A Framework for Achieving Sustainable Urban Mobility in Asian Cities

Clean Air Initiative for Asian Cities (CAI-Asia) Center
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LIST OF ABBREVIATIONS

ADB  Asian Development Bank
BRT  Bus rapid transit
CAI-Asia  Clean Air Initiative for Asian Cities
CO2  Carbon dioxide
EST  Environmentally Sustainable Transport
GTZ-SUTP  German Technical Cooperation Agency Sustainable Urban Transport Project
I-CE  Interface for Cycling Expertise
ITDP  Institute for Transportation and Development Policy
MRT  Mass rapid transit
NMT  Non-motorized transport
PM  Particulate matter
Sida  Swedish International Development Cooperation Agency
SUMA  Sustainable Urban Mobility in Asia
SUT  Sustainable urban transport
TDM  Transport demand management
UNCRD  United Nations Center for Regional Development
WRI-EMBARQ  World Resources Institute Center for Sustainable Transport

1. INTRODUCTION

1. In 2006, the Clean Air Initiative for Asian Cities (CAI-Asia) launched the Sustainable Urban Mobility in Asia (SUMA) program, through a grant from the Swedish International Cooperation Agency (Sida) to the Asian Development Bank (ADB). This was an important program in a series of ADB-, Sida- and other donor-supported activities that, in a decade or so, helped transform the thinking on urban air quality and the role of transport in urban development in developing Asia. These activities deepened the understanding of technical issues and democratized the subject matter adding a broader social and urban development dimension to its traditional engineering and physical development core.

2. The issue of sustainable transport and its role in developing Asia is a very broad issue and in order to sufficiently address this, the CAI-Asia Center worked in partnership with reputable international organizations and experts to address various issues related to this topic in Asia. As such the SUMA partnership was established, which included organizations like the Institute for Cycling Expertise (I-CE) based in the Netherlands; the World Resources Institute Center for Sustainable Transport – EMBARQ and the Institute for Transportation and Development Policy (ITDP), who are based in the United States, but with offices in various developing or transition economy countries; the United Nations Centre for Regional Development (UNCRD) and the German Agency for Technical Cooperation (GTZ) Sustainable Urban Transport Projects (SUTP).
3. SUMA embodied a shift of approach from an early emphasis on motor vehicles towards recognizing the role also played by the design of urban infrastructure, non-motorized transport and other factors, as had been CAI-Asia’s focus in its early days. Furthermore, the modest amount of work on climate change repercussions of rapid motorization in developing Asia of the early part of the decade became an avalanche during the life of the project. The scope for simultaneously reaping several types of local or global benefits through well conceived urban transport interventions found its expression in the concept of co-benefits. Other initiatives on sustainable transport grew rapidly during the past years, most notably the Global Transport Knowledge Partnership, the Regional Environmental Sustainable Transport (EST) forum of the UNCRD, and the recently established Sustainable Low Carbon Transport Partnership led by the ADB, the IDB, and United Nations Department of Economic and Social Affairs (UN DESA), and where all of the SUMA Partners are also members. Interestingly, during this time period, various governments, like India, Indonesia, People’s Republic of China, and the Philippines in Asia have started to adopt and/or develop sustainable urban transport policies.  

4. Building on the experience of the SUMA program, this discussion paper aims to stimulate further thinking on a framework for implementing sustainable urban transport in Asian cities. This discussion paper aims to stimulate thinking on investing equally on the process of implementing SUT in cities, from the introduction, lobbying, planning, implementation, and monitoring stages, it is important that cities have access to state-of-the-art knowledge and experience, as well as tools to ensure successful implementation of SUT policies and projects.

2. SUSTAINABLE URBAN TRANSPORT FOR BETTER AIR QUALITY AND LIVABLE ASIAN CITIES

5. Sustainable urban transport may be defined differently by different people. Under SUMA, sustainable urban transport was broadly defined as "the urban transport system that prioritizes movement of people over vehicles and includes technological and non-technological solutions to ensure the environmental, social, and economical sustainability of the urban transport system."

6. In 1975, 80 cities in Asia had a population greater than one million. By 2025, it is estimated that this will rise to 332 cities. In 1990, about 50% of people live in cities and by 2050, this will increase to almost 75%, and many of new urban residents are poor people.

7. The essence of poverty is not only lack of material resources but also lack of power and choice. Good transport systems are important in combating poverty, because transport costs are a large proportion of the costs for many poor people. For instance, the low income population in Shanghai paid as much on transport as on healthcare (5%), clothing (5%) and rent (0.8%) combined in 2003. A similar situation,

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1 Adapted from the SUMA Final Evaluation Report (2009)
although of varying scales, can be found in other Asian cities, and rising fuel prices and fuel security issues will further exacerbate this in the future.

8. In Asia, government policies and urban development traditionally favor private vehicles and support a demand driven approach, whereby new roads are built to accommodate a growing vehicle fleet, rather than managing this demand. A significant and continuing expansion and widening of roads occurs at the expense of pedestrian space, and cyclists and motorcyclists are banned from an increasing number of roads. Many public transport systems are in bad condition as they are not given sufficient priority. This development further stimulates private car and motorcycle ownership in cities and leads to a continued decline in investments in integrated public transport systems and infrastructure for non-motorized transport.

9. One of the key characteristics of a sustainable urban transport system is that it provides adequate service to the broader community. Sustainable transport therefore also is an important development issue because poorer people are more dependent on public transport and non-motorized transport for access to work, education, health services, and social purposes. Poor people mostly cannot afford to live in central business districts of cities where many of the jobs are and thus have longer travel times. Private vehicle ownership is rapidly increasing across Asia, leading to traffic congestion and even longer travel time. This in turn leads to poor people having less time to spend at home with their families, moving to cities and leaving their families behind, or in the worst case giving up jobs that take too long to get to.

10. Research is not conclusive as to whether air pollution affects the health of the poor more than the non-poor, but as relatively more poor people in cities travel with public transport, walk and cycle, they are definitely more exposed to air pollution and susceptible to health problems. Poor people also have less financial means to get medical help and loss of income and jobs resulting from air pollution induced/enhanced diseases have more severe consequences for the poor and their families.

11. An explosive increase in motorized vehicles in Asia means higher fuel consumption, leading to a projected four-fold increase to CO\textsubscript{2} emissions in 2035 compared to 2005. Figure 1 compares the current and estimated number of vehicles, in absolute terms and in per thousand of people in India, PRC, and Southeast Asia. This figure, showing all types of vehicles, shows that cities in the ASEAN region have relatively higher motorization levels than PRC and India. Initial gains in reductions of particulate matter (PM) emissions will be offset by a continued increase of the vehicle fleet. Black carbon or soot, which is PM component, from diesel and biomass burning is also a dominant absorber of solar energy. Recent scientific studies suggest that black carbon is the second largest contributor to global warming following CO\textsubscript{2}.\textsuperscript{5} The consequences of climate change will be more felt by the poor.

Figure 1. Motorization Index in ASEAN, China, and India

Note: ASEAN = Association of Southeast Asian Nations; ASEAN countries included are Indonesia, Malaysia, Philippines, Singapore, Thailand and Viet Nam.

12. Sustainable urban transport is essential for the sustainability of cities as a whole. The business-as-usual scenario based on heavy private motorization will surely become a major impediment to achieving economic growth and better livability of cities. To achieve this, a first step is to understand the main reasons for poor urban transport systems, in order to then determine what should change. ADB analyzed main reasons and proposed a new paradigm shift that is summarized in Box 1 below.

13. The important next step is to work out a process for achieving sustainable transport systems in cities. The next chapter describes a framework developed by the CAI-Asia Center taking the lessons and experiences in SUMA into account.

Box 1. Changing Course – a New Paradigm for Sustainable Urban Transport

Mutually reinforcing factors contributing to unsustainable transport systems in Asian cities
- Absence of a city development strategy
- Unsustainable transport policies driven by meeting demand by creating additional infrastructures
- Ineffective transport planning by the experts, thus disenfranchising users, residents and other stakeholders
- Little implementation due to a disconnect between plans and available budgets
- Little data about the success or failure of implementation in achieving policy goals
- Governance problems where politics won over technocratic advice.

Proposed new paradigm for sustainable urban transport consisting of:
- Increased governance and stakeholder involvement in the decision-making process to ensure transport systems reflect actual needs
• Linking city vision, strategies and land use planning with plans for transport systems
• Managing demand for travel around supply with an increased focus on traffic restraint and public transport instead of building infrastructure to feed a seemingly unstoppable growth in private vehicles
• Increased realism in decision-making on transport systems, giving equal attention to institutional, financial, social, economic and environmental considerations
• "Avoid-Shift-Improve" policies combined with measuring effectiveness of policies


3. FRAMEWORK FOR IMPLEMENTATION

14. Developing cities need clearer and better guidance in developing a vision of a livable city and translating this into sustainable urban transport policies and projects. Figure 2 depicts an inverted triangle that represents a “paradigm shift” framework for achieving sustainable urban mobility in cities in four broad steps based on past experience in assisting cities in Asia:

• Visioning livable cities
• Integrated environmentally sustainable transport systems
• Analysis on feasibility of specific policies/ projects
• Implementation of policies and projects

Figure 2. Framework for Achieving Sustainable Urban Transport in Asian Cities
15. This Framework integrates and builds on the 7-step process applied by development banks, such as ADB and World Bank, shown in Figure 3.  

![Figure 3. Loan and Project Development Process Applied by Development Banks](image)

16. Related to this is the notion of "co-benefits" that can be achieved by a sound transport system as illustrated below. It is important to realize that co-benefits are a secondary, albeit often explicit, benefit of good transport systems. There is a risk that the "cart is placed in front of the horse" when policies aimed at reducing air pollutant and greenhouse gas emissions fail to address fundamental transport and mobility issues. For example, if we were theoretically able to make all cars emission-free, we would still not have solved traffic congestion problems and thus retain low mobility and accessibility. For many developing countries, transport and traffic problems will drive future investments, not climate change or air pollution, although these can be important factors in steering transport systems in a more sustainable direction.

17. Organizations, like the CAI-Asia Center and its Country Networks assist in implementing such a framework in three different ways: policy development, process facilitation, and technical advice. Support to policy development at the regional, national and local level can take the form of surveying and sharing existing practices and of supporting the process of developing or strengthening policies. Furthermore, CAI-Asia can help cities in going through the process illustrated in the framework and provide information, access to experts, financiers and others, and facilitating the involvement of stakeholders. Technical advice may relate to the problem analysis, visioning-backcasting, identifying policies and projects, feasibility analysis from an air pollutant and GHG emissions perspective.

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6 Adapted from the Cities Development Initiative for Asia
3.1 Visioning Livable Cities

3.1.1 Problem Analysis

18. In any undertaking, it is important to include an analysis of the current situation and to identify the problems related to the city's current transport system. Main activities include the analysis of

a. Existing and emerging transport problems, such as traffic congestion, fuel prices, traffic accidents, pollution, poor public transport systems, and limited affordability by poorer segments of society.

b. Existing urban, land-use and transport plans, and relevant policies. As provincial and national decisions often affect the transport system at the city level, it is important that city, provincial and national policies and plans are considered. The analysis should also assess whether these plans and policies are actually implemented and enforced, to be able to ascertain that if problems are not addressed effectively, whether this is due to the absence of plans and policies, their appropriateness for sustainable transport, or the lack of implementation or enforcement.

c. Management of CO₂ emissions and air pollution from the transport sector, making use of the Clean Air Scorecard assessment tool developed by the CAI-Asia Center, to assess
Framework for Achieving Sustainable Urban Mobility in Asian Cities

- Air pollution levels and CO₂ emissions in the city and the contribution by the transport sector
- The city’s capacity to determine sources, levels and impacts, and address air pollution and CO₂ emissions
- The presence and enforcement of policies and actions to address emissions from the city’s transport sector.

3.1.2 Develop vision with stakeholders

19. A clear vision of what the city should look like in the future is needed. What a livable city constitutes is determined by what type of city its citizens want to live in. For this reason, consultations have to be conducted with relevant government agencies and stakeholder groups that influence their decisions, including community groups, private sector, NGOs, academic and research institutions, and development agencies.

20. The aim of this consultation is to determine the characteristics of a livable city. These will vary between cities, however, common characteristics are accessibility of all citizens to work, education, healthcare and other places of importance to them, sufficient public spaces for relaxation and recreation, security and safety, a green environment and clean air. This vision has consequences for land use planning, covering, amongst others, office buildings, public spaces, residential areas, and the transport system that connects these. Consequently, it will help in identifying what transport policies and projects should be given priority.

3.1.2 Visioning-backcasting for low emissions development

21. An important basic assumption is that "low emissions development" is a cornerstone of a sustainable city, and thus a key element of a sustainable transport system. This is in line with the Bellagio Declaration on Transportation on Climate Change, which calls for sustainable, low carbon transport combined with maximized co-benefits that include air pollutants reduction.²

22. For this reason, emissions in the current year and forecasted emissions for a future year of the transport system need to be determined, and then the broad policies (“policy packages”) must be identified that are needed to retain transport emissions below a certain level in the future year. This can be done by combining the 3-step visioning-backcasting approach and the ASIF³ methodology as follows:

   a. Baseline forecasting: establish an emissions baseline for a certain year (e.g. 2000)⁹ and make a forecast for a future year (e.g. 2050) under a business-as-usual scenario for CO₂, PM and NOx

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² http://www.slocat.net/bellagio-process/
⁹ The CAI-Asia Center is collaborating with ITDP on the development of methodologies to assess transport sector emissions for ADB and GEF projects
b. Visioning: determine one or more desirable alternative scenarios for low carbon and low emissions transport in the future year

c. Backcasting: determine which policies are needed to achieve the alternative scenario(s), including the degree of effectiveness and a realistic timeframe for their adoption between the baseline and future year. Such policies can be oriented towards urban planning and transport and are categorized as follows: 10

- Avoid unnecessary travel by reducing the overall passenger and freight vehicle-kilometer traveled
- Shift from private motorized modes to public transport and non-motorized modes for passenger travel and from road to rail for freight
- Improve fuel efficiency and reduced emission factors for various transport modes and fuels.

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3.2 Integrated EST Systems

3.2.1 Identify EST policies and projects

23. At the national level, national policies that promote environmentally sustainable transport policies should be developed and mandated. As part of SUMA, the UNCRD helped to establish National EST strategies and action plans (see Annex and Table 1). In order to achieve better air quality and livable cities through sustainable urban transport, there are policies that need to be strengthened or established at the national level, like vehicle emissions standards, fuel economy standards, and certain economic policies that promote sustainable transport. Policies and projects are grouped by avoid-shift-improve and policies can be further categorized based on the type of policy: planning, regulatory, economic, information, technological.

<table>
<thead>
<tr>
<th>AVOID</th>
<th>SHIFT</th>
<th>IMPROVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Promote mixed use development (compact, shorter trip distances)</td>
<td>• Provide non-motorized transport facilities</td>
<td>• Adopt EURO IV specifications for sulfur</td>
</tr>
<tr>
<td>• Incorporate green architecture principles in transport infrastructure design</td>
<td>• Integrate public transport network</td>
<td>• Strengthening road air quality management and assessment</td>
</tr>
<tr>
<td>• Travel demand management strategies</td>
<td>• Develop mass-transit systems, especially BRT</td>
<td>• Develop and enhance freight transport policies</td>
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24. At the city level, transport master plans should be placed in the context of a broader city and/or land use plans that considers sustainable urban transport policies as one of its cornerstone priorities. In several Asian cities, transport master plans or strategies typically cover twenty years. However, many other cities do not have such plans or have outdated or “traditional” plans focusing on supply improvement like construction of more roads and rail lines, without adequate linked to land-use plans and not including pedestrians, cyclists and commuters.

25. Transport master plans should aim to manage the demand for transport and mobility, rather than facilitate the demand and should be derived from the vision established in the previous step. For example, if access for all is considered an important criterion for a livable city, then transport systems must contribute to improving accessibility to all its citizens and not just for private vehicle owners. A green and healthy environment implies ample ability for people to walk and cycle, and clean air through clean fuels and low-emitting vehicles. Box 2 describes selected characteristics of a sustainable urban transport system that should be considered in transport master plans.

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26. At the same time, the identified policies and projects should be consistent with the transport master plan and the nationally existing and planned policies and projects, and could even be made part of the transport master plan for the city.

27. It is also important that transport modes are given different priorities in the selection of policies and projects. A vision of a compact and healthy city does not rhyme with a car-based city. At the same time, a spread-out city cannot be served by sidewalks and bicycle lanes alone. Within the selected transport modes different options may be considered. Whether a public transport system will consist of metro, heavy trains, light rail, bus rapid transit (BRT) systems or improved bus systems or a combination of these depends on the city. A growing city with a relatively large low income group and with still wide corridors available may opt for a less costly BRT system, whereas a metro system may be more appropriate for a wealthy and already dense city. For example, in Bangkok a light rail system and metro were built inside the city center, and improved bus systems are introduced in other parts of the city.

Box 2. Selected characteristics of a sustainable urban public transport system

- **Accessibility**: the proximity of destinations of choice and the facilitation offered by the transport system (including public transport and non-motorized transport to reach them).
- **Mobility**: both the ability to travel to destination of choice and the amount of movement required.
- **Availability**: availability to means of transport facilities such as buses or rail based systems.
- **Affordability**: cost of travel to destinations expressed as a certain percentage of household income.
- **Safety**: This relates to road safety as well as safety inside buses or trains (e.g. emergency exits), at platforms, station facilities and access routes to stations.
- **Health**: Exposure to hazardous chemicals or materials, air, dust, light and noise pollution of transport users and residents alongside transport routes.


3.2.2 Stakeholder dialogues

28. Consultation and dialogues with different stakeholder groups are needed to obtain feedback on policies and projects, which in turn will help with the selection of policies and projects for further feasibility analysis. These stakeholder groups most likely include all groups that were involved in formulating the vision for a livable city, and could be expanded with specific groups that have an interest or expertise in the transport topics covered by the proposed policies and projects.

3.2.3 Identify tools and expertise and build capacity

29. Various tools and methodologies are needed to review and design urban transport systems. Under SUMA, guidelines were developed for integrating motorized 2- and 3-wheelers, and cycling into urban transport systems, and walkability surveys were conducted for several Asian cities already (see Annex). However, guidelines for the design of roads in urban areas, including all aspects of roads, different transport
modes, and air pollution and GHG management in road constructions particularly for the Asian region are insufficiently developed. Most guidelines that exist are developed for highways or are incomplete or out of date.

30. In some developed countries, guidelines or manuals for a comprehensive urban transport network are available and can be used by cities in developing countries, albeit in an adapted fashion. An example is the United Kingdom's Department for Transport's Manual for Streets (2007), which includes guidelines and tools to effectively integrate non-motorized transport in the urban area.

31. In addition to tools and guidelines, organizations and individuals with the required expertise and experience to help analyze the proposed policies and projects, also must be identified at the local, national and/or international levels. Different organizations need to be involved for projects to, for example, improve pedestrian facilities as compared to building a BRT system.

3.3 Analysis of transport policies and projects

3.3.1 Feasibility analysis of selected policies and projects

32. Proposed policies and projects in support of an urban sustainable transport system should undergo a thorough analysis that includes the macro issues in society to which transport systems contribute. These analyses should include macro-economic analysis, political, economic, social, technological, and environment.

33. Expert organizations and individuals identified previously could assist with the feasibility analysis. Very often these are engaged through development banks or other organizations that will provide the loan or funds for implementation of policies and projects. The Cities Development Initiative for Asia (CDIA)\(^\text{12}\) specializes in conducting pre-feasibility analyses of projects, including transport projects, to bridge the gap between project ideas and full-fledged feasibility analyses.

34. The design and analysis of transport systems is a reiterative process, whereby the analyzed results are used to make revisions to the design of the system, and which may require subsequent analysis. To ensure that a realistic transport system is proposed, "core" or essential policies and projects could be distinguished from those that are not as critical to the functioning of the system and achievement of a sustainable transport system and contribution to a livable city.

35. Sometimes different projects may be assessed in parallel, for example a light rail system and a BRT system, to determine the most viable option. One of the most critical factors in designing the transport system is integration of different transport modes. Far too often, a public transport system is designed without proper attention to walking and cycling facilities, and public transport feeder systems. Roads are often designed for private vehicles (mostly cars) with pedestrian walking bridges added as an afterthought. The backbone of urban transport systems should be pedestrian and cyclist accessibility, and as well as public transport commuters.

\(^\text{12}\) www.cdia.org
3.3.2 Implementation plan

36. A common reason for poor urban transport systems is the limited implementation of good transport plans. In addition to a detailed analysis of the proposed transport system that is based on improving the mobility and accessibility of people, it is therefore equally important to ensure that the critical elements are in place for successful implementation and monitoring. The development of an implementation plan helps to make sure that these projects are implemented successfully and efficiently.

3.3.3 Design support framework for implementation

37. It is also important to design and establish a support framework before the implementation of the transportation policies and projects. This is often done by, or on behalf of, the government authority responsible for the policy, or the financier or developer of projects.

38. Five conditions for successful implementation of transport policies and projects are identified and examples for some are provided in the Annex:

- Political support, which relates to the decision-making on which policies and projects are approved following their feasibility analyses, as well as support during the implementation phase. This should not be underestimated because the political reality can be very different from what makes sense for a sustainable transport system.
- Institutional set up, which particularly applies to government agencies involved in the implementation and monitoring of policies and projects and cooperation amongst these.
- Financial arrangements, which will vary for different policies and projects, and amongst others, depends on whether a city is able to secure its own financing or whether support or a loan is needed from central government, a developer, or a commercial or development banks.
- Stakeholder involvement, which should not stop at the development of a vision and prioritization of policies and projects for their feasibility, but extend to the implementation phase. For example, a local agency or authority in partnership with civil society groups can be made responsible for the monitoring of the implementation of transport policies and projects and the extent to which they meet the criteria of a livable city and sustainable transport system.
- Capacity building remains as an important element of any efforts to improve urban transport systems. The capacity of government officials in developing countries is limited to address challenges of rapid motorization that take the form of traffic congestion, air pollution, road accidents, land changes, and investments needed to address these.

3.4 Implementation, monitoring, and evaluation of transport policies and projects

39. The last step of the inverted paradigm involves the implementation of transport projects, combined with ongoing monitoring and evaluation at specific intervals.
ANNEX. EXAMPLES FOR SUMA FRAMEWORK STEPS

The examples below are from the SUMA program and other ADB sources and illustrate different steps of the SUMA Framework.

Step 2. Integrated Transport Systems – Identify EST Policies and Projects

Example: Components of an Environmentally Sustainable Transport (EST) Strategy:

1. Public health
2. Road safety and maintenance
3. Traffic noise management
4. Social equity and gender perspectives
5. Public transport planning and transport demand management
6. Non-motorized transport
7. Environment and people-friendly infrastructure development
8. Cleaner fuels
9. Roadside air quality monitoring and assessment
10. Vehicle emissions control, standards, inspection and maintenance
11. Land use planning
12. Knowledge base, awareness and public participation


Example: Integrating Cycling into Urban Transport Systems

Cycling is reducing rapidly across Asia as motorized vehicles encroach road space. Transport projects, systems and policies often neglect cycling. The fact that in Asia, cycling is also considered a “poor man's vehicle” does not help. A bicycle-friendly infrastructure has to satisfy five main requirements:

- Coherence: a complete network with a very dense mesh of cycle lanes to connect origins and destinations
- Directness: routes with minimal detours and journeys with minimal stops (such as intersections with exclusive right of way for cyclists)
- Safety: minimum number of conflicting points or intersections with motorized vehicles or reduced intensity of conflict between cyclists and motorists (such as removing parking spaces from cycling lanes)
- Comfort: ease of finding and selecting routes and minimum nuisance such as noise, fumes, congestion, and motorized interferences.
- Attractiveness: degree of visual and spatial experience of the ride during the user’s journey.

These requirements have to be considered in planning, detailed design, implementation and management of bicycle friendly infrastructure.

Example: Integrating 2- and 3-wheelers into Urban Transport Systems

Many plans for transport systems insufficiently consider 2- and 3-wheelers, even though their numbers are high compared to other vehicles.

Some of the key considerations in integrating 2- and 3-wheelers in policies and design standards are:

- Limiting the number of cycle rickshaws through commercial vehicle regulation is better than banning cycle rickshaws or motor rickshaws on roads other than high-speed roads.
- Banning motorcycles as a traffic congestion mitigation measure will not be successful.
- Banning bicycles as a traffic mitigation measure will not be successful.
- Banning any vehicle types is justified in zones not in compliance with an international/national recognized ambient air quality or noise standard.
- Innovative use of road user charging should be explored to encourage use of 2- and 3-wheelers with lower weight, which generate fewer emissions, less noise, and operate at slower speeds.
- Banning access to motorcyclists (less than 125cc), bicyclists, cycle rickshaws, or motor rickshaws on specific roads based on unsafe driving and accidents is unjustified.


Step 3. Analysis – Feasibility Analysis of Selected Policies and Projects

Example political analysis: different public transport systems in Cebu, Philippines

Cebu City in central Philippines and adjacent cities form a fast-growing metropolis. Over the past 17 years many urban transport studies recommended rail as the solution to traffic problems. However, a rail-based system did not materialize, due to high investment costs combined with the limited improvement Metro Manila’s light rail system has brought for air pollution, road accidents, and traffic congestion. After visiting the Bus Rapid Transit (BRT) system in Curitiba, Brazil in the 1990s, the Mayor of Cebu City was convinced of the need for a strong land-use-integrated public transportation system, consisting of a BRT system combined with walkways and cycling facilities. His argument is that lower construction time and costs would allow for a larger bus system to be established as compared to a rail-based system, and would thus be better able to address traffic woes and pollution. Lower operating costs would also allow lower-income groups to benefit.

The Mayor sent official letters to relevant national government agencies and development organizations, rejecting the rail initiative. The Mayor and his city planning officer, in partnership with various organizations, and the Department of Transportation and Communications continue to advocate a transport system in Cebu that is not only more environmentally sustainable, but also more cost-effective, socially equitable and inclusive, and built on the principle that “people come first.” The political reality, however, is that various interests are at stake when deciding on a transport system, and there are strong voices for a light-rail system.

Source: Presentation of Paul Villarete, City Planning and Development Coordinator, Cebu City Government, at the SUMA Summit 29-30 October 2009.
Example technical analysis: development of a service plan for the BRT system in Ahmedabad, India

An operational or service plan is essential to provide a high performance system. From a BRT perspective, operational planning is required to identify and evaluate:

- Trunk routes on the segregated BRT corridors
- Feeder routes required to complement the trunk services
- Fleet required on each route based on service frequency, which in turn depends on passenger demand and minimum service requirements
- Schedule for trunk and feeder buses
- Terminals that buses will operate between
- Depots where buses will be maintained
- Locations where buses will be parked during driver breaks and off-peak periods
- Fare structure for the trunk and feeder service

From Ahmedabad’s perspective, the development of operational plan also helped in shortening, re-routing, removing other buses thus improving the effectiveness of the total system.


Example technical analysis: Walkability surveys to assess policies and access to infrastructures

Pedestrian accessibility should be a fundamental element of a good sustainable urban transport system. The ability to walk (“walkability”) in Asian cities has gradually deteriorated due to the increase of motorized vehicles. Motorization has also resulted in increased pedestrian facilities. Walkability surveys provide a tool to assess the supply, demand and needs of pedestrians. As such, these surveys assess the quality of infrastructure and supporting policies, and cover:

- Field Walkability Survey: state of the pedestrian facilities (sidewalks, crossings, obstacles, lighting, suitability for wheelchairs and prams, safety)
- Pedestrian Interview Survey: pedestrian needs and preferences (width of sidewalks, location and type of crossings, separation from roads, shading by trees, etc.)
- Government/Stakeholder Survey: the policies, roles and responsibilities of government and stakeholders in providing and maintaining pedestrian facilities.

Figure 6 shows that walkability infrastructure in Karachi, Pakistan, varies within the city. The pedestrian infrastructure availability and quality in central Karachi is much better than Tariq road, but when demand is considered, more people walk on Tariq road. Some of the main barriers found were narrow sidewalks that restrict access to disabled people, and insufficient road crossings.

With ADB and Fredkorpset support, the CAI-Asia Center conducted walkability surveys for Cebu, Davao and Manila (Philippines) Colombo (Sri Lanka), Hanoi and Ho Chi Minh City (Vietnam), Jakarta (Indonesia), Karachi (Pakistan), Kathmandu (Nepal), Kota (India), Hong Kong and Lanzhou (PRC) and Ulaanbaatar (Mongolia). Main findings are

- Scores ranged from relatively poor walkability (45 out of 100 points) to good walkability (70 points)
• Walkability is best around commercial areas in cities (61 points) and is surprisingly lowest around public transport terminals (54 points) despite the need for people to get to and from these terminals. Facilities for disabled people scored lowest, with only 39 points, indicating a neglect for this group.
• Most respondents (78%) are not willing to walk more than 100 m to pedestrian crossings. More importantly, if walking facilities are not improved, 81% of respondents indicated that they will shift to other transport modes. This means that unless the walkability of Asian cities is improved, we can expect a further rise in use of motorized transport as more people are able to afford this, thus leading to higher emissions.

![Figure 6. Results of a Field Walkability Survey in Karachi, Pakistan](score out of 100 points)


**Example environmental analysis: e-bikes in PR China**

Electric two-wheeler use has rapidly expanded in PRC. Rapidly changing the mode split of many cities. Currently, the PRC produces over 20 million electric bikes yearly, up from a few thousand a decade ago. In the past decade, about 40-60 million electric bikes have entered the transportation system, posing solutions to rising mobility challenges. But this also poses question of environmental impacts, performance, and future demand.

Electric bikes in the PRC are defined as electric two-wheelers with relatively low speeds and weights compared to a motorcycle. They are classified as bicycles and given access to bicycle infrastructure, but they can generally be classified as bicycle style electric bikes (with functioning pedals and bicycle styling) and scooter-style electric bikes (with many of the features of gasoline scooters). Few cities in other Asian
countries have any measurable presence of electric bikes. In countries with dominant gasoline two-wheeler mode split, it is expected that replacing those vehicles with electric two-wheelers could produce significant air quality improvement and greenhouse gas reductions.

An environmental impact assessment of e-bikes in PR China found that
- E-bike emissions per passenger km compared with a bus with 50 passengers produces 15% less CO$_2$, but more PM and SO$_2$: e-bikes produce less CO$_2$ than motorcycles but more SO$_2$; and generate less CO$_2$ and less air pollutants (PM, SO$_2$, CO, HC, NO$_x$) than cars.
- The main reason for higher SO$_2$ emissions is that electricity in PR China is largely generated by coal-fired power plants
- E-bikes can result in increased lead emissions—lead acid batteries, however lithium ion battery technology can prevent this.

<table>
<thead>
<tr>
<th>Table 2. Lifecycle Environmental Impact per Passenger Kilometer Traveled</th>
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</thead>
<tbody>
<tr>
<td><strong>Energy Use (kWh/100 pax-km)</strong></td>
</tr>
<tr>
<td>Car$^2$</td>
</tr>
<tr>
<td>Bus</td>
</tr>
<tr>
<td>Motorcycle</td>
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<tr>
<td>Bicycle</td>
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<td>BSEB</td>
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<td>SSEB</td>
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</tbody>
</table>


**Example environmental and economic analysis from urban transport systems**

Environmental analysis of transport projects, systems and policies is needed to review their environmental impact, and thus allows for the identification of design mitigation strategies and less polluting transport systems. With an increasing realization that transport causes air pollution and CO$_2$ emissions, an environmental analysis that includes both will allow identification of measures that reduce both types of emissions.

It is important to note that expression of air pollution and CO$_2$ emission in monetary terms will not significantly influence the economic analysis. Figure 7 provides an example of earnings/cost savings from CO$_2$ and fuel reductions for a bus rapid transit system in Mexico City. The figure shows that even when the price of carbon is increased from $5 to $85 that the CO$_2$ benefits are very modest. Health cost benefits from lower air pollution also is relatively small compared to fuel savings. In order to have a balanced assessment of projects, systems and policies a multi-criteria analysis is needed to supplement the economic analysis.
Framework for Achieving Sustainable Urban Mobility in Asian Cities

Figure 7. Relative Impact of CO2 Reductions on the Financial benefits for a BRT system in Mexico City

Sources:

Example social analysis: Performance indicators for selected social issues of public transport systems

- Accessibility: spatial distance to education, health care, services, or the bus stop per household unit, whereby the lower the distance the higher the accessibility.
- Mobility: Daily travel time to work or education per household or daily trip fare to work or education per household unit, whereby the higher the value the higher the mobility.
- Availability: Types of public transport are available, number of change-overs or different types of public transport needed to reach certain destinations.
- Affordability: Cost of fares for traveling to different destinations compared to household income.
- Health: Noise levels expected around public transport systems compared to standards. Expected air pollution levels at bus stops compared to ambient air quality standards.
- Time saving: Amount of time to reach a destination by public transport compared to private vehicles. Comparison of trip durations with one year ago.


Step 3. Analysis – Design support framework for implementation

Example political support: Cycle unit in Pune

Pune Municipal Corporation (PMC), in order to improve conditions for and promoting cycling and walking, created an NMT cell which acts like an NMT watchdog. The responsible agency is the Municipal Commissioner Office, under the PMC. All the proposals originating from the NMT cell, upon due
consideration by the Municipal Commissioner, are conveyed to the concerned departments for action. The concerned departments must provide information, data and personnel as needed by the NMT cell and report back on progress of action items. More details are provided at http://government.wikia.com/wiki/N.M.T%28Non-Motorized_Cell%29

**Example institutional set up**

Figure 8 illustrates an example of the agencies at the city level that are responsible for different aspects of the urban transport system. A central agency, which in this example is the city government or municipality, needs to oversee and coordinate the segregation of roles and collaboration between different agencies.

![Institutional set up diagram](image)

**Figure 8. Institutional set up: typical institutional set up of a sustainable transport system**

**Example capacity building**

Under SUMA, following a variety of training schemes and activities by GTZ-SUTP ranging from training of trainers conducted in India and PRC to more specialized training courses, SUMA partners and other stakeholders determined that future efforts should

- Place more emphasis on applied research rather than just isolated training courses.
- Ensure a longer-term support from donors
- Build institutional capacity in addition to capacity building of individuals, otherwise the institutional memory disappears when the individual leaves
• Develop training for different levels of government officials and other stakeholders involved in transport system design and implementation: decision-makers, managers and practitioners/operators
• Integrate SUT into academic courses to ensure that a future generation of transport planners, engineers and other transport practitioners will incorporate sustainable development thinking into the design and implementation of transport systems.

This is reflected in the capacity building components in Figure 9.

Figure 9. Capacity building: Components of an SUT capacity building approach in Asia

**Step 4. Implementation – Monitoring**

**Example: Monitoring system of public transport systems**

A management system is required to monitor the performance of public transport systems, especially if the system is expanding. It involves monitoring of scheduling, routing, user interaction, safety, reliability, regularity of service and utilization of rolling stock. Monitoring allows tracking of current operations and projecting forecasts. Using this information, a transport operator can re-organize operations to cater to the evolving demand and passenger needs.
Figure 10. Performance Monitoring System of Indore

Source: Partnering with Indian Institutions and organizations for sustainable urban transport: a showcase of the experience of WRI-EMBARQ in India. (2009)