

CHAPTER 4 - SUSTAINABLE URBAN TRANSPORT

Cities should respect nature, consider the urban ecological environment as an asset, integrate environmental issues into urban planning and administration, and accelerate the transition to sustainable development. They should promote the use of renewable energy sources and build low-carbon eco-cities. They should strongly advocate for conservation of resources and promote environment-friendly manufacturing. Cities and their citizens should join together to create sustainable lifestyles and an ecological civilization in which people and environment co-exist in harmony.

Shanghai Declaration on Better Cities, Better Life

INTRODUCTION¹

As a Mayor, one of your greatest challenges is to plan and invest wisely in infrastructure for sustainable urban transport. Transport plays a crucial role in urban development by providing access for people to education, markets, employment, recreation, health care and other key services. Especially in cities of the developing world, enhanced mobility for the poor and vulnerable groups is one of the most important preconditions for achieving Millennium Development Goals. Those cities with transport modes in an integrated system are more likely to evolve and prosper as centers for trade, commerce, industry, education, tourism and services. It is common that cities ranking at the top of surveys measuring urban quality of life have high quality urban transport systems that prioritize public transport and non motorized modes.

The existing reality, however, is that urban transportation systems in most developing cities are far from ideal. The most visible and frequently mentioned transport problem of a city is its traffic congestion, and it is well known that high levels of congestion create significant impact on local and national GDP. Accessible and affordable public transport service and safe infrastructure for non-motorized transport such as cycling and walking are lacking in most developing country cities. The number of private vehicles has been increasing continuously and dominates the roads. As a result, the transportation sector is heavily responsible for public health issues in cities such as air pollution (acidification, smog), noise, greenhouse gas emissions, and road accidents. While transport enables the economy to grow, if not well-managed, it can also retard growth and the efficient delivery of essential social services. The lack of comprehensive planning of transport systems, without due consideration to social, economic, environmental and cultural

¹ This chapter was authored by Carlos Felipe Pardo, with valuable input and contributions from Yang Jiemin, Yu Hongyuan and Choudhury Rudra Mohanty.

elements of the city, can result in physical breaks in the fabric of communities and reinforce social exclusion. The impact on quality of life and the environment cannot be underestimated.



Caption: Guayaquil restored its waterfront as part of a large redevelopment plan which also included a Bus Rapid Transit System and a housing improvement project. Previously an area of high crime rate, the riverfront is a place where citizens can enjoy public space and have an additional opportunity for daily leisure. (photo Carlos Felipe Pardo)

In order to return urban places to people and to create more livable cities, decision makers in these cities urgently need to change the direction of urban transport development toward a more sustainable future. Establishing a sustainable urban transport system requires a comprehensive and integrated approach to policymaking and decision-making, with the aim of developing affordable, economically viable, people-oriented and environment-friendly transport systems.

Political will has become a key ingredient to improving urban transport policies in cities. The knowledge of what is happening and how to improve a situation is already there, and tools to address problems are well known by many practitioners. When a city mayor or another decision maker takes these tools and applies them in their city knowingly and appropriately, positive outcomes and benefits for city inhabitants can result.

1. ISSUES AND CHALLENGES

1.1 UNCONTROLLED MOTORIZATION

*“Adding highway lanes to deal with traffic congestion is like loosening your belt to cure obesity.
– Lewis Mumford, The Roaring Traffic’s Boom.*

With rapid urbanization and economic growth, motorization has been accelerating in cities in developing countries. For example, in the Asian region, the number of motor vehicles per one thousand people has more than tripled in the past 30 years. Owning a private car or a motorized two-wheeler is a major aspiration for people in these cities, in particular, where public transport service is often inadequate and unsafe.

Figure 4-1. Vicious Circle of Car-Oriented Transport Development



Source: Buis, 2009b

Unfortunately, city managers in developing countries are following the same car-oriented transport development patterns made by many cities in developed countries in the past. Ironically, many cities in developed countries are now trying to recover from a car-dominated development era by halting the building of more infrastructures for private vehicles and re-allocating road space for public transport and non-motorized transport. This approach has been called in some cases a “road diet” or “complete streets” (the first is one where space for cars is explicitly reduced, the second emphasizes the need for streets where all road users are catered to).²

One considerable problem that is seen the world over is that there is a feeling, mainly prompted by traditional road engineering, which can be summarised in the phrase “build your way out of congestion”. It essentially reduces the problem of congestion to a lack of sufficient road space and a need for better traffic flow, disregarding other more complex problems of travel demand management, negative externalities (side-effects) of such policies and overall liveability in an urban setting. This approach has luckily started to lose strength, but some cities still erroneously promote this vision as the solution to congestion and transport problems.

In the developing world, however, the trend is still largely in favor of the expansion of infrastructure for private motor vehicles. Policies for more and more road construction have clearly failed to cope with ever increasing demand from rapid motorization, resulting in a vicious circle as depicted in Figure 4-1.³ This cycle shows how the increase of infrastructure to alleviate travel demand will have apparently positive consequences in the short term, but some months later there will be a much greater congestion than before, thus increasing the problem rather than solving it.

² McCann, B., Rynne, S., Editors (2010). Complete Streets: Best Policy and Implementation Practices. American Planning Association Planning Advisory Service Report Number 559.

³ Buis, J. (2009b) *A new Paradigm for Urban Transport Planning: Cycling Inclusive Planning* at the Pre-event Training Workshop on Non-Motorized Transport in Urban Areas, 4th Regional EST Forum in Asia, 23 February 2009, Seoul, Republic of Korea

1.2 URBAN AIR POLLUTION

“Because we don’t think about future generations, they will never forget us.”

- Henrik Tikkanen, author and artist, 1924-1984

Table 4-1. Air Pollution in Selected Cities

	PM ₁₀ (µg/m ³)	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)
WHO Air Quality Guidelines:	20	20	40
Beijing	89	90	122
Delhi	150	24	41
Tokyo	40	18	68
Seoul	41	44	60
Mexico City	51	74	130
Bangkok	79	11	23
London	21	25	77
New York	21	26	79
Paris	11	14	57
Shanghai	73	53	73
Santiago	61	29	81
Sao Paulo	40	43	83

Data Source: World Bank, 2009⁴

Another major problem for city managers is urban air pollution, which is a widespread environmental hazard. As shown in Table 4-1, even though the level of different air pollutants in cities of developing cities are generally higher than those of developed ones, still very few cities overall stay below the recommended levels by the World Health Organization (WHO). In most cities in the world, the road transport sector is the largest contributor of these urban air pollutants, as well as to high levels of carbon monoxide and hydrocarbons, among other substances. These high levels contribute to various respiratory and cardiovascular illnesses. Various epidemiological studies have clearly linked transport-related contaminants to asthma, bronchitis, heart attacks, and strokes.

The groups most vulnerable to urban air pollution include infants, the elderly, and those suffering from chronic respiratory conditions. For example, from 1999 to 2009, 25.6 per cent of the children in Bangalore, India, suffered from asthma.⁵ WHO estimates that nearly 2 million premature deaths in the world are caused by air pollution, where road transport is one of the major contributors to these premature deaths due to its effects on outdoor air pollution.⁶ Urban air pollution also has a huge economic cost. For example in

⁴ World Bank (2009). *World Development Indicators 2009*. World Bank, Washington, D.C.

⁵ Majumdar, S. (2010). *More and more kids falling prey to asthma in Bangalore*. DNA. (Available at http://www.dnaindia.com/bangalore/report_more-and-more-kids-falling-prey-to-asthma-in-bangalore_1342244)

⁶ World Health Organization (WHO) (2008). *Air quality and health*. WHO online article. (Available at <http://www.who.int/mediacentre/factsheets/fs313/en/index.html>)

2000, approximately 15,100 cases of chronic bronchitis and 7,200 cases of premature deaths in Shanghai were due to fine particulates (PM₁₀), and resulted in a cost of US\$ 880 million.⁷ Since exposure to air pollutants is generally beyond the control of individuals, local authorities need to take action to tackle the serious health problems with appropriate measures including policies to reduce private vehicle use, to encourage more public transport and non-motorized transport options, and to promote cleaner fuels. Air quality monitoring systems with a sufficient number of sampling stations also need to be established.

1.3 ROAD SAFETY

“The road system needs to keep us moving. But it must also be designed to protect us at every turn.”

- www.visionzeroinitiative.se

Urban managers have to take road safety seriously as it is a universal problem. The importance of focussing on road safety has reached such a degree that 2011-2020 has been defined as “the Decade of Action for Road Safety” by the World Health Organization.⁸

Some recent facts include the following:⁹

- Over 90 per cent of the deaths on the roads occur in low-income and middle-income countries, which have only 48 per cent of the world’s registered vehicles
- Pedestrians, cyclists, and riders of motorized two-wheelers and their passengers (who are collectively known as "vulnerable road users") account for around 46 per cent of global road traffic deaths. This proportion is greater in low-income countries than in high-income countries.
- Less than one-third of countries have taken necessary measures - for example low-speed zones - to reduce speed in urban areas
- More than 1.3 million people die annually on the road in the world and another 20~50 million people are injured

⁷ United Nations Environment Programme (UNEP) (2007). *The fourth Global Environment Outlook: environment for development (GEO-4)*. UNEP, Malta (Available at http://www.unep.org/geo/geo4/report/GEO-4_Report_Full_en.pdf)

⁸ World Health Organization and FIA Foundation (2010). Decade of Action for Road Safety 2011-2020. <http://www.decadeofaction.org/>

⁹ WHO (2011b). 10 Facts on Global Road Safety. <http://www.who.int/features/factfiles/roadsafety/en/index.html>

In fact, road traffic injuries are the leading cause of death for people aged 15-29 years; killing more young people than HIV/AIDS. In addition, almost half of those killed in traffic accidents are pedestrians, cyclists, passengers in public transport and motorcyclists.¹⁰ This share is even larger in developing country cities where simply walking or cycling can be a serious risk due to lack of road safety infrastructure for pedestrians and cyclists. Generally, many of the road safety measures are not focused on these vulnerable groups but rather on drivers.

1.4 MOBILITY OF THE URBAN POOR



Caption: Women are a specific group which has different transport needs in their daily activities. This road in Pune (India) does not provide suitable infrastructure for this walking woman. (photo Carlos Felipe Pardo)

“Poverty must be seen as the deprivation of basic capabilities rather than merely as lowness of income”
- Amartya Sen, 1999

Urban transport needs of all social groups are seldom met, especially in cities of developing countries. This may be due to a lack of understanding of such needs, a lack of data on the transport trends of different population groups or simple lack of knowledge about the importance of understanding all these needs and acting upon them.

A more comprehensive approach towards the travel patterns of different groups in society reveals the following:

- There are many more trips being taken by individuals with higher income than by those of lower income, mostly because low-income groups do not have the capacity (in time or money) to travel more. This weighs heavily on their capacity to access jobs, education, health and all other services that a city can provide, reducing their participation in society as a whole.¹¹

¹⁰ World Health Organization (WHO) (2009). Global Status Report on Road Safety. WHO, Geneva.

¹¹ Thynell, M. (2009). GTZ SUTP Technical document No.2: Social Change and Urban Transport. Eschborn: GTZ.

- There is much less accessibility for lower-income groups (and vulnerable groups in general) due to high/inequitable transport fares, lack of public transport provision to areas where low-income populations live, and lack of safe and high quality infrastructure for these users (including sidewalks, which are often neglected in favour of roads).¹²
- Transport patterns of citizens vary widely, with low-income women travelling in trip chains (various short trips chained to one another) rather than pendular trips (one trip in the morning and one in the afternoon), and a great use of non-motorized transport modes (walking, cycling).
- Negative impacts from unsustainable transport systems affect the poor disproportionately.¹³

This situation poses a threat to social development and general equity in cities. For instance, non-motorized transit is often an ‘orphan’ in transport systems and is frequently overlooked and considered as a peripheral issue rather than a core requirement. In most cases, for example, cycling is not well integrated with public transportation, which leads to loss of potential passengers. Also, partly as a result of this circumstance, the majority of victims in traffic accidents are pedestrians and cyclists, many of whom belong to lower income groups.

1.5 MOBILITY NEEDS OF DISABLED AND SENIOR CITIZENS

The disabled and the senior citizens are important disadvantaged social groups with special mobility needs which ought to be addressed more effectively.¹⁴ The special needs should be anticipated in the planning and construction of new transport infrastructure. Barrier-free facilities can significantly enhance the mobility for these social groups.

In recent years, a growing number of cities have issued municipal regulations on barrier-free facility construction, requiring all new construction projects, including public and residential buildings, roads, bridges, pedestrian overpasses and underpasses, metro and rail stations, as well as tourist sites, to be barrier-free, thus enabling the safe and

¹² World Bank (2002). *Cities on the Move: A World Bank Urban Transport Strategy Review*. Washington.

¹³ Badami, M. G., Tiwari G., and Mohan, D. (2004) *Access & Mobility for the Urban Poor in India* presented at the Forum on Urban Infrastructure and Public Service Delivery for the Urban Poor, 24-25 June 2004, New Delhi, India. (Available at <http://www.wilsoncenter.org/topics/docs/badami.doc>)

¹⁴ In 2006, the United Nations General Assembly adopted Resolution 61/106 establishing the Convention on the Rights of Persons with Disabilities.

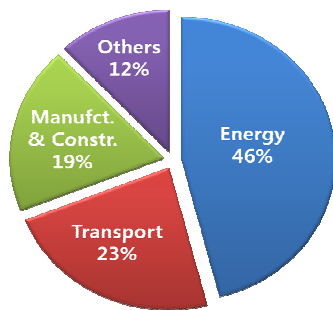
convenient mobility of the disabled, seniors, injured and other disadvantaged social groups.¹⁵

Barrier-free bus stations and buses, sidewalks for the blind, ramps, elevators, lifting platforms and wheelchair waiting positions are essential elements which can enable barrier-free mobility.

1.6 ENERGY SECURITY & GREENHOUSE GAS (GHG) EMISSIONS

“Urban transport represents one of the fastest growing sources of greenhouse gas emissions that contribute to global climate change” - UNCRD, 2009

Figure 4-2. Global CO₂ Emissions by Sectors



Source: UNEP, 2010

Transport is the second largest sector contributing to global carbon dioxide (CO₂) emissions from fossil fuel combustion as shown in Figure 4-2.¹⁶ Of the 23 per cent of global CO₂ emissions from the transport sector, road transport accounts for 73 per cent, followed by international shipping and international aviation. However, the transport sector is not receiving enough attention in global climate change mitigation efforts, despite the fact that, according to UNFCCC (2011) it is the sector where emissions have

increased the most (by 14 per cent from 1990-2008) and, in a business-as-usual scenario, are expected to grow by 25.8 per cent by 2020 compared to 1990 levels.¹⁷

Cities must understand that action upon climate change must be done collectively and seeking global goals of mitigation, while acting locally. The co-benefits of such an approach would also be significant and must be always understood as part of a package of urban transport improvements.

To date, the number of transport-related projects funded by the Clean Development Mechanism is few. However, a new possible source of funding is Nationally Appropriate Mitigation Actions or NAMAs. This is an instrument developed by the UN Framework

¹⁵ To prepare itself for hosting the 29th Olympic Games (8-24 August 2008) and the 13th Paralympic Games (6-17 September 2008) Beijing Municipality implemented a series of measures to enhance barrier-free facilities around the city. The Organizing Committee compiled a Guide to Barrier-free Services which was published in four languages and distributed to the public free of charge.

¹⁶ United Nations Environment Programme (UNEP) (2010). *2009 Annual Report - Seizing the Green Economy*. UNEP, Nairobi

¹⁷ UNFCCC (2011a). *Compilation and synthesis of fifth national communications*. Subsidiary Body for Implementation, Thirty-fourth session, Bonn, 6–16 June 2011.

Convention on Climate Change (UNFCCC) to generate more projects which can mitigate climate change and can improve knowledge on emissions in cities and countries throughout the world. This opportunity has been identified as a possible “game changer” in climate change mitigation, especially for the transport sector since previous methodologies such as CDM have proven difficult to adjust to the nature of transport projects. While specific procedures and rules for NAMAs are now being developed, it is important to identify them as a potential source of financing for sustainable urban transport measures.

The table below identifies some of the key financing instruments used in climate change mitigation and how they can be used to develop sustainable urban transport. Please note that since NAMAs have not yet been fully developed as an instrument, they are not included in the table below.

Table 4.2 Financing instruments for climate change mitigation applicable to transport projects

Source of climate finance	Nature of support			Type of intervention supported				Modes supported			
	Grants	Loans	Technical	Infra-structure	Technology	Operations	Capacity building	Road	Rail	Urban public transport	Non motorised transport
Clean Development Mechanism	✓		✓	✓	✓				✓	✓	✓
UNDP Millennium Development Goals (MDG) Carbon Facility			✓				✓	✓	✓	✓	✓
Hayotama Initiative	✓	✓	✓	unclear				unclear			
Global Environment Facility	✓		✓	✓	✓	✓	✓		✓	✓	✓
Clean Technology Fund	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
International Climate Initiative	✓			✓	✓		✓			✓	✓

Source: Harald Diaz, 2011¹⁸

2.POLICY OPTIONS FOR URBAN TRANSPORT

A sustainable urban transport system requires strengthening various features of the system including mobility, accessibility, affordability, social equity, efficiency, safety, security, convenience, low carbon, comfort, and people- and environment-friendliness. In order to achieve all these elements, various challenges need to be addressed in an integrated manner. These challenges include improving human health through the

¹⁸ Diaz-Bone, Harald, 2011, Use of Climate Finance (CDM, GEF, NAMA) in the Transport Sector, presentation at Forum on Sustainable Transport for Latin America, Bogotá, Colombia, 22 - 24 June 2011

reduction of urban air pollution, tackling climate change, reducing the number of deaths and injuries from road accidents, controlling excessive motorization, improving public transport services, encouraging more walking and cycling, and recognizing the specific needs of urban poor, women, the elderly, people with disabilities, youth, and children. It is critically important to understand that urban transport (or mobility) is not an isolated issue and is related to many other aspects of urban life in general. It is useful to note this integrated approach as an introduction to the more specific measures that are presented below.

There are various ways to describe an implementation method for sustainable urban transport in a city. While this document will present a specific framework, it is important to see other approaches to understand how to act upon the challenges posed above. In general, sustainable transport emphasizes the use of public transport, bicycles and walking and discourages the use of individual motorized modes of transport (cars and motorcycles). It also promotes the improvement of institutions, urban development plans, sound policies, appropriate technologies and the development of promotional schemes that persuade users into using sustainable urban transport modes.

2.1 PUSH – AND PULL APPROACH

One way to view the problem is to analyze it from the standpoint of “where” people should be in transport (where we should “push” them) and from which modes we should “pull” them. This is commonly called the “push and pull” approach.¹⁹ It emphasizes that urban transport measures must persuade users into using public transport and non-motorized transport, while developing strategies to “push them out” of automobiles and similar transport modes. To achieve the “pull” component, one must provide good quality of service in public transport, develop infrastructure for public transport and non-motorized transport and in general develop policies that improve conditions for the use of these modes. To arrive at a situation where people are “pushed from cars”, policies must be in place to discourage their use by eliminating fuel subsidies, creating charges to automobile ownership and use, and in general creating policies that increase the cost of using these modes while using the revenue from those charges to enhance sustainable urban transport modes. This approach is generally used by transport economists as it follows a rationale of “price-driven-behavior”.

2.2 PUBLIC TRANSPORT, NON-MOTORIZED TRANSPORT, TRANSPORT DEMAND MANAGEMENT, AND TRANSIT ORIENTED DEVELOPMENT

A second approach to describing how to implement sustainable urban transport is by applying the four measures listed above.

Public Transport: This measure implies the development of high quality public transport systems, which includes mass transit systems. A specific public transport mode

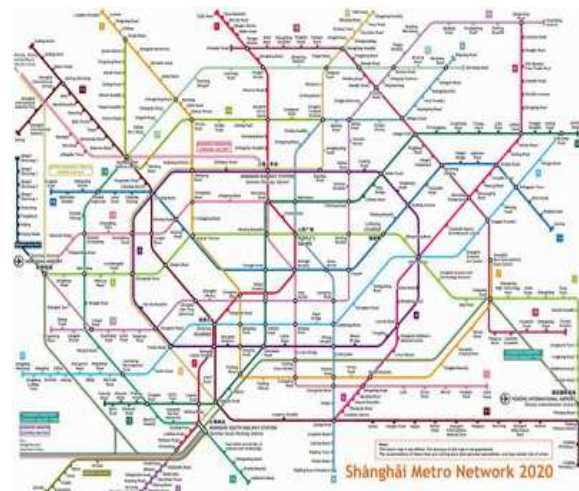
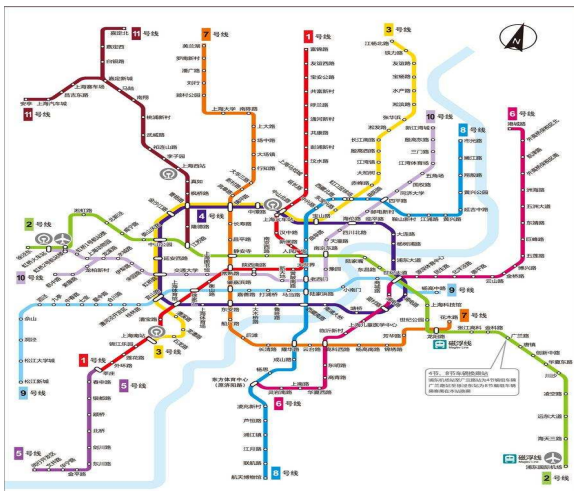
¹⁹ Müller, P., Schleicher-Jester, F., Schmidt, M.-P. & Topp, H.H. (1992): Konzepte flächenhafter Verkehrsberuhigung in 16 Städten”, Grüne Reihe des Fachgebiets Verkehrswesen der Universität Kaiserslautern No. 24

called Bus Rapid Transit (BRT) has been generally favoured in recent years due to its moderate cost of implementation, relatively short implementation time, high quality of service, and capacity to move large numbers of passengers once it is implemented.



Caption: Bogotá's TransMilenio Bus Rapid Transit system is a good example of how public transport can be improved with moderate costs and in a relatively short time span (photo Carlos Felipe Pardo)

Subway and light-rail systems are other means of rapid, cost-effective and environmentally benign urban passenger transport. For example, 116 cities, located mostly in the industrialized countries, operate their own metro systems, which are used by an estimated 155 million passengers each day. In addition, there are about 400 light-rail systems worldwide, while over 200 new systems are being planned. Many megacities in developing countries are also investing in the construction, modernization and expansion of urban light-rail systems.



Caption: Shanghai Metro System 2011 and Planned Expansion for 2020²⁰

Metro and urban light-rail systems are costly to construct and to maintain but can provide significant long-term economic, social and environmental benefits. Various studies analyzing investment in urban public transport infrastructure and services have shown that in the long term the sum of public benefits by far exceed the investment costs.

Urban public transport systems are more attractive for commuters and more economically viable for operators if they offer the option to travel from any point in the city to any other point. This can be achieved through the expansion of network as well as through intermodal connections.

Non-Motorized Transport: Also called “Active Transport”, it essentially refers to walking and cycling (and all other modes that have wheels but no engine such as pedicabs and freight tricycles), as well as related infrastructure, policies and education.²¹ These modes have been greatly promoted recently due to their great benefits for reducing transport emissions and for improved human health.



Caption: Non-motorized transport is a key mode of transport which can be promoted at a relatively low cost and with considerable benefits. One modality in which it has been promoted is by means of bicycle sharing systems such as Paris’s Velib system with 21 thousand bicycles available to citizens throughout the city. (photo Carlos Felipe Pardo)

Travel Demand Management: Also termed “Transport Demand Management”, it refers to all measures that try to reduce the demand for travel/transport, and re-evaluate the actual need for providing more road infrastructure to cater for such demand (Broaddus,

²⁰ For detailed information on the Shanghai Rail Transit Network, please see: <http://baike.baidu.com/view/70683.htm>

²¹ Godefrooij, T.; Pardo, C.F.; Sagaris, L. (eds) (2009). Cycling Inclusive policy Development: a handbook. Eschborn.

Litman & Menon, 2009). It specifically focuses on implementing fuel policies, road charging and parking pricing, and other related measures which are similar to those described in the section above under the “push” definition.

Transit Oriented Development: This refers to an approach to urban design where policies promote urban development of higher density along mass transit corridors (Cervero, 1998). The rationale for this approach is that significant energy efficiency and transport efficiency can be realised through urban designs where mass transit provides rapid access to the main nodes of urban activity (home, work, education, recreation, health services).



Caption: Transit Oriented Development implies that public transit corridors are planned in conjunction with land policies to complement each other. Such is the case of Bogotá’s Bus Rapid Transit System. (photo Carlos Felipe Pardo)

2.3 AVOID, SHIFT, IMPROVE

Avoid: This first strategy seeks to avoid unnecessary travel and reduce trip distances. It implies measures where land use and transport planning are properly integrated and mixed use development is promoted, and where there is a greater role of information and communications technologies (ICT) to reduce the number of trips being taken by a person. This measure can effectively increase accessibility and reduce trip distances and times by properly integrating land use and transport and by developing areas so that home, work and shopping locations are near each other (mixed use development). This is accomplished through urban development master plans. Additionally, this approach can avoid many trips due to the ease with which ICT can replace many activities that previously required travel.

The “Avoid” strategy is described first since, if its policies are applied in a comprehensive way, it can have a great impact on urban transport and provide great social, economic and environmental benefits.

Shift: This strategy seeks to shift passengers towards more sustainable transport modes. It means that citizens who are using automobiles or motorcycles should be encouraged to

start using more public and non-motorized transport. It uses all travel demand management measures in its toolbox, as well as a better development of inter-city passenger and goods transport. It also seeks to persuade existing public and non-motorized transport users to continue using them, applauding their contribution to sustainability.

The shift approach can be the second most potent means of delivering sustainable urban transport if implemented properly. If one can implement Avoid and Shift strategies in one city, most of the hard work has been done, though more can be still improved.

Improve: The third strategy focuses on policies that aim to improve transport practices and technologies. It is a more technological approach to improving urban transport problems. Its measures include improving fuel quality and vehicle fuel efficiency standards, developing vehicle emission standards, implementing vehicle inspection and maintenance (I&M) policies, and transitioning to “intelligent transportation systems” that take advantage of information and communication technologies to improve transport management. It also emphasizes the need to improve freight transport technologies and logistics.

Though this measure is not generally seen as the most crucial to achieve substantial benefits in the short and long term for urban transport, it is an important complement to the Avoid and Shift measures, and can achieve incremental benefits for society, the environment and the economy.

Although the Avoid, Switch, Improve approach is generally described as having the three components described above, the Bangkok 2020 Declaration also states that there should be a fourth strategy which emphasizes a “people first” approach. This would provide a more humane angle to delivering sustainable urban transport policies by improving safety in urban transport systems, delivering health benefits and reducing negative impacts in air quality and noise, and mitigating global climate change. It would also provide an improved scenario for energy security, while also improving access to information and raising public measures in urban populations. The case study in section 4.3 below provides a detailed description of these strategies and policy options.

2.4 POLICY OPTIONS AND MEASURES FOR ROAD SAFETY

Solving the problem of road safety calls for finding solutions in four main areas:

- *Engineering:* Redevelopment of road designs, emphasizing protection of vulnerable road users as well as transport sensitive groups and physically enforcing speed limits through traffic calming and other measures. City planners should consider providing quality pedestrian facilities such as spatial, safe, refuge islands and medians, and non-interrupted walkways and at-grade crossings that are necessary for many people, but particularly children, women, the elderly, and people with disabilities.

- *Emergency Response*: Improvement of the response time and quality of emergency vehicles and institutions – this relates to the term “pre-hospital care” of WHO,²²
 - *Education*: Development of strategies to improve road users’ understanding of the risks related to, for example, driving improperly;
 - *Enforcement*: Improvement of the enforcement of speed limits and other safety-related measures that have a direct effect on accident rates.
- In related terms, the Global Plan for the Decade of Action for Road Safety 2011-2020²³ has defined 5 “pillars as key activities to improve road safety worldwide. These are: road safety management, safer roads and mobility, safer vehicles, safer road users, and post-crash response.

One very good example of an ambitious approach to road safety is Sweden’s Vision Zero initiative, which is described in greater length in the case studies section that follows. They have aimed to reduce their road accidents to Zero, established clear guidelines, and have made good progress towards this goal.

2.5 POLICY OPTIONS FOR MOBILITY OF THE URBAN POOR AND OTHER DISADVANTAGED SOCIAL GROUPS

Urban transport is often provided in an inequitable manner in which the transport needs of low-income and/or vulnerable user groups are left behind or neglected. Fortunately there are a wide range of policy options and initiatives in place in some cities which have led to enhanced mobility for the urban poor and generated greater equity between citizen groups. Some examples of these are the following:

- Women-only carriages in trains or buses. These have been implemented in some cities in India, as well as Rio de Janeiro and Mexico City (among others). They provide increased passenger comfort for women. Though sometimes these initiatives have been debated, they have undoubtedly improved conditions for passengers.
- Multi-trip or time-based fares. In Hong Kong and many other cities where an integrated fare structure has been established, many population groups have found it easier and less expensive to travel when their trips are not pendular (several short trips, going back and forth) but are trip-chains (various small trips linked together to run specific errands).
- Cross-subsidies to increase affordability. In some cases, such as Bogotá’s BRT system, public transport fares have been established in such a way that the fare for low-income groups is subsidised by that of high-income groups. The specific strategy in Bogotá has been to have one flat fare for all trips; thus longer trips of

²² World Health Organization and FIA Foundation (2010). Decade of Action for Road Safety 2011-2020. <http://www.decadeofaction.org/>

²³ WHO (2011a). Global Plan for the Decade of Action for Road Safety 2011-2020. Geneva.

- low income populations that tend to live on the periphery of cities are subsidised by shorter trips of higher income individuals who tend to live in city centers.
- Universal access. Many cities in the world have implemented infrastructure that has taken into account the needs of disabled citizens -- aids for visually impaired, audible signals, accessible ramps, stations and vehicles, etc). This has not only increased access to these population groups, but in some cases has actually created the opportunity for them to travel which was not readily available before.

2.6 NETWORKS AND ORGANIZATIONS PROMOTING SUSTAINABLE URBAN TRANSPORT

Promotion of sustainable transport has become a major issue in cities around the world. Several partnerships have been established to create synergy and leverage resources among different institutions and organizations. For example, the Partnership for Clean Fuels and Vehicles (PCFV), with well over 100 partners has been successfully working on phasing out lead from fuels, establishing standards for low-sulphur fuels and promoting clean vehicle technology. The United Nations Environment Programme (UNEP) acts as the Clearing House for the PCFV and also works in the area of fuel economy (Global Fuel Economy Initiative), public transport and investments in non-motorized transport (Share the Road Initiative) (www.unep.org/transport). The Partnership on Sustainable Low Carbon Transport (SLoCaT), www.sutp.org/slocat/ is another example. With over 30 members, it aims to provide options and advice for the establishment of sustainable transport systems. Other initiatives have been established in developing cities, such as the Sustran network (which has chapters in Asia and Latin America and acts primarily as a discussion group of practitioners), the Cities for Mobility network (initially a European Union project and from 2007 a network led by the city of Stuttgart), and in general various electronic debate forums. Other initiatives such as the Sustainable Urban Transport Project from the German Cooperation Agency (GIZ) have concentrated in developing documents and other material to support implementation of sustainable urban transport.

There are also regional efforts to address the issues of unsustainable transport. For instance, the United Nations Centre for Regional Development has implemented the Asian Environmentally Sustainable Transport (EST) Initiative since 2004. In support of the EST, 44 Asian city Mayors have signed the Kyoto Declaration on the promotion of EST at the city level. Recently, at the 5th Regional EST Forum in Asia, held in Bangkok, Thailand, on 23-25 August 2010, twenty-two participating countries agreed on the “Bangkok 2020 Declaration” in order to demonstrate their commitment to realizing a decade (2010-2020) for action on achieving safe, secure, reliable, affordable, efficient, people-centred and environment-friendly transport in rapidly urbanizing Asia.

Due to its success in Asia, the EST initiative began being replicated in Latin America from 2011 by the Inter-American Development Bank (IDB) and other regional partners, where a similar framework was established and began its activities.

Finally, various non-profit institutions have been crucial to the promotion and implementation of sustainable urban transport. These include the New York-based Institute for Transportation and Development Policy (ITDP), the World Resources Institute’s Embarq network, and the above-mentioned Sustainable Urban Transport Project.

3. CASE STUDIES

3.1 GUANGZHOU'S HIGH CAPACITY BUS RAPID TRANSIT SYSTEM



Caption: Guangzhou, one of the world's cities with highest density, has implemented a high capacity Bus Rapid Transit system which rivals many metros in efficiency. (photo Carlos Felipe Pardo)

This case study describes the experience of Guangzhou (China) and its Bus Rapid Transit (BRT) system. Its recent implementation was able to take advantage of experiences in other cities in the developing world, often improving on some well-known features of BRTs. It is useful as a case study since it provides an example of a mass transit system that has followed the main guidelines of planning, design and implementation of a high quality and high capacity bus-based system. It is also useful in that it can be replicated in many cities within an adequate time span and at a moderate cost.

Context

Guangzhou is one of the densest cities in the world, with 12.7 million inhabitants and a density of 1,708 people per square kilometre. As such, it had a great need for an efficient transport system. Although it had a metro system, most of its public transport passengers travelled by bus. Before the implementation of its Bus Rapid Transit system, congestion at specific locations of the city, such as Gangding, was intolerable and generated very negative impacts on the city's economy. As one of its main advisors stated, "the most vexing question posed by this unprecedented urban development is how to avoid gridlock".²⁴

Policy options and measures

²⁴ Fjellstrom, K (2010). "Year of the Transit Tiger in Guangzhou" in Sustainable Transport magazine, Winter. Institute of Transportation and Development policy. pp. 10-15

The city of Guangzhou embarked upon the very complex task to redevelop its main avenues with a Bus Rapid Transit (BRT) system with support from international organizations. This was also complemented by the development of a greenway project and a bike sharing system. A Bus Rapid Transit system generally is comprised of dedicated bus lanes and stations where passengers can prepay the bus fare. These innovations speed the buses by setting them apart from any traffic congestion and ensuring quick entry and exit of passengers. The Guangzhou BRT has 980 buses along 23 kilometres of dedicated trunk lines, and is moving 800,000 passengers per day. Hand in hand with this, the city implemented a bicycle sharing system in June 2010, which has 5 thousand bicycles at 113 stations, mostly built adjacent to BRT stations, as the programme was developed initially as a complement to the BRT. There are plans to increase the programme to 15 thousand bicycles in the near future, and this is being complemented by the development of infrastructure for bicycles and more than 5 thousand bicycle parking positions at BRT stations.

Outcome

Bus Rapid Transit is a concept of bus-based transport which has revolutionized the common understanding of how to plan and operate mass transit, especially since buses were previously regarded as vehicles that could not operate above certain passenger limits. However, the example of Guangzhou is one which has shown that passenger flows can be greatly enhanced in these systems. This had also been demonstrated previously with TransMilenio in Bogotá (Colombia) and even more than 3 decades ago in the BRT systems of Curitiba (Brazil) and Quito (Ecuador).

The Guangzhou BRT has the following impacts in operations:

- Peak passenger flows of 26,900 passengers per hour per direction, which is generally regarded as a “metro-level” capacity.
- Daily ridership of around 800,000 passenger-trips per day on the system.
- Integration of the BRT with bicycle parking, bicycle sharing and the city’s metro system. Integration is one of the key elements of a successful transport system, since users can use more than one mode and have greater access to different places in the city with greater ease.
- This is the first BRT system in China with more than one BRT operator. Three corporate groups consisting of seven different bus companies all operate along BRT routes. Having more than one operator is generally positive since there is competition for the best service and users receive high quality service at a lower cost.
- The BRT has produced 30 per cent higher bus speeds, resulting in an average time saving of 6.63 minutes per BRT trip, or more than 30 million passenger-hours saved each year. Also, the percentage of riders satisfied with public transport rose from 29 per cent in December 2009 (when there was no BRT) to 65 per cent by the following year.²⁵

²⁵ Fjellstrom, K (2010). "Year of the Transit Tiger in Guangzhou" in Sustainable Transport magazine, Winter. Institute of Transportation and Development policy. pp. 10-15

Though it is still too early to evaluate quantitatively in a comprehensive fashion, this system has improved access to places in the city and it is safe to say that Guangzhou's economy, environment and society have greatly benefited from these interventions.

Engagement of urban stakeholders

The Guangzhou BRT and its related projects had a very strong commitment from the local government, which from 2005 gave a clear directive to implement these projects and prioritize them. During project development, there was international support, namely from the Institute of Transportation and Development Policy, which established a permanent office to participate in planning during the entire project development phase and beyond. Planning for the Guangzhou BRT started in 2005, when a conceptual plan was developed over two years. Following the conceptual plan and stakeholder discussions, there was a full year of detailed engineering design during 2008, and construction was begun in 2009.

Lessons learned

The Guangzhou BRT provides important lessons for other cities, notably:

- Proper planning of a mass transit system may take time, but it bears fruit in terms of better performance of the system, quality of service and overall improvement of urban transport in a city. Guangzhou has shown how dedicated planning has produced a successful and high quality mass transit system at a moderate cost, which also includes integration with other modes of transport.
- Bus systems have the potential to provide high quality service and great performance, rivalling the capacity of rail-based systems at a fraction of the cost. Though this had already been shown by the Latin American examples of Curitiba and Bogotá's TransMilenio BRT systems, this Asian example provides similar results in a completely different political, economic and cultural context.
- The integration between this bus-based system and the rail-based metro has proven to be an indispensable feature of the BRT and the mass transit network of the city, not only for its complementarity but for the overall improvement of public transport service in the city. BRTs and mass transit systems in general must be planned with an entire system in mind, including those existing modes and others that may be planned in future.

3.2 A TALE OF TWO BICYCLE CITIES: BOGOTÁ AND COPENHAGEN

“At the core of the new model... all citizens will move exclusively using public transport, bicycles, or walking... it would get all citizens together as equals regardless of income or social standing. And most importantly, it would allow cities to become a place primarily for people, a change from the last 80 years a time during which cities were built much more for motor vehicles' mobility than for children's happiness.”

Enrique Peñalosa, former Mayor of Bogotá, Colombia.

This case study describes the development of bicycle-oriented policies in two cities: Bogotá, Colombia and Copenhagen, Denmark. Both cities have a considerable history of bicycle use, while being in developing and developed countries, respectively. Though there are issues in common with both cities, there are also other issues which have unfolded differently due to their different contexts. The story of Bogotá is one of recreational bicycle use that was transformed into transport-related use for all citizens. It still needs to work on specific issues to arrive at a “critical mass” in bicycle use comparable to the levels of some European cities.

On the other hand, Copenhagen can be seen as a city with a long history of cycling that improved its policies and infrastructure over decades to arrive at an incredibly high level of use. Riding a bicycle is not seen as something unusual or specific to a subgroup of citizens but something that all citizens do and is just as normal as riding a bus or a car.

Context



Caption: Bogotá built almost 300 kms of bikeways in less than 3 years, and continues to expand and promote them through innovative policies. Photo by Carlos Felipe Pardo.

Bogotá is a city with approximately 8 million inhabitants and has had considerable growth in population and physical size in the past 50 years,²⁶ while preserving a relatively high density of 4,684 inhabitants per square kilometre. Until 1998, little had been done with regards to non-motorized and public transport. Though an urgent need for improvement in the transport sector had been identified, specific policies had yet to be chosen and implemented.

For many, the latter part of the 1990s is seen as the turning point in transport policies of Bogotá. In terms of bicycle use, it must be noted that Bogotá had a considerable history of recreational bicycle use since 1974 with its Sunday Ciclovía, an initiative

²⁶Martin, G., & Ceballos, M. (2004). Bogotá: anatomía de una transformación. Bogotá: Editorial Pontificia Universidad Javeriana.

which closes major avenues of the city and allows only bicycles, pedestrians and any non-motorized mode to ride along them. This 121-km network served as one of the policies that would inadvertently increase bicycle use as a transport mode when proper policies were implemented after 1998.



Caption: Taking children to school on a cargo bicycle is very common in Copenhagen, as are many other daily activities in this city which has promoted bicycle use for more than 40 years. Photo by Carlos Felipe Pardo

The city of Copenhagen is, as many other European cities, one where population is not so large (1.2 million) and density is adequate at 2,632 inhabitants per square meter. Bicycles have always been a part of Copenhagen life since the 19th century, and the second world war increased substantially this level of bicycle use. It was only in the post-war era until 1960 that cars dominated urban policies and were given precedence over other modes of transport.²⁷ The turning point in its transportation policy came with the oil crisis of the early 1970s, and the growing traffic congestion. The plan to address these issues not only redirected the transport policy but also their urban redevelopment plans. It must also be emphasized that cities like Copenhagen a high GDP per capita choose bicycles not just for economical reasons but also for their great efficiency and various co-benefits.

Both cities faced considerable challenges around the time that their policies and projects shifted to develop a more bicycle-oriented approach. In the case of Bogotá, the challenge was to cope with increasing transport demand and congestion, the need for an improved overall transport system and the provision of cheap, reliable modes of transport for the entire population. This challenge was seen as an opportunity by Enrique Peñalosa, who was mayor of the city from 1998 to 2000. He took the enormous political risk to reduce the investment related to private automobiles and redirect the entire transport policy to one where people would be at the center and infrastructure would be developed for them,

²⁷ City of Copenhagen (2009). City of Cyclists: Copenhagen bicycle life.

while space would be taken away from cars and given to pedestrians, cyclists and public transport users.

In the case of Copenhagen, the challenges were very similar to those faced by many European cities in the decade of the 1970s. The difficulty of providing affordable transport to all which would be dependent on oil was insurmountable and the only way out was to redirect their transport policy to one where bicycles would have a predominant role. This was also linked to the need for a comprehensive urban development plan, which would need to take the needs of all citizens into account while providing suitable transport to everyone.

Policy options and measures

The example of Bogotá and the development of policy options that improved conditions for cyclists was linked to the overall transport plan that Mayor Peñalosa envisioned during his term. His view was that citizens come first, and, because of that, he felt that road space and other public space should be redistributed. This entailed the following:

- Sidewalks were widened in order to develop new space for pedestrians and fully segregated two-way cycletracks. This meant that space was taken away from cars -- either full traffic lanes and/or parking spaces were eliminated in order to make space for pedestrians and cyclists;
- A public transport network was designed, and its first phase was built during his mandate. This turned into the well-known TransMilenio Bus Rapid Transit system, which now carries almost 2 million passengers per day. It was integrated with cycletracks and every trunk line of the BRT system has an adjacent cycletrack by law.
- A full citywide cycletrack network was designed and its first 200 kms was built during his mandate. This created a network of high level bicycle infrastructure where users felt safe riding from home to work or study, and where travel times were reduced for cyclists. As of 2011, this network is 357 kms in length and still expanding. There was great emphasis on segregating these cycletracks from roadways as the cultural attitudes in the city were such that road users often did not respect cyclists if they were only in a painted cyclelane.
- This was also complemented by a set of strategies promoting bicycle use in the city as a mode of transport, complementary to the already-existing culture of recreational and sports cycling in the city.

In the case of Copenhagen, their policy was also citywide and its scope was overarching for all transport. This entailed:

- The creation of an urban development plan referred to as the “five finger plan”, in which development followed along five main rail lines that started from the city center. The spaces in between those lines of urban development became green spaces. This urban plan was able to increase the size of the city without risking urban sprawl.
- A cycletrack network (part of the National Bicycle Route network) which, as of 2010, consisted of 350 kms of segregated cycletracks and many more kilometres

of non-segregated cyclelanes.²⁸ This resulted in 1.2 million kms ridden on bicycles every day and in 37 per cent of daily transport trips in the city being done by bicycle.

Since 2000, a stronger policy was developed, where more ambitious goals were set. These now include a goal of 50 per cent of trips done by bicycle and 50 per cent less bicycle-related injuries on the streets by 2015. Specific measures developed in the most recent years include:

- An initiative to develop “Green Waves” of cyclists based on traffic light phases, where these are synchronized to cyclists’ speed and movements rather than that of cars (it is set for 20 km/h speeds, which is achieved easily on a bicycle). This has increased comfort for cyclists and improved overall conditions. There is also a 6-second “green advance” for cyclists at stop lights, while cars must wait for their green light after cyclists have passed.
- The development of Green Cyclists Routes, which are essentially a high level network of cycle routes which have little or no contact with other traffic, making trips in the city more agile and safer.
- The redevelopment of infrastructure to improve safety for cyclists, reducing risks especially in crossings where conflicts with other road users may arise.²⁹

Outcome

In Bogotá, the development of bicycle-related policies has had significant impacts on the transport situation of the city, complementary to what was achieved by other measures such as the BRT system and overall public space transformation. Specifically, the mode share of bicycles before the development of a cycletrack network was measured at 0.58 per cent of all trips in the city in 1996.³⁰ After all these developments, the use of bicycles rose to 5 per cent by 2010 (Bogotá Cómo Vamos, 2010), which represented an almost ten-fold improvement of bicycle use for Bogotá. Unfortunately, there is still a lag in data collection for Bogotá, but preliminary studies have shown that more women are using bicycles than before and that people feel safer on the streets when riding a bicycle.

In Copenhagen, the policy reorientations in the 1970s resulted in significant bicycle ridership gains, such that bicycles now account for 37 per cent of trips in the city. Studies show that while bicycle use has increased, traffic accidents have been reduced (City of Copenhagen (2002) – this is referred to as the “safety in numbers effect”. Copenhagen is also known for its cultural/fashion approach to cycling, where initiatives such as “Cycle Chic” have been created and bicycle users seem to feel part of this Chic culture of

²⁸ City of Copenhagen (2009). City of Cyclists: Copenhagen bicycle life.

²⁹ City of Copenhagen (2002). Cycle Policy 2002-2012 ,City of Copenhagen.

³⁰JICA. (1996). Estudio del plan Maestro del transporte urbano de Santa Fé de Bogotá en la República de Colombia: informe final (informe principal). Bogotá: Chodai Co Lt d,

cycling, which is now spreading all over the world. Copenhagen also has its frequent “Bicycle Account” where they do a follow-up on the goals that have been set from year 2000 to improve the situation of cyclists in their city (City of Copenhagen, 2008; 2010).

Engagement of urban stakeholders

The transformation of Bogotá could be described as one which was implemented “top-down”, where the decision makers defined the policies and moved forward to implement them. Since the policies were properly researched and had as their main goal to improve quality of life for citizens as a whole, it produced positive effects in the short, medium and long term.

However, one must also note that after some years, there was a strong emergence of local groups related to cycling which enabled an appropriation of bicycle culture and promotion from the citizens’ side. This complemented the “top-down” approach with several “bottom-up” initiatives which have given these policies a more long-term outlook. The strongest of these groups are Ciclopaseo de los Miércoles and Mejor en Bici, both striving to find ways to promote bicycle use in the city. With their work, cycletracks have been improved and policies have been redirected towards a more comprehensive approach to cycling as a mode of transport.

In the case of Copenhagen, ideas such as “Cycle Chic” and “Copenhagenize” have resulted in an interaction between political levels and citizen initiatives. These initiatives promote urban cycling in the city of Copenhagen as a “chic” mode of transport, while promoting this vision beyond the city limits, such that various cities have now developed their own versions of the “Copenhagen Cycle Chic” and follow this approach to promote cycling.

Lessons learned

The following lessons can be drawn from these two examples:

- Cycling can be a suitable mode of transport, regardless of a city’s economic conditions, level of development and previous history.
- Promoting cycling by means of infrastructure, policies and education results in higher levels of use and greater road safety for all users.
- There are many risks associated with promoting cycling, both at political and cultural levels, but these can be overcome.
- Policies related to cycling policy must not be isolated from general transport and urban planning policy, and must form a coherent whole. The Bogotá and Copenhagen examples are useful because their cycling policies were part of a broader set of policies which created positive feedback to the other transport systems.
- Stakeholders must be engaged for the development of these policies, and citizens can act as powerful agents of change in a properly developed policy. Engaging stakeholders from the outset of projects can produce greater outcomes.

3.3 GOTEBOURG'S ROAD SAFETY VISION ZERO



Caption: Goteborg has implemented a set of measures which have improved road safety substantially, and has a clear vision of reducing traffic accidents to zero in the near future. (photo City of Goteborg)

One of the greatest examples of how road safety can be improved is with the bold approach and high goals of the Swedish “Vision Zero” initiative. It has become a world example of how to reduce road accidents with specific measures that can produce significant results.

Context

Goteborg, Sweden is a city with around 500,000 inhabitants (900,000 in its metropolitan region) and with an area of 450 km². It is an industrial city built in the beginning of the 17th century. In terms of road safety, it had a very bad record of traffic accidents.³¹ As was the case in many European cities in the 1970s, motorization had grown and urban transport policies at the time often did not give priority to non-motorized or public transport.

However, in the 1970s there was a halt in this trend. In the view of the city’s decision makers, road safety was “one of the most important prerequisites for an attractive city”.³² Their plans also included the idea of promoting public transport, cycling and walking. This generated demands for changes in the design and improvement of public spaces to enhance the use of those transport modes. The inclusion of safety was a crucial component of such a policy. One specific issue which heightened the

³¹ City of Goteborg (2010). Year 2020: more people move around in the city - but fewer are injured in traffic.

³² Ibid.

need to discuss and address road safety directly was the modification of traffic to the right-side of the road in 1967. The change to right-side traffic was quickly followed by the establishment of suitable speed-limits, and legislation for the obligatory use of seat-belts and helmets.

Policy options and measures

City leaders in Goteborg developed two main policies to improve road safety. The first policy was called traffic-calming. Implemented in 1978, it comprised specific infrastructure changes designed to reduce speeds of motorized vehicles and give priority to non-motorized transport. This approach gave physical signals to drivers which forced them to reduce their speed and to give right of way to other transport modes. By 2004, the municipality had implemented nearly 3000 countermeasures.³³ The traffic calming measures were also included in the “Goteborg agreement” which established how state funds would be allocated to transport.³⁴

The approach of traffic calming has been used in other cities in the world with good success, since speed is one of the key issues that must be addressed when improving road safety, and developing physical strategies to reduce speeds is the most effective way of doing it. There are other approaches that go beyond traffic calming such as that of “shared space” or “naked streets”, where streets have no significant signals for road users, which has the result of increasing car drivers’ awareness of the road setup and its users. This has proven effective in many places, and has been termed “post-traffic calming” by some.

The second set of measures developed by Goteborg with the aim of increasing road safety was the initiative called “Vision Zero”. In summary, this initiative aims at having zero fatalities due to road accidents; it is a very ambitious goal but has produced highly positive impacts. This initiative had such impact that in 1997 the Swedish parliament suggested it should be the basis for all traffic-safety related work in Sweden.

The Vision Zero approach has four main components, namely infrastructure (planning and building roads and related infrastructure to improve road safety), vehicle technology (improving driver, passenger and pedestrian safety), services and education (ranging from driver education to planning services), and control and

³³ City of Goteborg (2006). *Calm, safe and secure in Goteborg: positive effects of traffic-calming countermeasures*. Goteborg.

³⁴ *Ibid.*

surveillance (systems for monitoring traffic and weather).³⁵ The approach includes the following guidelines:³⁶

- Focus on fatalities and serious injuries
- Integrate the failings of human beings in design
- Share responsibility between system and design
- Stimulate industry to improve safety design
- Saving lives is cheap.

Outcome

The measures implemented by Goteborg in improving road safety have had positive impacts on its main target: reducing deaths and injuries on the road. The Swedish National Road and Transport Research Institute stated that three quarters of the significant reduction of deaths and injuries on roads were attributed to the effects of the implemented Traffic-calming measures.³⁷

The Traffic and Public Transport Authority aimed to reduce the number of killed and seriously injured by 60 per cent by 2005, and this number was achieved for pedestrians and cyclists. Their reports state that the total reduction by year 2003, based on the statistics for years 1985-89, was approximately 2460 people, which represents a reduction of 47 per cent.³⁸

Engagement of urban stakeholders

As has been described, the initiatives of traffic calming and Vision Zero have been mainly led by the city government but with wide support from citizens. While citizen support has grown over time, some measures in 1978 (such as a speed bump in Kapplandsgatan) created some initial public outcry; but this was overcome when the results from the measures were seen. Initially traffic planners were somewhat against the measures when they were proposed, but once they saw the very positive effects, they quickly adopted the traffic calming techniques to improve road safety in their streets.³⁹

³⁵ Traffic Safety by Sweden (2011a). Vision Zero Initiative: Solutions. in <http://www.visionzeroinitiative.se/en/solutions/>

³⁶ Traffic Safety by Sweden (2011b). Vision Zero Initiative: Long presentation. in [http://www.visionzeroinitiative.se/PublicDownloads/Presentations/Long per cent20presentation per cent20\(1.6MB\).pdf](http://www.visionzeroinitiative.se/PublicDownloads/Presentations/Long%20presentation%20(1.6MB).pdf)

³⁷ City of Goteborg (2006). Calm, safe and secure in Goteborg: positive effects of traffic-calming countermeasures. Goteborg.

³⁸ Ibid.

³⁹ City of Goteborg (2006). Calm, safe and secure in Goteborg: positive effects of traffic-calming countermeasures. Goteborg.

An additional activity which increased public support and generated greater positive impact of the measures was the definition of target groups for special road safety measures, the development of a common agenda between the Traffic Authority, police, emergency services and public transport companies. According to the city government, stakeholder discussions were responsible for influencing the choice, design and placement of those measures”.⁴⁰

Finally, it should also be mentioned that property owners in commercial areas took special interest in the decisions related to traffic calming measures, which were implemented to enhance road safety in shopping areas and parking lots.⁴¹

Lessons learned

One key lesson from these experiences was that the city of Goteborg found that these measures were difficult to implement at the beginning, both for technical reasons and for reasons of public acceptance. But results showed they were well worth the trouble and the impacts of the strategies that were implemented were very positive.

Adopting speed limits was a decision that implied a significant amount of work but was something specific that could be tackled with simple but bold measures. From this experience, it can be seen that reducing traffic speeds can have a very high impact on road safety in city streets.

A co-benefit of these measures was that citizens felt the areas where these strategies were implemented had improved not only in terms of road safety, but also in terms of liveability since the areas seem livelier and more pleasant to spend time in, as measured by surveys in various areas of the city.⁴²

⁴⁰ Ibid.

⁴¹ Ibid.

⁴² Ibid.

3.4 SINGAPORE'S APPROACH TO REDUCING TRAFFIC CONGESTION



Caption: Singapore's Electronic Road Pricing system is highly dynamic and changes according to actual demand in a corridor. This is one of the various measures implemented by the city to manage congestion. Photo by Carlos Felipe Pardo.

Context

In terms of transport, Singapore is unique among other South Asian cities in that it has a high motorization rate but does not have a high level of motorized two wheelers as well as a very high use of bicycles. In the 1970s in its space-constrained area and with a rapidly growing economy, Singapore was on the brink of major traffic congestion and potential gridlock. It was also concerned with its air quality problems and needed a solid approach to remedy the situation. As in many other countries in the world, the oil embargo at the beginning of the 1970s showed the risks of an oil-dependent transport system and urgent action was needed.

Policy options and measures

In 1975, Singapore embarked upon an aggressive approach towards improving transport conditions for all its citizens. It involved two projects. One project provided a large network of public transport which placed a mass transit stop no more than 500 meters from any place in the city. This called for significant, investment in public transport. The second project was to manage travel demand by means of various measures that addressed everything from car ownership to use of roads. It implied a considerable restriction on automobiles in terms of property and use, but also generated much needed revenue which was needed to fund public transport.

Singapore's well-known policy of travel demand management began in 1975 when it implemented a manually-operated scheme where cars would have to pay to access the city center during the morning peak hours. The cost of using those roads was based on the actual demand of the area, which would regulate the demand based on price.

This scheme successfully managed traffic congestion, and was known as the Area Licensing Scheme (ALS). It was implemented from 1975 until 1998 when the Electronic Road Pricing (ERP) Scheme took its place. ERP was an improvement because in-vehicle units provided information to entrances and discounted the cost of using roads, and it was now possible to charge for road use depending on the time of day and the estimated demand of a road. That is, a certain road could have a cost of 2S dollars to enter at 6am, but it would cost 3S Dollars to cross at 7am, all of this being automatically defined and published to users. This made managing demand something more complex but at the same time more efficient.

In addition to the well-known congestion charging scheme, Singapore also implemented other measures related to vehicle ownership. Since 1990 it has implemented a “Vehicle Quota System” policy, where people interested in buying new vehicles must enter a bidding system to bid for the price of the right to purchase a vehicle. As a result of the quota system and taxes, the cost of a vehicle can amount to 3 times the price of its normal market value, which not only discourages automobile purchasing, but also generates revenue to cover costs related to automobile travel such as road construction maintenance and improvement of road safety conditions.

Outcomes

The main outcomes of these initiatives to improve urban transport are the following:

- Public transport remains the main mode of choice for all citizens, while having an affordable cost and being fully integrated.
- Congestion in the city roads has kept constant at 50 per cent of gridlock levels, despite the growth of the motorization rate. For instance, the average speed on expressways is 45-65 km/h; that of other road arteries is 20-30 km/h⁴³
- Considerable revenue has been earned by the ALS and ERP schemes. US\$ 75 million was earned in 2008 alone from the ERP scheme.⁴⁴

The Singapore example can be seen as a success after more than 30 years of implementation. It has been replicated successfully in London (through its congestion charging scheme) and Stockholm, while other smaller cities (Oslo, Trondheim) have also implemented schemes with similar results.⁴⁵

Engagement of urban stakeholders

Developing schemes that restrict the use of the automobile in a city are seldom popular, especially before results in terms of reduced traffic congestion become apparent. Implementing a scheme like the ALS-ERP and its related measures has had its share of

⁴³ International Technology Scanning Programme (2010). Reducing Congestion and Funding Transportation Using Road Pricing in Europe and Singapore. Washington: US Department of Transportation.

⁴⁴ Ibid.

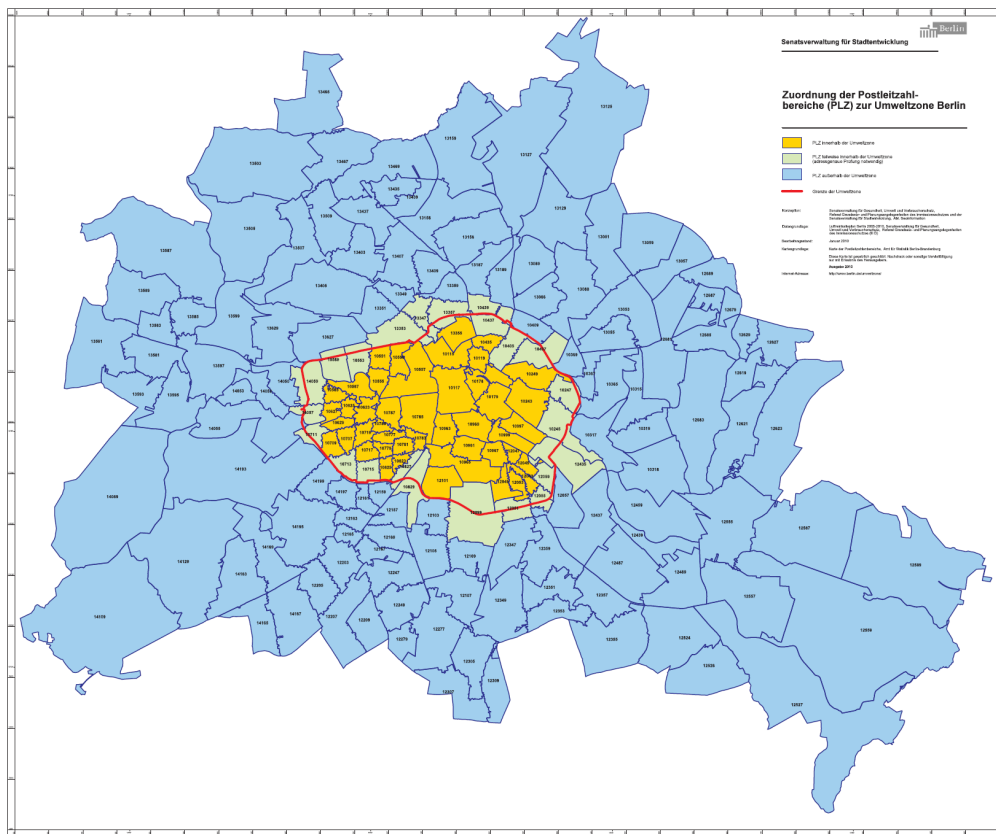
⁴⁵ Broaddus, A. Litman, T & Menon, G. (2009). Transportation Demand Management. Eschborn: GTZ.

debate among the population in Singapore, but it is now well accepted by the population and it is well understood that this measure is responsible for the free-flowing traffic in the streets.

Lessons learned

The example of Singapore has shown that, despite being a very unpopular measure, congestion charging is feasible to implement and retains its strength and effectiveness through the years.

3.5 BERLIN'S LOW EMISSION ZONE



Caption: Berlin's Low Emission Zone (area indicated in red) and postcodes. Source: City of Berlin.

Context

Due to the increased awareness of the importance of tackling pollution and mitigating GHG emissions due to its impact on climate change, many cities in Europe have chosen to develop unique strategies for the transport sector. One of these is the implementation of Low Emission Zones (LEZ). Berlin is an example of a progressive and effective implementation of such a measure.

Like many other cities, Berlin was concerned about the need to reduce emissions in the city core, and therefore designed their LEZ to be the inner city within the urban railway ring. This area is 88 km², and one third of the city's inhabitants live within the ring.

The LEZ was evaluated as part of various measures to reduce congestion and pollution in the city. In 2005, a study⁴⁶ recommended that:




- The scheme should include all vehicles (heavy duty, passenger, petrol and Diesel);
- The key area for implementation of the LEZ should be the inner city (“S-Bahn Ring”) due to population density and exposure to pollutants;
- There should be a transition period but it should be short;

Policy options and measures

Starting from 2008, access to the Berlin LEZ area was restricted. As defined by the city, the LEZ is an area where only those vehicles are allowed to drive that meet certain exhaust emission standards.

To achieve this, different stickers were developed according to the “class” to which vehicles belonged. Four emission classes were defined, the first of which does not have a sticker, and classes 2, 3 and 4 were defined as shown in the table below.

Table 4.3 Vehicle stickers that restrict access to urban low emission zones in Germany

Emissions class	1	2	3	4
Sticker	No Sticker			
Requirement for diesel vehicles	Euro 1 or worse	Euro2 or Euro1 particulate filter	Euro3 or Euro2 particulate filter	Euro4 or Euro3 particulate filter
(ban for Diesel vehicles older than...)		1992	1996	2000
Requirement for petrol vehicles	Without a catalytic converter			Euro1 with catalytic converter or better

Adapted from Lutz (2009) and <http://www.lowemissionzones.eu/countries-mainmenu-147/germany-mainmenu-61/berlin>

The stickers are based on a national regulation and are issued by the vehicle registration office, technical certification organizations and authorized repair workshops at a cost of between 5 and 15 Euro. Drivers must place these in their windshield. If visitors from outside of Berlin drive into the city, they must purchase a sticker for the duration of their

⁴⁶ Lutz, M. (2009) *The Low Emission Zone in Berlin – Results of a first Impact Assessment*. Presented at the Workshop on “NOx: Time for Compliance”, Birmingham, Nov 2009.

trip and abide by the rules of the LEZ. If a citizen from Berlin drives into another city in Germany with LEZ, the stickers remain valid since they are part of a nationwide LEZ scheme.

The LEZ has had two stages. From the 1st of January 2008, vehicles (both heavy duty and passenger cars) had to meet the requirements of Pollutant Class 2 (red sticker). In that phase, only cars with no sticker (i.e. Euro 1 or worse requirement in Diesel or petrol vehicles without catalytic converters) were not allowed into the LEZ

Starting from January 1st 2010, the LEZ became more stringent, allowing only those vehicles with a green sticker (i.e. Euro 4 or Euro 3 with particulate filter for Diesel, or Euro 1 with catalytic converter or better) are allowed into the LEZ. All other vehicles (yellow, red or no sticker) are not allowed into the zone.

The penalty for not following the law is 40 Euros and costs one point in the national traffic penalty register. The measure is valid 24 hours a day, 365 days a year, and enforcement is by police. Vehicles must not only meet the expected emission standard but must also display the sticker. Failure to have a sticker results in a fine. There are, however, some specific exemptions from the LEZ but these are few and related to very specific cases. The zone is identified on the street by signs such as the one shown below.



Caption: Sign indicating the entrance to the Berlin LEZ, where only class 4 vehicles can enter (lowest emission standards). Source: City of Berlin.

Outcomes

The scheme has been successful and has produced beneficial impacts on pollution and congestion. Some of these impacts for phase 1 (before 2010) are presented in the list below.⁴⁷

⁴⁷ Lutz, M. (2009) *The Low Emission Zone in Berlin – Results of a first Impact Assessment*. Presented at the Workshop on “NOx: Time for Compliance”, Birmingham, Nov 2009.

- Net reduction of 24 per cent of exhaust particulate emissions and 14 per cent lower NOx emissions from Berlin's motor traffic
- impact on annual PM10 (fine particulates) pollution is about a 3 per cent reduction
- SO2-concentrations have fallen to 5 per cent of the levels 20 years ago
- A decrease of traffic by 4 per cent inside the zone and 6 per cent in the surrounding areas
- 70 per cent of high polluting passenger cars and more than 50 per cent of old commercial vehicles have disappeared from the city center
- Reduction of 73 per cent of "no sticker" (class 1) passenger cars and 53 per cent of commercial vehicles when comparing 2006-2008.

Engagement of urban stakeholders

The LEZ in Berlin was a product mainly of the EU's promotion of measures to reduce air pollution and mitigate climate change, the German national government's establishment of emission classes, and the decision of the Berlin local government to be one of the first German cities (along with Hanover and Cologne) to implement such a scheme.

Lessons learned

The experience of Berlin's LEZ provides useful lessons for those motivated to develop similar measures in their cities. Some of the more relevant lessons are the following:

- An LEZ must be properly planned and progressively implemented in order to be successful. If restrictions are too stringent or inflexible at first, they may result in poor levels of acceptance and negative responses from citizens.
- An LEZ can have specific and immediate benefits in terms of air pollution and GHG emissions, and it can also produce other benefits related to traffic congestion and health.
- Support from higher levels of government can be crucial to the implementation of such a scheme.
- These measures have various components (establishment of emission classes, issuance of stickers, enforcement, specification of the LEZ area, etc) which must all be properly designed from the beginning of its implementation.
- Users may be willing to take part in the LEZ but may also need support from the government in retrofitting their vehicles or acquiring new ones. Measures to tackle this must also be studied, such as subsidies to those users.

4. BETTER CITY, BETTER LIFE - POLICY OPTIONS FOR SUSTAINABLE URBAN TRANSPORT

As sustainable transport requires a comprehensive multi-sectoral approach, some of the main strategies and possible policy options that city authorities might consider are outlined below. They were derived from the recommendations of the Bangkok 2020

Declaration agreed upon at the Fifth Regional EST Forum, 23-25 August 2010, Bangkok, Thailand.:

<i>Strategy 1: Avoid unnecessary travel and reduce trip distances</i>	
Policy Option 1	Formally integrate land-use and transport planning processes and related institutional arrangements at the city level
Policy Option 2	Achieve mixed-use development and medium-to-high densities along key corridors within cities through appropriate land-use policies and provide people-oriented local access, and actively promote transit-oriented development (TOD) when introducing new public transport infrastructure
Policy Option 3	Institute policies, programmes, and projects supporting Information and Communications Technologies (ICT), such as internet access, teleconferencing, and telecommuting, as a means to reduce unneeded travel
<i>Strategy 2: Shift towards more sustainable modes</i>	
Policy Option 4	Require Non-Motorized Transport (NMT) components in transport master plans and prioritize transport infrastructure investments to NMT, including wide-scale improvements to pedestrian and bicycle facilities, development of facilities for intermodal connectivity, and adoption of complete street design standards, wherever feasible
Policy Option 5	Improve public transport services including high quality, and affordable services on dedicated infrastructure along major arterial corridors in the city and connect with feeder services into residential communities
Policy Option 6	Reduce the urban transport modal share of private motorized vehicles through Transportation Demand Management (TDM) measures, including pricing measures that integrate congestion, safety, and pollution costs, aimed at gradually reducing price distortions that directly or indirectly encourage driving, motorization, and sprawl
Policy Option 7	Achieve significant shifts to more sustainable modes of inter-city passenger and goods transport, including priority for high-quality long distance bus, inland water transport, high-speed rail over car and air passenger travel, and priority for train and barge freight over truck and air freight by building supporting infrastructure such as dry inland ports
<i>Strategy 3: Improve transport practices and technologies</i>	

Policy Option 8	Support work towards more sustainable transport fuels and technologies, including greater market penetration of options such as vehicles operating on electricity generated from renewable sources, hybrid technology and natural gas
Policy Option 9	Cities can support and/or catalyze national auto fuel economy targets, plans, policies and standards by adopting locally appropriate incentives that aid the adoption and use of cleaner, more fuel efficient vehicles, including: procurement of fuel efficient vehicles for municipal fleets (both light and heavy duty), adopting congestion charging schemes for city centers that allow preferential access to low emission vehicles, provide low cost/free municipal parking for low emission vehicles, allow low emission vehicles priority access to low occupancy traffic lanes. Cities can also plan for and deliver municipal charging infrastructure for electric vehicles/plug-in hybrids and support car sharing schemes to lower vehicle use. Enforce standards for fuel quality and tailpipe emissions for all vehicle types, including new and in-use vehicles, set out by national authority
Policy Option 10	Enforce standards for fuel quality and tailpipe emissions for all vehicle types, including new and in-use vehicles, implemented by national authorities.
Policy Option 11	Enforce vehicle testing and compliance regimes, including formal vehicle registration systems and appropriate periodic vehicle inspection and maintenance (I/M) requirements set out by national authority
Policy Option 12	Adopt Intelligent Transportation Systems (ITS), such as electronic fare and road user charging systems, transport control centres, and real-time user information, when applicable
Policy Option 13	Achieve improved freight transport efficiency, including road, rail, air, and water, through policies, programmes, and projects that modernize the freight vehicle technology, implement fleet control and management systems, and support better logistics and supply chain management
<i>Strategy 4: People First Policy with a focus to Protect people and environment</i>	
Policy Option 14	Work towards zero-fatality policy with respect to road, rail, and waterway safety and implement appropriate road design and infrastructure, speed control, traffic calming strategies, strict driver licensing, motor vehicle registration, insurance requirements, and better post-accident care oriented to significant reductions in accidents and injuries
Policy Option 15	Promote monitoring of the health impacts from transport emissions and noise, especially with regard to incidences of asthma, other

	pulmonary diseases, and heart disease. Assess, assess the economic impacts of air pollution and noise, and devise mitigation strategies, especially aiding sensitive populations near high traffic concentrations
Policy Option 16	Enforce national air quality and noise standards, also taking into account the WHO guidelines, and mandate monitoring and reporting in order to reduce the occurrence of days in which pollutant levels of particulate matter, nitrogen oxides, sulphur oxides, carbon monoxide, and ground-level ozone exceed the national standards or zones where noise levels exceed the national standards, especially with regard to environments near high traffic concentrations
Policy Option 17	Implement sustainable low-carbon transport measures to mitigate the causes of global climate change and contribute towards national energy security
Policy Option 18	Adopt social equity as a planning and design criteria in the development and implementation of transport infrastructure projects. This leads to improved quality, safety and security for all and especially for women, universal accessibility of streets and public transport systems for persons with disabilities and elderly, and affordability of transport systems for low-income groups, and upgrading, modernization and integration of intermediate public transport
Policy Option 19	Encourage innovative financing mechanisms for sustainable transport infrastructure and operations through measures, such as parking levies, fuel pricing, time-of-day automated road user charging, and public-private partnerships such as land value capture, including consideration of carbon markets, wherever feasible
Policy Option 20	Encourage widespread distribution of information and awareness on sustainable transport to all levels of government and to the public through outreach, promotional campaigns, timely reporting of monitored indicators, and participatory processes
Policy Option 21	Develop dedicated and funded institutions that address sustainable transport-land use policies and implementation, including research and development on environmentally sustainable transport, and promote good governance through implementation of environmental impact assessments for major transport projects

5.LINKS FOR FURTHER INFORMATION

AECOM (2007) *Case Studies of Transportation Public-Private Partnerships around the World* (Available at http://fhwicsint01.fhwa.dot.gov/ipd/pdfs/int_ppp_case_studies_final_report_7-7-07.pdf)

Asian Development Bank (ADB) (2005) *ASEAN Regional Road Safety Strategy and Action Plan*. ADB, Manila

BMU Low Emission Zones description:

http://www.bmu.de/english/air_pollution_control/general_information/doc/40740.php

CAF Urban Mobility Observatory <http://omu.caf.com/>

Environmentally Sustainable Transport for Asian Cities: A Sourcebook. UNCRD, Nagoya (Available at http://www.uncrd.or.jp/env/est/docs/EST_Sourcebook.pdf)

European Cyclists' Federation <http://www.ecf.com>

European Low Emission Zones <http://www.lowemissionzones.eu/>

ELTIS Urban Mobility Portal <http://www.eltis.org/>

Global Transport Knowledge Partnership: www.gtkp.org

IDB Sustainable Transport: <http://www.iadb.org/en/topics/transportation/sustainable-transport,2875.html>

Institute for Transportation and Development Policy www.itdp.org

International Association of Public Transport www.uitp.org

ITDP BRT database <http://www.chinabrt.org/default.aspx>

Singapore Land Transport Authority <http://www.lta.gov.sg/>

Sustainable Urban Transport Project (GIZ) www.sutp.org

Transport and Climate Change <http://www.transport2012.org/>

UN Decade of Action (Road Safety): <http://www.decadeofaction.org/>

UNCRD Environmentally Sustainable Transport (EST) project
<http://www.uncrd.or.jp/env/est/>

UNFCCC <http://unfccc.int/>

Victoria Transportation Policy Institute www.vtpi.org

Vision Zero Initiative <http://www.visionzeroinitiative.se/>

WHO Road Safety Report

http://www.who.int/violence_injury_prevention/road_safety_status/2009/en/index.html

World Bank Urban Transport: <http://go.worldbank.org/1K4AXE3VM0>

WRI Embarq www.embarq.org/