroccan cities can consider implementing in order to tackle its urban mobility problems are listed below for three of the four clusters considered for the Mediterranean region. The cluster of ‘city logistics’ was not considered due to the high priority of the other three clusters present for Morocco.

Solution
Public transport
Mass transit systems (metro and tram)
Integrated fare systems
Bus priority measures
Transport infrastructure
Dedicated bus lanes
Intermodal interchanges
Pedestrian infrastructure
Integrated planning / SUMP
General preparation of SUMP
Vision building for future sustainable urban mobility
Stakeholder participation and citizen engagement

Turkey’s urban mobility SOLUTIONS

Country profile

Population: 75.93 million (2014) ⁶

Area: 783,560 km²

Istanbul

With over 14 million people and covering 5,343 km², Istanbul is Turkey's biggest city. Due to urban sprawl, the city suffers from a variety of urban transport problems, especially traffic congestion. Three entities affiliated to the Istanbul Metropolitan Municipality provide public transport. The biggest, Istanbul Public Transport Authority (İETT) operates a fleet of 3,000 buses, the city's BRT systems and funiculars. İstanbul Transport Co., the next biggest, operates the city's metro and tram systems, which serve around 1 million passengers per day. The Ministry of Transport, Maritime and Communication is responsible for the Marmaray train system with a line constructed under the Bosphorus carrying approximately 800,000 passengers per day. The last company, İSPARK, manages the city's car parks and bike-sharing system.

Kocaeli

Kocaeli is a major industrial and transit city in Turkey with a population of about 1.6 million. Located fairly close to Istanbul, it expects to play an important role in some of Istanbul's future transport developments, such as the construction of a high-speed rail line and the İzmir Gulf suspension bridge. The city offers high-quality public transport services through more than 50 privately owned bus operators. Considering its role as a transit city to Istanbul as well as the large number of industries located there, transport infrastructure is a major concern for the city.

Konya

Konya covers the largest area in Turkey and has a population of approximately 2.1 million. Although the city's public transport system includes both buses and trams, 'Dolmuş' (minibuses) present the highest share mainly due to the poor integration of the aforementioned modes. Although the city is equipped with ITS systems enabling it to obtain traffic data in order to control traffic and improve road safety, it still has not developed well-integrated urban transport plans. With over 250 km, Konya also has the longest cycle network in Turkey.

Ankara

Ankara is the capital of Turkey with a metropolitan population of about 2.1 million. In 1989 the city conducted its first urban transport master plan which is currently being revised based on a 2012 study. Both central and local authorities highlight the need for an integrated public transport system and better transport infrastructure. The city's vision for public transport focuses mainly on extending its metro. Private companies, in cooperation with the Ministry of Transport, have delivered two metro lines. Another is still under construction while a line connecting the airport to the city centre is still in the tendering process.

Izmir

Izmir is the largest port-city in the Mediterranean part of Turkey, with a metropolitan population of approximately 4.1 million. The city's population is growing at a rate of 5.3% a year, high compared to the rest of Turkey. High migration from rural areas is reshaping the metropolitan area. The city's overall vision is to improve quality of life for its citizens and support the economic activities in its metropolitan area by providing sustainable development and an efficient urban transport system.

Needs, gaps and priorities

Buses and minibuses ('Dolmuş') are the main providers of public transport services in Turkey, while some major cities, such as Istanbul, have also implemented Bus Rapid Transit (BRT)

systems. Although buses are mostly preferred for urban trips, the number of minibuses is also quite high. The BRT system in Istanbul is also popular, providing high-quality services daily for a large number of passengers.

Several Turkish cities are interested in increasing the use of public transport over private cars, and specific targets have been set within their urban transport plans for achieving this goal. The dependency on private cars for urban trips often leads to bad congestion - a major issue for most Turkish cities. The lack of integrated urban mobility planning further intensifies the existing problems. Once finished, a series of transport infrastructure projects currently underway should contribute towards improving traffic conditions. There is a particular emphasis on extending pedestrian zones and cycle paths, and providing technical assistance and the required funds.

Urban sprawl is responsible for several urban transport problems in Turkey. Cities are mostly car-oriented, causing severe traffic congestion and significant safety and accessibility issues for the urban public transport system. Although cities promote cycling as a sustainable alternative to cars, the lack of the appropriate infrastructure hinders its wider use by Turkish citizens. On the positive side, due to the existence of various public transport modes, municipalities have significant knowledge and efficiently operate integrated public transport systems.

Following the example of Istanbul, several other Turkish cities are interested in BRT systems (Şanlıurfa has completed the first phase of a 17 km BRT corridor) and developing rail transport, with several large cities undertaking major construction projects over the last decade, using both EU and central government funds. However, as all of these projects fall under the responsibility of the central government, conflicts often occur with the provincial transport master plans.

Managing fares and implementing smart-card systems are also major priorities for Turkish cities to further increase the share of public transport and provide high-quality services. Istanbul, Izmir, Eskişehir, Antalya, Şanlıurfa and Kocaeli boast successful examples. In others, such as Bolu - a non-metropolitan city - such integration is currently underway. Izmir, however, which has a high population of elderly people, had to overcome problems related to ticket subsidies. Şanlıurfa, on the other hand, is the only Turkish city with a clear commitment to supporting disabled and vulnerable groups of passengers. However, the infrastructure needed for accommodating such groups is still missing, presenting another important challenge for Turkish cities.

Turkey has not yet developed targeted and carefully planned strategies and policies dedicated to urban freight transport systems, which, as a result, are disorganised. Kocaeli is an exception, however, developing and implementing its urban freight master plan several years ago. Istanbul also has started work on a urban freight master plan. The presence of several industrial and logistics facilities in many Turkish cities actually urges the efficient development and organisation of urban freight transport operations. To this end, connecting Turkish cities efficiently with their surrounding hubs (i.e. ports, airports, etc.) is an emerging priority. ITS applications, such as the ones implemented in Konya and Istanbul for traffic control and management may further support this process. The Provincial National Police is implementing a new ITS system, which will enable municipalities to better control traffic operations.

Policy barriers and drivers

One of Turkey's main barriers to developing sustainable transport policy is the focus of transport master plans on large infrastructure projects rather than on smaller, softer measures. There is no specific provision for sustainable urban transport and no audit body for the planning process. Turkish cities often have the necessary legislative power to impose changes in their urban area; when they do not exercise this power, it is mainly because of the lack of political

capital, the fear of public rejection or opposition from bodies with vested interests. Furthermore, politicians often make unrealistic manifesto commitments that can remove the focus from the goals.

A government-led initiative forces Turkish municipalities to develop urban transport master plans. This approach ensures that all urban areas have a transport planning method in place. However, in most cases, there is little focus on sustainability. With the development of such plans often outsourced, the municipality holds little ownership of the proposed measures, and there is no method for holding the municipality, mayor or governing body to account if they do not implement the plan. On the other hand, if they implement an action not included in the master plan, there can be repercussions. Turkey's central government is familiar with the SUMP concept, which fits well with the existing process of developing transport master plans. Local authority urban planners also appreciate SUMP, but do not have a detailed understanding.

The lack of technical capacity and assistance in local authorities is an important issue to address. Municipalities also have to cope with reductions on the available budget coming from the central government, mainly due to political issues. Despite this, several Turkish cities have successfully implemented measures that enhance urban mobility, as in the case of Izmir, which managed to introduce sweeping changes on the bus management system, leading to an effective service thanks to implementing targeted policies. Only a mayor who showed clear leadership and had the required political capital to counter vested interests and the status quo made this possible. In the Izmir case, some local experts stated that the national policy framework worked against this change, rather than assisting it.

Solutions and recommendations

Turkish cities have managed, especially within the last 5 years, to improve their urban public transport systems significantly, especially considering the increased concentration of the population in urban centres. However, there is still room for improvement, with the development of a coherent national transport policy being the first priority. City officials have expressed the urgent need to have such a policy efficiently guiding their actions. Despite the existing variety of metropolitan and non-metropolitan municipalities, there is a common need to increase technical capacity and for assistance in considering all relevant processes within the implementation and operation phases.

Considering that there is already a process requiring the development of transport master plans, the central government in Turkey should take sustainability issues into account within this process. It needs, for example, a coherent sustainable approach to better manage bus services. The heavy dependence of passengers on buses for their daily movements presents an opportunity for Turkish cities in achieving the goal of sustainable urban mobility. Planning and better managing bus services could play an important role to this end.

Nationally, there is a clear need to reorganise urban public transport systems and achieve a better level of integration between different urban transport modes. Better transport infrastructure and technical support for successfully implementing relevant projects is a high priority. Aiming to cope with the increased levels of traffic congestion, a direct result of rapid population growth and migration from rural to urban areas, Turkish cities need to allocate adequate resources for a reliable, efficient and green urban public transport system. Within the SUMP concept, cities should also build capacity for the efficient integration of public transport and non-motorised modes. However, as most city officials are not fully aware of SUMP, municipalities should efficiently map out its main principles and fit them into the existing development process of the urban transport master plans. Specific, transferrable measures that Turkish cities can consider implementing in order to tackle their urban mobility problems are in the table below for the four clusters considered for the Mediterranean region.

Solution
Public transport
BRT system
Integrated planning of public transport network
Integrated fare systems
Transport infrastructure
Intermodal interchanges
City logistics
Increased use of rail and waterborne transport
Integrated planning / SUMP
General preparation of SUMP
Vision building for future sustainable urban mobility
Engaging external support for SUMP development

Conclusions

Among the four thematic clusters considered for the Mediterranean region, ‘Integrated planning/SUMPs’ and ‘Public transport’ received the greatest attention and were identified as the most important ones by local city officials in **Israel, Morocco** and **Turkey**. Many of the solutions considered for the ‘Transport infrastructure’ cluster also referred to public transport infrastructure projects, indicating the high priority of improving urban public transport systems and the significant overlap of the two clusters. ‘City logistics’ was the least advanced cluster but there will be increased attention in the following years considering the expected greater freight volumes and the respective development of Mediterranean port-cities to efficiently cope with the increased demand.

The common priorities for the Mediterranean region are:

Public transport

- Developing an efficiently integrated public transport system that considers transport modes suitable for that region and build upon existing provision.
- Improving the overall reliability of public transport services, leading to an enhancement in its attractiveness to users.
- Reducing the negative public perception towards sustainable transport modes such as walking, cycling and buses.
- Prioritising public transport and integrated fare systems to ensure a good level of service, and supporting the attractiveness of the system.
- Many Mediterranean cities are considering the implementation of transport modes moving on fixed guideways (e.g. BRT, LRT), which are seen as more reliable, so more favourable to users.
- In several Mediterranean cities, public transport vehicles are in poor condition, which diminishes the attractiveness of the provision. Upgrading fleets would go a long way to making the provision more attractive (and reliable).
- Appropriate and more coherent policies (national or local) should couple urban mobility measures and provide incentives for passengers to use more efficient and sustainable modes of transport.
- National and local authorities, and private stakeholders, should establish efficient methods of cooperation and consensus (including the division of responsibilities) to effectively implement public transport provision.

Transport infrastructure

- Transport infrastructure in the Mediterranean region lacks integrated planning at the municipal level and between public bodies. This makes the provision of a reliable service difficult to develop;
- Mediterranean cities should develop adequate public transport infrastructure (such as dedicated bus lanes and bus stations) to meet transport demand and ensure a reliable service;
- Developing dedicated pedestrian prioritisation and bike routes will help promote walking and cycling;
- Local authorities should enhance their technical capacity internally or through third party provision, so that planned infrastructure projects can be efficiently realised (considering both the implementation and operation phases).
- In many cases, investments and available funds (either public or private) proved to be insufficient to expand or improve transport infrastructure to meet increasing transport demand and maintain acceptable transport conditions.
- Considering that transport infrastructure plays a predominant role towards supporting urban public transport systems, there is a clear need for a coherent policy enabling the development of comprehensive and integrated solutions.

City logistics

- Urban freight operations in Mediterranean cities are either underdeveloped or not developed at all. However, city authorities have started to pay attention to the efficient organisation of such operations, realising the growth potential they can present due to the strategic location of some cities, as well as for effectively addressing their negative externalities.
- Mediterranean cities reported that a major priority is to connect major logistics centres efficiently with transport hubs (ports, rail terminals, airports).
- Carefully planning and implementing logistics centres/villages will ensure their efficient connection to the transport network. Cities should also consider underutilised terminals.
- Trucks carry out most urban freight distribution trips. However, there is an increasing need to also consider other transport modes (rail, cycle freight), which reduce this dependency.
- Mediterranean cities apply a limited number of city logistics measures, mainly focusing on parking areas. However, they found solutions such as off-hour deliveries interesting and transferable to their cities.

Integrated planning/Sustainable Urban Mobility Plans (SUMPs)

- City officials identified this cluster as one of the most important ones for Mediterranean cities due to the fact that it encompasses various important processes.
- A major priority is integrating transport modes in urban areas and major city centres.
- Improving public space, enhancing collaboration between national and local authorities and establishing policies, guidelines and evaluation criteria can improve the planning, operation, management and maintenance of the transport system. Urban planning and development should be in accordance with local and regional investments for promoting sustainable transport.
- All relevant stakeholders should be included in the development of urban transport plans.

- Although several Mediterranean cities have undertaken developments similar to SUMP (e.g. PDU), local officials have little knowledge regarding SUMP and their implementation in Europe. To this end, knowledge-sharing events will provide real benefits to Mediterranean city officials in advancing relevant developments within their city.
- Local authorities should build capacity and technical support on SUMP addressing all major challenges within their city.

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