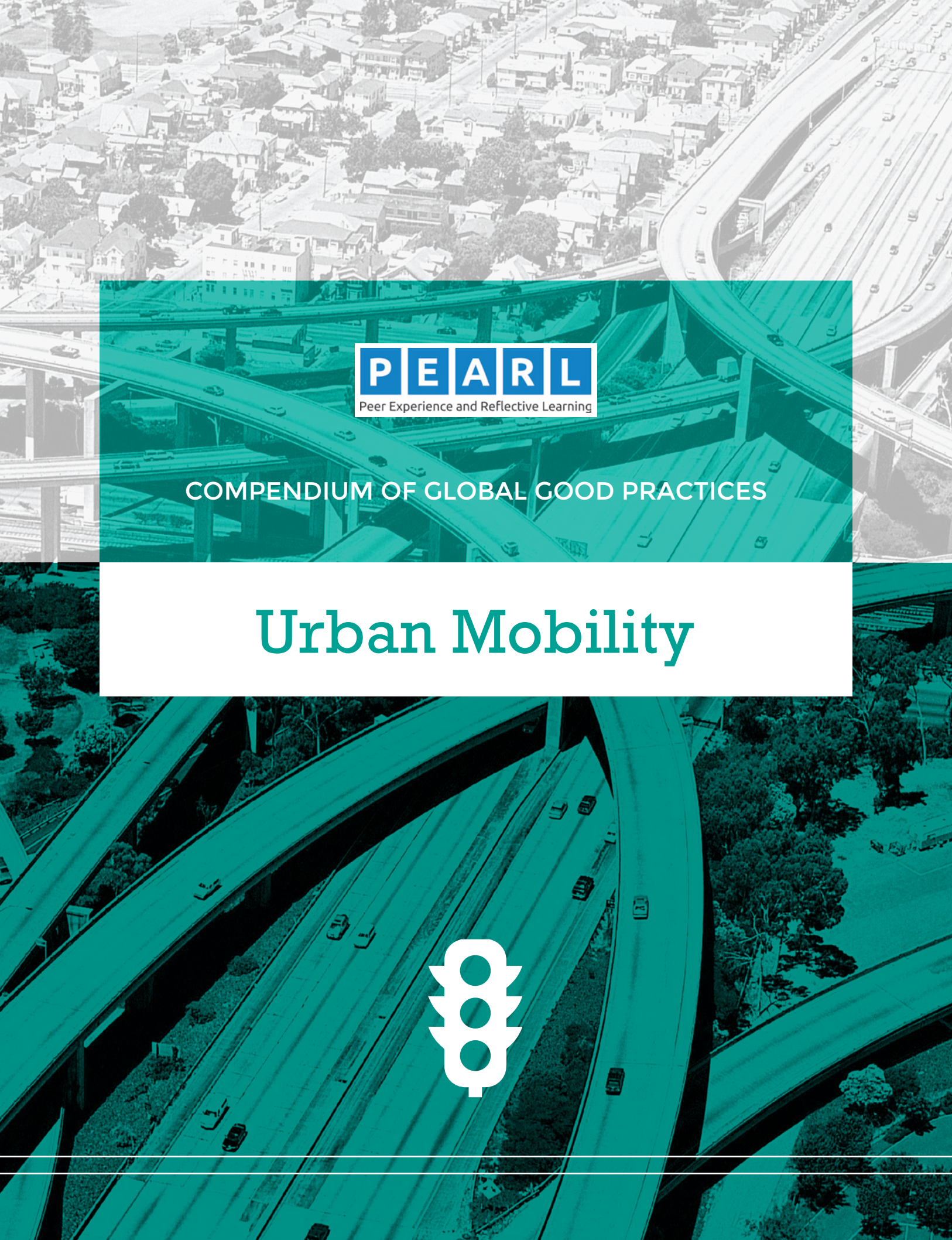

PEARL
Peer Experience and Reflective Learning

COMPENDIUM OF GLOBAL GOOD PRACTICES

Urban Mobility

POLICY AND INSTITUTIONAL FRAMEWORK

MASS TRANSIT

TRAVEL DEMAND MANAGEMENT

ECOMOBILITY

PRO-POOR MOBILITY

PEARL

Peer Experience and Reflective Learning

an initiative of

National Institute of Urban Affairs

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COMPENDIUM OF GLOBAL GOOD PRACTICES

Urban Mobility

National Institute of Urban Affairs

PREFACE

The National Institute of Urban Affairs is the National Coordinator for the PEARL Initiative (Peer Experience and Reflective Learning). The PEARL program ensures capacity building through cross learning and effective sharing of knowledgerelated to planning, implementation, governance and sustainability of urban reforms and infrastructure projects – amongst cities that were supported under the JNNURM scheme.

The PEARL initiative provides a platform for deliberation and knowledge exchange for Indian cities and towns as well as professionals working in the urban domain. Sharing of good practices is one of the most important means of knowledge exchange and numerous innovative projects are available for reference on the PEARL website. "Knowledge Support for PEARL" is a program supported by Cities Alliance that aims to qualitatively further this initiative. One of its key components is to carry out a thematic and detailed documentation of good practices in various thematic areas related to planning, governance and service delivery.

In an effort to fill the critical knowledge gaps for efficient service delivery in Indian cities, a number of good practices from across the globe have been compiled to address specific issues in the areas of water supply, sanitation, solid waste management, urban mobility, and the incorporation of information & communication technology in service delivery processes. Each volume examines case specific processes, activities and results to garner ways of improving operational efficiency – integrated water management, increasing customer base, corporatization of supply, reducing NRW etc. for efficient ***water supply;*** waste water treatment programs, pro-poor sanitation policy formulation, reclamation & reuse initiatives and public private partnerships for better ***sanitation***; comprehensive waste management strategies, at source reduction and segregation, municipal capacity building, recycling, reuse and resource recovery for effective ***solid waste management;*** integrated land transport systems, travel demand management, pedestrianisation for EcoMobility and integration of informal systems for enhanced ***urban mobility;*** and finally e-Government development models; GIS mapping for municipal functions and intelligent service delivery systems using ***ICT.***

The compilations assemble good practices from countries like Burkina Faso, Senegal, Ireland, Japan, Cambodia, Bolivia, Brazil, Kenya, Netherlands and Mongolia (Water Supply); South Africa, Denmark, Singapore, Thailand, Indonesia, Pakistan, Uganda, Mauritius, Philippines (Sanitation); Australia, USA, Brazil, Bangladesh, Egypt (Solid Waste Management); Nigeria, Mexico, UK, South Korea, Colombia (Urban Mobility); Germany, China, Peru, UAE (ICT). Cases are examined from the perspective of increasing operational efficiency, enhancing systemic capacity, creating efficient public private partnerships and building long-term sustainability into urban management activities. Priority has been given to cases from developing countries in order to increase adaptability and replicability of key concepts and practices.

Jagan Shah
January 2015

ACKNOWLEDGEMENTS

The compendium of global good practices focusing on "Urban Mobility" is an outcome of a collective contribution of several individuals. NIUA acknowledges their contribution and thanks them for their support.

Firstly, we wish to sincerely thank the Cities Alliance and World Bank whose grant support and knowledge partnership for PEARL has made the documentation possible at a time when urban infrastructure development is one of the main agendas of the Government of India.

We would like to thank Deeksha Matta, Apurva Bajpai, Shoma Mathew and Shilpi Madnawat of the PEARL team, who have contributed in putting the compendium together; and Deep Pahwa and Kavita Rawat for designing and formatting the compendium.

This report would not have been complete without the coordination and editorial support of PEARL Team members Shabana Charaniya, A. Nanda Kishore, Yogita Lokhande, Siddharth Pandit and Sridipta Ghatak.

Special thanks are due to Ajay Suri, Regional Adviser-Asia, Cities Alliance and Prof. Jagan Shah, Director NIUA for their support, guidance and inputs. NIUA has been enriched by the experiences gained in this process and sincerely hope that the report will contribute towards strengthening mobility services in India in cities.

Dr. Debjani Ghosh
Project Coordinator

CONTENTS

INTRODUCTION

URBAN MOBILITY

Urban Mobility refers to the efficient movement of people and goods, through efficient, environmentally sound, safe and affordable transportation that contributes to improving social equity, public health, resilience of cities and productivity. Transportation and mobility are recognised as central to sustainable development since they enhance economic growth, improve accessibility and achieve better integration of the economy while-respecting the environment. Better transport promotes universal access to social services and therefore can make an important contribution to consolidating and achieving development gains in urban centres.

National and city governments all over the world are undertaking various initiatives for improving urban mobility with a view towards providing universal access to transport and reducing transit-related carbon emissions. The best practices identified and discussed here reflect innovations in transportation employed in cities worldwide that, when replicated, could positively impact the urban transportation systems.

Successful initiatives in cities across the globe show that efficient systems for urban mobility are essential for achieving-the overall socio-economic growth. These systems are also vital in ensuring that the positive agglomeration effects and synergies of urban settlements materialize in a way that is sustainable in environmental, social and economic terms.

The ultimate goals of the best practices are to achieve **equitable access to transportation services**, increase **economic productivity** and **lower negative environmental impacts.**

In an effort to promote and support sustainable urban mobility, governments worldwide are working towards taking a lead in advocating increased awareness on approaches, policies and investments as well as for implementing strategies and programmes for more transport and improved infrastructure. Most strategies aim to reduce growth in private motorized vehicles, thus reducing traffic congestion and greenhouse gas emissions in the cities.

The impact of planned urban mobility

The sustainable urban mobility solutions intend to achieve positive impacts in the cities that replicate the best practices. These impacts are:

- more compact settlement patterns for travel reduction and reduced energy consumption
- integrated transport policies and planning for better access to housing and employment opportunities
- mobility management and intermodal network for seamless urban transport systems
- more accessible and efficient public transport systems
- better infrastructure for pedestrians and cyclists allowing for greater safety and liveability

Key Application Areas

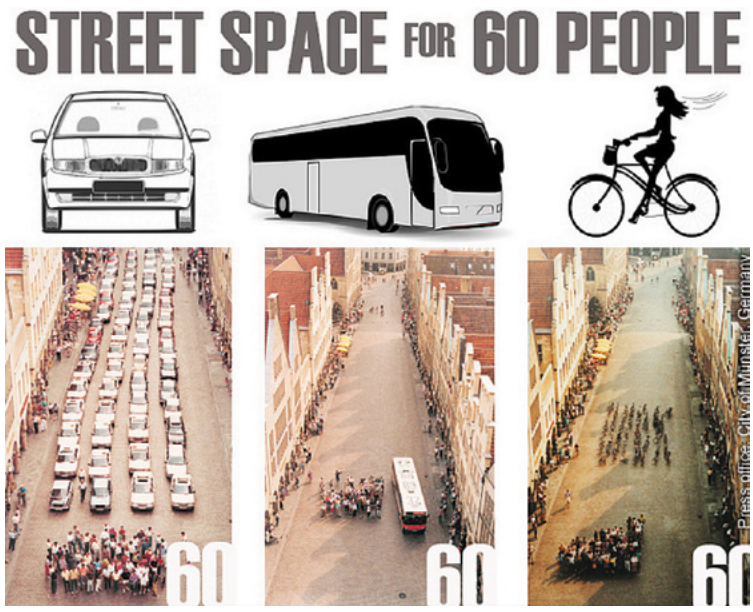
This documentation takes into consideration the current transport situation and dynamic challenges faced by each city, including high levels of energy consumption, carbon dioxide emissions, congestion, road casualties, urban sprawl, and social exclusion. It also describes how these cities have implemented certain solutions that aim at improved urban planning, traffic demand management, public transit development, non-motorized transport, streetscape design, road planning, low-emission vehicles and logistics planning. Before replication, the strategies and programs have to be tailored and contextualised specifically to the needs of the city. The key initiatives to improve urban mobility have been discussed under the following thematic areas:

THEME 1 - POLICY AND INSTITUTIONAL FRAMEWORK: The city selected under this theme has demonstrated the implementation of a transport policy for inter-modal coordination with a focus to service delivery to the end users.
Singapore - Integrated Land Transport System: Singapore has adopted a people-centric approach to urban mobility planning, enforced by an integrated transport policy and master plan. Transit-oriented development is the backbone of Singapore's urban development, with continuous innovation with regard to technology, schemes and programs.

THEME 2 - MASS TRANSIT: Under this theme, the case studies that illustrate ways to make public transport in cities more efficient and sustainable to meet the challenges of mass mobility have been included.
China - High Speed Rail (HSR) network: This case is an example of one of the modern high speed train systems (or bullet trains) being built around the world to enable faster mobility and foster economic growth between different urban centres.
Bogota, Colombia - TransMilenio Bus Rapid Transit System (BRT): The BRT system in Bogota demonstrates the implementation of the dedicated bus corridor with a sound legal and institutional framework, and the involvement of the private sector. The system is well integrated with feeder services as well as non-motorized modes like bicycling and walking.

THEME 3 - TRAVEL DEMAND MANAGEMENT: The initiatives described under this theme are strategies that have been


SONY
MIDORI
MELON
LIQUEUR
SONY
Coca-Cola
Sobelsohn School
Steak & Brew Burger



URBAN MOBILITY STRATEGIES
Development of policy frameworks, and investment strategies that address urban mobility needs in an economically efficient, environmentally sustainable, and socially inclusive manner
Adoption of metropolitan/city mobility plans and implementation strategies
Technical assistance for better public transport solutions
Improving infrastructure for pedestrians and cyclists
Travel demand management
Transit-oriented development (TOD); Urban design to accommodate travel needs
Integrating informal transportation systems and non-motorized transport
Knowledge dissemination, awareness campaign and citizen participation
Global partnerships to promote sustainable mobility options

undertaken by the cities to addresses the problem of traffic congestion by reducing travel demand of private vehicles, instead of increasing the capacity of transportation facilities.

London, United Kingdom - Congestion Pricing Scheme: The scheme involves charging the single occupant vehicles a fee for entering the central London area, in order to reduce congestion at the same time encouraging the use of public transport over private modes.

Seoul, Korea - Demolishing road infrastructure and improving non-motorized transport: The project implemented by the Seoul government involved tearing down an elevating highway to reclaim the road space and restoring the Cheonggyecheon stream into a vibrant public space.

THEME 4 - ECOMOBILITY: The theme covers best practices in urban mobility aimed at environmental sustainability, either through regulatory mechanisms or by improving the non-motorized transport infrastructure.

Mexico City, Mexico - EcoMobility through Green Plan: The environmentally-friendly transportation and mobility strategy, aimed at improving the city's public transportation system and promoting non-motorized transportation, has been implemented in the Mexico City through a Green Plan.

Paris, France - Public Bike Share Programme: This case demonstrates the successful implementation of a large scale public bicycle sharing program under a public-private partnership with the aim of promoting bicycling as a choice mode for short distance trips.

Buenos Aires, Argentina - Pedestrian Priority Program: The program initiated by the Ministry of Urban Development aims as designating pedestrians as preferential users, with the aim of reclaiming public spaces for pedestrians and discouraging car use.

THEME 5 - PRO-POOR MOBILITY: The initiatives undertaken to provide affordable mobility options to the poor have been discussed under this theme.

Lagos, Nigeria - BRT-Lite System: An affordable public transit system was developed by the transport authority to serve the poor, which retained as many of the desirable BRT characteristics as possible, with reduced costs and lower technical specifications.

Indonesia - Pangkalangs for Informal Transport System: Co-operative organizations of informal transport drivers, called Pankalang, have been formed in Indonesian cities in order to regulate the operations of informal modes of transport.

THEME 1

POLICY AND INSTITUTIONAL FRAMEWORK

Governments worldwide are working to promote national and regional policy and regulatory framework that supports more sustainable urban mobility systems. An integrated transport policy is an effective measure to ensure a holistic approach in the design, development and implementation of various urban transit systems. It governs the institutional framework, financing mechanism, construction, operation and maintenance of the transit networks in the city. With the implementation of a comprehensive transport policy, the varied mobility needs of all the citizens can be addressed in an integrated manner. It facilitates coordination in all transport-related activities.

Initiatives in India

In India, the **National Urban Transport Policy (NUTP)**[1] was launched in 2006 by the Ministry of Urban Development (MoUD) to motivate the building of people centric urban transport solutions instead of focusing on improving the conditions for private motor vehicles. The needs of the majority of the population using public transport and non-motorized modes were given utmost importance. It was then mandated that all urban transport projects receiving financial assistance from the Jawaharlal Nehru National Urban Renewal Mission (JnNURM) program are to conform to the rules and regulations stated under the NUTP mission. This linking provided motivation to the states, medium sized cities and Tier II cities to attempt to design and implement sustainable public transport solutions like the Bus Rapid Transit systems (BRT) and other non-motorized transport projects.

In this section, one case study, that of Singapore, has been discussed. Singapore's integrated approach to urban transport management is supported by continuous innovation and technology. An autonomous body, the Land Transport Authority (LTA) has undertaken various initiatives to facilitate public transport a choice mode over private vehicles. Integrated multi-modal transport hubs enable seamless interchange between various modes of transport. Non-motorised transport modes such as bicycling and walking are encouraged to provide last mile connectivity to the users. A key strategy has been to integrate land use planning with transport planning with an aim to ensure transit-oriented development (TOD).

[1] Transport policy of the Ministry of Urban Development (MoUD), Government of India, accessed: moud.gov.in/sites/upload_files/moud/files/pdf/TransportPolicy.pdf

INTEGRATED LAND TRANSPORT SYSTEM, SINGAPORE

Location	Singapore
Region	Southeast Asia
Year	1995-96
Agency	Land Transport Authority (LTA)
Award	UITP's 'Grow with Public Transport award 2013'

Project Aim

To have integrated measures for consistent improvements to the existing transport and have provisions for better transport alternatives according to change in demand and ownership in order to provide the people with a safe, efficient and comfortable public transportation network.

Context

The rapid economic growth, a growing population and the rising affluence of Singaporeans caused the demand for travel to burgeon in the last few decades. In September 1995, the Singapore Government set up the Land Transport Authority (LTA) by the merger of four government agencies to spearhead efforts to improve the land transport network. With the merger, all Governmental functions relevant to land transport were integrated under one roof. The merged entity became responsible for the planning, designing, development and management of all transport-related functions including road building and maintenance, rail development, vehicle ownership and demand management policies. As a single integrated agency, the Authority is able to ensure that the transport projects and measures, previously carried out by different agencies, supplement and complement each other in the most effective and efficient manner. The bulk of transportation is land-based, via roads and rail (Mass Rapid Transit which runs the length and width of Singapore and the Light Rail Transit which runs within a few neighbourhoods).

Project Description

The Singapore Government published in 1996, in its White Paper for a 'World Class Land Transport System,' that a high magnitude of all passenger trips over the next 10 to15 years will be provided by a good quality public transport system. In the White Paper, the following policy goals were set:

- To increase the capacity and quality of Singapore's land transport system to a level that is sustainable, given the economic, social and environmental constraints.
- To provide a wide spectrum of transport choices, while ensuring that they are integrated, affordable and correctly priced to suit each individual's preference and pocket.

The following strategies have been adopted to attain the above-mentioned twin-policy goals:

1. Integrating transport and land use planning
2. Developing a comprehensive road network and harnessing technology to maximise network capacity
3. Manage demand for road transport
4. Provide a quality public transport system

The focus in the transport sector in Singapore is gradually shifting away from a car-centric mode of planning, to a more 'people-centric approach'.

Key Results and Impacts

- The initiatives listed in LTA's White Paper were successfully implemented in the 10 years after its launch, and contributed to improving the land transport system and meeting the growing travel demands of the population.
- The high car prices, soaring certificate of entitlement premiums and associated motoring costs such as parking and Electronic Road Pricing have persuaded people to turn to public transport.
- *Public Transport indicators:* As a result, the modal share of public transport has increased as compared to that of private transport. The percentage of trips made by using public transport increased from 51% in 1996 to 60% in 2004.
- *Private Vehicle indicators:* There is a decrease in the vehicle to population ratio from 1:15 in 1980 to 1:10 in 1996 to 1:7 in 2010.

Lessons learnt

- Prudent policies that address the requirements of the majority of the population, i.e. enabling the development of public transport act as the backbone of the city infrastructure.
- Long-term strategic planning for integration of landuse strategies and transport planning is an effective tool for achieving the goals of sustainability.
- Control on car ownership can be ensured with traffic-demand management initiatives such as: Vehicle quota system, Taxes and Fees on Vehicles, Area Licensing System, Park and Ride System and Extensive network of Public Transport.
- A holistic and visionary approach to improving public transport systems and integrating the different modes for a seamless journey facilitates a shift towards public transport.

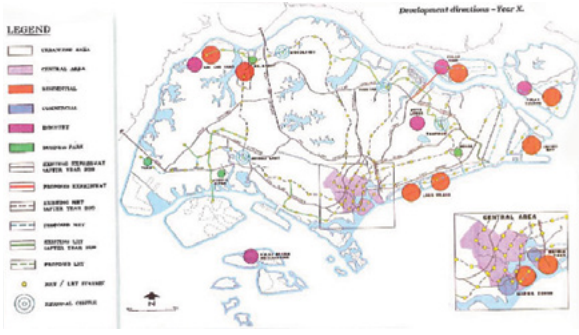
Replicability

The National Urban Transport Policy devised by the MoUD-should be implemented in Indian cities to ensure that an integrated approach to urban transport management is adopted instead of undertaking piecemeal efforts. An enabling step

Project Implementation

1. INTEGRATED TRANSPORT AND LANDUSE PLANNING

1971 Concept Plan



1991 Concept Plan

2001 Concept Plan

1971 Concept Plan was Singapore's first integrated land use and transport development plan. Its key features included:

- A proposal for a rail network branching North-South and East-West was first mooted in the 1971 Concept Plan, to serve a series of commercial centres along the route. The plan also proposed a comprehensive network of expressways and arterial roads.
- **Transit-oriented Development (TOD)** was encouraged in the plan. Developing new towns along major corridors and transit hubs enables the city to support high densities effectively.

Subsequent Concept Plans and Land Transport Master Plans further built on this structure, proposing extensions of the road system and the mass rapid transit (MRT) network.

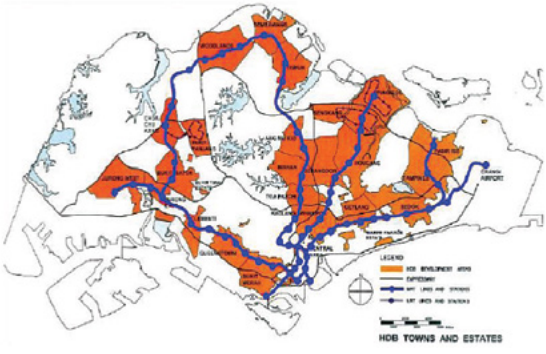
Land Use Plan 2013 considers *'Greater, green mobility with enhanced transport connectivity'* as its main aim. Its stated objectives include:

(a) Public transport, walking or cycling should be the default means.

(b) Encourage greater use of public transport by making it even more convenient, frequent, and comfortable, along with cheaper fares and season passes.

(c) Discourage private transport by reviewing car parking policies, like reducing parking lots, or charging higher parking fees.

(d) Provide a dedicated network of cycling lanes and complimentary facilities.



Integration Plan: Transport &Housing estates

The *Integration of Transport and Housing Estates* has been encouraged as a key strategy in the land use planning. It ensures:

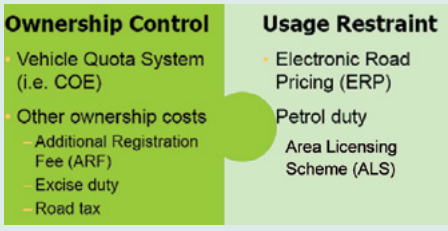
- Increase in commuters' walkability and accessibility
- Reduction in the need of car dependency
- Promotion of high density, compact public transport-centric urban fabric
- Safeguarding future transport corridors

2. DEVELOPING A COMPREHENSIVE ROAD NETWORK AND HARNESSING TECHNOLOGY TO MAXIMISE NETWORK CAPACITY

Fort Canning Tunnel – adopting environmentally sustainable processes in the planning and development of transport infrastructure

- LTA expanded the road network from 2,972 km in 1995 to 3,356 km in 2010. Vehicular underpasses were constructed at many major junctions to facilitate more efficient traffic flow.
- This has ameliorated congestion and kept more than 95% of the expressway and 90% of the arterial road traffic within the optimal speeds of 45km/h to 65km/h and 20km/h to 30km/h respectively.
- To maximise road network capacity, LTA continued to invest in various innovative Intelligent Transport Systems (ITS). [For further details about Singapore's ITS refer to NIUA's Best Practices Report on the ICT sector]

3. MANAGE DEMAND FOR ROAD TRANSPORT



Electronic Road Pricing

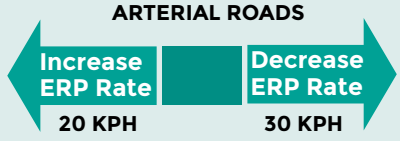
JUNE 2013 1ST BIDDING EXERCISE FOR COE

	Quota	Quota Premium	Bids Received
Non-Transferable Categories			
Category A (Car <=1,600cc)	341	$67,301	855
Category B (Car >=1,601cc)	302	$75,000	732
Category D (Motorcycles)	511	$1,701	616
Transferable Categories			
Category C (Goods veh & buses)	277	$57,989	292
Category E (Open)	239	$76,000	534

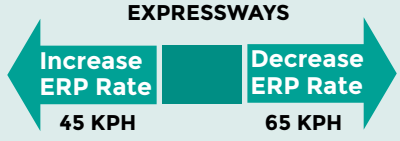
Singapore adopted the "user pays principle" in managing road congestion by charging motorists with marginal business and social costs they impose on others. Some innovations in travel demand management include the following:

- Vehicle Quota System (VQS)- Introduced Introduced in 1990, it is a scheme whereby the prospective vehicle buyers need to obtain a quota license, Certificate of Entitlement (COE), before they can make their purchase. This ensures that the growth rate of vehicles can be sustained by road capacity.
- Area Licensing Scheme (ALS)- Implemented in 1975, ALS reduces traffic entering the Restricted Zone (RZ).
- Electronic Road Pricing (ERP) system- Introduced in 1998, ERP is a congestion management tool. It optimises the use of road capacity through the pricing of roads. The rates are flexible; they vary by location/ time, based on local traffic conditions.

ARTERIAL ROADS



EXPRESSWAYS



4. MANAGE DEMAND FOR ROAD TRANSPORT

Singapore has been consistently working towards improving its public transport systems to encourage a modal shift away from private vehicles. Land Transport Master Plan 2013, drafted by LTA, states its vision that, by 2030, Singapore will have:

- 8 in 10 households living within a 10 minute walk from a train station
- 85% of public transport journeys (less than 20km) completed within 60 minutes
- 75% of all journeys in peak hours undertaken on public transport'

The following are the various public transport systems operating in Singapore:

Mass Rapid Transit (MRT)

- 152.9 km, 114 stations
- MRT serves heavy transit corridors
- Fares and service standards are regulated

Buses

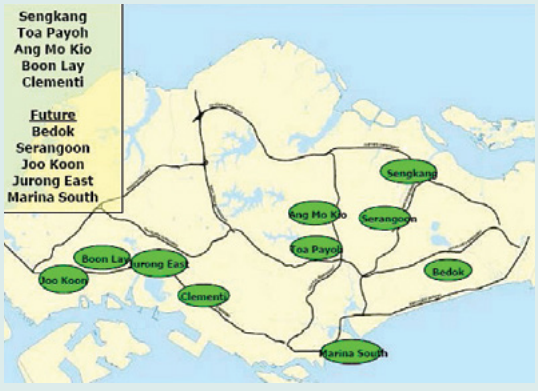
- 330 routes, 4,000 buses
- Comprehensive coverage
- Fares and service standards are regulated

Taxis

- More than 24,000 taxis operational
- High end personalised public transport service

Light Rail Transit (LRT)

- 28.8 km, 43 stations
- Acting as feeder services to the Mass Rapid Transit network



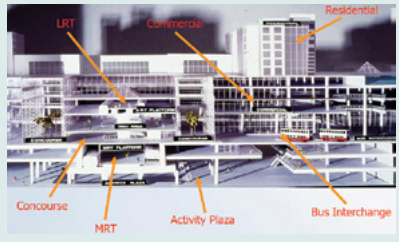
Map showing existing transport hubs

INTEGRATION OF PUBLIC TRANSPORT MODES AND SYSTEMS

The buses and the LRT serve as feeders to bring people to transfer hubs, i.e., MRT stations or bus interchanges, to enhance the seamlessness of commuters' journeys.

Integrated public transport hub: The transit stations are designed to integrate physically with or connected to other transport facilities. The hub includes bus interchanges, taxi stands and pick up/drop off points. The transfer between modes is made as sheltered as possible.

SENGKANG TOWN CENTRE – AN INTEGRATED TRANSPORT HUB



FACILITATING CYCLING

- Foldable bicycles allowed on buses and trains
- Improved bicycle parking facilities at public transport nodes
- Implement cycling path networks and parking facilities; Dedicated cycling tracks next to pedestrians footpaths

towards this would be the establishment of an autonomous transport authority to oversee the operations of all transport modes in the city. The authority can facilitate seamless interchange in multi-modal journeys by developing integrated transport hubs, as well as providing infrastructure for bicycling and other non-motorised modes.

The transport strategy adopted by the city should be synchronized with the land use strategy in order to ensure transit-oriented development (TOD), with the development of high density mixed-use residential and commercial areas around multi-modal transport hubs to maximize access to public transport. Regulatory framework and institutional set up can be instrumental in the implementation of an integrated mobility policy. The future of transport in Indian cities will be determined by the strategies and legislations that would result in an integrated use of the existing transportation systems.

THEME 2

MASS TRANSIT

Despite the long history of auto-centric or car-centric city planning in the twentieth century, recent trends in various cities worldwide show a transition towards in mass transit or public transit systems. Capital investments are being made to enhance bus-based or rail-based transit service. Studies have shown that public transit use is a more sustainable transportation option than the dependence on private motorized vehicles.Cities that have shifted towards improved mass transit systems have observed air quality and lower pollution levels. As most transit riders are also pedestrians or cyclists, closely related factor is also the potential health benefits. In order to promote the implementation of public transit solutions, the creation of technical and institutional framework for transport systems is imperative.This section discusses the initiatives to expand or create efficient, affordable, accessible and environmentally sound public transport systems, giving priority to collective means of transport with adequate carrying capacity and frequency that support the mobility demand.

The success of public transportation is usually reflected in the modal share it attracts in the city, i.e., the percentage of travellers using the transportation system. A shift in modal share can serve as a vital yardstick in assessing sustainable mass transportation systems within a city or region. Modal share targets for sustainable transit in a city can be considered at 30% of efficient and reliable public transport along with 30% of non-motorized transport (cycling and walking). Some cities with high public transport mode share include Hong Kong (over 64%), Bogota (64% in 2008), New York City (55% in 2009), Tokyo (51% in 2009), Singapore (44% in 2011) and Vienna (39% in 2012)[2].

Initiatives in India

Mass transit in India consists of bus, metro, monorail and light rail systems. The first rapid transit system in India was the Kolkata Metro, which started operations in 1984. The Delhi Metro, beginning operations in 2002, is India's first modern metro and the third rapid transit system in India overall, after the Kolkata Metro and Chennai Mass Rapid Transit System. The Mumbai Monorail, which opened on 7 February 2014, is the first monorail in India, since the closing of the Patiala State Monorail Trainways in 1927. Currently, mass rapid transit systems operate in 15 cities and more are under construction or in planning in several cities.

In this section, two mass transit case studies have been discussed, that is, high speed rail (HSR) in China and bus-rapid transit (BRT) system in Bogota, Colombia. The development of the HSR network in China started in 2007 as a modern inter-city rail transit system operating at significantly higher speeds than traditional rail systems. The network continues to expand as the work is being carried out at a fast pace. It has become the most heavily used HSR network in the world. The second case study of BRT in Bogota was developed in 2000 based on the successful experience in Brazil, Curitiba. The system involves the development of a dedicated bus way integrated with other modes of transport in the city, with the participation of the private sector. The mass transit system functions as an efficient, safe and reliable public transit mode.

[2] The modal split of journeys to work can be compared and accessed from the compilation at: en.wikipedia.org/wiki/Modal_share

HIGH SPEED RAIL IN CHINA

Location	China
Region	Asia
Year	2007-on going
Agency	China Railway Corporation

Project Aim

To build high-speed railway network connecting the major urban centres to boost economic growth.

Context

State planning for China's high-speed railway began in 1990. At that time, the key rail line from Beijing to Shanghai was facing overcapacity issues and running inefficiently – its average speed was only 48 km/h (30 mph), resulting in a journey of around 20 hours. The country started construction of its first high-speed rail line, the Qinhuangdao–Shenyang Passenger Railway, in 1999, which subsequently opened in 2003 with a design speed of 200 km/h (124 mph).

The government's long-term goal was to make its high-speed rail the largest, most extensive, and most accessible rail network in the world. After years of 'speed-up' campaigns, the HSR in China was introduced in 2007. One year later, China began construction on the high-speed rail from Beijing to Shanghai, which was open for commercial use in June 2011. The train currently travels up to 320 km/h and the travel time is under 5 hours (for a journey of around 1500 kilometres).

Project Description

The country has undergone an HSR building boom with generous funding from the Chinese government's economic stimulus program. China has built the world's longest HSR network with over 11,028 km (6,852 mi) of track in service as of 2013, including the world's longest line, the 2,298 km (1,428 mi) Beijing–Guangzhou High-Speed Railway.

China's HSR network consists of upgraded conventional railways, newly built high-speed passenger designated lines (PDLs), and the world's first high-speed commercial magnetic levitation (maglev) line. Nearly all high-speed rail lines and rolling stock are owned and operated by the China Railway Corporation, the national railway operator formerly known as the Railway Ministry. The Shanghai Maglev Train is owned and operated by Shanghai's city government. China's early high-speed trains were imported or built under technology transfer agreements with foreign train-makers including Alstom, Siemens, Bombardier and Kawasaki Heavy Industries. Chinese engineers then re-designed internal train components and built indigenous trains that can reach operational speeds of up to 380 km/h (240 mph).

High speed rail network map, China

HIGH SPEED RAIL (HSR)

High-speed rail is an inter-city rail transport that operates significantly faster than traditional rail traffic (at speeds of over 200 km/h or 125 mph), using an integrated system of specialized rolling stock and dedicated tracks. High-speed trains normally operate on standard gauge tracks of continuously welded rail on grade-separated right-of-way that incorporates a large turning radius in its design.The first such system, Shinkansen (or the bullet train), began operations in Japan in 1964[3].

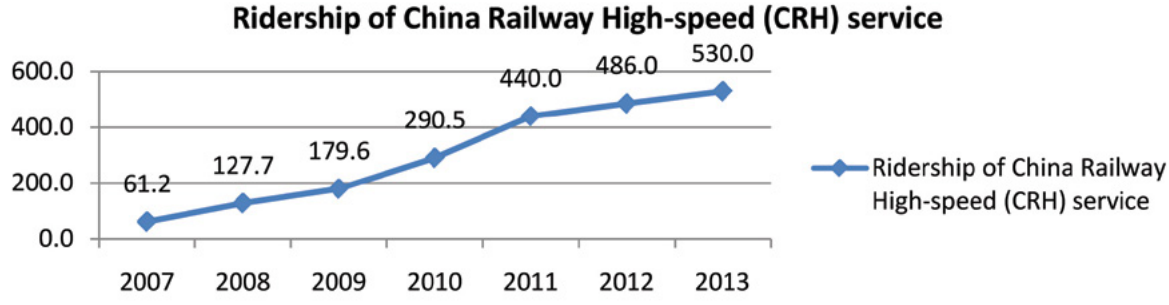
Other countries that have developed HSR to connect major cities include China, France (TGVs-*train à grandevitesse*), Germany (ICE- InterCityExpress), Italy, Taiwan, Turkey, South Korea and Spain (AVE-*Alta Velocidad Española*)[4]. In India, high-speed corridors have been proposed but not implemented. High Speed Rail Corporation of India Limited was launched by the Ministry of Railways on 29th October, 2013. The Mumbai–Ahmedabad high-speed rail corridor, an approved HSR corridor if built, will be India's first high speed rail line. The first high speed railway line in India is expected to become operational between 2021 and 2035[5].

[3] Baruch Feigenbaum, High-Speed Rail in Europe and Asia: Lessons for the United States, Reason Foundation, 2013, accessed: reason.org/files/high_speed_rail_lessons.pdf
[4] Ibid.
[5] The website of High Speed Rail Corporation of India Limited: hsrc.in/index.html, accessed in September 2014

BEIJING–GUANGZHOU–SHENZHEN–HONG KONG HIGH-SPEED LINE

Stations	46
Opening	26 Dec. 2009 (1st section)
Owner	China Railway
	MTR Corporation
Operators	China Railway High-speed
	MTR Corporation
Line length	2,230 kilometres (1,390 mi)
Track gauge	1,435 mm (4 ft 8 1⁄2 in)
Operating speed	350 kilometres per hour (220 mph)

Annual ridership figures (in millions of passengers)							
Year	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Ridership of China Railway High-speed (CRH) service	61.2	127.7	179.6	290.5	440.0	486.0	530.0



Key Results and Impact

Since HSR service was introduced, the daily ridership has grown from 237,000 in 2007 to 1.33 million in 2012, making the Chinese HSR network the most heavily used in the world.

Replicability

In India, the Chinese model can be replicated in terms of the implementation and institutional framework. A single government agency can be set up which will own, develop and manage the HSR corridors. India needs to define its own standard for its HSR, using which it can bring in competition among the bidders and induce technology transfers. HSR can be effectively used to build the economic growth corridors connecting the major urban centres.

TRANSMILENIO, BUS RAPID TRANSIT SYSTEM, BOGOTA, COLOMBIA

Location	Bogota, capital city of Colombia
Region	Latin America
Year	2000
Agency	TransMilenio S.A.
Awards	City Climate Leadership Award for Urban Transportation, 2013; Sustainable Transport Award 2005; Ranked 'Gold' under the 2013 BRT Corridor Standard

Project Aim

To transform Bogota into a model for innovative, efficient, safe and accessible transportation networks, under the city government's strong leadership with careful design and planning.

Context

Bogota is the largest and the most populous city in Colombia. By the end of the 1990s, the city's roads had become highly congested following significant growth in private car ownership and use. The city also suffered from a high rate of accidents and extremely severe air pollution during peak travel hours. Before TransMilenio, the mass transit system consisted of independently operated and uncoordinated mini buses with poor quality service and efficiency. In 1998, the Mayor launched an urban mobility plan which consisted of measures to restrict private automobiles, promote non-motorized transport, development of pedestrianized zones and cycle paths and improve public transit by partly financing infrastructure improvements. The BRT was launched as a part of this package of urban transport reforms.

Project Description

In 1999, the mayor's office proposed the Bus Rapid Transit (BRT) system, based on the successful experience in Brazil, Curitiba, in order to alleviate congestion and provide an efficient and cost-effective means of transportation. The TransMilenio system became operational in December 2000, in the most important public transport corridor of the city, the Avenida Caracas, along with two other corridors. The system has now reached almost 75% of the city and its metropolitan area.

Key Results and Impacts

- The TransMilenio provides the city with an efficient and safe mass transit system that encourages high ridership.
- With the system's implementation, there has been a 32% reduction in overall travel time; a 40% reduction in air emissions from the scrapping of more than 2,100 old public service buses; and a 92% reduction in accident rates in corridors where the TransMilenio system operates.
- It provides fast and reliable transport for over 1.8 million passengers per day and in the process reduces traffic congestion.
- The system has proved to be a socially inclusive one with the lower and middle income groups being the largest proportion of users and beneficiaries of the BRT system.

BUS RAPID TRANSIT (BRT)

Bus rapid transit (BRT) is a bus-based mass transit system. A BRT system has specialized design, services and infrastructure to improve system quality and remove the typical causes of delay. It aims to combine the capacity and speed of light rail or metro with the flexibility, lower cost and simplicity of a bus system.

The first BRT system, the RedeIntegrada de Transporte ('Integrated Transportation Network'), entered service in 1974 in Curitiba, Brazil[6]. This inspired many similar systems around Brazil and the rest of the world. As of 2013 more than 166 cities had implemented BRT, accounting for 4,336 km (2,694 mi) of BRT lanes serving about 27 million passengers every day. BRT systems are concentrated in Latin America and the Caribbean (64% of global ridership)[7] and Asia (27% of global ridership). Latin America currently has 55 systems, the most in the world. The region is also home to many of the world's highest-capacity systems, including Bogota, Sao Paulo, Curitiba and Mexico City.

Lessons Learnt

- The system was a success due to many factors: strong leadership from the city Mayor, careful design and planning, use of state-of-the-art technology, the establishment of a well-managed company, sound investment in infrastructure and an efficient single-fare pricing system.
- BRT systems can achieve high coverage at low investment costs. As they are road based systems they can go near homes and destinations and cover most of the city.
- It is essential to integrate the BRT system with pedestrian and bicycle pathways, and other non-motorized modes.

Replicability

The TransMilenio bus-based rapid transit system has been opera-

[6] Accessed: en.wikipedia.org/wiki/Bus_rapid_transit
[7] UN HABITAT, *Planning and design for sustainable urban mobility: Global report on human settlement 2013*, Routledge, New York, 2013, accessed: unhabitat.org/planning-and-design-for-sustainable-urban-mobility-global-report-on-human-settlements-2013/

TRANSMILENIO – STATISTICS, 2013

No. of lines	12
No. of Stations	136 (17 under construction)
Operator	TransMilenio S.A., a transit authority created in 1999
System length	112 km (70 mi)
Daily ridership	2.2 million
Capacity	Up to 50,000 passengers per hour per direction
Type of system	Closed system: buses stay only in the bus-way (connection is through feeder services)

TransMilenio bus at a station on the busway

Project Implementation

1. INSTITUTIONAL FRAMEWORK

A new institutional arrangement has been put in place to manage the TransMilenio system. Under a public-private partnership, the public sector is in charge of the system's infrastructure and the oversight of the BRT system, while the private sector is in charge of the system's operations and maintenance. The system is divided between three entities: regulators, managers and operators.

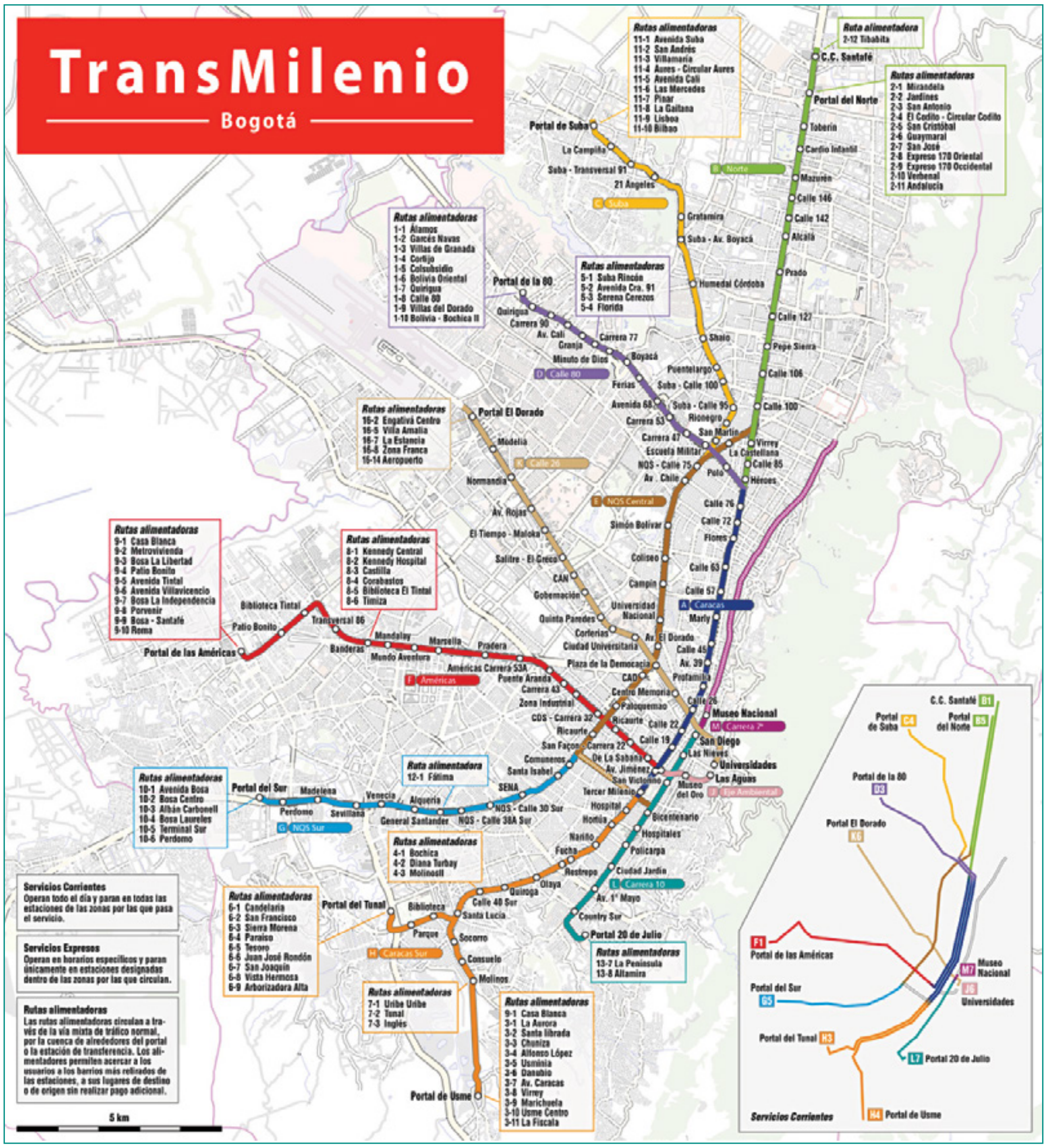
- **Regulator is** the Ministry of Transport, which is in charge of national policies and plans, and the Municipality of Bogota, primarily the transit and transport secretariat.
- **Managers** include TransMilenio S.A. and Institute for Urban Development (IDU). TransMilenio S.A. is a shareholding company created in 1999 with representation from several public agencies. This transit authority is in charge of planning, development and control of the BRT system. IDU supervises the construction and maintenance of the infrastructure, including bus lanes, terminals, parking, pedestrian overpasses and sidewalks.
- **Operations** are under private concession contracts awarded on a competitive basis by TransMilenio S.A. The operations can be broken down into: bus operators, fare collection and a control centre. There are 5 private groups with 7 concessionaires for trunk operations, 6 concessionaires for feeder services and 1 concessionaire for the fare collection system.

TransMilenio bus running in the dedicated corridor

2. PLANNING

Sufficient resources and priority were assigned for planning and construction, and adequate coordination mechanisms were created. There was active participation of knowledgeable consultants who were able to design an operational scheme that was able to handle very high demand levels.

Corridor Selection: Selection of the first corridors, Av. Caracas, Calle 80, AutopistaNorte, came after the completion of an alternatives analysis. The three selected corridors connect the extended central business district (CBD) with dense residential areas in the southern, north western and northern parts of the city, and are very visible to the general public.



Map of TransMilenio network in Bogota

Busway and traffic lanes accessed by the pedestrian bridge

Articulated buses for TransMilenio

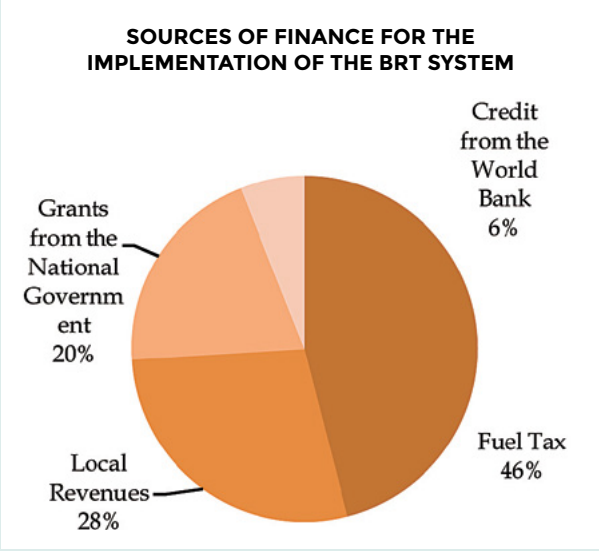
Ticket barriers at the entrance to a TransMilenio station in Bogotá

Boarding from elevated platform

3. INFRASTRUCTURE PROVISIONS

- TransMilenio consists of several interconnecting BRT lines, each composed of elevated stations in the center of a main avenue, or 'troncal'. Passengers typically reach the stations via a bridge over the street. Usually, four lanes down the center of the street are dedicated to bus traffic. There are both express and local buses, the latter stopping in every station. The outer lanes allow express buses to bypass buses stopped at a station.
- The infrastructure, therefore, includes reconstructed busways and general traffic lanes, enclosed stations and terminals, bus depots, non-grade intersections, pedestrian overheads, bikeways, sidewalks and local roads for feeder services. It has been built by the IDU with local and national funds. Public investment has also included the centralized control centre, which manages data and voice communications with trunk buses and supervisors.
- The buses running on dedicated lanes are articulated (split into two sections with an accordion-like rotating middle to allow for sharp turns) and have a capacity of 160 passengers. They are built with clean diesel engines complying with Euro II environmental standards. Smaller feeder buses, with a capacity of 80 passengers, are also integrated into the system.
- Seven feeder zones with 309 kilometers of feeder routes within 74 neighborhoods are established to move passengers from remote areas to the main BRT system.
- TransMilenio uses a prepaid method of payment. Users pay at the station entrance via a smart card, pass through a turnstile, and await the arrival of the bus inside the station, which is typically 5 m wide. The bus and station doors open simultaneously, and passengers board by simply walking across the threshold.
- The centralized coordinating control center provides monitoring and communications to schedule services, identify possible new routes into the system and real-time responses to contingencies. The satellite control center allows continual supervision of the operation of the buses. Weight sensors in the bus suspension are used to prevent overload. Each bus has a Global Positioning System receiver to report the bus location.

SOURCES OF FINANCE FOR THE IMPLEMENTATION OF THE BRT SYSTEM



4. FINANCIAL ASPECTS

TransMilenio's funding is via a public-private partnership, in which the public sector is responsible for the investment to develop the required infrastructure, while the private sector is responsible for the investment of the bus fleet, the ticket selling and validating system, and for the operation of the trunk and feeder services. TransMilenio is designed such that the private sector recovers 100% of its operational costs through passenger fares.

Fare collection: The fare is adjusted using a predefined formula built into the concession contracts. A trust fund receives all the revenue collected on a daily basis and distributes them weekly among the system agents as per the concession contract rules.

5. ACCESSIBILITY ASPECTS

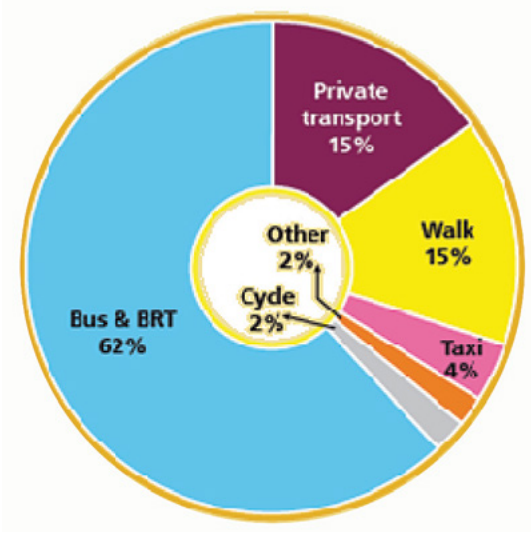
Elevated bus stations allow the young, elderly and disabled to easily board and alight from the buses. The system was designed to be wheelchair accessible for the trunk stations, terminals and buses. Standards set by the Colombian law for size and inclinations of ramps were used, as well as the implementation of special turnstiles in every station and designated areas inside the buses with adequate restraints.

6. IMPLEMENTATION MECHANISM

The TransMilenio System was launched as a first phase of a plan for 388 km of trunk ways. Phase II and Phase III planning started with the previous phase partially implemented. Gradual implementation gave the opportunity to the private operators and the government agency in charge of control to learn and adjust operational and infrastructure details. It also gave the opportunity to new commuters to adapt their travel patterns gradually.

The implementation of TransMilenio Phase I went from a general idea to initial implementation in 35 months, and fully completed within a 4-year period.

MODAL SHARE IN BOGOTA, 2008



tional for 10 years as a public-private partnership with a sound legal framework that has served as an example to be replicated in other cities. Indian cities currently have a number of operational BRT systems (like Ahmedabad, Jaipur, Indore, etc.) and many more planned or under construction (Hubli-Dharwad, Chennai, Nagpur, etc.). The cities that have a BRT system existing and operational need to integrate the dedicated bus network with feeder services and non-motorised modes like bicycling and walking, to ensure last mile connectivity. Investments need to be made, with the assistance from the private sector and the community, to develop bicycle and pedestrian pathways.

The cities that are planning to build the BRT networks can replicate the institutional framework developed for TransMilenio. The transport ministry or the transport department can act as a regulator. An agency can be established in order to oversee the overall planning, design, implementation and operations of the BRT system. The operations can be awarded to concessionaires through a competitive bidding process.

THEME 3

TRAVEL DEMAND MANAGEMENT

Travel demand management (TDM) is the application of policies and strategies to reduce travel demand (specifically that of single-occupancy private vehicles), or to redistribute this demand in space or in time. TDM has come out as a policy choice for solving transportation and traffic problems by reducing and restricting travel demand instead of increasing the capacity and supply of the transportation facilities in the city.

The historical roots of TDM may be traced to the World War II, when company buses, carpools and staggered work shifts were used to attract employees and manage on-site congestion problems. In the 1970's the combination of budget constraints, oil prices, energy crisis and environmental concerns prompted policy makers to focus on increasing the efficiency of the transportation system. Although the term TDM has its origins in the United States in the 1970s and 1980s, the concepts of TDM have been borrowed from mainstream transport planning in Europe[8]. Under these concepts, alternatives other than private car are being promoted as a solution for urban mobility.

The British Government's White Paper on Transport (published in 1998) and a study by the United States Federal Highway Administration (released in 2004) recognised the need for a proactive approach to transportation demand management by scaling up the existing small, scattered sustainable transport initiatives and integrating them in a national transport strategy[9]. Since then, the successful TDM strategies that have been adopted worldwide have been listed in the table.

In this section, two case studies have been discussed, that is, a congestion pricing scheme in London, UK and an initiative to facilitate modal shift in Seoul, Korea; both implemented in 2003. The congestion pricing scheme in London is an example of a road pricing mechanism being used to reduce traffic in the city. In Seoul, the riverfront redevelopment project that has been undertaken has facilitated a shift from the use of car to non-motorised transport modes by restoring the expressway into a vibrant public space.

TDM Strategy	Examples
Road Pricing, such as congestion pricing, toll pricing, distance-based fees	Singapore (1975), London (2003), Stockholm (2007), Milan (2012)
Parking Management	Singapore
Modal Shift	Seoul (2004), New York City (2008)
Low Emission Zones	Tokyo (2003), Berlin (2008), London (2008)
Vehicle Quota System	Singapore (1990), Shanghai (1994), Beijing (2011), Tianjin (2013)
Vehicle Travel Restriction	Latin American cities (1989-2010), European Union (1982), Chinese cities (2008-2012)

[8] Genevieve Giuliano and Martin Wachs, Responding to Congestion and Traffic Growth: Transportation Demand Management,Transportation Centre, The University of California, 1992, accessed: www.uctc.net/papers/086.pdf
[9] Accessed: en.wikipedia.org/wiki/Transportation_demand_management

CONGESTION PRICING SCHEME IN LONDON, UK

Location	UK
Region	Europe
Year	2003
Agency	Transport for London (TfL), local government body under Greater London Authority (GLA)
Awards	Sustainable Transport Award 2008

Project Aim

To discourage drivers from using private vehicles in the congestion charge zone during peak hours and using public transport instead, thereby reducing traffic congestion and air pollution.

Context

By the late 1990s, London was suffering from the worst traffic congestion in the UK. In central London average traffic speeds dipped below 10 mph in the period 1998-2000 for the first time since records began, and the delays were costing time and money to the citizens. In order to tackle the problem, the Mayor proposed a Transport Strategy in 2001 'for the promotion and encouragement of safe, integrated, efficient and economic transport facilities and services to, from and within Greater London'. The Strategy included proposals for a congestion charge for central London as an economic instrument, aimed at decreasing congestion.

Project Description

London introduced the Central London Congestion Charging Scheme in February 2003 and extended it westwards in February 2007. In 2003, London began charging single occupant vehicle (SOV) drivers to enter, drive or park a vehicle on public roads in the congestion charge zone i.e., in central London, during daytime hours. The scheme is an area based scheme and the daily charge applies from 7a.m. to 6 p.m. on weekdays, excluding public holidays and weekends. In 2007, London expanded the congestion pricing plan with a doubling of the congestion zone, increased fees for motor vehicles, and new city-wide emission-based tolls that are spurring more rapid adoption of cleaner, fuel efficient vehicles.

Key Results and Impacts

- Traffic levels inside the charging zone have been cut by 20%, equating to 75,000 vehicles, the scheme has led to reduced congestion in the zone by around 30% during charging hours and a reduction of between 40-70 road traffic casualties per annum.
- A 16% reduction in road transport CO2 emissions were estimated within the original charging zone, amounting to 30,000 tonnes annually and cutting an estimated 40-50 million litres of vehicle fuel consumption.
- There has been a switch to public transport from private vehicles - around 40,000 daily movements. There has also been a large increase in pedal cycle trips - an 83% increase across London – which the congestion charge has helped stimulate.
- The charge raises £122 million annually, which is invested in improving public transport, providing buses, improving road safety and implementing energy efficiency in transport.

ROAD PRICING

Road pricing (or road user charges) are direct charges levied on the users for the use of roads. These charges include road tolls, distance or time based fees, congestion charges and charges designed to discourage use of certain classes of vehicle, fuel sources or more polluting vehicles. These charges are an effective TDM tool used to reduce peak hour travel and the associated traffic congestion or other social and environmental negative externalities associated with road travel such as air pollution, greenhouse gas emissions, noise and road accidents. The application of congestion charges is currently limited to a small number of cities and urban roads, and notable schemes include the Electronic Road Pricing in Singapore, the London congestion charge, the Stockholm congestion tax, the Milan Area Congestion charge and high-occupancy toll lane charges in the USA.

Lessons Learnt

- For the success of a road pricing scheme, complimentary measures like improving the bus services, increasing the capacities and extensive traffic management schemes around the affected areas are necessary.
- The congestion charge can be implemented as a part of a transport strategy, with a well-defined vision and targets.

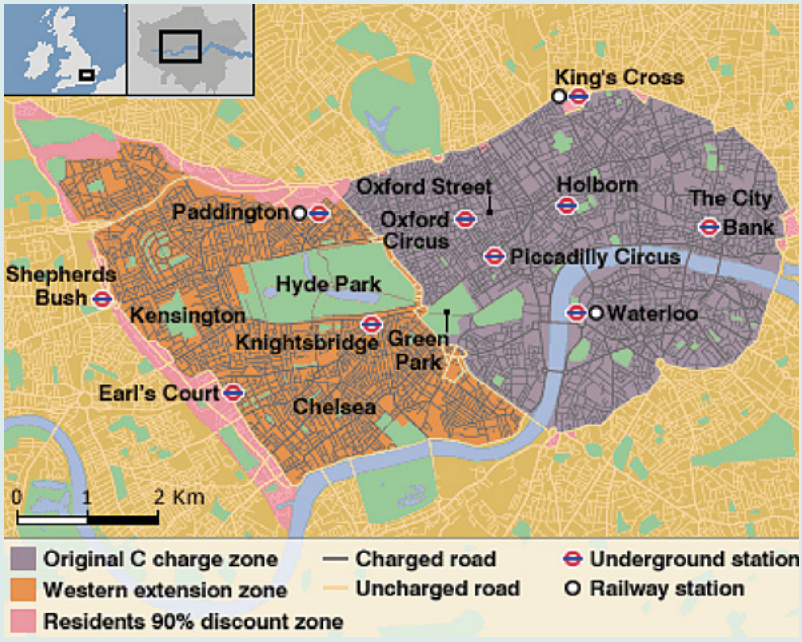
Replicability

The success of London's congestion pricing scheme has inspired other cities around the world to implement road pricing mechanisms to reduce traffic congestion. The congestion charge can be implemented in large cities in India, where the central business districts and the old city areas face high congestion caused by vehicular traffic, as an economic instrument to decongest the central business districts and the inner city areas. The revenue raised from the pricing scheme can be used towards develop-

Central London Congestion Charging Scheme Implementation

1. AREA COVERAGE

The original central London congestion charging zone in 2003 covered an area 22 sq. km. in the heart of London bounded by the Inner Ring Road. In 2007, the zone was extended by about 50% to include parts of west central London and included a free route (the original western boundary) through the centre of the enlarged zone.



Boundary of the extended Congestion Charging zone

Signs in red and white indicating the entrance and exit of congestion charge zone

Road in the congestion charge zone

A driver paying the exit fee

2. SALIENT FEATURES OF THE SCHEME

Financial Aspects

- The implementation cost of the scheme was £230 million, including £100 million of complementary traffic management measures, like bus services, being spent across Greater London. The annual operating costs are around £88 million.
- Preceding implementation, TfL added 300 new buses and improved services to accommodate new riders.

Charges

- The standard daily charge is £11.50 (raised from £5 in 2003) for each non-exempt vehicle that travels within the zone.
- The charge aims to raise investment funds for London's transport system along with reducing congestion.
- The revenue raised must be spent, by law, on transport improvements in London for the next 10 years.

Exemptions

- Various vehicle types are exempt, including buses, taxis, private hire vehicles and motorcycles; other types of vehicle can register for a 90% or 100% discount, such as vehicles used by residents of the zone or used by those with a disabled persons badge.

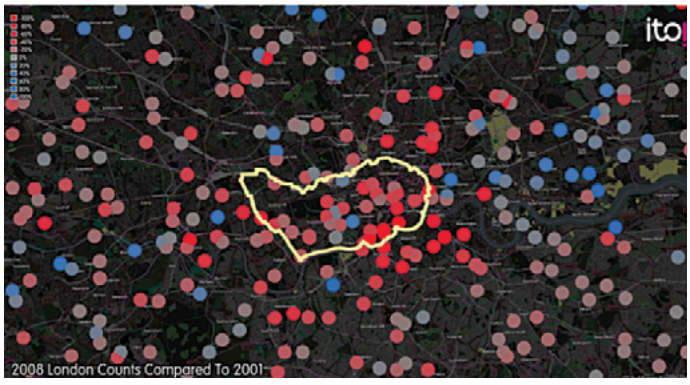
Payment Method

- There are no manned toll booths. Payment can be made by post, telephone, internet, SMS, at self-service machines, retail outlets and some petrol stations.
- The easiest way to pay the charge is by registering for Congestion Charge Auto Pay.

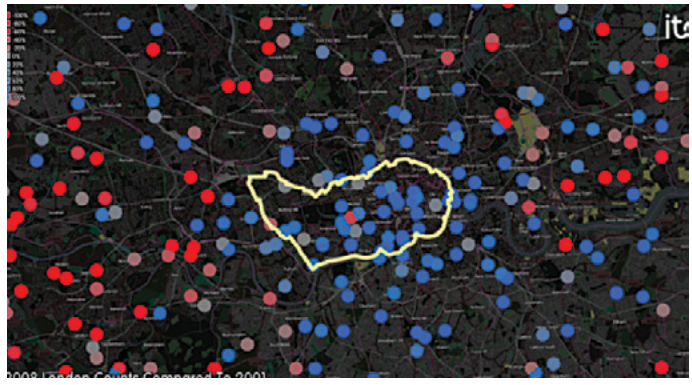
Enforcement and Penalty

- Enforcement is based on an Automatic Number Plate Recognition (ANPR) system that matches vehicles with the database of registrations to charge drivers who have not paid.
- CCTV cameras have been installed along the boundary and inside the zone to capture the number plates of vehicles within the zone.
- A penalty of £130 (increased from £80 in 2003) is levied for non-payment; it is reduced to £65 if paid within two weeks. Penalty will rise to £195 for non-payment in 28 days.

CHANGES IN THE COUNTS OF CARS AND TAXIS IN LONDON AT OCTOBER 2008 COMPARED TO OCTOBER 2001



CHANGES IN THE COUNTS OF BICYCLES AT OCTOBER 2008 COMPARED TO OCTOBER 2001



Red dots show reduction, Blue dots show increases

ing and implementing a sustainable mobility and redevelopment plan for the affected areas. Improving public transport systems and introducing alternate transportation strategies can be facilitated with the revenue thus raised. The future transport initiatives in Indian cities should include strategies and legislations for more efficient use of the existing transportation systems instead of increasing the supply by expanding the vehicle fleets and infrastructure.

SEOUL'S EXPERIENCE IN DEMOLISHING ROAD INFRASTRUCTURE AND IMPROVING PUBLIC TRANSPORT

Location	Cheonggyecheon stream, Seoul, Korea
Region	Asia
Year	2003-2005
Agency	Seoul Metropolitan Government
Award	Sustainable Transport Award 2006

Project Aim

To facilitate a drastic shift from car-oriented development to a human-centric development, which values quality of life of its residents by restoration of an expressway into a vibrant public space.

Context

Cheonggyecheon is a stream running from west to east in the heart of downtown Seoul. Having been long neglected, the stream was completely covered by concrete roads over a period of 20 years, starting in 1958. Later in 1967-76, a 5.84 km long and 16 m wide elevated highway was constructed over the covered stream, which became the symbol of Korean development era. More than 168,000 cars a day were running on the road and the elevated highway, and 62.5% of them were through-traffic. The heavy car movement on the highway brought along serious problems of *congestion, illegal on-street parking, and high pollution levels* in the downtown area around the stream. The area lacked pedestrian facilities, which limited the movement of the common citizens substantially. As a result, the population in the downtown area saw a decline of 66% over a period of 10 years and the business activities declined by 24.1%.

Project Description

The Seoul Metropolitan Government had two options: either to invest in road infrastructure and expand the supply or to manage the demand by investing in alternative transport. With the intent of improving the quality of life in downtown and improving connectivity between the north and south sides of the city, the city government decided to reclaim the road space occupied by the elevated highway by tearing it down and restoring the Cheonggyecheon River covered by it. The restoration, carried out between 2003 and 2005, created a 3.6 mile (5.84 km) continuous east-west green corridor for pedestrians and bicyclists. The corridor included a riverfront park, pedestrian walkways and public squares. As part of the system, 22 bridges - 12 pedestrian bridges and 10 for automobiles and pedestrians –have been built

MODAL SHIFT

Many cities across the world are in the process of recovering from a car-dominated development era by undertaking initiatives like removing motorways that sever communities, reclaiming road space from cars and re-allocating it to buses, bicycles and pedestrians, and improving public transport network extent, connectivity, and service quality. The movement toward 'car free cities' is strong, particularly in Europe and East Asia.

In North America as well, such initiatives are gaining momentum. One such example is that of New York City, which demonstrated sweeping urban transportation reforms. In 2008, the city implemented key parts of the long-term sustainability vision, PlaNYC 2030. The city changed 49 acres of road space, traffic lanes and parking spots into bike lanes, pedestrian areas and public plazas and advocated biking and walking as investment-worthy transportation alternatives. The laudable changes made throughout 2008 have reshaped the experience of walking on New York City streets.

Map showing the long park that runs on both sides of the stream

View of the park on both sides of the stream

Cheonggyecheon Stream at night

Walkway along the stream

Bridge crossingover the stream

to connect the two sides of the stream.

Connectivity and accessibility within the greater transportation network has been improved by adding connections with 5 nearby subway lines, and 18 bus lines serving the neighbourhood. The stream now can be accessed at 17 locations. To reduce traffic congestion, car use was discouraged in the city centre and rapid bus lines were added. The project has assisted in improving the non-motorized transport (NMT) infrastructure. Levelled terraces, vertical walls and sidewalks were built alongside to create interest as well as improve access and interaction of the citizens with water. On both sides of the stream, as much as 13.5 m of space has been left for one-way-two-lane roads, sidewalks and loading/unloading activities.

The neighbouring area near Cheonggyecheon is about 688.5 acres with 22 blocks. The project also led to the preparation of a downtown revitalisation plan, which aimed at developing this area into an eco-friendly urban environment enhancing cultural and commercial activities and tourism.

Key Results and Impacts

- The restoration has helped in discouraging car use, strengthening public transport use and promoting non-motorized transport (NMT) in the area.
- There has been a 2.3% reduction in vehicles entering downtown Seoul. The project has contributed to 15.1% increase in bus ridership and 3.3% in subway ridership in Seoul, other than providing a safe, green corridor for pedestrians and bicyclists.
- The removal of the paved expressway, increased vegetation, and the stream helped in reducing the urban heat island effect in the downtown area with temperatures reduced by approximately 2-5 degrees Celsius.
- The number of vehicles passing through downtown decreased 9% with the implementation of a BRT system and TDM measures undertaken as part of the project.

Lessons Learnt

- Cheonggyecheon project offers evidence that reductions in road capacity accompanied by a comprehensive strategy of TDM and transit expansion can mitigate negative impacts, even where the roadway is a key link in the regional network.
- Transport design solutions must consider the needs of all users from the initial planning and design phase. Cities need to be transformed to be people friendly and not car-centric.

Replicability

The restoration project has proved to be very successful in reviving the declining economy of Seoul and is now being studied by government officials across the world as a good example of urban renewal and a shift away from car-oriented planning. In Indian cities, the highway restoration project can be replicated to give back public space to the people with a focus on non-motorized mobility, to help reduce problems like high pollution levels, congestion, noise, etc. in the city centres. In the past two decades, cities in India have witnessed an increase in supply by boosting flyover building to address traffic congestion, instead of managing the travel demand. This has resulted in the marginalization of pedestrians and loss of public space in the cities. Seoul has demonstrated how roads can be demolished to reclaim public space for use by pedestrians and non-motorized vehicle users. When implemented, this can lead to a shift in choice mode of travel and an improvement in the environment.

THEME 4

ECOMOBILITY

EcoMobility can be defined as an integrated form of mobility, aimed at environmental sustainability, that combines the use of non-motorized means of transport with the use of public transport to allow people to move in their local environments without utilizing privately owned motor vehicles[10]. EcoMobility is travel through transport modes involving low to no emission, like walking and cycling, as compared to the emissions from privately owned vehicles. EcoMobility indicates an approach to mobility that highlights the importance of sustainable means of transport in a city enabled by policy changes, capacity building, data sharing, financing, and other resource allocation efforts. Incorporating EcoMobility into the development of traffic systems and policies benefits the local governments in attaining the overall goals of sustainable development.

Initiatives to expand or establish comprehensive and safe infrastructure services for pedestrians and cyclists in cities provides urban transport solutions with direct positive impacts on the urban environment and public health. Expanding designated non-motorized transportation infrastructure in cities increases the safety for non-motorized commuters and provides enhanced equitability as well as increased ranges of mobility for all income groups in the city. Walking and bicycling have the potential to link all other means of public transportation and provide last mile connectivity. Promoting at least 30% walking and cycling modal share in the city is considered as sustainable.

In this section, three cities that illustrate the applications of the concept of EcoMobility have been chosen as case studies and discussed. These include the implementation of the Green Plan in Mexico City, public bike share programme in Paris and pedestrian priority programme in Buenos Aires.

Mexico's Green Plan serves as an instrument to facilitate sustainable mobility. Various EcoMobility schemes and projects have been implemented in the city that are required to align with the framework laid down in the Green Plan. The public bike share programme in Paris is one of the many shared mobility initiatives being undertaken across the world with the aim of providing affordable and sustainable alternative for short distance travel within the city. The pedestrian priority programme in Buenos Aires is an example of a sustainable mobility initiative implemented with a view to providing safe commute for pedestrians on selected streets in the city. All the three cities have been awarded the Sustainable Transport Award in 2013, 2008 and 2014 respectively.

[10] As defined by the Global Alliance for EcoMobility, which was founded and launched by a group of global organizations on the occasion of the Climate Change Conference in Bali, in December 2007, accessed: www.ecomobility.org/home/about-ecomobility/

ECOMOBILITY IN MEXICO CITY'S GREEN PLAN

Location	Mexico City, Mexico
Region	Latin America
Year	2007
Agency	Government of Mexico City
Awards	Sustainable Transport Award 2013

INTEGRATED APPROACH TO ECOMOBILITY

Strategies and legislations can result in more sustainable use of existing transportation resources to reduce the dependence on private vehicles and therefore lead to reduction in transport-related emissions. Legislations can create incentives for mobility substitutes and regulations for efficient transport policy reforms to correct current distortions in transportation planning practices. Mobility management can provide increased efficiency, reliability and sustainability to the existing transport infrastructure through political or technological interventions, as well as enabling mobilization of resources to increases opportunities for more sustainable mobility patterns and higher levels of urban transport services.

Project Aim

To offer environmentally-friendly transportation options to citizens by means of a transportation and mobility strategy, as part of the city's Green Plan aimed at improving the city's public transportation system and promoting non-motorized transportation– essentially, EcoMobility.

Context

Mexico City is the largest metropolis as well as the financial, political and cultural capital of Mexico. Transportation plays an integral part in the city functions, while at the same time, it is a serious logistical issue. Before the implementation of the Green Plan, 4,500,000 cars, 23,000 minibuses, 5,000 buses and 130,000 taxis operated daily within the megacity, *generating road saturation, slow and uncomfortable transportation alternatives, and poor air quality*. Mexico City's car-centred culture hampered the safety of cyclists and pedestrians. Therefore, improving the city's public transportation system was a major priority since the transport sector contributes to roughly half the city's total emissions. The Green Plan (2007-2022) responds to these challenges with an integrated approach to improve transportation infrastructure.

Project Description

Mexico City developed the 'The Green Plan (Plan Verde)' having seven pillars: land conservation, public spaces, air pollution, waste management and recycling, water supply and sanitation, climate action program, transportation and mobility. The Plan is based on a multi-component strategy to reduce traffic congestion and reduce greenhouse gas (GHG) emissions. Facilitated largely through the assignment of multiannual budgets, the Green Plan and the Integrated Urban Transportation Program have succeeded in changing a decades old paradigm about the city's transportation problems and its possible solutions. The Mexico City government's sustainable mobility strategy focuses on the development of mass transit and non-motorized transport systems, involving inter-institutional partnerships with a medium term horizon.

Transportation in Mexico City's Green Plan

The transportation section of the Green Plan is structured as follows: "A 15-year mid-term plan which integrates EcoMobility principles, for example, enhancing infrastructure for cyclists, pedestrians and public transportation. The ambitious strategy has five sub-components or goals:

- Improve the quality and availability of public transportation
- Lower the number of private vehicles on the roads

MetroBus

Mexico City metro train

Ecobici bicycles at a bike station

Mueveteen Bici Sundays

- Promote non-motorized means of transportation
- Speed up mobility on the road
- Foster a road culture that respects cyclists and pedestrians"

Improvements to the city's **public transportation system** focus on two key areas: Subway expansion and bus route expansion. The plan proposes to add a 12th line to Mexico City's subway system which is already one of the biggest underground systems in the world. For buses, the Plan calls for three additional bus corridors to be added to two pre-existing transport channels. Mexico City's MetroBus system, launched in 2005, provides rapid service using bus-only road lanes. The Plan advises replacing the city's old, polluting microbuses, with large eco-friendly vehicles.

The Plan also asks for improvements to the city's *walking and cycling* conditions. The 'pedestrianisation' of the city's historical centres and some of its neighbourhoods began in 2010. Cycling-friendly infrastructure was introduced by increasing the length and number of bike lanes – an endeavour called *Programa de Corredores de Movilidad No Motorizada (Non-Motorized Lanes Program)* which also includes an educational program, *Mueveteen Bici* (Get on your Bike).

On certain Sundays, part of the Paseo de la Reforma, the biggest city centre street, is blocked to cars in order to provide space for recreational activities among pedestrians and cyclists. The Plan introduced a bicycle sharing system in 2010, *Ecobici,* located in strategic places downtown, which allows people to borrow bicycles for short periods at an affordable price. Bikes can be returned to one of 85 stations, which are usually situated close to public transportation stops in the city centre to allow functional interchange between different means of transportation.

Stakeholder Participation: Citizens are being educated about the role of sustainable mobility in fostering a healthier, more mobile, and safer city. The Green Plan emphasizes local action, in particular, through initiatives such as the *Hoy No Circula* (Today Don't Drive) and *Mueveteen Bici* (Get on your Bike) programs. The *Hoy No Circula* programme aims to relieve traffic congestion and improve air quality by prohibiting a segment of automobile traffic once in a week. The Plan also aims to improve existing road infrastructure, for example, with road adjustment in order to solve 350 conflict points in the city or the introduction of intelligent traffic lights along the main streets.

Key Results and Impacts

- ***Improvements in the public transportation:*** Mexico City has succeeded in increasing the coverage of the Metro rail and the MetroBus BRT system; in replacing 5,784 buses and 80,000 taxis with new, more energy-efficient vehicles. Subsequently, the city's emissions have decreased by 80,000 tons annually. The MetroBus currently shuttles about 473,000 passengers daily, 15% of whom previously commuted by car.
- ***Revitalization of the public spaces:*** The expansion of MetroBus, from the airport to the historic centre, has revitalized the downtown area and demonstrated that even old narrow streets can be converted into avenues for better transportation.
- ***Lowering the number of private vehicles in circulation:*** The Programa de Transporte Escolar, a rule that prohibited parents from bringing their children to school by car was launched in 2009. The daily average number (excluding Sundays) of cars on roads reduced by 342,000.
- ***Promoting non-motorized means of transportation:*** Mexico City's bicycle lanes have been extended by 31km and the Sunday Mueveteen Bici program has become popular among citizens. Ecobici registered an estimated 50,000 trips taken in the city using Ecobici bikes.
- ***Environmental Improvement:*** The Hoy No Circula Sabatino program cut roughly 960 tonnes of pollutants (mix of hydrocarbons, carbon monoxides, nitrogen oxides) each Saturday.
- ***Recognition:*** The MetroBus system won the 2009 Roy Family Award for Environmental Partnership from the Harvard Kennedy School of Government. The Mueveteen Bici program was honoured by the WHO in 'Active Cities, Healthy Cities 2008' contest.

Lessons Learnt

- The Green Plan allows for long-term strategizing with a holistic view to policy making and resource planning. It allows more precise goal-setting for environmental issues.
- An integrated approach to EcoMobility, including measures like introducing a MetroBus system, microbus replacements, and a subway expansion, contribute to GHG emissions.
- Planning and public participation are crucial aspects to the success of a city's eco-transportation plan. Careful consideration about available resources as well as context help to form realistic plans wherein challenging goals motivate stakeholders.

Replicability

There is an immense potential for the replication of the Green Plan in Indian cities aiming to achieve the goals of sustainability. Various cities in India, like Surat, Kolkata, Pune, among others, have prepared Comprehensive Mobility Plans to implement the urban mobility schemes and projects. The transport plans prepared by cities in the future should have a focused approach to environmental improvement and be called as 'Sustainable Mobility Plans' or 'EcoMobilityPlan'. The Plan needs to concentrate on infrastructure improvements for sustainable modes of transport that have low or no emissions. It should state long-term investment strategy and emission reduction targets for the city. Well defined sustainability goals incorporated into a broader policy frameworks ensure implementation and monitoring of the Plan. Promoting mass public transport for long distance travel and a comprehensive network of bicycle and pedestrian paths for short distance travel can serve as a sustainable and affordable transport solution for cities of all sizes.

PUBLIC BIKE SHARE PROGRAMME IN PARIS

Location	Paris, France
Region	Europe
Year	2007
Agency	Mairie de Paris (municipality); JCDecaux, a French advertising corporation
Awards	Sustainable Transport Award 2008

Project Aim

To provide affordable access to bicycles for short-distance trips in the urban area as an alternative to motorised private vehicles, thereby reducing traffic congestion, noise, and air pollution.

Context

Paris, the capital city of France, is one of the most densely populated cities in the world. The Paris transportation network is very diverse and exists over many levels. The city's buses, trams, Metro, and trains together all serve to maintain high levels of connectivity between different districts and beyond. Paris has steadily increased its network of bicycle paths since the late 1990s. Since then, cycling and walking have become the main forms of getting around in the city as a result of various initiatives. Velib was launched as part of Paris's Espaces Civilisés ('Civilized Space') project, the overall greening and liveability strategy introduced in 2001.

SHARED MOBILITY

Shared transport is defined as a demand-driven vehicle-sharing arrangement, in which travellers share a vehicle either simultaneously (e.g. ride-sharing) or over time (e.g. car sharing or bike sharing), and in the process share the cost of the journey, thereby creating a hybrid between private vehicle use and mass public transport[11]. Shared transport systems include carsharing, bicycle sharing, carpools, community buses and vans, para-transit, a range of taxi projects, etc.

A bike share scheme is a service in which a bicycle is made available for shared use to individuals on a very short term basis for an affordable price. As of 2013, there were around 535 bike-sharing programmes around the world, made of an estimated fleet of 517,000 bicycles. Adoption of the system rocketed between 2011 and 2013 in the world over. The Wuhan and Hangzhou Public Bicycle bike-share programmes in China are the largest in the world, with around 90,000 and 60,000 bicycles respectively[12]. Bike-sharing systems can be categorised into three phases or generations. The first generation, called white bikes (or free bikes), includes the earliest known programme started in 1965 in Amsterdam called the White Bicycle Plan. The second generation included coin-deposit systems; and the third generation includes information technology (IT) based systems. The third generation programmes solve the problem of bicycle theft and damage through membership and user fees, and automated, wireless technologies. Some of the successful programmes globally include ByCyklen (Copenhagen, 1995), Velib' (Paris, 2007), Bicing (Barcelona, 2007), SmartBike (Washington DC, 2008) and Bixi (Montreal, 2009), among other[13] .

[11] Accessed in September 2014: en.wikipedia.org/wiki/Shared_transport
[12] UN HABITAT, *Planning and design for sustainable urban mobility: Global report on human settlement 2013*, Routledge, New York, 2013, accessed: unhabitat.org/planning-and-design-for-sustainable-urban-mobility-global-report-on-human-settlements-2013/
[13] Ibid

Velib PBS Programme Implementation

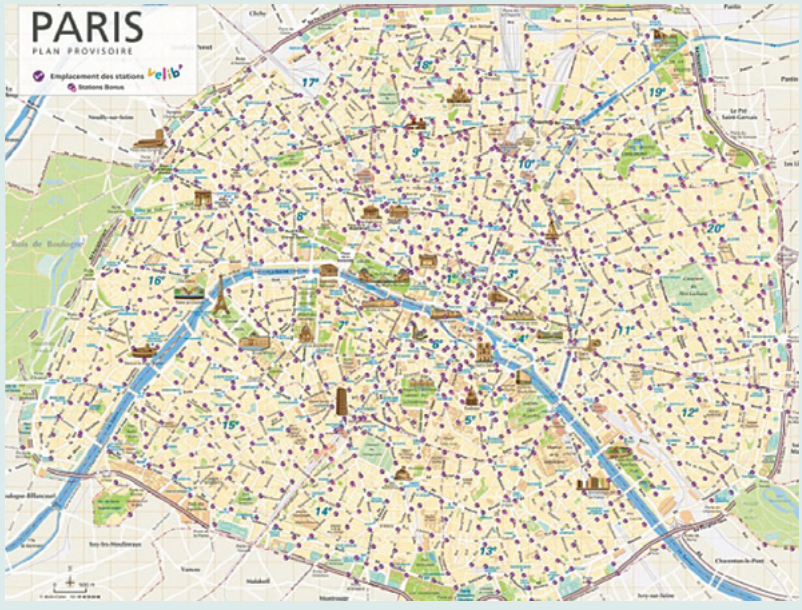
1. OPERATIONS AND FINANCING
The system is operated and maintained as a concession by the French advertising corporation JCDecaux under a public-private partnership (PPP). JCDecaux holds the billboard franchise contract, won over a competitive bid, with the municipality of Paris in exchange for rights to 1,628 advertising billboards and other street furniture.
The company incurred the full cost of the initial start-up capital ($142million), and employs around 285 people full-time to operate the system and repair the bikes on a ten-year contract. In return, JCDecaux receives exclusive control over 1,628 city-owned billboards. The company earns its returns annually from advertising revenues.

A grey colour Velib bicycle

2. VELIB BICYCLES
Velib bicycles are easily recognizable because of their grey colour and unique handlebars. They are three-speed bicycles, each weighing approximately 22.5 kilograms (50 pounds).
The bikes are equipped with a locking system, an adjustable cushioned seat, a mesh basket a front bicycle basket and LED lighting powered by a front-hub dynamo for safety.

3. VELIB COVERAGE
Velib docking stations can be found every few blocks throughout the city (average density is 28 bikestation/square miles) and are placed on the sidewalk, in the place of car parking spots, along the edges of public parks and under elevated train tracks. Bikestations range in size from around 12 docks/station in less highly trafficked areas to up to 70 docks/station around major tourist attractions. Bikestation density typically increases around commercial and transit hubs.

Approximately 1 square mile of central Paris. Each purple dot is a bike-station



Bike stations cover the entire city. Each dot is a bike station

4. INFRASTRUCURE FOR VELIB

Bicycle Path Network in Paris

Bandecyclable

Pistecyclable

BICYCLE PATH NETWORK

Paris invested €24 million to enhance the streetscape by widening sidewalks, planning trees and improving the bicycle network. As of 2010, there were 440 km of cycling routes in Paris. Lane quality ranges from on street marked bike lanes to shared bus-bike lanes to fully separated bike lanes.These include pistecyclable (bike lanes separated from other traffic by physical barriers such as a kerb) and bandecyclable (a bicycle lane denoted by a painted path on the road). Paris has also experimented with contraflow facilities which are physically separated bike lanes with bicycle traffic that travels in the opposite direction of vehicular traffic. In all, bike lanes exist on about 17% of Paris' roads.

Cyclists at Velib PBS station

Velib bike stations along the street

An automated Vélib' pay station

BIKE STATIONS

Velib's bike stations are designed to blend into the surrounding streetscape. They are free-standing and look like small bollards. Each Velib station is equipped with an automatic rental terminal, a map of other nearby stations and stands for dozens of bicycles. The rental terminals also display information about neighbouring Velib stations, including location, number of available bicycles and open stands.

Users using ..... the card at a bike station

5. RATES

A credit card or debit card with a PIN is required to sign up for the program and to rent the bikes. The card is charged a €150 deposit, to protect against bikes not being returned. In order to use the system, users need to take out a subscription, which allows the subscriber an unlimited number of rentals. Subscriptions can be purchased at €1.70 per day, €8/week, €29/year, or €39/year.

With a subscription, the first 30 minutes of use is free. The Velib fee structure incentivizes many short trips instead of a few long trips. After the first half an hour of usage, which is free, a user pays €1 for the second 1/2 hour, €2 for the third 1/2 hour and as of the third 1/2 hour,€4per additional 1/2 hour.

VELIB – STATISTICS

Owner	Mairie de Paris (municipality)
No. of Stations	Over 1,400
Operator	JCDecaux
No. of Bicycles	20,600, largest outside of China and third largest in the world
Daily Ridership	224,000 annual subscribers (2012)
Average Ridership	85,811 (2011) daily
Bike availability	1 bike per 97 inhabitants

Cyclists riding Velib Bicycles

Project Description

The Velib initiative was launched as a large-scale public bicycle sharing (PBS) system in July 2007 by the then Paris mayor, following the success of Lyon's Velo'v and the 1974 free bike-sharing programme of the French city of La Rochelle. Initially under Velib, 7,000 bicycles were introduced to the city, distributed among 750 automated rental stations, with fifteen or more bicycle parking slots each. The following year, the initiative was enlarged to some 16,000 bicycles and 1,200 rental stations; with roughly one station every 300 metres (980 ft.) throughout the city centre. Velib is presently the second-most-extensive system of its kind in the world. Since December 2011, Velib has been complemented by Autolib, an electric car sharing operating on similar principles.

Key Results and Impacts

- During its first year in operation, Velib reported 20 million trips made, and at its sixth anniversary, a total of 173 million journeys were reported.
- Current data from Paris shows that the city has seen a 70% increase in bicycle use and a 5% reduction in car use and congestion since the Velib scheme was introduced.

Lessons Learnt

- Bicycle sharing systems are an effective way to solve the 'last mile' problem and connect users to public transit networks.
- High population density, a dense urban environment and the existence of cycling infrastructure such as bike lanes are some of the vital prerequisites for a successful bike share program.

Replicability

Introducing a bike share program in Indian cities is in sync with the National Urban Transport Policy (NUTP), which promotes the building of people centric urban transport solutions instead of focusing on private motor vehicles. Proposals for an Indian bikeshare program should first consider what benefits the city hopes to realize. Small programs and pilots can create awareness and can produce increases in bicycling or any associated multi-modal transportation gains. The success of a pilot can be followed by larger programs, which although are initially capital intensive, eventually create substantial shifts in mode-split and may reduce congestion, as demonstrated in Paris. Neighbourhoods with high residential and worker population density are strong candidates for a bikeshare program. Areas around transit hubs should also be considered. The bike share program can also be integrated into the city's tourism plan with the development of green heritage corridors and bicycle path networks.

PEDESTRIAN PRIORITY PROGRAM IN BUENOS AIRES

Location	Buenos Aires, Argentina
Region	Latin America
Year	2008
Agency	Ministry of Urban Development of the Buenos Aires Government
Awards	Sustainable Transport Award 2014; Citizen's Choice Award 2013

Project Aim

To increase pedestrian movement, discourage car use, and reclaim public spaces for pedestrians, with the intention of encouraging an active lifestyle and improving environmental conditions.

Context

Buenos Aires is the capital and the largest city of Argentina, and the second-largest metropolitan area in South America, after Greater Sao Paulo. Before the Pedestrian Priority Program (PPP) being introduced in the city, there were several signs of deterioration in the transport system existing in the city centre including: increased traffic congestion caused by all types of transportation – private vehicles, taxis, public transport, and commercial vehicles; absence of traffic controls, including a lack of marked parking promoting the misuse of public space as an area to park vehicles; air and noise pollution, risk to pedestrians as many vehicles drove on sidewalks and spaces intended for pedestrians; and corrosion and congestion of sidewalks.

Project Description

The Pedestrian Priority Program (PPP) emerged as part of the Healthy Mobility initiative sponsored by the City of Buenos Aires Ministry of Urban Development. It is designed to *"put pedestrians first, focusing heavily on generating bold changes to public spaces to strengthen the diversity of activities, and promote social and functional recovery"*. The three primary objectives of the PPP are to promote pedestrian traffic, encourage more active lifestyles and improve environmental conditions of the city, home to over 13 million people.

Project Implementation

Under the PPP, the pedestrians were designated as preferential users, with narrow streets and public spaces redesigned to better meet their needs. Car traffic flow was restricted to the minimum necessary. Carabelas, Reconquista and Suipacha streets were the first Pedestrian Priority Streets where the most significant interventions were carried out. These streets were selected for the program after an analysis of the degree of compactness in the central city neighbourhoods in Buenos Aires. The streets selected are abutting the neighbourhoods with high residential densities.

There are several components involved in the development and implementation of the program:

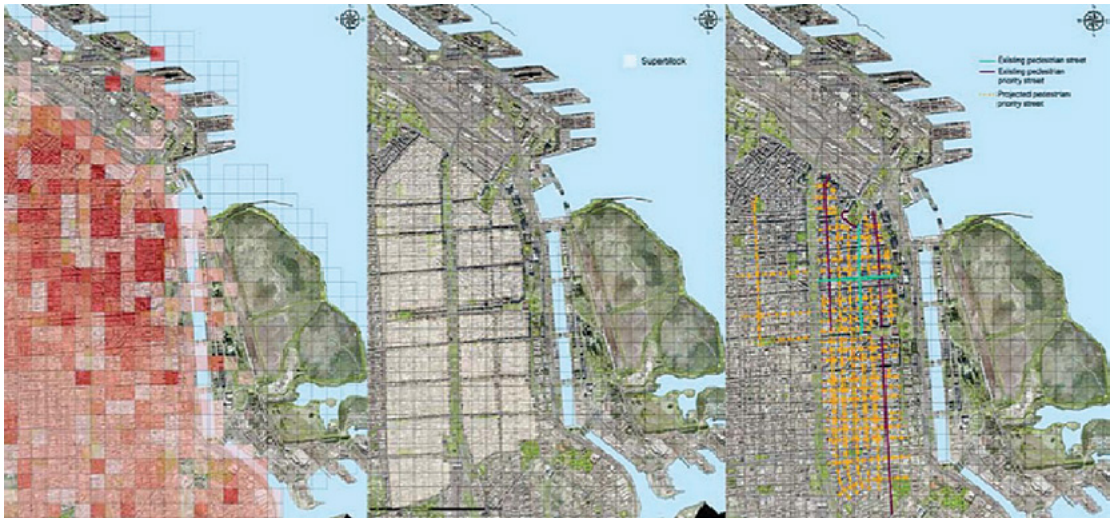
- ***Street renewal:*** The city converted dozens of blocks in the city centre into a pedestrian-friendly environment with pedestrian walkways, widened and levelled sidewalks, and new protected cycle lanes.
- ***Waste:*** The existing waste collection system was replaced with centralized waste receptacles on street corners to facilitate the movement of garbage collection vehicles. This helped in creating a clean and hygienic environment for pedestrians.
- ***Trees:*** More trees were planted to create a public promenade character.
- ***Crosswalks:*** Pedestrians were given priority at specific crosswalks with the help of signage and traffic signals.
- ***Equipment:*** Street furniture, improved lighting and pedestrian street signs were installed to facilitate smooth pedestrian circulation.

PEDESTRIANISATION

Since the advent of the automobile, the needs of pedestrians in the city have been neglected. However, the current focus on addressing climate change through sustainable mobility has created an increased interest in *pedestrianisation*, which is the transformation of the car-dominated city centres into lively street systems for pedestrians, building walkways, converting a street or an area to pedestrian-only use.

Good pedestrian networks are said to comprise of the following 5Cs: connected (to each other, public transport, schools, work, leisure destinations), convivial (pleasant, social, safe and inviting to use), conspicuous (clear and legible signage/routes), comfortable (high quality pavement surfaces, away from traffic, opportunities for rest and shelter) and convenient (direct, convenience, pedestrian prioritised over car)[14]. In addition, in the subtropical context, it is critical that pedestrian journeys and routes are adequately shaded, from both the sun and rain. European cities like Copenhagen, Rotterdam, Mdina (in Malta) have been known for their initiatives like creation of Pedestrian zones (also known as car-free zones), which are areas of a city reserved for pedestrian-only use and in which some or all automobile traffic may be prohibited. The idea is fast spreading to other parts of the world as well.

[14] Evonne Miller and Rosemary Kennedy, Public Realm and Transport,Centre for Subtropical Design, Queensland University of Technology , 2012



Left: High compactness in the Central Area of Buenos Aires. Middle: Projected superblocks. Right: Pedestrian Priority Street according to the compactness

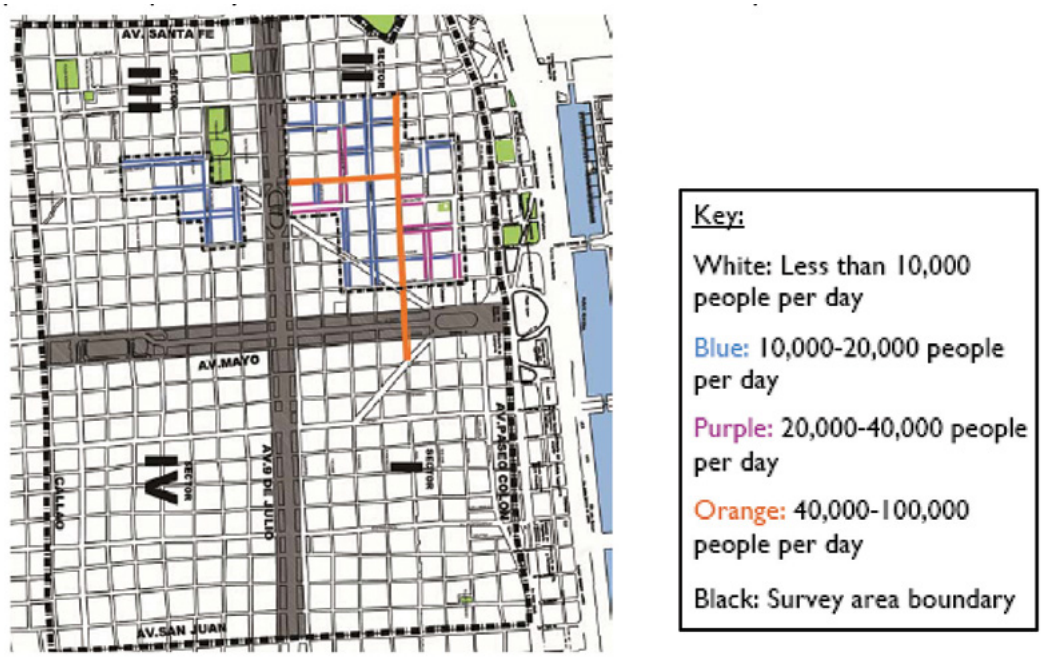
Left: Carabelas street before the intervention. Right: Carabelas street after the intervention

Reconquista Street before the Pedestrian Priority Program

Reconquista Street before the Pedestrian Priority Program

ENVIRONMENTAL AND ECONOMIC IMPROVEMENTS IDENTIFIED IN RECONQUISTA STREET BEFORE (R0) AND AFTER (R1) THE INTERVENTION

	Origin of the impact	Impacted factor	Impact	Results			
				Units	Before (RO)	After (RS1)	% Improvement
Urban Public transport	**Emission and rediant temperature**	Air quality	CO_2 Emissions	(Ton./year)	211,68	6,16	~97%
			Reduction of the Average temperature of the air % (change of materiality)	T °C Average %	39,6°C	30.74	-22%
	Noises	Acoustic quality	Noise leavels	Decibel	60 a 120	Until 60	~50%
	Vibrations	Buildings	Useful life and pathologies	%	Without fact	void	100%
Car Load/ Unload	**Moterized street**	Percentage pedestrian surface		%	7.78%	9.80%	+34%
		Transport circulation		%	92.22%	90.2%	-3%



The pedestrian priority streets saw a considerable increase in pedestrian movement

Key Results and Lessons Learnt

Environmental sustainability: A big reduction of the noise and air pollution was observed because of the restriction in the vehicular traffic to a minimal access. The parking in the street was removed; therefore noise, emission, and vibrations have been reduced.The restriction of vehicles in the Pedestrian Priority Streets led to 97% reduction in the levels of the pollutants produced, which improved the air quality. The reduction of noise impact is considered to be about 50%, reaching values inside the levels of acoustic comfort.

Social Sustainability: Each Pedestrian Priority Street is constituted like a meeting place, generating points of social activity and promoting the diversity in the function of the area: offices, shops, bars and restaurants. The area is activated by the presence of the pedestrians during the day and in the night.

Economic Sustainability: The interventions in Carbelas, Suipacha and Carabelas streets have allowed the development of economic activities, and the improvement of land value and rents. The renovation of the public space like a meeting place creates new opportunities of investments and contributes to attracting businesses in the area.

The impacts observed on the Reconquista, Suipacha and Carabelas streets allow for appreciating the benefits of the Pedestrian Priority Program, which provides the basis for the success of future projects with similar characteristics. The new complete streets are more comfortable for walking and less determined by the presence of cars.

THEME 5

PRO-POOR MOBILITY

Enhancing mobility options for the urban poor is of prime importance to the cities as mobility is a critical step towards improving their socio-economic conditions; higher mobility choices imply higher access to socio-economic opportunities. Provision of adequate and quality mobility choices for all sections of the society is being widely recognized as a mainstream challenge for the cities in the developing countries, driven mainly by the demand-supply mismatch. The low income population is the most affected because of the inadequacy in mobility options in the cities and are also the most vulnerable to the negative externalities such as, high levels of emissions, traffic congestion, unsafe pedestrian and cyclist environment, poor road safety, etc. Therefore, a pro-poor mobility approach while planning for transportation is important as it is this section of the society, which faces severe mode-choice constraints, due to the inability to own personal modes, low levels of affordability for public transport services, locational disadvantage and unusual demand character (for example, long-distance travel in odd hours – early mornings and late evenings).

The non-motorized transport (NMT) modes, like walking and cycling are the primary modal choice for the poor. For distances which cannot be traversed by either pedalling or walking, the poor depend on the cheapest available mass motorized options, like public buses. If public transportation is unaffordable or inaccessible, then they depend on informal transport modes to meet their mobility needs. The initiatives being undertaken worldwide to improve the transportation systems, with special consideration to the needs of the urban poor, can broadly be categorized as:

- Pro-poor mobility policies and planning
- Providing public transit connectivity to the neighbourhoods of the urban poor
- Organizing the informal transport sector
- Reducing the environmental impacts of the informal transportsector
- Pro-poor transport infrastructure planning and development
- Promoting non-motorized transport (NMT) modes

In this section, two case studies have been discussed, namely the BRT-Lite system in Lagos and the *Pankalangs* in Indonesian cities. The former was introduced in Lagos in 2008 as an affordable bus-based public transit system suitable designed for the poor. *Pankalangs* are an example of cooperative organizations of informal transport drivers, which regulate the operations of informal modes of transport in Indonesian cities.

BRT-LITE SYSTEM IN LAGOS, NIGERIA

Location	Lagos, Nigeria
Region	Africa
Year	2008
Agency	Lagos Metropolitan Area Transport Authority (LAMATA); National Union of Road Transport Workers (NURTW); LAGBUS

Project Aim

To provide local users with a cheap mobility option and to improve quality of life, economic efficiency and passenger safety.

Context

Lagos, the capital city of Nigeria, is one of the largest cities in Africa. Prior to the introduction of the BRT-Lite system, the city did not have any formal public transport system. The public transport was dominated by largely unregulated private operators who offered unreliable and uncomfortable service, often with changeable fares and aggressive touts. The city inhabitants who did not have access to private vehicles were solely dependent on the informal transport such as mini buses *(danfo)*, midi buses *(molues)*, shared taxis *(Kabu-kabu)* and motor cycle taxis *(okadas)*. The routes served by these modes were short, the journey was slow and of low quality. The commuters were vulnerable to crime, both during the journey and during the waiting time.

Project Description

In 2008, Lagos launched a BRT 'lite' corridor, a high-quality system that is affordable in the local context, while retaining as many of the desirable BRT characteristics as possible. This marked the first substantial investment in public transport for the city and the first BRT system to be implemented in Africa. The unique characteristic of this project is that it is a BRT system but without the high-level specifications, and the technical and infrastructure requirements of a conventional BRT system. It is therefore suitable to provide for the needs of a city that has low capital investment for public transport. The project was completed within a time period of 15 months with a limited budget. The cost of completion of the project was USD 1.7 million per km compared to the project cost of 6 million per km of TransMilenio, Bogota and the Brisbane South east Busway, thus, giving rise to a new low cost BRT system.

In order to address the transport issues in the city, an authority Lagos Metropolitan Area Transport Authority (LAMATA) was formed in 2002, which consolidated various government

PROVIDING PUBLIC TRANSIT CONNECTIVITY TO URBAN POOR

The low income population is largely dependent on public transportation for travelling distances which are beyond the pedalling and walking ability. Therefore, it is essential to plan and develop public transport systems judiciously so as to ensure connectivity to the neighbourhoods with concentration of the urban poor population. Focused efforts are been undertaken worldwide by various cities to promote pro-poor public transport systems. African cities, especially, have made remarkable strides in developing such systems. The efforts in these cities include providing physical connectivity to poor neighbourhoods, context-specific design solutions, planning affordable housing along the bus rapid transit system corridors, among others.

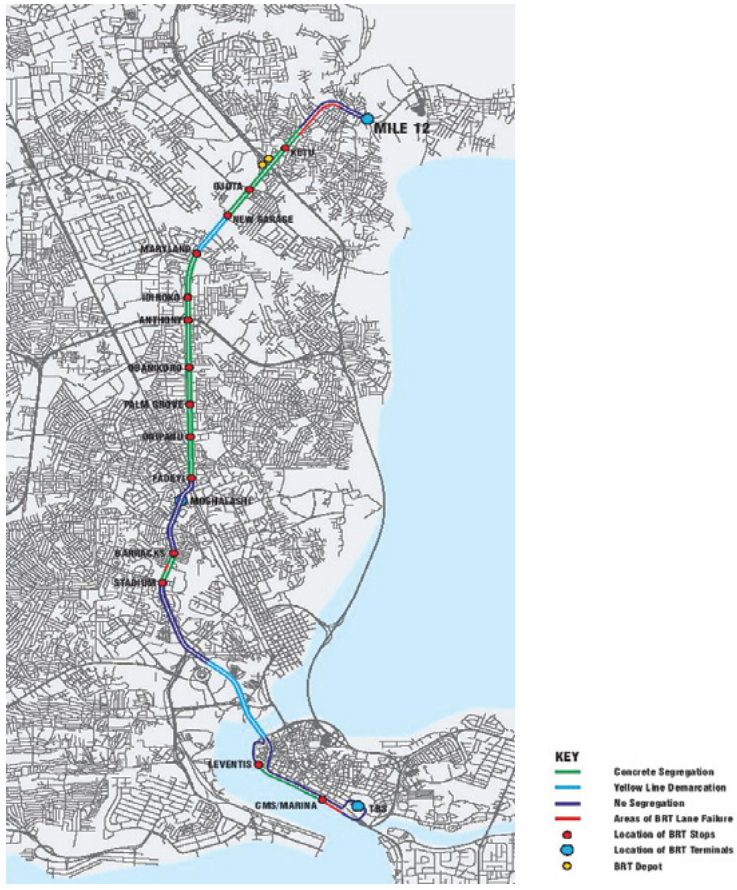
LAGOS BRT LITE – STATISTICS

Owner	Lagos Metropolitan Area Transport Authority (LAMATA)
No. of Bus Shelters	26
Operator	NURTW Cooperative and LAGBUS
Corridor Length	22 km
Designed Capacity	60,000 passengers
Daily Ridership	220,000 passengers(2010)
Peak Hour Ridership	10,000 passengers per direction
No. of buses	220 high capacity buses

BRT-Lite bus in the dedicated lane

Segregated bus lane in the carriageway

A bus waiting at the bus shelter



22-km BRT-Lite route from Mile 12 to Lagos Island

functions and had considerable powers to undertake transport planning and implementation. The development of a Bus Rapid Transit corridor has been a hallmark project of LAMATA, which adapted the high-performance BRT models seen in cities such as Bogota to yield a simplified, low cost BRT system. The planning for the BRT-Lite was started in 2006 and it emphasized efficient levels of service, adequate institutional framework and regulation, high socio-economic benefits especially for the poor, minimum public expenditures, and adequate mitigation of environmental impacts.

Project Implementation

LAMATA developed the system in close cooperation with the National Union of Road Transport Workers (NURTW), the legally recognized and dominant representative of the bus sector in urban transport. LAMATA provided the traffic management systems in the corridor, developed the stops-and stations, and provided bus depot and workshop facilities. In return, the private operators, represented through NURTW structures, agreed to accept regulation and enforcement over their operations and make their own purchases of vehicles to operate on the corridor. In practice, 100 buses were purchased by NURTW operators, 40 buses were operated by a state-owned company, LAGBUS and 120 buses were bought by LAGBUS and leased to private-sector operators.

The BRT infrastructure consists of physically segregated lanes along 65% of the corridor length, exclusive BRT lanes marked by paint along a further 20%, and buses travelling with the mixed traffic for 15% of the route. It was constructed in the main roadway area with the parallel service lanes remaining intact. Unlike the conventional BRT design, the bus lanes run along the outer lanes of the main roadway instead of being constructed along the median. The system uses kerb-aligned busways and not median-aligned busways.

The BRT routes connect the extended suburbs and satellite centres to the main city of Lagos and run seven days a week between 6 am and 11 pm. The operational hours are reduced during the weekends. Only vehicles of the BRT-Lite system are permitted to operate in the BRT lane. The other commercial bus services, *molues* and *danfos,* are restricted from operating in the BRT lanes or the main mixed traffic roadway, and are restricted to operating in the service lanes. The passengers usually use them for shorter distances and as feeder services to BRT-Lite.

Bus shelters: The BRT-Lite system includes simple, partly-sheltered stops between the service road and the BRT lane. Tickets are purchased at the stops before boarding. In common with other BRT systems, the stations and vehicles are branded

and clearly identifiable. Operating headways (the time gap between buses) on the system range from 30 seconds in peak hours to 45 seconds in off-peak, with express buses which service only selected stops. Queues are sometimes encountered, with median queuing time during peak hours of 15 minutes.

Public Participation: The needs of different users were considered during the design of the system; the major concerns being safety, affordability, and reliability. The catchment area population (about 6 million) of the BRT-Lite system, which included 65% of the captive public transport users and 25% reluctant users and the wealthy, were engaged to promote BRT system as means to solve their own problems. This helped in achieving public support for the project and in educating and creating public awareness about the BRT-Lite system.

Key Results and Impacts

- The BRT-Lite in Lagos serves the inhabitants of the city with premium services at fares that are lower and preferential over other alternatives.
- The BRT-Lite reduces the need to interchange, saving time, money and effort, since they run for longer distances compared to the informal modes. Passengers enjoy a 30% decrease in average fares and their travel time reduced by 40% and waiting time at stations reduced by 35% (from 45 to 10 minutes).
- LAMATA has claimed that the BRT-Lite system has resulted in a 13% reduction in CO2 emissions along the operating corridor and proved to be a safe, clean and reliable transport.
- Other significant socioeconomic benefits include the creation of direct employment for 1,000 people and indirect employment for over 500,000 people.

Lessons Learnt

- The success of the Lagos BRT can be attributed to the leadership and political commitment at all levels of government; and a capable, strategic public transport authority (LAMATA), a focus on user needs and deliverability within a budget and programme.
- Also core to the Lagos BRT success was a community engagement programme, which assured citizens that the BRT 'lite' system is a project created, owned and used by them.
- The Lagos experience has shown that an effective, high-capacity BRT system can be achieved using relatively low-tech and cost-effective means.
- A BRT-Lite system can succeed without operating subsidies from public funds, through the combined effects of infrastructural and institutional system design.

Replicability

A BRT-Lite system similar to the one designed in Lagos can be implemented in Indian cities where the governments have insufficient financial resources to build a capital intensive BRT system. This system is an ideal public transit system for smaller cities and towns. A low-cost, pro-poor transport system can serve the large proportion of urban poor population in India that remains without access to efficient and safe mobility options. A public transport authority having the appropriate expertise and capacity to plan, regulate, and form relationships should be the regulator during the project implementation. Stakeholder engagement program involving supportive transport organizations, private sector, NGOs and community groups should be initiated in order to educate, spread awareness, define roles and demonstrate the benefits of the program.

Bus shelter

Lagosians queuing to board a bus

PANGKALANGS FOR INFORMAL TRANSPORT SYSTEM IN INDONESIAN CITIES

Location	Indonesia
Region	South East Asia

Project Aim

To regulate the operations of informal transport modes and have their influence in city level planning by means of a cooperative organization of informal transport drivers called *'Pankalang'*.

Context

A variety of informal modes operate in the Indonesian cities: *Angkot, Ojek, Bajaj,* and *Becak* are examples of common informal modes. Angkot is a 10–12 seat minivan, Ojek is a motor cycle taxi to ferry a single passenger, *Bajaj* is a motorized three-wheeled taxi service, and Becak is a non-motorized three-wheeled vehicle used as taxi service. The informal systems in Indonesian cities not only complement the formal public transport systems, but also meet the needs of specialized traveller groups. The flexible services provided by these modes accommodate a variety of demand and uses. The informal transport modes are also a cheap mobility option, thus meeting the needs of the low-income and urban-poor population in Indonesian cities.

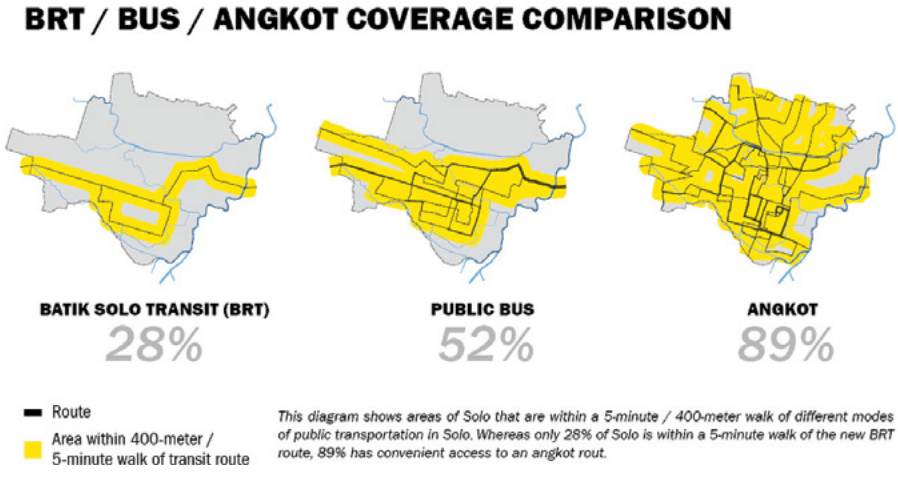
The figure shows coverage of the formal public transportation system as well as the informal systems in the city of Solo, a medium-sized city located in central Java. Comparison of both the networks clearly shows the extensive coverage of the informal system. The informal transport network does not overlap with the formal transport network. Informal systems provide a wider coverage in the city along with providing last mile connectivity to the passengers, which the formal public transportation system is unable to provide.

ORGANIZING THE INFORMAL TRANSPORT SECTOR

Worldwide, the informal transport sector provides much-needed (and much-valued) urban mobility needs, particularly for the poor. The lack of affordable and accessible public transport systems in the developing countries has led to the proliferation of informal operators, such as private microbus, shared taxis, rickshaws and mini bus services. This is especially true in the case of small and medium-sized cities in Asia, Africa and Latin America. Despite catering to large amounts of urban travel, the role of the informal sector in providing pro-poor mobility remains largely unacknowledged. Poor organization of informal transport sector is one of the major challenges, which leads to operational inefficiencies, low earnings, lack of road safety, high cost due to lack of resource sharing, etc.

Various innovative approaches have been adopted in different parts of the developing world to organise informal transport systems. Some developing countries attempt to regulate market entry, vehicle and driver fitness, and service practices with respect to informal transport. For example, in Nairobi, Kenya, the Ministry of Transport enforced that all seats be fitted with seatbelts in mini buses, while standing is no longer permitted on larger buses. Red plates distinguish the 55,000 legitimate shared-ride taxis of Beirut, Lebanon[15].

[15] UN HABITAT, Planning and design for sustainable urban mobility: Global report on human settlement 2013, Routledge, New York, 2013, accessed: unhabitat.org/planning-and-design-for-sustainable-urban-mobility-global-report-on-human-settlements-2013/



Angkot in Indonesia

An Ojek stand


Pangkalang of Becak drivers


Bajaj in Indonesia

Project Description

Pangkalang, or rank, is a cooperative organization of informal-transport drivers in Indonesian cities. Ranks can be formed through a variety of means, ranging from government recognition to sharing of uniforms among the rank members. The membership in a rank permits a driver to operate in a particular territory like near a market or in a neighbourhood or to serve a station or a specific customer group. Rank members have access to uniforms, parking attendants, shared repair equipment and sometimes even an emergency fund. Each rank could be identified through its distinct uniforms, design of vehicles, sign boards, etc. This makes the informal transport stands easy to locate.

In Pangkalangs, members are accountable to the group; the drivers tend to follow safety guidelines like providing passengers with helmets. Sometimes, these organizations are also supported by public and private actors like police, hotels, or other businesses. Such associations not only enhance the mobility options for the residents but also benefit the informal transport drivers by ensuring they have a regular income. Formation of *Pangkalang* helps the member drivers gain political leverage. This helps them to negotiate with the police or the local government. Thus in this way, if powerful enough, the *Pangkalang* can also influence policies. This was demonstrated in the case of Solo where a rank – PPBS consisting of 400 members influenced the annual participatory budgeting process in 2008-09. Through this process, the residents can direct government investment into their neighbourhoods. The PPBS in 2008–09 participated in this public planning forum and received a grant of USD 36,600 for the purchase of *becaks*.

Key Results and Lessons Learnt

- This small innovation in the form of *'Pangkalang'* on the part of informal transport drivers is not just ensuring resource sharing, political influence, and more importantly a stable income, but steps like an emergency fund are providing some form of insurance in this sector.
- Such organizations are proving their worth for the society at large through incorporating better safety conditions.
- Although this is a step towards better urban mobility, more needs to be done to organise the sector and gain from its 'unique' operational characteristics. The government should participate proactively in providing integration between the formal and the informal public transport systems.

Replicability

In the context of Indian cities where the formal and informal transport systems coexist, it is important that both systems complement each other. But, if instead of working as complementary transport modes, they act as competing modes, problems like oversupply on certain routes and under supply on others start occurring. Such a situation causes problems like reduced revenue for both modes, poor safety conditions due to competition, reduced last mile connectivity, etc. To enhance urban mobility, a proper support mechanism should be evolved for the operators of informal transport. The government can provide support to informal public transportation (IPT) providers through provision of infrastructure, like parking space, designated stands/stops, etc. Small investments towards integration of formal and informal public transport systems can go a long way in enhancing the quality of public transportation in Indian cities, like in the case of Indonesian cities.

ANNEXURE

CONTACT DETAILS OF IMPLEMENTING AGENCIES FOR THE CASE STUDIES

Location	Source of Information	Agency's Contact
Theme 1: POLICY AND INSTITUTIONAL FRAMEWORK		
Singapore	www.lta.gov.sg/content/ltaweb/en/about-lta.html (accessed in July 2014)	Singapore Land Transport Authority 1 Hampshire Road, Singapore 219428 Tel: (65) 62255 582 Email: feedback@lta.gov.sg
Theme 2: MASS TRANSIT		
China	en.wikipedia.org/wiki/High-speed_rail_in_China (visited July 2014)	China Railway Corporation, Ministry of Railways No. 10, Fuxing Road, Haidian District, Beijing, China Website: http://www.china-railway.com.cn/index1.html
Bogota, Colombia	• www.transmilenio.gov.co/en • "Social, environmental and economic impacts of BRT systems" by EMBARQ, accessed in July 2014: www.embarq.org/research/publication/social-environmental-and-economic-impacts-bus-rapid-transit	TransMilenio S.A Av. Dorado No. 66-63 Bogotá, Distrito Capital , Cundinamarca Tel:(057) (1) 220 3000 ext 2500
Theme 3: TRAVEL DEMAND MANAGEMENT		
London, UK	www.tfl.gov.uk/modes/driving/congestion-charge, accessed in July 2014	Transport for London Congestion Charge PO Box 4782 Worthing BN11 9PS London Tel: +44 20 7649 9122
Seoul, Korea	• www.sisul.or.kr/grobal/cheonggye/eng/WebContent/index.html " Cheonggyecheon Restoration And Downtown Revitalization" by Prof. Kee-Yeon Hwang, Department of Urban Planning & Design, Hongik University, Seoul, Korea	Seoul Metropolitan Government Deoksung-gil 15, Jung-gu, Seoul 100-739, Republic of Korea Tel: +82-2-2290-7111 Fax: +82-(0)2-2133-1070 Email: policyshare@seoul.go.kr
Theme 4: ECOMOBILITY		
Mexico City, Mexico	"Mexico City's Green Plan: EcoMobility in motion" by ICLEI, accessed in July 2014: www.ecomobility.org/fileadmin/template/project_templates/ecomobility/files/Publications/CS_Mexico_city.pdf	Ministry of Environment Government of Mexico City Constitution Square No. 1, 3rd Floor, Col. Centro, Del. Cuauhtémoc, CP 06068 Mexico City, Mexico Tel.: 5345 8187/ 5345 8188 Email: atencionciudadana@sma.df.gob.mx www.sedema.df.gob.mx/sedema/
Paris	• en.velib.paris.fr	Mairie de Paris (Municipality)

Location	Source of Information	Agency's Contact
France	• www.velib.paris.fr/content/download/6450/63793/version/1/file/DP-5ansVelib.pdf • "World Cities Best Practices: Innovations in Transport" by NYC Department of City Planning, October 2008	5 rue de Lobeau, 75004 Paris, France Tel: 33 1 42 76 40 40
Buenos Aires, Argentina	"To put pedestrian first in the heart of Buenos Aires. Pedestrian Priority in the Central Area" by HéctorLostri, Undersecretary of Urban Planning; Fernando Alvarez de Celis, General Director ofUrban planning; Susana Eguía, Consultant architect; María EmiliaPersico, Consultant architect, accessed July 2014	Ministry of Urban Development, BuenosAires Government 291 Carlos Pellegrini Street-Buenos Aires CityArgentinaC1009ABE Tel: 541143238168 Email:ssplaneamiento@buenosaires.gob.ar
Theme 5: PRO-POOR MOBILITY		
Lagos, Nigeria	• "Lagos BRT-Lite: Africa's first bus Rapid Transit" by DayoMobereola, accessed in July 2014: siteresources.worldbank.org/EXTAFRSUBSAHTRA/Resources/DP09-Lagos-BRT.pdf • "Lagos BRT-Lite" by Kyle Mason-Jones andBrett Cohen, accessed in July 2014: awsassets.wwf.org.za/downloads/lcf_lagos_brt_2012.pdf	Lagos Metropolitan Area Transport Authority (LAMATA) Block C 2nd Floor Motorways Centre, Motorways Avenue, Alausa, Ikeja, Lagos, Nigeria Tel: 01- 2702778-82 Fax: 01- 2702783 BBM: 2ABD7F61 Email: info@lamata-ng.com, enquires@lamata-ng.com Website: www.lamata-ng.com
Indonesia	"Improving InformalTransport: Case studies from Asia, Africa and Latin America" by TERI, accessed in July 2014: mirror.unhabitat.org/downloads/docs/11804_1_594697.pdf	Ministry of Transportation Jl. Merdeka Barat No. 8 Jakarta 10110, Indonesia Tel: 021-381 1308 Fax: 021-345 1657 Website:www.dephub.go.id

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Cities Without Slums

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