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Environmentally Sustainable Transport for Asian Cities: A Sourcebook

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Front cover (Kunming, China) and back cover (Kyoto, Japan) photos by Lloyd Wright.
Preface

Effective access and mobility is a basis for making sustainable human development a reality. In Asia today, though, as the streets become increasingly congested and contaminated, the strides being made in economic development are at risk. The uncontrolled growth of cars and motorcycles has undermined human health, urban environmental quality, economic productivity, and social equity.

This Sourcebook on Environmentally Sustainable Transport for Asian Cities seeks to offer an alternative to the current mobility form of urban centres that are increasingly chaotic, dangerous, unhealthy, and environmentally damaging. Measures and practices such as efficient public transport, quality public space and cycleways, and prudent restrictions on private motorised vehicles have proven effective in not only reducing the negative impacts of unsustainable transport but also in providing a means to improve the basic quality of human life.

This document highlights the best practice in Environmentally Sustainable Transport as evidenced by the efforts of leading cities in Asia such as Hong Kong, Seoul, Singapore, and Tokyo. Additionally, this document builds upon the body of knowledge and leadership shown in examples globally, including Amsterdam, Bogotá, Brisbane, Copenhagen, Curitiba, Guayaquil, Rouen, and Zurich.

Beginning in 2004 with the development of the "Manila Policy Dialogue on Environment and Transport in the Asian Region", UNCRD, in collaboration with the Ministry of Environment of Japan, has sought to help create a new paradigm in transport practices for the region. With the assistance of world-leading sustainable transport experts and governmental partners, UNCRD developed the "Aichi Statement" in 2005. This statement outlined specific actions that cities can take across 12 major areas of Environmentally Sustainable Transport (EST). Additionally, the Aichi Statement marked the launch of the Regional EST Forum which brings together all major regional stakeholders in addressing the urgent problems facing Asia’s urban transport sector.

This Sourcebook has been prepared in advance of the "Asian Mayors Dialogue on Environmentally Sustainable Transport” being held in April 2007 in Kyoto. This event marks another milestone in setting a new standard of environmental excellence for sustainable transport practices in Asian cities. By sharing knowledge amongst Mayors in the region and by offering support to those cities wishing to pursue a more sustainable path, UNCRD hopes that catalytic new examples will emerge.

The Sourcebook has been produced at a critical juncture in the development of Asian cities. This year has already given us the news from the Intergovernmental Panel on Climate Change (IPCC) in which the dangers and spectre of global climate change are ever more worrying. The transport sector is already recognised as the fastest-growing source of greenhouse gas emissions, and Asia is at the front edge of this wave towards increasing motorisation and increasing emissions.

As populations continue to intensify in urban areas, the provision of sustainable transport becomes even more pressing in environmental, economic, and social terms. Once an automobile culture becomes entrenched in the rapidly-growing economies of Asia, there will be few opportunities to reverse the consequences. Thus, now is the time to act to move towards a more sustainable path before irreparable damage is done to the quality of our life today as well as that for future generations. We only require the will to do it.

Kazunobu Onogawa
Director, UNCRD
Acknowledgements

The Sourcebook for Environmentally Sustainable Transport has been made possible by the exceptional efforts of a wide group of governmental officials, partner organisations, international experts, and UNCRD staff. Only by drawing upon such a wide-range of experiences can a truly comprehensive set of best practices be compiled.

Much credit must be extended to the members of the Regional Forum on Environmentally Sustainable Transport (EST). This group, which was formed out of the development of the Aichi Statement, has contributed greatly to articulating the specific components of EST and in helping to disseminate that message.

The Regional EST Forum particularly depends on the sincere involvement and efforts of the participating countries. Thus, special appreciation is given to the participating countries of: Brunei Darussalam, Cambodia, P. R. China, Indonesia, Japan, Lao PDR, Malaysia, Mongolia, Myanmar, Philippines, Republic of Korea, Singapore, Thailand, and Viet Nam.

Additionally, the Regional EST Experts Forum has provided much of the technical knowledge that has supported the EST Project. The members of this forum include: Christopher Weaver (EF&EE), Narayan Iyer (SAFE / SIAM), Masahiko Hori (JARI), Manfred Breithaupt (GTZ SUTP), Katsutoshi Ohta (Toyo University), Karl Fjellstrom (ITDP), Charles Melhuish (ADB), Nozomu Mori (JACIC), Tohru Suzuki (JHPC), William H. K. Lam (Hong Kong Polytechnic University), Lloyd Wright (Viva), Fumihiko Nakamura (Yokohama National University), A.T.M. Nurul Amin (AIT), Yoshitsugu Hayashi (Nagoya University), William Barron (Civic Exchange), Hisashi Ogawa (WHO), Cornie Huizenga (CAI-Asia), and Marie Thynell (Göteborg University).

UNCRD’s own EST staff has applied much effort to ensuring this document and all the related EST events are co-ordinated and delivered in an effective and professional manner. Members of the UNCRD EST team include: Kazunobu Onogawa, Choudhury Rudra Charan Mohanty, Ken Shimizu, Tadahiro Shibata, Yoshiro Kaburagi, Sayako Kimura, and Sayaka Iizuka.

UNCRD is not alone in its efforts to promote Environmentally Sustainable Transport in Asian nations. The collaborating agencies in this effort include: Asian Development Bank (ADB), ASEAN Working Group on Environmentally Sustainable Cities (AWSGSC), Clean Air Initiative for Asian Cities (CAI-Asia), Institute for Global Environmental Strategies (IGES), Overseas Environmental Cooperation Center (OECC), German Agency for Technical Cooperation (GTZ), Swedish International Development Agency (Sida), Seoul Development Institute (SDI), World Health Organization (WHO), and Japanese International Cooperation Agency (JICA).

UNCRD would also like to express gratitude to the Ministry of the Environment of the Government of Japan for providing the financial support to the critical issue of Environmentally Sustainable Transport in Asia. The ministry’s expertise and investment has already made a positive difference in cities across the region.

Finally, UNCRD would like to express appreciation to the Mayors and other officials who have come together for the Mayors Dialogue in Kyoto. Without the political will and seriousness shown by this group of leaders, Environmentally Sustainable Transport would not be growing in awareness and reality in cities of Asia.
Introduction to Environmentally Sustainable Transport

“Efforts to promote environmentally sustainable transport will result not only in the improvement of human health through the reduction of urban air pollution but will also have important complimentary benefits, including the reduction of greenhouse gas (GHG) missions, the reduction of deaths and injuries from road accidents, the reduction of harmful noise levels, and the reduction of traffic congestion levels.”

Aichi Statement, 2005

Asian cities are at a crossroads. Along the current path, growing numbers of cars and motorcycles will overwhelm streets and neighbourhoods. Pollution, congestion, and accidents will become Asia’s defining features. The cities will be less a place for human interaction than for storing and operating metal machines.

Yet, there is another path. Environmentally Sustainable Transport (EST) offers an alternative to uncontrolled motorisation and its related problems. Instead, a complementary package of public transport, quality footpaths and cycleways, vehicle-restriction measures, clean fuels, safety programmes, and high standards will create a new paradigm for urban mobility and access.

Many cities in the region, such as Seoul and Singapore, have already adapted many of these elements as part of a comprehensive policy towards a more human urban environment. This EST Sourcebook sets forth the elements of a complete EST strategy for Asian cities.
Urban transport and sustainable development

The ability to access jobs, education, and public services is a fundamental part of human development. An efficient and cost-effective transport system essentially connects people to daily life. For many Asian cities, though, effective transport has been forgone, leaving mobility needs exclusively in the hands of private vehicles and uncoordinated paratransit operators.

Transport services affect all aspects of sustainability. First, the ability to move goods and people is inextricably linked to economic development. A city locked in congestion is a city losing a significant portion of its economic productivity. Second, the ability to safely and cost-effectively access jobs and public services carries direct implications for social sustainability. Providing quality public transport services and non-motorised options is an essential part of achieving greater social equity for all, and especially for transport-sensitive groups including the poor, women, children, the elderly, and the physically disabled. Finally, mobility and the quality of the urban environment cannot be separated. Existing transport systems and the resulting impacts on air quality are closely associated with questions of environmental sustainability.

Figure 2. The many impacts of unsustainable transport
Current conditions

Current trends in Asia show that cars and motorcycles are increasingly becoming dominant in nearly every city of the region. By the year 2045, there will be more motorised vehicles in Asia than there will be in Europe and North America combined. It is questionable whether Asian cities and the global environment could support such an outcome.

Few cities can afford to build themselves out of traffic congestion. Asphalting over Asian cities will in the end only destroy the urban fabric without really changing congestion levels. The endless construction of flyovers and elevated roadways in many Asian cities has absorbed large sums of capital but has not kept pace with the growing demand for cars and motorcycles.

The impact of this trend on quality of life cannot be underestimated. As cities become saturated with vehicle traffic, then community interactions and social bonds will become permanently severed.

While investment in motorways has expanded, all too often more critical elements of transport infrastructure have been forgotten. Footpaths, cycleways, and public transport services in much of the region are in poor condition. Merely attempting to walk in many Asian cities can be quite challenging.
As this document will assert, there is another way. The principles of Environmentally Sustainable Transport (EST) offer a cost-effective way forward that affords high levels of mobility and access but without the intrinsic problems associated with car-dominated streets.

EST represents a collection of best practice measures that can help to transform transport and the very urban structure of cities towards a more sustainable model. Through the development of "environment and people friendly urban transport infrastructures", cities can reap the benefits of a more liveable and more productive urban space.

EST is also about prevention. It will clearly be less costly to prevent negative consequences of motorisation rather than to try to retroactively mitigate the problems. The leadership shown in cities such as Bogotá, Curitiba, and Seoul indicate that Environmentally Sustainable Transport is possible in a variety of circumstances and local conditions.

The remainder of this Sourcebook will outline a synergistic package of EST measures that any city can implement within a period of a few years. The structure of this Sourcebook is based on the 12 thematic areas of the UNCRD EST Project.
1. Public health

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

Henrik Tikkanen, author and artist, 1924 - 1984

World air quality rankings show that Asian cities are by far the most polluted across a full range of contaminants, including particulate matter, nitrogen oxides, and carbon monoxide. A recent WHO/ADB study shows that the transport sector is the largest contributor of urban air pollution, with 50 to 80 percent of Metro Manila’s pollution being from vehicles.

Air pollutants from transport are linked to several illnesses, most notably respiratory and cardiovascular illnesses. Epidemiological studies have directly linked transport-related contaminants to asthma, bronchitis, heart attacks, and strokes. A survey of studies shows that the number of deaths from outdoor air pollution ranges from 200 000 to 570 000 annual deaths globally (WRI, 1998).

In addition to premature mortality, there are also other economic costs resulting from pollutant-induced illness. Hospital admissions, lost workdays, discomfort, and stress are just a few of these impacts. Air pollution also harms tourism and degrades the built environment.

The most vulnerable groups are those with weaker immune systems, which include “infants, the elderly, and those suffering from chronic respiratory conditions including asthma, bronchitis, or emphysema” (WHO, 2000). In developing-nation cities air pollution causes an estimated 50 million cases of chronic coughing in children under the age of 14 years (WRI, 1998). Sadly, leaded fuels, which impair the mental development of children, are still in use in some nations.

Figures 9. Respiratory and cardiovascular illnesses are the most common health issues related to vehicle emissions. Photo courtesy of Swisscontact.

Figure 10. Vehicle emissions can have a serious impact on child development. Photo courtesy of Swisscontact.

Obesity has become another outgrowth of societies dependent less on walking and more on private vehicles. In a survey of Beijing residents, the Beijing Centre for Disease Control and Prevention uncovered the following troubling results:

- 32 percent of Beijing residents suffer from coronary heart disease, hypertension, or obesity
- 47 percent of the population rarely or never undertook exercise
- 18 percent of all secondary students qualify as obese.

The best mechanism to combat such health effects is to reduce private vehicle use. Through the application of Environmentally Sustainable Transport (EST) measures, such as public transport, clean fuels, and non-motorised options, emissions can be eliminated before they cause harm.
2. Road safety and maintenance

"Not everything that counts can be counted, and not everything can be counted counts."

Albert Einstein, physicist, 1879 - 1955

Globally, approximately 1.2 million lives are lost through roadway accidents each year (WHO, 2003). More deaths occur due to road accidents than through many other high-profile causes, including malaria, measles, and breast cancer. More disturbingly, almost half of these deaths are not to the motorists themselves but rather pedestrians and cyclists.

In Asia, injuries and deaths from road accidents have reached near epidemic proportions. Nations in Asia have traffic fatality rates some 80 times higher than European nations. In ASEAN countries alone, an estimated 75,000 persons die each year on the roads and another 4.7 million are injured. All together, the ADB estimates that the economic losses from such tragedies are US$ 15.1 billion per year, or approximately 2.2 of the regional Gross Domestic Product.

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<thead>
<tr>
<th>Country</th>
<th>Police reported</th>
<th>Estimated*</th>
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<tr>
<td></td>
<td>Deaths</td>
<td>Injuries</td>
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<td><strong>Total ASEAN</strong></td>
<td><strong>43,259</strong></td>
<td><strong>187,343</strong></td>
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* Based on local research, health statistics, sample surveys, or international experience.

Source: ADB, 2003
To combat this alarming problem, ADB has launched several initiatives as well as has provided technical manuals on road safety. Proper maintenance programmes for both roadways and vehicles are also a principal means to reduce the death and injury rates. Sweden’s "Zero Tolerance" programme in which the nation has set its aims upon zero road traffic deaths has become a world-wide model, one which many Asian nations and cities may wish to investigate.

3. Traffic noise management

"The system of nature, of which man is a part, tends to be self-balancing, self-adjusting, self-cleansing. Not so with technology." (Small is Beautiful)

E.F. Schumacher, economist, 1911 - 1977

Noise is also a growing concern from both the perspectives of health and economic productivity. Noise from vehicle operation, horns, and car alarms can all bring negative health consequences. The World Health Organization (WHO) has documented the most common problems associated with sustained and/or excessive noise levels (WHO, 2005):

- Pain and hearing fatigue
- Hearing impairment including tinnitus
- Annoyance
- Precipitation of anti-social behaviour (aggressiveness, protest and helplessness)
- Interference with speech communication
- Sleep disturbance and all its consequences on a long and short term basis
- Cardiovascular effects
- Stress and its possible consequences on human metabolism (nutrition) and the immune system
- Negative impacts on work and school performance.

Sustained exposure to noise has been associated with reduced cognitive development and classroom performance of children (Evans and Maxwell, 1997). Even seemingly harmless background noise has been indicted for its impact on the ability to concentrate. In turn, these lapses in concentration carry with them implications for worker productivity and child development.

The best measure against noise pollution is to simply prevent it from happening in the first place. Promoting silent, non-motorised options (such as walking and cycling) is the most effective policy direction. Likewise, shifts from private to public modes can lead to substantial noise reductions. In some cases, mitigation measures such as sound barriers and porous road surfacing may be necessary, although such infrastructure can often be far more expensive than noise prevention.

Figure 14. The cacophony of noise generated from chaotic transport systems harms human health and undermines city-wide productivity. Photo by Karl Fjellstrom.
4. Social equity and gender perspectives

"Any town that doesn’t have sidewalks doesn’t love its children."

Margaret Mead, anthropologist, 1901-1978

The transport inequities experienced in Asian cities are most acutely experienced by groups that are least able to cope with the difficulties. Gender and age inequities create mobility challenges for large parts of the population. Women face specific restrictions on movement due to the nature of their activities in many cities. Activities such as child-care, household management, and informal sector employment “require women to make more and shorter trips than men, more trips at off-peak hours and off the main routes, and engage in more complicated multi-leg trips, all of which tend to make their movements relatively expensive to provide for by public transport, and hence highly priced or poorly supplied” (World Bank, 2001). When 700,000 squatters resettled on the periphery of Delhi, female employment fell by 27 percent due to the limited transport options available.

The provision of public transport with regular services throughout the day and with good physical and fare integration can do much to help women travellers. Likewise, provisions for patrons carrying children as well as amenities such as baby changing areas should be considered in all design efforts.

Figure 16. As shown with the steep access to this pedestrian bridge in Bangkok, infrastructure sometimes fails to account for more vulnerable users. Photo by Lloyd Wright.

Figure 17. Child- and bicycle-friendly infrastructure can do much to ease transport burdens on women. Photo by Lloyd Wright.
Women may also be more susceptible to insecurity related to travelling alone or by way of public transport, which may force women to depend upon more expensive alternatives or to forgo important trips. Thus, the presence of security staff, security cameras, and good-quality lighting can do much to give women more confidence with public transport and public space.

5. Public transport planning and transportation demand management (TDM)

"The technologies which have had the most profound effects on human life are usually simple."

Freeman Dyson, physicist, 1923 -

For much of Asia, public transport is a necessary evil that must be endured rather than appreciated. For many individuals and families, the ultimate goal is to one day afford individual motorised transport, either in the form of a motorcycle or automobile. The state of public transport implies discomfort, long waits, risk to personal safety, and restrictions on movement. Customer satisfaction with the myriad of informal and formal vans, mini-buses, and full-sized buses that ply Asian streets is typically quite low.

However, high-quality public transport is possibly more affordable than many cities are aware. The advent of Bus Rapid Transit (BRT) has done much to enable virtually any city to achieve a world-class public transport system. BRT is a high-quality bus-based transit system that delivers fast, comfortable, and cost-effective urban mobility through the provision of segregated right-of-way infrastructure, rapid and frequent operations, and excellence in marketing and customer service. BRT essentially emulates the performance and amenity characteristics of a modern rail-based transit system but at a fraction of the cost. A BRT system will typically cost 4 to 20 times less than a light rail transit (LRT) system and 10 to 100 times less than a metro system (Wright and Hook, 2007).
The Latin American cities of Bogotá and Curitiba have done much to demonstrate the effectiveness of BRT systems. However, several Asian cities have now also developed systems of their own, including Beijing, Hangzhou, Jakarta, Nagoya, Pune, Seoul, and Taipei. New projects are currently underway in several cities, including Ahmedabad, Bangalore, Bangkok, Chiang Mai, Delhi, Guangzhou, Hanoi, and Xi’an.

To make a truly car-competitive public transport system, cities must focus on some key customer-service oriented attributes, including:

- Existence of an integrated “network” of routes and corridors
- Enhanced stations that are convenient, comfortable, secure, and weather-protected
- Stations provide level access between the platform and vehicle floor
- Special stations and terminals to facilitate easy physical integration between trunk routes, feeder services, and other mass transit systems
- Pre-board fare collection and fare verification
- Distinctive marketing identity for system.
Rail-based services can also be quite appropriate in the right circumstances, especially on corridors with very high customer demand and when cities have sufficient resources to finance a higher-cost option. Technologies such as LRT, commuter rail, elevated rail, monorails, and underground metros can all have applicability under the right conditions. In Asia, cities such as Hong Kong, Osaka, Singapore, and Tokyo have achieved much success with rail-based systems.

Bangalore Metropolitan Transport Corporation (BMTC) has adopted a well-structured, constructive management polices and maintained the tradition of putting constant efforts for safe, affordable and commuter-friendly services. By focusing on safety, reliability and efficiency, the Corporation has been able to improve public transport systems while at the same time able to achieve a record surplus of 1,148.80 million rupees in 2005-06 and is anticipating a surplus over 2,000 million rupees during 2006-07. (Source: BMTC, India through personal communication, 6 April 2007)

A high-quality public transport system, though, is just one side of the equation. Combining public transport with transportation demand management (TDM) measures that discourage car and motorcycle use is the most effective package to transform the transport sector.

Congestion charging was originally popularised with its application in Singapore and now has gained fame elsewhere, including in the cities of London and Stockholm. Congestion charging places a monetary value on using the road space during certain hours of the day. Motorists who wish to enter a congestion zone must pay a fee to gain legal access to the use of the road.
From 1975 until 1998, Singapore operated a manually-controlled road pricing scheme. The scheme requires motorists to pay for entry into a central Restricted Zone. Technological advances enabled the city to implement an Electronic Road Pricing (ERP) scheme in 1998.

Singapore has also successfully curbed vehicle ownership and usage through a clever application of fees and a Certificate of Entitlement (COE) programme. The city essentially fixes the market for the number of vehicles that can use city streets.

Parking fees, restrictions, and enforcement can also be highly effective TDM measures. Simply charging the appropriate fee for use of a private or public parking space can help to ensure vehicles pay for the resources consumed. Parking space levies as applied in Australia both discourage private car use and raise revenues for public transport development. Sydney charges a levy of A$ 800 (US$ 615) per year on each central area parking space, whether the space is used or not. The parking levy is currently returning approximately A$ 40 million (US$ 31 million) per year to the city.

Bogotá utilises a fairly simple license tag restriction in which 40 percent of the private cars are prohibited from the city streets each day during the morning and afternoon peak.
6. Non-motorised transport

"At first it may appear that pedestrian space is a frivolous issue in a developing country; but the privations of low income people are not really felt during working hours - it is during leisure hours that the differences are felt. While higher income people have cars, clubs, country houses, theatres, restaurants and vacations, for the poor, public space is the only alternative to television. Parks, plazas, pedestrian streets and sidewalks are essential for social justice. High quality sidewalks are the most basic element of respect for human dignity, and of consideration for society's vulnerable members such as the poor, the elderly and children."

Enrique Peñalosa, former Mayor of Bogotá

The simplest and most environmentally-sustainable transport options are unfortunately also some of the most neglected. Footpaths in Asian cities are often of poor quality, and create an assortment of barriers for residents:

- Unpaved and/or uneven footpaths
- No physical separation from high levels of traffic and from high-speed traffic
- Lack of infrastructure to permit crossing of street
- Obstructed pavements due to car parking, vendors, etc.
- No protection from harsh climatic conditions (e.g. no shading or rain protection)
- Lack of street lighting
- Pedestrian overcrowding due to narrow or below-capacity pavements
- High levels of robbery, assault and other crime befalling pedestrians

Simply improving the quality of local footpath networks can be one of the most cost-effective EST measures. In some cases, it may be possible to entirely pedestrianise streets to create a very social and human-friendly environment. Pedestrianisation schemes have also been the basis for economic regeneration efforts, as shops sales often improve dramatically. Waterfront regeneration efforts, such as Singapore’s Boat Quay and Osaka’s Dotomburi have been successfully instigated through pedestrianisation. Nanjing Road in Shanghai is the world’s busiest pedestrian mall.

Figure 28. Nanjing Road in Shanghai is the world’s most successful pedestrian mall, proving such schemes do indeed add much economic and social value to the city. Photo courtesy of ITDP.
Car-free days have become increasingly popular as a mechanism to curb car and motorcycle use as well as encourage citizens to experience their city in a personal manner. Each year, World Car Free Day is held on 22 September. In 2007, China has committed to participating on a nation-wide scale. In some cities, such as Bogotá and Tokyo, sections of the cities are closed to cars each Sunday in order to allow families to stroll at ease in the city.

Bicycles have historically played a vital role in Asian transport. Ironically, even as environmental concerns become ever more important in the region, many cities have actively discouraged bicycle use. The restoration and expansion of cycle-ways and the promotion of a bicycle lifestyle should be a priority within any EST strategy. The provision of secure bicycle parking at public transport stations can be an effective cornerstone of making cycling a formal part of the transport system.
Bicycle taxis or pedicabs have likewise been unfortunately banned in many parts of Asia (e.g. Bangkok, Delhi, and Jakarta). However, a revolution in pedicab design has helped to rejuvenate the viability and market for these services. As pedicabs and cycle rickshaws are being banned in parts of Asia, their usage in Europe and North America is expanding at a rapid rate.

Through a collaboration between ITDP and several local partners, a modernised cycle rickshaw has been developed for the Indian market. The project produced a modern, light weight vehicle at a modest cost. Today, over 100,000 modernised pedicabs are plying the streets of Indian cities. Likewise, Manila has long had a history of pedicabs as a useful community transport service.

Figures 32 and 33. Modernised pedicabs have helped lead a renaissance in the use of this sustainable mode. Photos by Lloyd Wright.
7. Environment and people friendly urban transport infrastructures

"The Cheonggyecheon stream, which had been covered with roads and concrete overpasses for a long time, glistened in the bright sunlight as the clear, clean water flowed. The sight of the stream flowing again after so long has special significance beyond merely environmental and cultural restoration. It seemed to open the hearts of Seoul citizens, washing away the darkness and sufferings of the hectic economic development period of the modern history of Seoul."

Lee Myung-Bak, former Mayor of Seoul

Unlike car-based infrastructure such as roadways and flyovers, EST infrastructure is based more on the human scale. And thus, such infrastructure is orders of magnitude less costly. "Environment and people friendly urban transport infrastructures” imply the customer is placed at the centre of the design process.

Perhaps the most renowned infrastructure project of the past decade in Asia was the Cheonggyecheon restoration project in Seoul. The Cheonggyecheon stream was historically a defining part of Seoul’s environment, and in fact was the reason why Seoul was selected as the capital of the Joseon Dynasty in 1394. Unfortunately, in the face of modernisation, the waterway was covered in 1961 to provide better access for private cars. By 1968 an elevated expressway provided another layer of concrete erasing the memory of the waterway.
Upon his election in 2002, Seoul Mayor Lee Myung-Bak decided it was time to bring back the Cheonggyecheon stream from its years of hiding under concrete. The Cheonggyecheon project has meant the restoration of 5.8 kilometres of waterway and historical pedestrian bridges, the creation of extensive green space, and the promotion of public art installations. Based upon a study by the Seoul Development Institute (2003), the Cheonggyecheon restoration project will produce economic benefits of between 8 trillion and 23 trillion won (US$ 8 billion to US$ 23 billion) and create many new jobs. Over 40 million visitors experienced the Cheonggyecheon stream during its first year after restoration.

People-friendly infrastructure also refers to designing for society’s most disadvantaged. By building public transport systems and footpaths that cater to the physically disabled and the elderly, the infrastructure is friendly to everyone. Design should be undertaken from the perspective of the most vulnerable users.

Figure 36. Over 40 million visitors have made their way to see the Cheonggyecheon restoration. Photo courtesy of the City of Seoul.

Figure 37. Level, even surfaces across the transport system can do much to make the city accessible to everyone. Photo courtesy of Queensland Transport.
8. Cleaner fuel

"We must learn to provide affluence without effluence...by consuming less from the environment, not more. We can use less, and have more. Consume less, and be more. The interests of business, and the interests of environment, are not incompatible.”

Tachi Kiuchi, former CEO of Mitsubishi

Technology alone will not win back Asian cities. A sole focus on tailpipe technologies and fuels means little against the growing tide of motorisation. However, cleaner fuels and propulsion technologies are one component of a complete sustainable transport package. Some of the fuel options available may include:

• Clean diesel
• Compressed natural gas (CNG)
• Liquid petroleum gas (LPG)
• Electric
• Bio-diesel
• Ethanol
• Hybrid-electric (diesel-electric and CNG-electric)
• Hydrogen (fuel cell technology)

The choice of fuel and propulsion technology will have a profound impact on operating costs, maintenance costs, supporting infrastructure, as well as emission levels. Local circumstances play a central role in fuel choice as the availability of a fuel and experience in maintaining a particular vehicle technology are key factors. There is no one right solution to fuel technology.

The adoption of compressed natural gas (CNG) public transport vehicles in Delhi has done much to improve air quality. CNG was chosen in order to overcome the problem of diesel fuel being adulterated with kerosene.

In the future, advanced technologies such as hybrid-electric vehicles, biofuels (ethanol and biodiesel), and fuel cells may play a bigger role, especially as economies of scale are achieved and costs are reduced. Cities can help make the transition to cleaner fuels a reality by converting city vehicle fleets to alternative fuels. Local government leadership can help to establish new markets for these fuels as well as provide the pre-requisite re-fuelling infrastructure.
9. Strengthening road side air quality monitoring and assessment

"Plan for what is difficult while it is easy, do what is great while it is small. The difficult things in this world must be done while they are easy, the greatest things in the world must be done while they are still small." (The Art of War)

Sun Tzu, Chinese General, 400 BC

Asia’s fast-growing economies have left behind a trail of smog and toxic-laden air in many of its largest cities. Vehicle emissions are one of the principal contributors to poor air quality. Establishing an air quality monitoring regime can help decision makers understand the severity of the problem.

Air quality monitoring actually can encompass several different levels of measurement. Ambient monitors will capture the general background air quality levels of the city. These ambient measurements provide the basis for comparing to the established norms of the World Health Organisation (WHO). However, there can also be reason to measure air quality levels at a much more localised level.

In many cases, the person walking along the street may experience contaminant levels well in excess of those experienced at the ambient level. Further, some vulnerable groups may be more exposed to contaminants than others. For example, the height of children means that they are actually more in the direct line of exhaust tailpipes. Low-income persons often work from informal stalls quite near the roadway, and may spend as much as 10 to 14 hours per day in an environment of intense emissions. Likewise, traffic police may spend long hours in direct contact with traffic and contaminants. For these special groups, spot monitoring of localised effects should be undertaken on a regular basis.

Ideally, an air quality monitoring system will already be in place. However, in many Asian cities, there may be an insufficient number of air quality monitoring stations or such stations may not exist at all. Discussions with both the national environmental agency as well as international organisations, such as the Clean Air Initiative, the World Bank, and the Asian Development Bank, should be undertaken to find a way of establishing an air quality monitoring network.
10. Vehicle emission control, standards, and inspection and maintenance (I/M)

“For a successful technology, reality must take precedence over public relations, for nature cannot be fooled.”

Richard P. Feynman, physicist, 1918 - 1988

Vehicle emissions testing should be a formal part of the regulatory code, both for new and older vehicles. Semi-annual or annual testing should be a base requirement to obtain an operating license for any vehicle. Many Asian nations have already adapted Euro II standards, and in cases such as Hong Kong and Thailand, Euro III standards are being applied. Setting strict standards for all new vehicles is one of the most effective mechanisms to renovate the overall fleet. At the same time, testing requirements should also apply to the existing, older vehicle.

In addition, spot monitoring on the roadway can also be appropriate. In some cases, drivers may specially fix their vehicles to pass a known, one-off annual test. However, once the test is finished, the owner may remove filters and other emission reduction devices. Random street tests thus serve the purpose of ensuring the actual vehicle performance meets the regulatory standards.

11. Land-use planning

“A good city is like a good party, people don’t want to leave early.”

Jan Gehl, Copenhagen planner and architect

“Land use” refers to the geographic distribution of activities and destinations within a city. A close relationship exists between a city’s land-use patterns and its transport system. Land use is sometimes defined by the 3 “Ds”: 1. Density; 2. Diversity; and, 3. Design.

Urban density refers to the number of inhabitants per hectare. The denser the city, the closer jobs and services are to the population. Areas with medium- and high-density populations provide a critical mass of inhabitants to support shops and public services without requiring access by motorised vehicles. By contrast, a highly sprawled city will force car dependency since it is difficult to operate public transport in low density areas. While Asian cities have historically enjoyed effective density levels, the current trend is towards new development in suburban areas.

Figure 43. Random, on-street spot monitoring of vehicles can be an effective way of ensuring regulatory norms are met in practice. Photo courtesy of UNCRD.

Figure 44. Asian cities have historically achieved good density levels, but there are now signs of sprawl development in many parts of the region. Graphic courtesy of Newman and Kenworthy (1989).
Diversity refers to creating a mix of uses within a local area. By combining residential and commercial uses into a single area, the number of trips and the length of travel are both reduced. People are able to meet most of their daily needs by walking, cycling, or public transport.

Design refers to the planning of housing, shops, and public transport in a manner that supports a reduced dependence on private motorised vehicles. Transit-oriented development (TOD) has emerged as one of the principal mechanisms to make this happen. By increasing the portion of destinations (homes, worksites, shops, schools, public services, etc.) located near public transport stations, both the residents and the public transport system gain advantages.

Despite the close relationship between land use and transport, the two areas are frequently planned separately, meaning an opportunity is lost to optimise both. Singapore’s Land Transport Authority represents a single agency combining both responsibilities. The success of Singapore’s transport system is clearly in part due to its effective institutional structures.

Figure 45. Many Japanese cities have successfully combined small commercial areas with residential areas to facilitate both sustainable transport and a vibrant local economy. Photo by Lloyd Wright.

Figure 46. The Hong Kong MTR system features shops within the system, bringing much convenience to the public transport user. Photo of the Hong Kong MTR Corporation.
City leaders wishing to make a commitment to Environmentally Sustainable Transport (EST) will not be alone in this effort. A full range of regional and international organisations exist to help Asian cities make this transformation.

As has been noted, the Asian Development Bank (ADB) provides information and guidance on a range of topics, including safety and vehicle maintenance. Likewise, lenders such as the ADB and the World Bank stand ready to extend financial resources for high-quality projects.

The Clean Air Initiative for Asian Cities (CAI-Asia) is a multi-sector network seeking to improve air quality in Asia. CAI-Asia hosts a variety of capacity-building events, including the bi-annual Better Air Quality (BAQ) conference. Additionally, CAI-Asia has been active in developing transport and air quality indicators for Asian cities, so that decision makers have the appropriate tools and information to make positive investments. More information on these topics can be found on the CAI-Asia website, www.cleanairnet.org/caiasia.
The Sustainable Urban Transport Project (SUTP) of the German Agency for Technical Co-operation (GTZ) has developed a full array of Sourcebooks on EST topics. Additionally, SUTP offers training workshops to cities on topics such as Bus Rapid Transit, car-free days, and sustainable transport marketing and awareness. To download the GTZ SUTP Sourcebook or to contact GTZ regarding interest in holding a training workshop, the website is www.sutp.org.

Other key organisations working in the region include the Institute for Transportation & Development Policy (www.itdp.org) and the Embarq programme of the World Resources Institute (http://embarq.wri.org).

Finally, UNCRD’s EST project stands ready to assist cities seeking to move towards a more sustainable form. The EST project provides information, hosts workshops, and supports policy formation in cities across Asia. More information on the EST project can be found at www.uncrd.or.jp/env/est. The Aichi Statement can be downloaded from this website.

Partnering with cities and officials who have been through the EST experience can ensure that the lessons learned from existing projects are shared with all.

With an objective to achieve greater harmony between environment and transport, the Ministry of the Environment (MoE), Government of Japan, has been promoting various initiatives to facilitate the exchange of information, best practices, tools, and technologies among Asian countries on EST. In line with the outcome of the First Meeting of the Regional EST Forum, 1-2 August 2005, Nagoya (Japan) and recommendations made in the Aichi Statement, MoE-Japan is committed to further promote efforts to attain the environmentally sustainable transport in Asian countries. More information on MoE’s initiatives can be found at www.env.go.jp/en/air/.

Figure 48. The GTZ SUTP Sourcebook has numerous modules on a variety of sustainable transport topics.

Figure 49. The EST website, www.uncrd.or.jp/env/est, provides up-to-date information on news, training opportunities, and upcoming events.
Making it happen through political will

"Any city, whether small or large, can be an agent of change."

Jaime Lerner, former Mayor of Curitiba

As stressed throughout this EST Sourcebook, most aspects of Environmentally Sustainable Transport do not require significant financial investments. Most aspects of EST are not technologically difficult to achieve. The principal barrier to implementing EST is the political will to do so. Overcoming entrenched practices and an acceptance of the status quo is the greatest challenge to creating an EST city, a city where people are put first.

For the officials who have made the decision to transform their cities, the rewards can be great. A healthier city, in which the residents can easily access jobs, services, and leisure without costly and polluting transport, awaits those who choose to accept this challenge. Environmentally Sustainable Transport is a cost-effective solution for today and for the future.

"We must be the change we wish to see."

Mahatma Gandhi, 1869 - 1948

Figures 50 and 51. Strong political leadership towards EST, as shown by former Seoul Mayor Lee Myung-Bak and Jakarta Governor Sutiyoso, can make all the difference. Left photo by Eric Möller. Right photo by Michael Replogle.
About the EST Project

The promotion of Environmentally Sustainable Transport (EST) represents a major priority for the United Nations Centre on Regional Development (UNCRD). By working with national Ministries, such as those related to Environment, Transport, Health, and Public Works, the EST Project seeks to achieve real change in terms of facilitating best practice efforts throughout the region.

To date, the adoption of the Manila Statement (January 2004) and the Aichi Statement (August 2005) and the establishment of the Regional EST Forum has already raised the issue of EST to stakeholders across Asia. Some of the on-going and future activities of the EST Project, include:

- Establish a Knowledge Base on EST in Asia
- Formulate national Strategy and Action Plans on EST for selected countries involving all key stakeholders
- Increase awareness and capacity on EST through training workshops
- Facilitate partnerships between the Asian countries and possible EST donors.

The EST Project focuses upon 12 different thematic areas related to Environmentally Sustainable Transport, as shown in the graphic below.
About the UNCRD

The United Nations Centre for Regional Development (UNCRD) was founded in 1971 as part of the United Nations (UN) system of organizations. It was set up in pursuance of the terms of the UN Economic and Social Council (UN/ECOSOC) resolutions 1086 C (XXXIX) and 1141 (XLI) which called for global action to promote regional development, and resolution 1582 (L) which provided guidelines for its operations.

UNCRD was created by an agreement between the UN and the Government of Japan. Under Article III of the agreement, UNCRD has four distinct but interrelated responsibilities:

(1) To serve as a training and research center in regional development and planning and related fields for developing countries which may wish to avail themselves of its services;
(2) To provide advisory services in regional development and planning and related fields at the request of developing countries;
(3) To assist developing countries in promoting the exchanges of data on research, practical experience, teaching, and other relevant subjects in regional development and planning and related fields; and
(4) To assist and cooperate with other organizations, national or international, concerned with regional development and planning and related fields.

To meet the goals, the Centre targets its programmes towards socially and environmentally sustainable development. The three multidisciplinary themes of human security, environment, and disaster management serve as a guide for the Centre’s training and research activities.

The Centre’s operations have benefited greatly from the cooperative relationship with UN/DESA and its valuable and consistent support.