Walkability

in Indian Cities

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Executive Summary

Indian cities were built for walking and cycling. However, rapid motorization combined with limited attention to pedestrian facilities has inadvertently resulted in a decrease in the overall mode share for non-motorized transport. Strategies must be introduced in order for people to reclaim the urban environment overrun by motor vehicles. Policies and investments provide an impetus to transform Indian cities, encourage pedestrianization and allow people to enjoy better mobility and quality of life.

This study provides information on the current pedestrian infrastructure in selected Indian cities. It includes (i) field walkability surveys in 6 Indian cities – Bhubaneswar, Chennai, Indore, Pune, Rajkot and Surat; (ii) pedestrian preference interviews in these cities; (iii) an assessment of the current policies and institutions relating to pedestrians and walking environments in the cities, including discussions with stakeholders and (iv) comparison of Indian cities with other Asian cities.

The main objective of this study was to benchmark Indian cities against different walkability parameters and to inform policy makers, development agencies and other stakeholders on the results and priorities for improving walkability. The field survey and pedestrian interviews resulted in a "walkability score" for each city.

Based on the surveys, it can be concluded that walking and pedestrian facilities are lacking and insufficient especially in areas with high number of pedestrians especially around public transport terminals and schools. The median walkability rating for the 6 cities was only 47 out of a total of 100. Residential areas received relatively higher ratings and public transport terminals the lowest. A total of 1915 pedestrians were interviewed on how they rate the walkability of a specific area and what makes a good pedestrian facility including specific improvements needed. The pedestrian preference interviews revealed that 60% of the respondents think that the pedestrian facilities in their cities are "bad" or "worst" (very bad). Moreover, the interviews revealed that 62% of the respondents would shift their walking trips to motorized modes of transport (with 20% shifting to cars and 22% to two-wheelers) if the walking environments in their cities do not improve.

The assessment of policies and institutions related to pedestrians and walking environments shows that, generally, there is a lack of relevant policies, dedicated institutions and political support that cater to the needs of pedestrians. Because of the neglect, minuscule funds are allotted for pedestrian infrastructure and improperly used.

Based on the findings of this study, a number of recommendations were identified involving various stakeholders who should play a role in developing policies, projects, and/or initiatives focused on improving walkability and pedestrian facilities in Indian cities.

List of Abbreviations

ADB	Asian Development Bank
BRTS	bus rapid transit system
CAI-Asia	Clean Air Initiative for Asian Cities
CDP	Comprehensive Development Plan
CSE	Centre for Science and Environment
CTTS	Comprehensive Traffic and Transportation Study (for Bangalore)
DDA	Delhi Development Authority
DIMTS	Delhi Integrated Multi-Modal Transit System
FHWA	Federal Highway Administration
GOM	Government of Mongolia
GWI	Global Walkability Index
HCMC	Ho Chi Minh City
HEI	Health Effects Institute
IRC	Indian Roads Congress
km	kilometer
KMC	Kathmandu Metropolitan City
MCD	Municipal Corporation of Delhi
MMDA	Metropolitan Manila Development Authority
MOUD	Ministry of Urban Development (India)
NDMC	New Delhi Municipal Corporation
NMT	Non Motorized Transport
NRs	Nepalese rupees
NUTP	National Urban Transport Policy
PM	particulate matter
PRC	People's Republic of China
PWD	Public Works Department
Rs	Indian Rupees
STI	Sustainable Transport Initiative
SUMA	Sustainable Urban Mobility in Asia
US DOT	United States Department of Transport
US	United States
UTTIPEC	Unified Traffic and Transportation Infrastructure Planning and Engineering Center
WHO	World Health Organization

1.Introduction

Have you ever wondered how the pedestrian infrastructure in Pune can be compared with that in Chennai or Hong Kong, or what can be done to improve walkability in Surat?

 Such comparisons, with some caveat, can be made by an assessment across these cities of available pedestrian infrastructure and demand for walking using a standard survey methodology and generating a "walkability index." Many definitions exist of "walkability." Walkability can be linked to the quality of built environment, the urban form and connectivity, safety and desirability to walk and accessibility of infrastructure. In simple terms, walkability can be used to describe and measure the connectivity and quality of walkways and sidewalks in cities. The walkability index can be used to compare cities and subsequently help identify areas for improvement that are site-specific. . The walkability survey can raise awareness and generate interest amongst policy makers and city officials and help them in improving the infrastructure.

While significant numbers of people do walk, there is an increasing threat from urban sprawl, motorization, pollution and deteriorating pedestrian infrastructure. There is an immediate need to measure and improve the state of pedestrian infrastructure in Indian cities as the conventional land-use and transport planning practices in Indian cities pay little attention to walking, leaving a gap between the demand and availability of pedestrian facilities This paper describes the results of a walkability survey in six Indian cities, compares and benchmarks them, and identifies common areas for improvement. This study is a follow-up of CAI-Asia's study "Walkability and Pedestrian Facilities in Asian Cities: State and Issues[1]" with support from ADB and other partners.

The Clean Air Initiative for Asian Cities (CAI-Asia) together with other partners initiated the Sustainable Urban Mobility in Asia Program in 2005 that helped transform the thinking on urban air quality management and sustainable transport and their roles in urban development in Asia. [2]

The program was designed to create several best practices in few cities across Asia. India was the major beneficiary of the program with Ahmedabad and Pune cities receiving active support from the International community. However, the activities on improving walking and pedestrian facilities were only covered indirectly. CAI-Asia was involved earlier in the initial development of Global Walkability Index (GWI) by Holly Krambeck from World Bank and others. GWI was pilot tested in various cities in 2006 including Virginia, USA; Beijing, China; Washington DC and Chicago, USA; Hanoi, Vietnam; Bangkok, Thailand; Manila, Philippines, Karachi, Pakistan; and Delhi and Ahmedabad, India.[3] However, walkability surveys were not conducted in full in Asian cities.

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1   ADB-CAI-Asia. 2011. Walkability and Pedestrian Facilities in Asian Cities: State and Issues. : http://cleanairinitiative.org/portal/node/7353

2   The SUMA program, 2006-2009, was supported by the Asian Development Bank through a grant from Swedish International Development Cooperation Agency. SUMA is implemented by the Clean Air Initiative for Asian Cities Center (www.cleanairinitiative.org), in partnership with EMBARQ - the World Resources Institute Center for Sustainable Transport (http://embarq.wri.org), GTZ Sustainable Urban Transport Project (www.sutp.org), Interface for Cycling Expertise (www.cycling.nl), Institute for Transportation and Development Policy (www.itdp.org), and United Nations Center for Regional Development (www.uncrd.or.jp/est)

3   For the Pilot Survey report see http://cleanairinitiative.org/portal/sites/default/files/60499_paper.pdf

To raise awareness of our cities' deteriorating walkability, and with the ultimate aim of promoting better air quality and livable cities, the CAI-Asia Center and partners decided to conduct walkability surveys in Asian cities. The figure below indicates the cities where the surveys have been conducted in Asia together with CAI-Asia partners. With support from the Asian Development Bank (ADB) and Fredskorpset, the CAI-Asia Center surveyed 13 Asian cities with a modified GWI survey methodology.

Following on the ADB-CAI-Asia Center Study on "Walkability and Pedestrian Facilities in Asian Cities: State and Issues" and with support from Shakti Sustainable Energy Foundation, the CAI-Asia Center conducted a walkability study in six Indian cities. The objective was to understand the current state of walkability in Indian cities, contribute to improving awareness, and provides a starting point for improving walkability in these cities by identifying key strengths, weaknesses and areas for improvement. This report is based on this ADB-CAI-Asia Center Study and focuses on Indian Cities.

The surveys covered three big cities namely Chennai, Pune, Bhubaneshwar, and three smaller but growing cities, Surat, Rajkot and Indore. These cities were selected from the list of Jawarlal Nehru National Urban Renewal Mission (JNNURM) priority cities and where CAI-Asia has established partners and contacts.

This report presents the results of this study including:
- An explanation of why the walkability in Indian cities must be improved (chapter 2)
- The walkability survey methodology applied for this study (chapter 3)
- Results of the walkability surveys, including the field survey (chapter 4), pedestrian interviews (chapter 5) and government policy and institutional analyses (chapter 6)
- Barriers to improving walkability and strategic approaches that can be taken (chapter 7)

A next step will be to publish the results of the walkability project in order to create an awareness and call for action from the public to decision makers at the national and city level to take action to improve the walkability in Indian cities.

Figure 1. Cities where CAI-Asia have conducted walkability surveys

2. Why Survey Walkability in Indian Cities?

2.1 India is Urbanizing Fast

India is urbanizing fast. Such a fast urbanization entails not only movement of population from rural to urban areas but also interchange of values, beliefs and attitudes thereby causing rapid transformation of individuals, society and cities. It is estimated that by 2030, 590 million people will live in Indian cities constituting 40% of the population. It is also estimated that by 2030, the urban areas would generate nearly 70% of India's GDP.[4]   With such a rapid growth of population and economic activities in cities, the demand for transport is expected to grow enormously. It is both a huge challenge and a huge opportunity.

It is critical to act now. Over the next 20 years, cities will create 70% of the new jobs. The population is set to explode from 340 million from 2008 to 590 million by 2030. To match the urban demand, researchers suggest that cities will have to build between 700 million and 900 million square meters of residential and commercial space a year i.e. a new Chicago being built every year.[5] Thus, current decisions and investments in the transport sector will lock-in future travel patterns for millions of people. This would impact the quality of life, economy, and future air pollution and greenhouse gas emissions.

2.2 India is facing Significant Transport Challenges

A review of literature on urban transport growth in India found the following challenges:

1. **Number of vehicles**: India's cities is motorizing fast. The majority of vehicles are registered in urban areas (in 1994, nearly 33% of India's vehicles are in the 23 top metropolitan cities).[6] According to the annual report of the ministry, in the next fifteen years 53 million two wheelers and 6 million cars will be on road in metropolitan cities. Vehicle registrations increased from 1.8 million in 1971 to 62.7 million in 2003 and to 99 million vehicles in 2007.[7] Some researchers expect the vehicle growth in this motorized scenario to increase at a rate of 8-12% per year. Experts have pointed out that the current trend of the growth of motor vehicles is almost four times faster than the growth of population.[8]

2. **Distances travelled**: A study carried out by RITES in 1994 projected that for different categories of cities (21 cities) in India the total intracity passenger demand of 759 million passenger kilometers (mpkm)/day would go up to 2511 mpkm/day in 2021. A total number of vehicular trips, which were of the order of 126 million in 1994, are expected to go up to 430 million in 2021. After more than a decade, in 2008, MOUD published an update of this report and included new data from 87 cities in India. The results showed an even higher intensity of projected travel. The report suggested that the daily trips in the 87 urban centers are anticipated to double from 229 million to 482 million during the next 24 years. The intracity passenger demand of 1763 mpkm/day would double to 3524 mpkm/day in 2021.

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4   McKinsey 2010. India's urban awakening: Building inclusive cities, sustaining economic growth. -- this report projects high urban growth similar to what others have argued. For example CRRI in 2008 suggested that India's urban population will increase from 230 million in 2001 to 402 million in 2025. It is also expected that share of economic activity in urban areas would increase from 56% of GDP in 1990 to about 75% in 2020 and most of the growth is expected to take place in the nine mega cities of the country.

5   Ibid.

6   Rail India Technical and Economic Services Limited and Operations Research Group, 1994.

7   Singh, A. 2010. Transport Sector – Greenhouse Gas Emissions 2007. See http://moef.nic.in/downloads/others/Anil%20 Singh.pdf

8   MOUD. 2008. Thirty-seventh Report on Urban Transport by Standing Committee on Urban Development (MOUD) India

3. **Fuel consumption:** Such a rapid increase of vehicles and distances travelled will impact fuel consumption. In 2004-2005, liquid fuel consumption in the transport sector accounted for 28% of India's total petroleum products consumption.[9]

4. **Road fatalities:** Almost half of the world's road traffic fatalities of approximately 1.3 million people are pedestrians, cyclists and motorcyclists and more than 90% occur in developing countries.[10] The latest WHO (2009) report which analyzed the causes of accidents and policy analyses suggested that: "Our roads are particularly unsafe for pedestrians, cyclists and motorcyclists who, without the protective shell of a car around them, are more vulnerable. These road users need to be given increased attention. Measures such as building sidewalks, raised crossings and separate lanes for two wheelers; reducing drink-driving and excessive speed; increasing the use of helmets and improving trauma care are some of the interventions that could save hundreds of thousands of lives every year. While progress has been made towards protecting people in cars, the needs of these vulnerable groups of road users are not being met". It is sad to note that pedestrians constitute a significant share of total fatalities and the magnitude is in fact much higher in cities where the facilities do not do meet the demand. For example, although the pedestrian fatality share at the national level is 13%, metropolitan cities like New Delhi, Bangalore and Kolkata have a pedestrian fatality share greater than 40%. The problem becomes more severe when we try to access the impact on most vulnerable section of society. For example, in the case of Bangalore[11], every two days, three pedestrians are killed on roads and annually more than 10,000 are hospitalized. Elderly people and school children carry a large share of the burden with 23% fatalities and 25% injuries.

5. **Household transport budget:** A study by Future Capital Research on 20 cities in India indicates that the impact of transport on people's lives is huge in the booming cities of India i.e. people spend more on transport (21.3%) than on health (7.6%), education (5.2%) and housing (8%) combined.[12]

6. **Emissions from transport:** A recent study by CAI-Asia indicated that due to rapid motorization, the CO_2 emissions from road transport is expected to increase at 7.75% per year, which is higher than many other Asian countries.[13] Even if the current trip mode share in cities is retained, CO_2 emissions would increase 2- to 3-fold between 2008 and 2025, due to a rapid growth in urban population and in the number of trips. Figure 2 presents the per capita intracity passenger transport emissions from Indian cities. It is noted that the growth in area and population of cities increase the emissions.

7. **Transport system expansion:** As urbanization and demand for mobility increase, a corresponding need for investments on transport infrastructure is needed. The McKinsey Study (2010) on urban development in India indicates that in transportation, India needs to build 350 to 400 kilometers of metros and subways every year, more than 20 times the capacity building of this type that India has achieved in the past decade. In addition, between 19,000 and 25,000 kilometers of road lanes would need to be built every year (including lanes for bus-based rapid transit systems), nearly equal to the road lanes constructed over the past decade.

8. **Funding requirements:** Considering the high growth in the transport sector, the funding requirement is also huge to cater for meeting mobility needs. The Rakesh Mohan Committee estimated that the cost of urban transport infrastructure was about Rs. 124770 million (approx USD

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9   Integrated Energy Policy, Planning Commission 2006; Page 10

10   See http://www.who.int/mediacentre/news/notes/2010/traffic_injuries_media_20100303/en/index.html

11   See http://www.deccanchronicle.com/bengaluru/city-pedestrians-face-grave-danger-354

12   See http://www.ncaer.org/popuppages/EventDetails/E7Aug2008/Presentation.pdf

13   See http://cleanairinitiative.org/portal/node/2319

2.700 billion, 1996 prices) over a 10-year period up to 2006. Estimates by Rail India Technical and Economic Services (RITES) indicate that the amount required for urban transport infrastructure investment in cities with population 100,000 or more during the next 20 years would be in the order of USD 46 billion. According to MOUD reports, In order to improve the urban transport the investment requirement is estimated as USD 30 billion in the 11th five year plan and about USD 97 billion over next 20 years. However, it is important to note that transport infrastructure investments does not only focus on expanding capacity and should also include providing facilities for pedestrians.

Per Capita CO2 and Per Capita PM Emissions
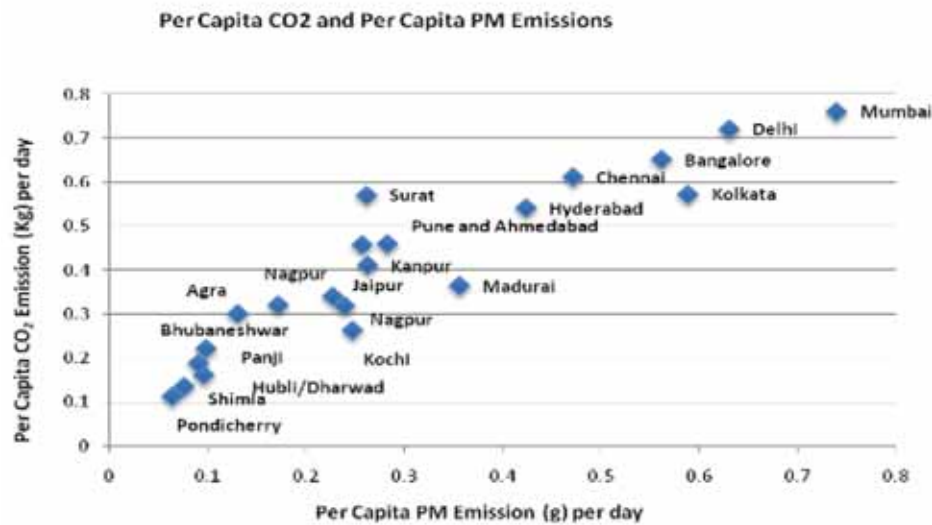
Source : Emissions from India's Intercity and Intracity Road Transport - CAI Asia (2009)

Figure 2. Per Capita CO_2 and PM Emissions from intracity passenger transport

2.3 Improving Walkability can help address Transport Challenges

Prioritizing investments which benefit non-motorized transport (NMT) with public transport and provide impetus to new urban planning which promote avoid, shift and improve approaches could transform the Indian cities and allow people to enjoy better access, mobility and quality of life. The magnitude of growth in population and urbanization is something unique in the world and thus the opportunities to create better cities.

Secondly, Indian cities are naturally built for walking and cycling and therefore the majority of destinations are easily accessible by non-motorized modes. The high density and mixed land use provides many advantages to NMT and public transport. The current data (table 1) from Indian cities indicate that walking forms at least a quarter of all trips and sometimes as high as half of all trips.

City Category	Description	Trip Mode Share						Average Trip Length
		Walk	Cycle	2-Wheeler	Public	Car	IPT	
Category-1 a	<0.5 million, Plain Terrain	**34**	3	26	5	27	5	2.4
Category-1b	<0.5 million, Hilly Terrain	**57**	1	6	8	28	0	2.5
Category-2	0.5 to 1 million	**32**	20	24	9	12	3	3.5
Category-3	1-2 million	**24**	19	24	13	12	8	4.7
Category-4	2-4 million	**25**	18	29	10	12	6	5.7
Category-5	4-8 million	**25**	11	26	21	10	7	7.2
Category-6	>8 million	**22**	8	9	44	10	7	10.4
National		**28**	**11**	**16**	**27**	**13**	**6**	**7.7**

Table 1. Trip Mode Shares in Indian Cities

Source: MOUD. 2008. Study on Traffic and Transportation Policies and Strategies in Urban Areas in India. See http://www. urbanindia.nic.in/programme/ut/final_Report.pdf

This has the potential to reduce over-all air pollution and CO2 emissions as described in Box 1.

Finally, health benefits of walking in developing cities are huge and should not be neglected. In a recent Lancet article[14] on health effects on alternate transport scenarios were estimated in London and Delhi, it was found that for Delhi, the lower-carbon-emission motor vehicles and increased active travel scenarios (walking and cycling) resulted in a greater health gain from reduced air pollution than for London. Authors estimated that the reduction in CO_2 emissions through an increase in active travel and less use of motor vehicles had larger health benefits per million population (7,332 disability-adjusted life-years [DALYs] in London, and 12,516 in Delhi in 1 year) than from the increased use of lower-emission motor vehicles (160 DALYs in London, and 1,696 in Delhi). Also, maximum benefits can be accrued with a combination of active travel and lower-emission motor vehicles notably from a reduction in the number of years of life lost from ischemic heart disease (10–19% in London, 11–25% in Delhi).

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14   Public health benefits of strategies to reduce greenhouse-gas emissions: urban land transport

In order to illustrate effectiveness of walking trips, consider a city A with population of 1 million people. The per capita trip rate is 2. The trip mode share and average trip length of the city A is shown below.

Mode	Trip Mode Share	Average Trip Length
Walking	31%	1.22
Cycling	20%	3.88
Two wheeler	13%	7.74
Public transport	17%	10.75
Car	13%	11.50
Intermediate Public transport	5%	8.83
Metro	1%	11.60

The current walkability score of city is 30. Assuming that the city invests heavily in walking infrastructure, the revised walkability due to such an investment is a score of 50.

Using the tool for pedestrian projects from GEF-ITDP-CAI Asia (TEEMP) Transport Emissions Evaluation Model for Projects (http://cleanairinitiative.org/portal/TEEMP) model, we calculate the emissions from the city passenger transport sector with following assumptions - Pedestrian interview surveys reveal that 68% walking trips would shift to other modes in case of no improvement and assuming that maximum benefits accurate the end of 5 years and project life of 20 years. [15] Also assuming that default fuel efficiency and occupancy values as in TEEMP.

The annual reduction due to walkability improvement is a reduction of **9% from the baseline or a saving of 9,700 tons/year**. The maximum savings are observed due to preventing shift from walking to other modes i.e. 66% of total savings. The shift from motorized modes to walking constitutes 34%.

Source: CAI-Asia Center

Box 1. Impact of Improving Walkability on CO_2 Emissions

It is a paradox that walking provides mobility to a large segment of the society especially the poor, who are most vulnerable in the urban transport system and heavily relies on walking, cycling and public transport; but current infrastructure for walking is generally poor. Reports suggest that the percentage of roads with pedestrian footpaths runs to hardly 30% in most cities. [16] Loss of accessibility due to poor infrastructure allows victimizing the vulnerable in the transport system. There is an urgent need to change this paradigm. **It is clear that pedestrian accessibility should become the first step in an enlightened urban transport policy.** [17] It is important to know what pedestrians need from the government and what the infrastructure actually provides so as to understand the implications and plan for the future.

The walkability study in Indian cities was conducted within this context. The next chapters highlight the walkability survey methodology and the results.

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16   MOUD. 2008. Study on Traffic and Transportation Policies and Strategies in Urban Areas in India. See http://www urbanindia.nic.in/programme/ut/final_Report.pdf

17   Badami, M. 2009. Where the pedestrian is a third class citizen. See http://www.thehindu.com/news/national/ article56631.ece

3. Walkability Survey Methodology

3.1 Overview of Existing Methodologies

Several methodologies exist in Asia to assess walkability and they vary with regard to the emphasis in qualitative or quantitative assessment, components, sampling and scoring. For example, the Ministry of Urban Development (MOUD) of India uses a walkability index that is a function of the availability of footpaths and rating of pedestrian facilities.[18] Using this walkability index, MOUD assessed the quality of pedestrian infrastructure in thirty cities in 2008 and found an average index of 0.52 (out of 1). Chandigarh scored maximum score of 0.82. The limitation of this methodology is that it is difficult to assess which parameter needs improvement, such as safety, security, amenities, disability infrastructure, etc. In addition, the MOUD also developed an urban transport benchmarking tool that uses only three indicators to calculate the pedestrian facility rating - signalized intersection delay(s)/pedestrian, street lighting (Lux) and % of city covered with footpaths wider than 1.2 m.

Similarly, a popular website, "walkscore.com" calculates an area's walkability based on the distance from residents' houses to nearby amenities.[19] Using this scoring system, Pune in India is considered a walker's paradise whereas Bangkok, Beijing and Cebu are considered car-dependent cities. Although walkscore.com measures how easy it is to live a car-free lifestyle and considers how dense the land use is (which can reduce trip lengths), it does not include a qualitative assessment of pedestrian facilities like street width, block length, street design, traffic and crime safety, etc. As a result, many Asian cities can have high scores in walkscore.com because of the traditionally mixed-use character of the cities and high density, but this does not mean that these cities are easy to walk in.

Figure 3. Snapshot of Walk Score Application and Ratings in Asia

A third example is a simple methodology popularly known as the GWI developed by H. Krambeck for the World Bank which provides a qualitative analysis of the walking conditions including safety, security, and convenience of the pedestrian environment.[20]

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18   MOUD. 2008. Study on Traffic and Transportation Policies and Strategies in Urban Areas in India. Available: http://www.urbanindia.nic.in/programme/ut/final_Report.pdf

19   See http://www.walkscore.com/

20   More information on the Global Walkability Index is available at http://cleanairinitiative.org/portal/node/4238

It consists of a field walkability survey to assess pedestrian infrastructure in four areas: commercial, residential, educational, and public transport terminals. The survey also identified pedestrian preferences, and analyzes government policies and institutional setup. The methodology is qualitative but because it encompasses several key parameters, it provides a good insight into the current state of the walkability environment and enables the identification of areas for improvement.

Fourth, the Central Road Research Institute of India has proposed a similar measurement tool which calculates the pedestrian LOS based on a mix of physical characteristics and user ratings.[21] It is a comprehensive evaluation as it consists of 10 parameters with each rated in a scale of 1 to 5. Based on the scoring, the Level of service (LOS) of the facility is determined.

3.2 Field Walkability Survey

The study used a modified GWI methodology to make it more applicable to the Asian situation. Areas with high pedestrian volume were selected based on preparatory surveys and consultation with local stakeholders. Complete route assessments were conducted by following logical pedestrian routes in the specific areas linking origins to destinations.

The below table shows the comparison of different parameters considered in GWI, CRRI ratings and for the walkability ratings adopted for this study. In order to facilitate comparisons among cities, the field survey used a uniform rating system for nine qualitative parameters (Table 3). Complete route assessments were conducted to provide a holistic overview that links design and execution to user perception and the built environment.

Parameter	GWI	CRRI	CAI-Asia
Walking Path Modal Conflict	✓	✓	✓
Pedestrian Volume	✓	✓	_ [22]
Availability of Walking Paths	✓		✓
Footpath Width		✓	
Footpath Continuity		✓	
Availability of Crossings	✓		✓
Grade Crossing Safety	✓		✓
Motorist Behaviour	✓		✓
Amenities	✓		✓
Disability Infrastructure	✓		✓
Obstructions	✓	✓	✓
Encroachment		✓	
Walk Environment		✓	
Comfort		✓	
Security from Crime	✓	✓	✓
Maintenance and Cleanliness	✓		✓
Footpath surface		✓	
Length of stretch	✓		✓

Table 2. Comparison of Parameters Used in the Index/Ratings considered in various Methodologies

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21 Parida, P. 2009. Design & Safety of Pedestrian Facilities. Central Road Research Institute. Available: http://www.iutindia. org/urban09/041209sess/Dr.%20Purnima%20Parida.pdf

22 Pedestrian counts were conducted but not included in the ratings because it can distort ratings where many pedestrians continue to use footpaths even though these are not in good condition.

Parameter	Description
1. Walking Path Modal Conflict	The extent of conflict between pedestrians and other modes on the road, such as bicycles, motorcycles and cars
2. Availability of Walking Paths	The need, availability and condition of walking paths. This parameter is amended from the parameter "Maintenance and Cleanliness" in the Global Walkability Index
3. Availability of Crossings	The availability and length of crossings to describe whether pedestrians tend to jaywalk when there are no crossings or when crossings are too far apart
4. Grade Crossing Safety	The exposure to other modes when crossing roads, time spent waiting and crossing the street and the amount of time given to pedestrians to cross intersections with signals
5. Motorist Behavior	The behavior of motorists towards pedestrians as an indication of the kind of pedestrian environment
6. Amenities	The availability of pedestrian amenities, such as benches, street lights, public toilets, and trees, which greatly enhance the attractiveness and convenience of the pedestrian environment, and in turn, the surrounding area
7. Disability Infrastructure	The availability of, positioning of and maintenance of infrastructure for the disabled
8. Obstructions	The presence of permanent and temporary obstructions on pedestrian pathways. These ultimately affect the effective width of the pedestrian pathway and may cause inconvenience to pedestrians
9. Security from Crime	The general feeling of security from crime on a certain stretch of road

Table 3. Field Walkability Survey Parameters

Field surveyors were asked to rate the selected road stretches from 1 to 5 for each parameter (1 being the lowest, 5 being the highest) in each of the area types. The averages for each of the parameters were translated into a rating system from 0 (lowest score) to 100 (highest score). Walkability ratings in the different area types in each city were derived by taking the average of the individual parameters' averages. The final city walkability ratings were derived by averaging the walkability ratings in the different area types in each city (see appendix).

This method of deriving a "Walkability Rating" differs from the Global Walkability Index as the latter takes into account the number of people walking (pedestrian count) during the time of the survey and the length of the stretch being surveyed. This study documented street lengths and pedestrian counts but excludes these two factors from the walkability rating to eliminate the inherent bias generated by the number of people walking on a certain stretch and its length. For example, a stretch with adequate infrastructure and very high pedestrian traffic should not receive a higher rating than a high-quality stretch with low pedestrian traffic. Utilization by itself should not be used as a parameter to assess the walkability of a certain area because it penalizes good areas with lower utilization rates. Current levels of pedestrian traffic are more useful in identifying priority areas for improvement (e.g. areas with high

pedestrian traffic but with low walkability ratings). This argument also holds true for distance. A relatively short but high quality stretch of footpath should not be penalized because it is shorter.

One of the limitations of the field surveys is the subjectivity of responses as it is influenced by the surveyor, especially in this study that involved different organizations and individuals to carry out the surveys. There needs to be a balance between accuracy, simplicity and resources availability. The methodology adopted for this study requires only limited resources and simple but less accurate when compared with many quantitative methodologies, even though other methodologies make surveys more expensive. What is important to keep in mind is that the results need to give a clear enough indication as to where main weaknesses exist in the current pedestrian infrastructure, facilities and supporting policies and institutional set up, so that actions for improvement can be selected.

3.3 Pedestrian Survey

Pedestrian interviews were also conducted to capture the views and preferences of pedestrians. A short questionnaire on social characteristics and walkability preferences was designed based on discussions with experts and policymakers. The surveyors completed the questionnaire during the interviews and used local language to improve respondents' comprehension of the questions.

More than 1900 pedestrians were interviewed in the 6 cities. They were asked to rate the walkability of a specific area, to describe what makes a good pedestrian environment, as well as to identify specific improvements that they would want in their walking environments. The minimum sample size was 50 respondents per area, and the actual number of respondents was influenced by resources available, outdoor conditions and willingness of the people to be interviewed.

3.4 Policy and Institutional Survey

Finally, interviews were held with several public agencies and other stakeholders and current policies and guidelines in the selected cities and countries were reviewed. This was an important component because while there are many reasons for the current state of the walking environment in Indian cities but the main ones are related to policies, institutions and allocation of financial resources. While current policies and guidelines for pedestrians in these cities were reviewed to identify strengths and gaps, the study does not provide a comprehensive analysis of the current design guidelines for pedestrian facilities in surveyed countries and cities.

4. Field Walkability Survey Results

Table 4 provides an overview of the length of streets surveyed in the six Indian cities with a total of approximately 150 km. The pedestrian count shown in the table is indicative only as it refers to only five min of count. Commercial areas and public transport terminals being trip attractors accommodate more pedestrians than residential areas. Indian cities constitute high intensity of road network and thus 150km surveyed constitutes a very small section of total network. But considering the fact that the landuse was segregated into four categories and adequate care was taken while considering the survey sample stretches based on discussions with various stakeholders, the results can be considered as representative of the whole city.

City	Residential		Educational		Commercial		PT Terminal		Total	
	Length (km)	Ped Count	Length (km)	Ped Count	Length (km)	Ped Count	Length (km)	Ped Count	Length (km)	Ped Count
Bhubaneshwar	5.5	27	4.4	138	4.9	174	9	156	23.8	495
Chennai	12.9	187	4.02	52	7.23	284	5.98	177	30.1	700
Indore	7.1	110	6.1	65	8.15	314	3.1	175	24.4	664
Pune	15	514	12.5	1140	16.2	2362	13.2	911	56.9	4927
Rajkot	5.5	80	4.3	112	8.2	130	4.7	88	22.7	410
Surat	6.16	135	4.92	102	8.91	172	3.37	186	23.3	595
Total	43.16	948	29.54	1361	42.49	3134	37.65	1451	152.8	6894

Note: The pedestrian count does not correspond to the pedestrian volume over the whole surveyed stretch but only in certain sections.

Table 4. Surveyed Length and Pedestrian Count in Indian cities

4.1 Overall Score

Based on results for the six Indian cities shown in Figure 4, it is clear that Indian cities have low walkability ratings due to poor and unsafe infrastructure. The average score of six Indian cities was only 47 (100 is maximum and 20 is minimum). Based on the evaluation, Chennai, Indore and Surat had relatively worse walkability when compared to Bhubaneswar, Rajkot and Pune.
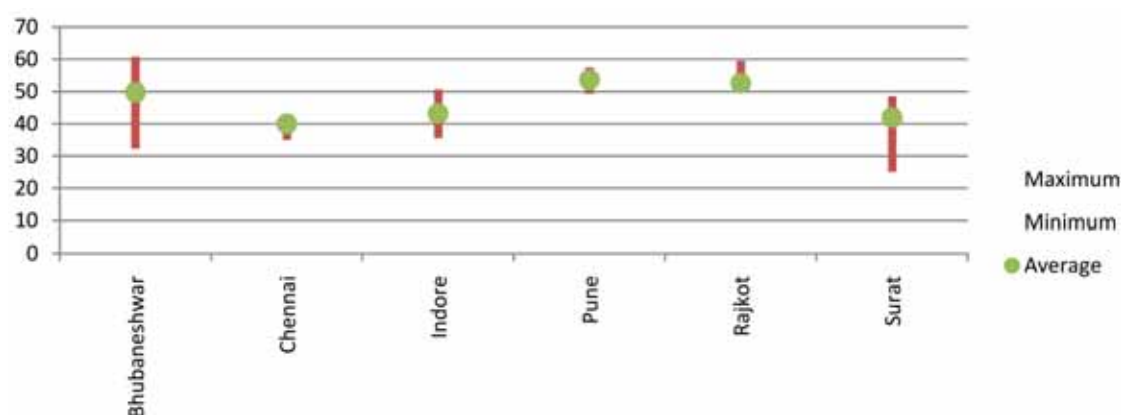

Figure 4. Variation of Walkability Ratings in Cities

Significant variations can be seen in the ratings pertaining to various parameters and land use classifications. Consistent low ratings were observed for the parameters amenities and disability infrastructure. It is important to note that the ratings for the other parameters varied greatly thus indicating that there exist some streets with good ratings for a few individual parameters.

It is critical to provide improvement in all the aspects of walkability rather than thinking of only capacity expansion or physical infrastructure i.e. expensive subways or overhead crossings or tiled footpaths. India is investing huge resources to improve public transport infrastructure; however ironically, access to such systems is extremely poor. Of the four categorizes surveyed, residential areas due to lower and calmer traffic had relatively high walkability and areas surrounding public transport terminals worst. The results for each of the four areas are presented next. Details on the ratings for the various parameters are shown in Table 5 below.
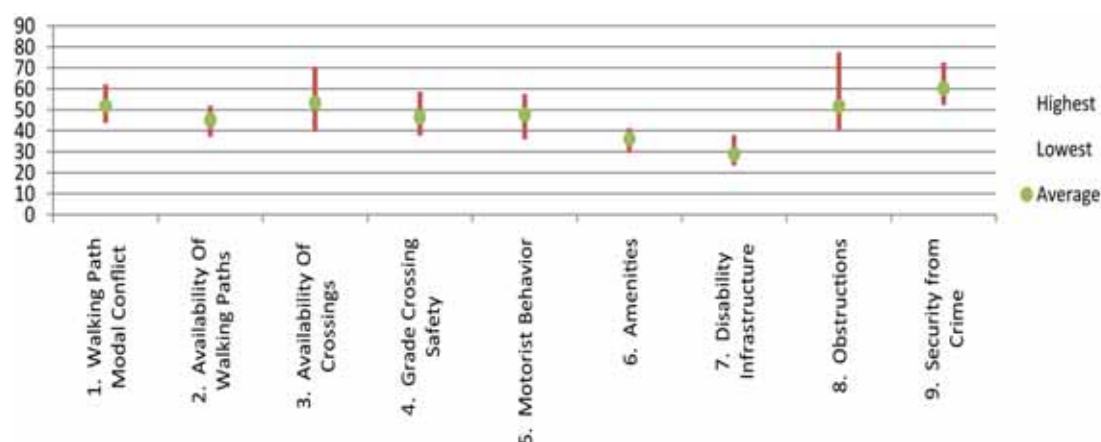
Figure 5. Variation of Walkability ratings by parameter

The rating for availability of walking paths is usually low because of lack or inappropriate footpaths or sidewalks. However, there are also several cases where pedestrian footpaths or sidewalks is not deemed as necessary especially in residential roads where traffic volume is very low including vehicular speed due to traffic calming. For availability of crossings, the ratings for individual parameters combining all the surveyed cities suggest that people found pedestrian crossings generally available in residential areas. Again it should be noted that vehicle traffic and speed is low and this pedestrians found that crossing streets is easier and that there is no need for a "formal" pedestrian crossing in these kinds of streets. In the GWI, the pedestrian counts have been included in the computation of the index. In this study, this was not used as part of the index but only for an indication on the number of pedestrians along some points in the surveyed route. Including pedestrian counts in the GWI creates a high bias due to multiplicative effect. It has been observed that areas with very poor ratings got higher ratings because people continue to walk on them and thus may give wrong impression to policy makers and city authorities. Walkability ratings include different parameters like safety, security etc. and hence these aspects gets adequately reflected in the field walkability rating and thus the volume of people in the walkability ratings have not been considered.

It is also interesting to compare the ratings of the Indian cities with those of other Asian cities. The forthcoming ADB study "Walkability and Pedestrian Facilities in Asian Cities: State and Issues" reported that Hong Kong with a score of 70 was the best city among other cities surveyed in Asia (13 cities) for pedestrians. The comparison of ratings of average Indian cities, average Asian cities and Hong Kong is shown in Figure 6.[23]

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23   Report has been released already: http://cleanairinitiative.org/portal/node/7353
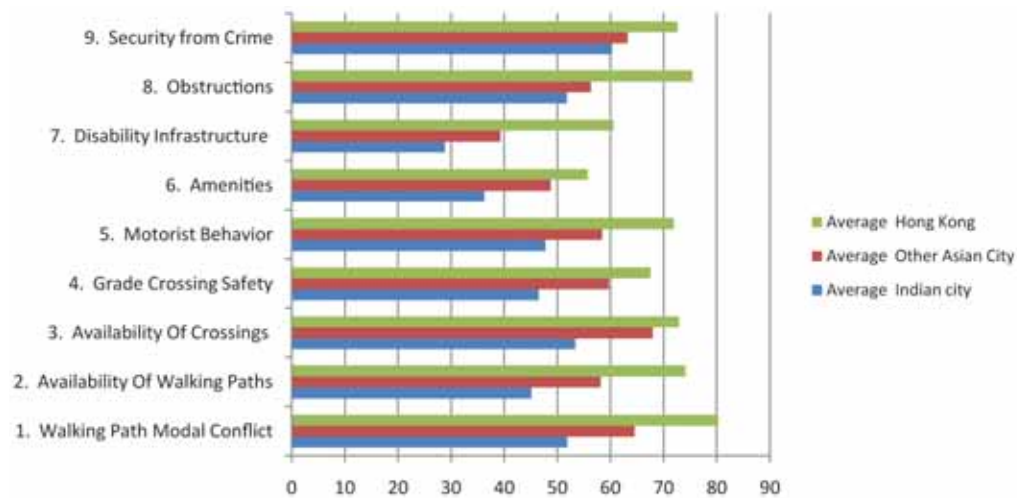
Figure 6. Comparison of Indian Cities with other Asian Cities

4.2 Residential Area Surveys

The average field walkability rating in the residential areas is 52 out of 100 (Figure 7). The highest is in Bhubaneswar where surveyors observed relatively higher availability of walking paths, positive motorist behavior, fewer obstructions, and security from crime. The survey was conducted in a relatively high income locality recently developed by the municipality. Chennai had limited infrastructure with several obstructions, and traffic was not adequately managed with calming devices thus making people feel unsafe near their homes. This is critical as by making walking pleasant near the homes, lot of recreational walking can be promoted. Pune scored higher in terms of driving behavior and in crossings but had lower ratings for amenities, obstruction and disability infrastructure.

The ratings for individual parameters combining all surveyed cities suggest that people found that crossings are generally available in the residential areas (64). It should be noted that vehicle traffic in residential areas is generally lower and calmer and thus pedestrians can easily cross streets. On the other hand, disability infrastructure scored very poorly (29) indicating that access to walking infrastructure is a big issue. The findings correlate with findings from other Asian cities where residential areas scored higher in terms of crossings and least in terms of disability infrastructure.
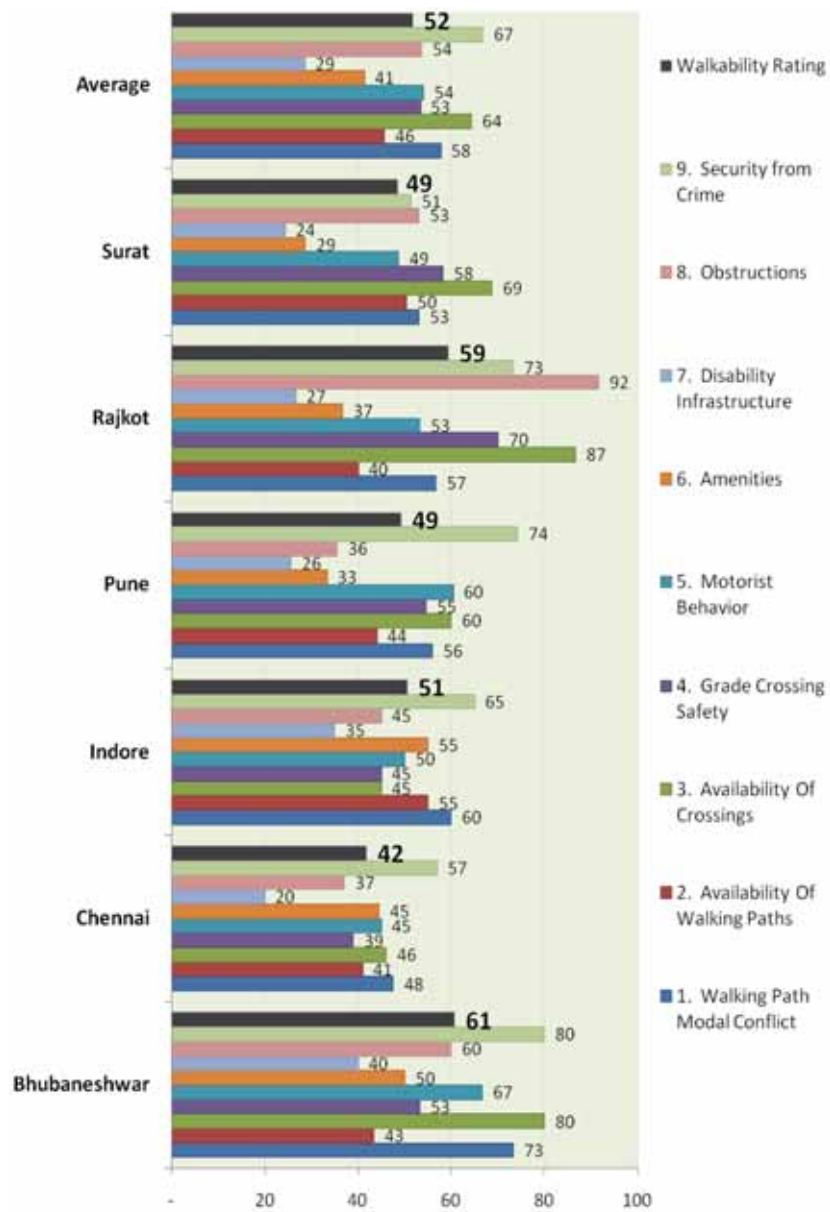
Figure 7. Walkability Ratings of Surveyed Residential Areas by Parameter

It is also interesting to observe the variability of rankings with parameter. Disability infrastructure consistently scores poor ratings across all cities. Similar insights can be derived for amenities parameter. However, the maximum variation is observed for "obstructions" and thus there are cities with areas which do not allow obstructions along pedestrian paths.

Parameter	Highest	Lowest
1. Walking Path Modal Conflict	73	48
2. Availability Of Walking Paths	55	40
3. Availability Of Crossings	87	45
4. Grade Crossing Safety	70	39
5. Motorist Behavior	67	45
6. Amenities	55	29
7. Disability Infrastructure	40	20
8. Obstructions	92	36
9. Security from Crime	80	51
Average	69	39

Table 5. Walkability Ratings with Variation of Surveyed Residential Areas by Parameter

4.3 Educational Area Surveys

The average walkability rating in the educational areas is 49 out of 100 (Figure 8). This is very critical as accident statistics often show that school children have high accident fatality rates. With poor walkability across the educational areas the authorities are exposing students to high accident risks and thus parents make additional trips to drop students to schools. This is especially critical for poor students who do not have a choice but to walk to school. Chennai, Surat and Indore had relatively lower ratings when compared to Pune and Bhubaneswar.

Security from crime (66) and walking path modal conflict (58) are the highest rated parameter which suggests that people found that such areas was well guarded by school and police authorities and that there is minimal modal conflict in the streets surveyed, probably due to the traffic calming facilities in place.

Similar to residential areas, disability infrastructure received the lowest rating (30). Availability of walking path was found to be the highest in Surat (73) and lowest in Rajkot (38). Rajkot had educational areas with very good security and thus people felt generally safe from external environment. However, the same cannot be suggested for driving behaviour as cities like Chennai and Surat scored very poor ratings. While conducting surveys in Surat many students were seen riding two wheelers illegally.
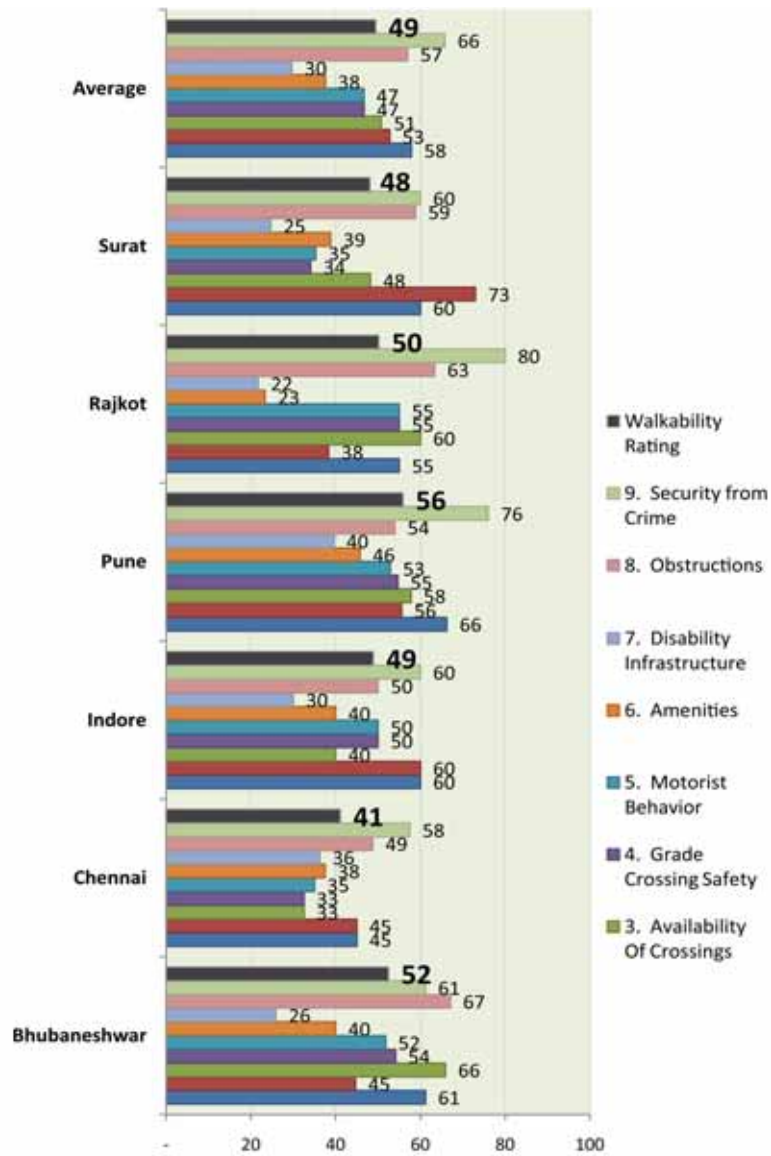
Figure 8. Walkability Ratings of Surveyed Educational Areas by Parameter

One interesting observation was on the consistency of the ratings across the various educational areas and cities. Large variations in terms of maximum and minimum ratings across various parameters in cities as found in residential areas were not observed.

Parameter	High	Low
1. Walking Path Modal Conflict	66	45
2. Availability Of Walking Paths	73	40
3. Availability Of Crossings	66	33
4. Grade Crossing Safety	55	33
5. Motorist Behavior	53	35
6. Amenities	46	22
7. Disability Infrastructure	40	22
8. Obstructions	67	49
9. Security from Crime	84	58

Table 6. Walkability Ratings with variation of Surveyed Educational Areas by Parameter

The findings correlate with findings from other Asian cities where educational areas scored higher in terms of modal conflict, crossings and security and least in terms of disability infrastructure.

4.4 Commercial Area Surveys

The average walkability rating in commercial areas is 48 out of 100 (Figure 9). Several studies have established that a good pedestrian environment positively supports commercial establishments. However, cities in India do not have good walkability across such commercial areas which have high pedestrian traffic. Disability infrastructure, amenities and crossings (opportunities and safety) had least ratings. There was consistency in terms of ratings as older markets generally had poor ratings when compared to areas with malls.

The results for Bhubaneswar and Indore are contrasting. Bhubaneswar had relatively higher ratings for the footpaths and sidewalks around commercial areas, low conflicts with other modes, less obstructions and good driving behavior, which could be due to strict enforcement by the authorities and dedicated vendor space. Indore, on the other hand, scored consistent poor ratings across all the parameters thus indicating that the commercial space needs renewal in terms of pedestrian environment.
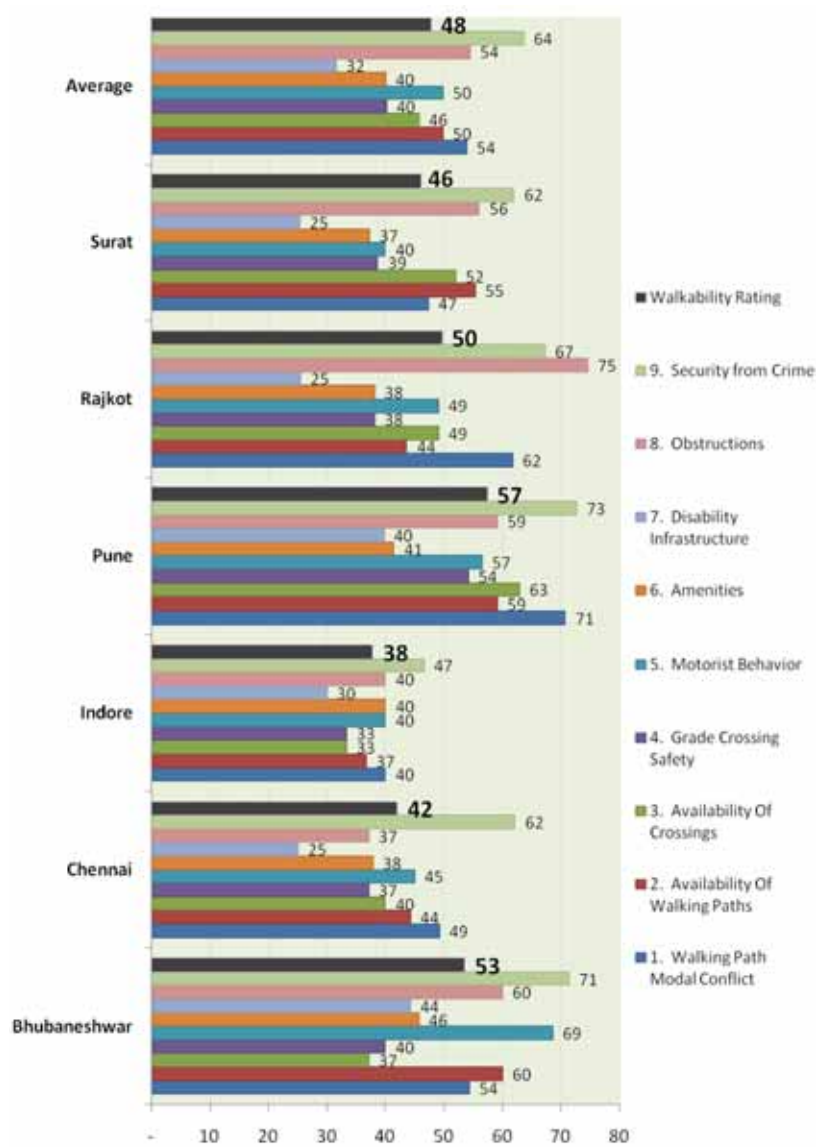
Figure 9. Walkability Ratings of Surveyed Commercial Areas by Parameter

High magnitude of variability can be seen among parameters across different cities. The maximum variation is observed for "obstructions".

Parameter	High	Low
1. Walking Path Modal Conflict	71	40
2. Availability Of Walking Paths	60	37
3. Availability Of Crossings	63	33
4. Grade Crossing Safety	54	33
5. Motorist Behavior	69	40
6. Amenities	46	37
7. Disability Infrastructure	44	25
8. Obstructions	75	37
9. Security from Crime	73	47
Average	62	37

Table 7. Walkability Ratings with variation of Surveyed Commercial Areas by Parameter

4.5 Public Transport Terminals Survey

The average walkability rating in the areas around public transport terminals is 39 out of 100 (Figure 10). Availability of crossings is the highest rated parameter with a rating of 53 and disability infrastructure is lowest with 25 and 26 ratings.

Of the cities surveyed, Surat received the lowest ratings. There was consistency in terms of ratings around the main railway stations. Across the cities, the main railway stations which cater for huge pedestrian traffic had the worst walkability ratings.

The findings from Indian cities correlate with other Asian cities. Public transport terminals across Asia received the lowest average rating among the different types of areas. This is alarming as such locations generate several intermodal trips and majority of public transport users access the terminals by walking. Improving walkability provides a win-win situation with improved accessibility benefiting the walkers and securing the ridership for expensive public transport system.
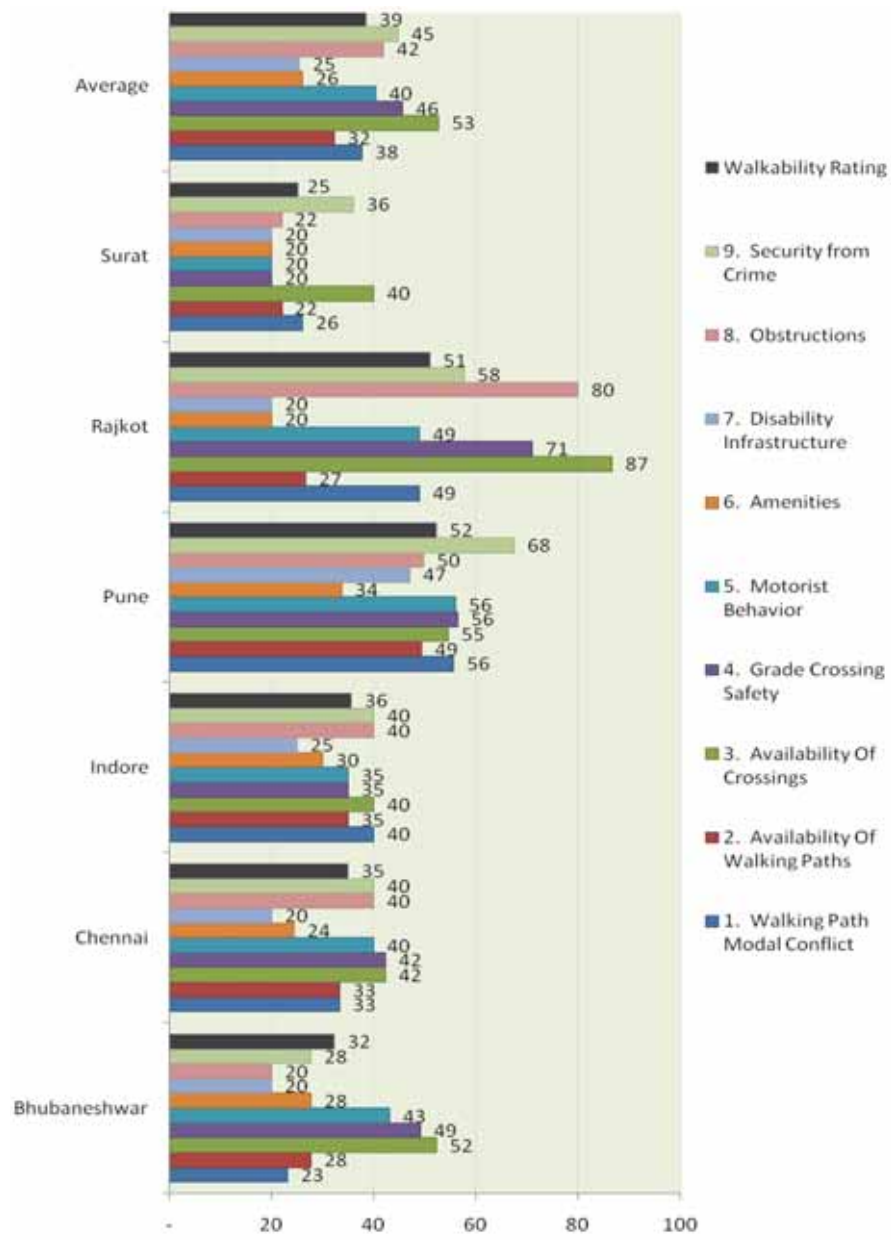
Figure 10. Walkability Rating around Surveyed Public Transport Terminals by Parameter

5. Pedestrian Survey Results

Pedestrian surveys were conducted along with the field walkability surveys. These surveys were conducted to validate the results of the field surveys as well as to collect the feedback of the pedestrians.

A total of 1915 pedestrians were interviewed on how they rate the walkability of a specific area and what makes a good pedestrian facility including specific improvements needed. Figure 11 provides an overview of the number of respondents per city. The minimum number of suggested samples was fifty respondents per area. The resources available, outdoor conditions and the willingness of the people to be interviewed influenced the number of respondents per area. The surveyors used local language in conducting the surveys to facilitate better comprehension of the questions by the interviewees.

5.1 Number of Pedestrian Interview Survey Respondents
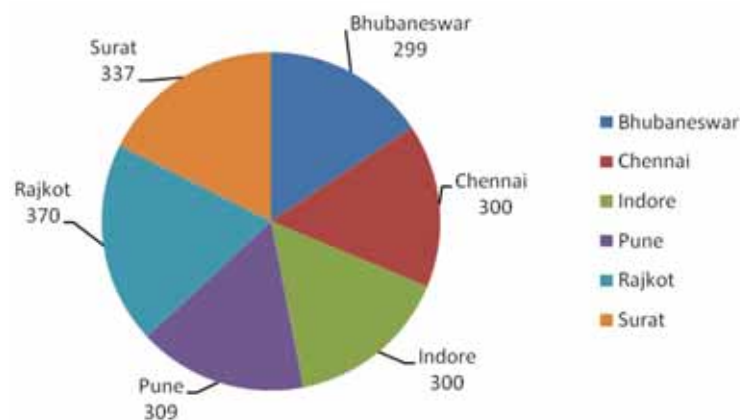
Figure 11. Number of Pedestrian Interview Survey Respondents

The questions included attitudinal, socio-economic and preferences. In order to capture a balanced sample, an attempt was made to collect similar sample sizes from each city, at least fifty respondents for each area, but total respondents for each city ranged from 250-300 on average.

5.2 Profile and Age Group of Respondents

Survey participants were dominated by males (71%). The majority of people (58%) were in the age group 15-30 years as shown in figure below.
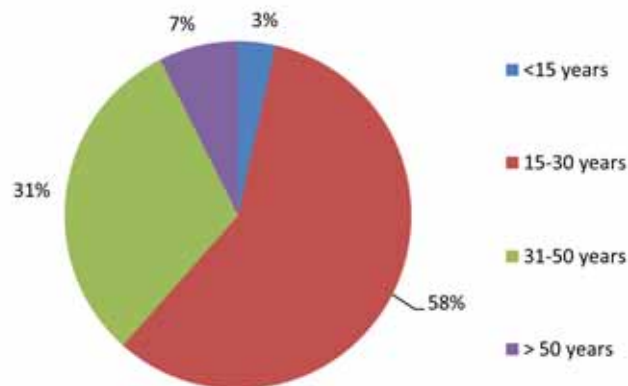
Figure 12. Age Group of Respondents

5.3 Travel Characteristics

In urban areas most of the trips entail chaining i.e. use of multiple modes. Based on the surveys, it was found that on an average day, majority of the trips were undertaken by walking (43%). Private modes constituted only 19%. The below figure shows the daily modes used of the people interviewed. Nearly 46% of people interviewed came from households which do not possess motorized vehicles and thus are captive to non-motorized and public transport modes. Of the households with vehicles, 71% owned two wheelers and 29% owned cars.
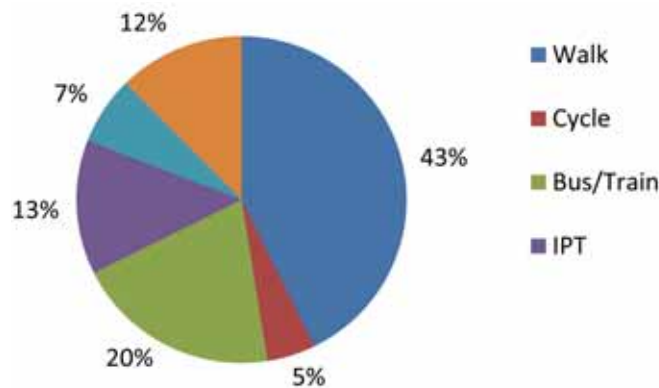
Figure 13. Travel Mode Share of Respondents

The average travel time (one-way) as estimated by the respondents showed that a majority of trips are within 30 minutes (53%). Similar insights can be derived from the trip length characteristics of the respondents with 47% of respondent's traveling less than six km.
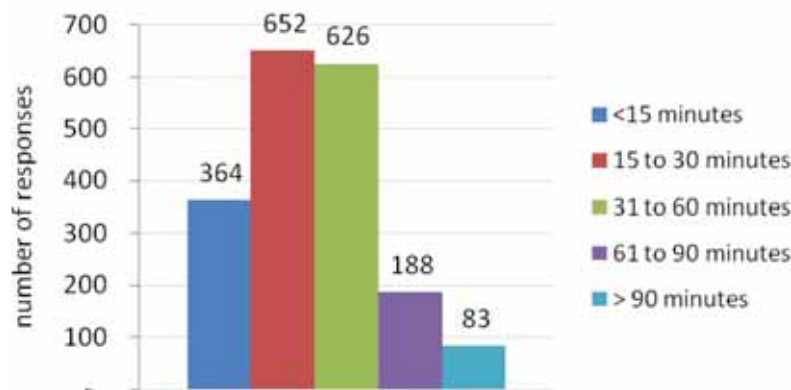
Figure 14. Average Travel Time of Respondents
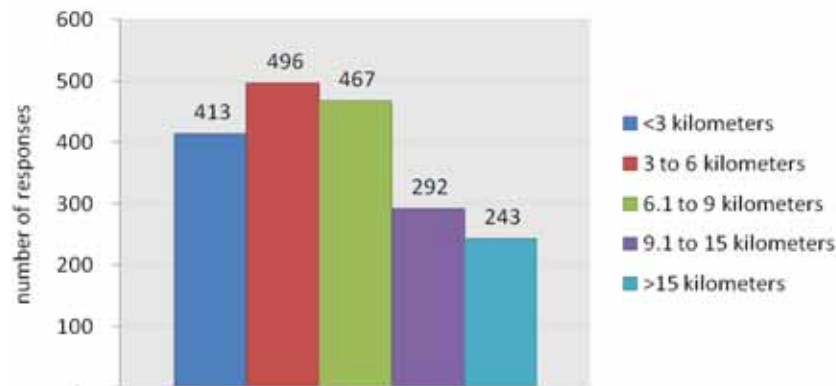
Figure 15. Average Trip Length of Respondents

The above travel characteristics show that a combination of walking, cycling and public transport dominates the private vehicle usage in cities.

5.4 Respondents' Rating of Pedestrian Facilities

The respondents were asked how they would rate the walkability of the area in general terms. 60% of the people consider the pedestrian environment to be in the "bad" and "worst" categories. Only 10% considered the facilities to be of good quality. The results from field surveys match pedestrian interview ratings and thus the conclusion is that the walkability in India is poor and it needs immediate and adequate attention. The below figure summarizes the pedestrian ratings.
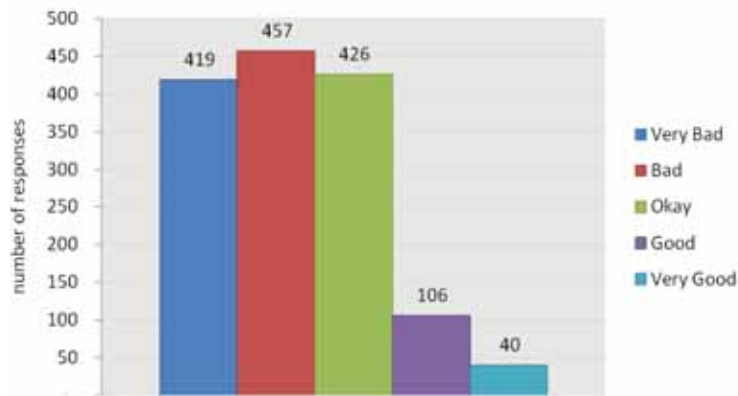
Figure 16. Respondents' Ratings of Pedestrian Facilities

A significant number of people (467) did not give any response to this question.

5.5 Pedestrian Preference

In order to understand the preferences of pedestrians on facility improvements, respondents were asked to rank the different types of facility improvements based on a priority scale. The figure below indicates that the top priority is to provide wider, level and clean sidewalks/ footpaths followed by the reduced and slow traffic and removal of obstacles and parking. Surprisingly the "crossings" which are the main conflict locations were of the least immediate priority (first). By considering all the rankings (1 to 5) and by providing weights 5 to 1 allocated to priority 1 to 5, the most important parameters as suggested by the respondents are (in decreasing order of priority)

1. Wider, level and clean sidewalks/ footpaths
2. Reduced and slow traffic on road
3. Remove obstacles/ parking from footpath
4. More crossing points
5. Improved street lighting
6. Easy access for people with special abilities

By comparing the interview observations with field walkability surveys, it was surprising to note that the parameter "Easy access for people with special abilities" had the lowest priority. Field surveys have suggested that the infrastructure acts as a biggest barrier for the people with special abilities. General lack of concern for this important parameter is 'wakeup call' for the authorities. The basic design philosophy of the infrastructure is to be sympathetic to the vulnerable and until this aspect has been realized, the infrastructure would never provide barrier free movement.

It is interesting to note that the 42% of respondents preferred at-grade crossings. Subways and Skywalks were second and third preferred option with 31% and 27%. More respondents from cities Indore, Rajkot and Surat gave preference to overhead crossings. These cities currently have only few crossings when compared to cities like Pune and Chennai where majority of people voted for at grade crossings. The main reason for request for overhead crossings can be the high traffic accidents prevailing in our cities and the lack of facilities which provide safe opportunities to cross the roads. There is one more important factor which needs to be considered i.e. crossing behavior (how far they are willing to travel to

access crossings). The majority of respondents are willing to walk to access pedestrian crossings within 50 meters (42%) and within 100 meters (27%) as shown in the Figure below. Nearly 30% are willing to walk more than 100 up to 200 meters to access crossings. Not even a single pedestrian agreed to walk more than 200 m to access the crossings. This provides a huge challenge to policymakers in planning for pedestrian crossings. There may be a need to revise existing guidelines that provide controlled crossings only at few locations in mid-blocks and at junctions which are more often separated by a long distance (>300 m). The call for overhead crossings also becomes void with such a small willingness to travel more than 200 meters.

Nearly 23 km of skywalks are being built in Mumbai. 23 skywalks have already been built and in operation as of August 2010. The cost of the project is around 160 million USD. Authorities believe that the cost of construction can be recovered in about 5-10 years by way of commercial provision or advertisements at suitable locations. Authorities suggest that the skywalks provide multiple access points for efficient dispersal of commuters and connect busy areas. It allows segregation of pedestrian and vehicular traffic for faster movement of vehicles on roads. It also provides safety of pedestrians and better utilization of road widths. The additional capacity generated by skywalks is a debated issue and the criticisms are mounting. Many suggest that it has adverse impact on the aesthetics and shops at ground level are losing business. Reports have suggested that building such skywalks entail massive budgets and thus prone to corruption. The comparisons between skywalks and massive roadway project Bandra Worli Sea Link (5.5 km, 32m width @ Rs 16.5 billion INR) has indicated that at some places the sky walk of 4 m wide is as expensive as 32m of Bandra Worli Sea Link when compared in terms of sqm unit.

Sources: See MMRDA, http://www.suchetadalal.com, http://mumbai.thecityfix.com
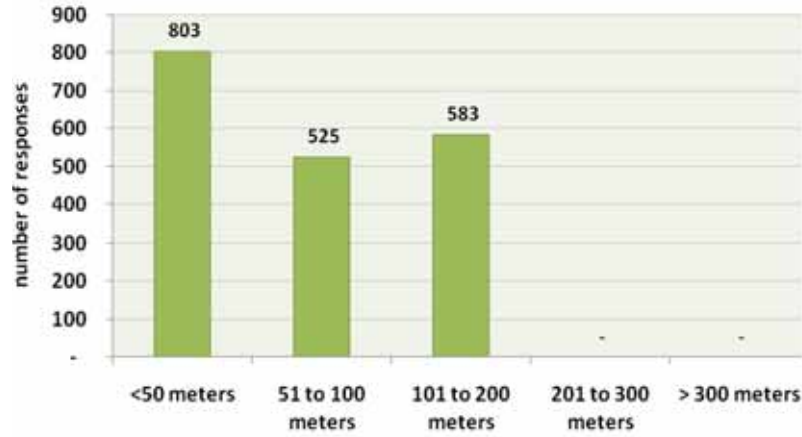
Box 2. Mumbai Skywalks – Boon or Bane?

Figure 17. Respondents' Willingness to Walk to Access Pedestrian Crossings

Pedestrians are quickly migrating to other modes with increasing motorization and inadequate pedestrian facilities if the walking environment is not improved. Of respondents, 62% indicated that they will shift to other modes (20% to cars and 22% to two-wheelers) if no improvement is carried out.
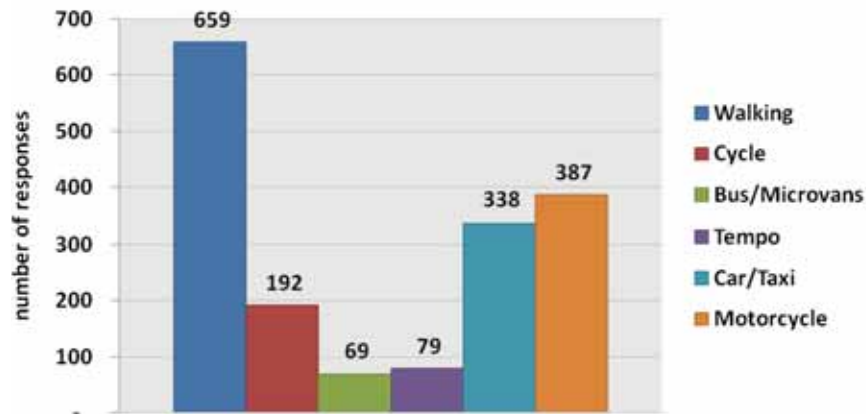

Figure 18. Transport Mode Preference if Pedestrian Facilities are not improved

5.6 Comparison of Six Indian cities data with other Asian Cities

Comparing the data obtained from six cities with an earlier similar survey in thirteen Asian cities show interesting insights. More Indians consider walking environment as "bad" and "worst" when compared to other Asian citizens. This is not surprising as the walkability of Indian cities is relatively poor than other Asian cities which were surveyed.

Parameter	Indian Cities	Other Asian cities
Pedestrian environment rating	**60%** of the people consider the pedestrian environment to be in the "bad" and "worst" categories.	**41%** of the people consider the pedestrian environment to be in the "bad" and "worst" categories
Top priorities	Top priority is to provide wider, level and clean sidewalks/ footpaths followed by the reduced and slow traffic and removal of obstacles and parking.	Top priority is to provide wider, level and clean sidewalks/ footpaths followed by the removal of obstacles/ parked cars from footpaths and the third is improved street lighting.
Shift to other modes if no improvements	**62%** indicated that they will shift to other modes (20% to cars and 22% to two-wheelers) if no improvement is carried out.	If the walking environment is not improved, **80%** indicated that they will shift to other modes if they can afford to: 29% to cars and 10% to two-wheelers
When are they most exposed to Air Pollution	Nearly **46%** of people suggested that they are most exposed to air pollution while walking or when waiting for the bus	Nearly **65%** of people suggested that they are most exposed to air pollution while walking or when waiting for the bus

Table 8. Comparison of pedestrian preferences of Indian and other Asian cities

6. Policy and Institutional Analysis Results

As discussed earlier, urban areas are getting attention as never before and thus it is imperative that authorities utilize this opportunity to create livable cities. Institutional arrangements and the right mix of policies at the national, state and local levels are needed to seize this opportunity.

6.1 National Institutional Arrangement and Policies

At the institutional level, India is unique in the world with a Ministry of Urban Development (MOUD), which allows city issues to be coordinated centrally at the national level, including urban transport. However, since urban transport is a main constituent of urban development, the primary responsibility lies with state government, local officials and urban bodies. Influencing local bodies to adopt low carbon transport modes and plans is of great importance. In order to influence local bodies, the central government formulated the National Urban Transport Policy in April, 2006 (NUTP-2006) with a vision:

- To recognize that people occupy center-stage in our cities and all plans would be for their common benefit and well-being.
- To make our cities the most livable in the world and enable them to become the "engines of economic growth" that power India's development in the 21st century.
- To allow our cities to evolve into an urban from that is best suited for the unique geography of their locations and is best placed to support the main social and economic activities that take place in the city.

This policy prioritizes the movement of people over vehicles and promotes NMT. At the same time as NUTP, large amounts of funds are being made available for urban infrastructure under the Jawaharlal Nehru National Urban Renewal Mission (JNNURM). Since the mandate for urban transport lies with each state, the implementation of the NUTP in the field is to be done by the concerned state governments and urban local bodies. At the central government level, the basic idea is to fund the process and initiate few projects that create a "domino effect" in cities. Central government has wielded "sticks" with "carrots" as it has formally tied approval of JNNURM funds to the NUTP. Thus, any city applying for JNNURM funds for transport improvements must, on paper, use them in a manner consistent with the NUTP. However, cities have not used this opportunity optimally and many of the initiatives have not yielded results.

6.2 City Development Plans

It is interesting to note that all cities with more than a million population that are covered under JNNURM are required to develop their respective city development plans (CDP) to identify the infrastructure projects that can be eligible for central and state assistance. As part of comprehensive development plans and transport plans, the city needs to develop a vision or a target and plan for such a vision. Consider the case of Indore. Indore vision as described in CDP is

"Year 2021 envisages 60% of all weather roads and a total road development of 2000 km is expected to cover the entire area and population of the corporation by 2011. Year 2021 envisages full section road development and intersections development of about 60% road length with an effective traffic management and effective public transport systems and introduction of metro, elevated roads and flyovers as also on the major corridors of the city by 2021."

The problem with such a vision is that it caters to the infrastructure and does not talk about livable cities or improved walkability. Here, the city needs active guidance. Some of the basic ingredients of livable cities 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.

Thus, when the current initiatives of Indian cities were reviewed, not many details were available on improving accessibility and walkability. Hence the new CDPs have not considered priority pedestrian movements as visualized by the NUTP. In order to determine the current initiatives, the traffic and transportation plans, and comprehensive development plans and media reports were reviewed and stakeholders were consulted.

The below table summarizes the current initiatives being undertaken in cities. It is clear that cities are not doing enough to rejuvenate pedestrian space and improving walking facilities. There are few isolated projects being planned but no major overhaul proposed. The trend is towards building few pedestrian overpasses and improving few kilometers of footpath. Majority of the emphasis is on the public transport and increase in road space. It is a serious concern that cities are investing millions of dollars on the public transport without improving accessibility of the system proportionately. Majority of people access public transport by walking and thus neglecting the accessibility of pedestrians could prevent ridership growth thereby putting the entire system at financial risk with increased congestion along the transport network.

Table 9. Review of City Transport Improvement Plans[24]

Initiative and City	Description
NMT Improvement	
Surat	33 Foot-over-bridges and subways are planned for the pedestrians
Chennai	A cycle track project is being planned. The bicycle tracks are proposed in a pilot project in Anna Nagar to improve conditions for pedestrians, cyclists, vendors, and other non-motorized users of the street. The cycle tracks are being designed with complete Streets principles and designs proposed by the Institute for Transportation and Development Policy (ITDP). Escalators have been proposed for 20 overhead crossings. The draft master plan proposes following 1. To ensure that the footpaths are not less than 1.5m in residential streets and 3.0m on major roads with commercial activities. 2. There is a need to redeem the existing footpaths from such encroachments as flag-posts, hoardings, hawkers, shops, places of worship, eat-outs, construction materials, parking of vehicles, PCOs, telephone boxes, electrical transformers / junction boxes, traffic umbrellas, waste bins, milk booths etc. 3. As in the case of evicting the encroachments on water-bodies with stringent penal actions as provided for in the recent Ordinance, similar legal framework is proposed for evicting the encroachments on footpaths / roads. 4. Demarcating stretches of roads or areas exclusively for movement by pedestrians and cyclists and providing safe passage of pedestrian / cyclists by sub-ways.

24　Bhubaneswar is missing in this list as comprehensive details of various proposals could not be collected due to lack of information available in public domain

Initiative and City	Description
Pune	As part of the Master Plan of the BRT, submitted by CIRT and IIT-Delhi, a cycle network has been proposed. There are also plans to encourage and designate pedestrianisation in core area, build number of overhead crossings and subways. According to reports nearly 25 pedestrian subways has been proposed. It proposes construction of underpasses for pedestrian access to BRT stations on the pilot corridor.
Indore	-
Rajkot	There are proposals for development pedestrian network for central area, Development of NMV lanes and Cycle track along 5 roads.

Improving Mass Transit

Surat	Canal Corridor Project - The total length of canal in Surat Urban Development Authority (SUDA) limit is approximately 32 kilometres. As this canal passes through the major important cross sections of the city, this corridor could provide an effective MRTS to the city of Surat. This corridor is under discussion. BRTS Project – Surat is currently planning and building a 29 km of BRTS corridor which will be financed by the Government of India (50 per cent), the Government of Gujarat (20 per cent) and the Surat Municipal Corporation (30 per cent). City Bus service based PPP Project – Under this initiative the contractor shall procure, operate and maintain the bus himself and he will collect the fare too from the passengers as per the Fare Notification. The advertisement rights are allocated to the contractor and the contractor would earn from the advertisements made on the bus. Based on the license issued to the contractors a yearly premium to the Surat Municipal Seva Sadan would be paid. Surat Municipal Seva Sadan has identified the routes and these routes have been divided into 4 bus zones.
Chennai	Strengthening and expanding the urban rail network including MRTS, Introduction of a hybrid monorail system for Chennai, Development of metro rail for Chennai for a length of 45 km (at a cost of Rs.50870 million for implementation during 2006- 2011). Completion and commissioning of other strategic transport developments such as the ongoing MRTS Ph.II, Gauge Conversion project. Augmenting the bus transport with an optimal fleet size of 4500-7000 buses to keep pace with the growing commuter travel demand.

Initiative and City	Description
Pune	Public transport systems are proposed for up-gradation through increase in bus supply and developing high capacity mass transit systems etc. Pune Mahanagar Parivahan Mahamandal Ltd. (PMPML) is implementing a BRT system on 11 routes covering 139 kms with pilot covered 2 corridors of 16 km in Pune. In addition to the BRT corridors possible High Capacity & High Speed Mass Transit System such as LRT/Metro/Monorail etc are assumed for implementation on appropriate corridors. PMPML currently holds a fleet of 947 buses and hires another 197 buses for operations which are inadequate considering the high population. The officials are planning to add a total of 1129 buses for both PMC and PCMC. Also, PMPML had sent a proposal for conversion of fleet to CNG and also conversion of 200 low floor (400 mm floor height) buses from non air conditioned to air conditioned. There are also proposals for provision of Passenger Information System at each bus stops and creating a central control facility
Indore	The Indore Mass Transport System (IMTS) was proposed to include 277 km of bus network and 44.75 km of rail network (IMTS) comprising three corridors: Green Corridor (East-West Corridor) comprising of 12.3 km, Red Corridor (A B Road) comprising of 15.25 length, Blue Corridor (Ring Road – W) comprising of 17.20 km length Indore developed a systems approach to implementing the BRT system consisting of planning, management, and control through the establishment of Indore City Transport Services Ltd (ICTSL). Its one of the unique Public Private Partnership model for public transport. Bus rapid transit system is being extended to a length of 109 Kms. Under the GEF SUTP project, Indore is planning to improve its Public transport and BRTS with Signal Prioritization and Automatic Fare Collection. There are also plans to decongest Sarwete Bus Terminal with an additional inter-state bus terminal at MR3. Authorities are also thinking of developing a metro system in Indore.
Rajkot	Establishment of Rajkot Bus Transport Service with an estimated fleet of 200 buses, development of six bus depots and one central workshop. Setting up of Rajkot Transport Company (RTC). A comprehensive BRTS network has been proposed. In the first phase, 29 km long stretch (called as Blue corridor) on 150 feet Ring Road is planned at an estimated cost of Rs 1100 million.

Supply intensive strategies

Surat	Important roads are planned to be improved. The major road network is planned to be converted from flexible pavement to rigid pavement. Also there are proposals to complete missing links along the ring road. There are proposals to build two major bridges along river Tapi to boost the connectivity. There are proposals to build approximately 670 K.M. of roads to facilitate movement of vehicles and improve 35 junctions. There are also plans to build 23 flyovers and many junctions to be signalized.

Initiative and City	Description
Chennai	Capacity expansion of the major arterial road corridors such as Anna Salai, Periyar EVR Salai, Jawaharlal Nehru Salai by constructing elevated roadway / transit-way along the median of the road. Removing bottlenecks in the road / rail corridors such as road-rail crossings, narrow bridges across rivers / canals etc and construction of grade separators at all the critical intersections of radial roads with IRR.
Pune	Upgrade of existing un-surfaced roads, new roads development, widening and strengthening of identified major roads, improvements to the transportation and traffic management systems. An additional 1850 km of surfaced road networks are proposed to be put in place. Proposal includes - 920 km of new roads would also be required to be developed by 2011-12 to provide better connectivity in the peripheral areas. Another 525 km of existing roads are identified for widening and strengthening to be carried out by 2011-12. Authorities are considering building 10 grade separators at congested intersections. The station area is proposed to be de congested by improving east-west alignment connecting Karve Road to Nagar Road directly through the Sangam. A HCMTR project worth Rs. 2439 million has been proposed. It involves construction of two elevated roads, two major bridges, two ROBs, four flyovers and the widening of an existing minor bridge. Another Rs. 2793 million is proposed for various improvements to roads within the city under the IRDP covering four ROBs & flyovers, thirteen bridges & subways and also shifting of utility lines to dedicated corridors along these stretches of roads.
Indore	Nearly 416 km of road network is proposed to be developed in phases by 2025. Of this, 133.8 km would be 2 lane roads, 13.1 km – 3 lane roads, 122.7 km – 4 lane roads and 146.3 km – 6 lane roads. Eight railway over bridges (ROBs) have been proposed all over the city. All major roads are proposed to be expanded to four-six lanes with footpaths and drains. Service roads are being planned wherever possible. Also the authorities are converting the flexible pavements to rigid pavements.
Rajkot	Supply strategies include Construction of flyovers, ROB's, RUB's and underpass. Construction of new ring road. There is a proposal for implementation of the traffic circulation system within central area. There are also plans to improve the central area internal road network in terms of geometrics, provision of footpaths, pavement strengthening etc. The peripheral roads are proposed to be expanded and traffic signals are proposed in many junctions etc.
Other measures	
Surat	A Traffic Management Institute is planned be set up which will co-ordinate Traffic education in primary, secondary schools. The institute shall run with state / SMC/ and NGO's fund. Tailpipe Management - Surat has managed to convert buses, motor vehicles and auto rickshaws into CNG and LPG based fuel and increased the number of supply stations for CNG

Initiative and City	Description
Chennai	Freight initiatives - the inner circular corridor (rail) (icc (rail) from velachery to ennore) and connecting chennai central and chennai egmore. Development of a centralized goods terminal for Chennai area at Korukkupet. Construction of a new railway line between Athipattu and Puttur/ Thiruvallur to bypass northeast and south-west rail corridors to decongest freight movement in the CMA. Additional truck parking at Adayalampattu Village along NH Bypass in an areas of 16 acres and a major truck terminal at the intersection of Thirumanam and Vayalanallur on ORR in an area of 160 Ha. Decentralisation - decentralization of the CBD is being proposed by shifting of the whole-sale market to koyambedu, the Iron and Steel Market to Sathangadu, construction of truck terminal at Madhavaram. UMTA- Based on the recommendation of the National Urban Transportation Policy creation of UMTA has been proposed based on various initiatives taken subsequently by GoTN on 24-10-2007.
Pune	Four truck terminals have been proposed at Nashik road, Vithalwadi, Loni and Satara road. Other measures include creation of urban transport fund, establishment of Pune Metropolitan Transport Authority (PMTA). Pune is also a recipient of GRF-SUTP project.
Indore	Freight Initiatives – Development of goods terminal at major roads and creating a "transport nagar" at MR 3. Other measures include Parking **-** Construction of parking lots and multi-store parking buildings in inner city areas, new traffic signs etc
Rajkot	Setting up of a Traffic Engineering & Management Unit (TEMU) in RMC, Setting up of Rajkot Transport Development Fund, Improvement in logistics support to Traffic Police

6.3 Institutional, Planning and Policy Barriers

This section identifies several institutional, planning and policy-related barriers for developing walkable cities in India.

1. **Policy** - There is a lack of pedestrian policies and political support that cater to the needs of pedestrians at the national, state and local levels. Only few cities have a pedestrian policy or even pedestrian master plan. A city like Bangalore has drafted a policy paper for pedestrian movement in the Bangalore metropolitan region. The policy paper and the comprehensive traffic and transportation study envision a pedestrian mode share target of only 20% by 2025. With such a relatively small vision/target, the city may be planning for 'poor walkability'. [25]

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25   Directorate of Urban Land Transport (Bangalore). 2008. Policy Paper for Pedestrian Movement in the Bangalore Metropoltan Region. Draft Report. See http://www.indiaenvironmentportal.org.in/files/Draft%20Pedestrian%20 Policy%20for%20BMR.pdf

2. **Institutions** - Dedicated institutions having legal support for pedestrians are not often found in Indian cities. In 2008, the Right to Walk Foundation submitted a query in Hyderabad as to who is ultimately responsible for the city's footpaths?

   The Roads and Bridges (R&B) department suggested: "Footpaths are not our concern; please approach the Greater Hyderabad Municipal Corporation (GHMC)." And the GHMC replied as follows: "Footpaths are under the R &B department's jurisdiction."[26]

   Urban transport in India is marred with multiple agencies having stakes in several aspects. The agencies involved in urban transport include - transport department, police, urban development department, municipal corporation, revenue department, finance department, public works department, pollution control board etc. With institutions bickering over taking ownership of pedestrian facilities, the conditions are deteriorating. There is little coordination among existing institutions. Also, there is a lack of communication mechanisms for users to provide input/feedback to urban transport decision-making and learn about issues and progress.

3. **Transport Plans** - There is a serious disconnect between existing transport plans and walkability. Current comprehensive development plans, city mobility plans / master plans provide emphasis to only high cost transport projects or supply intensive projects. Footpaths and other pedestrian facilities are not included as infrastructure as defined by the Planning Commission.[27] In a recent analysis of Comprehensive Development Plans of 20 Indian cities on Walkability found that only 10 cities had some provisions for pedestrians in the long term plan. [28] Many of such cities which had indicated future plans are in fact creating the infrastructure only in limited areas. It is clear that unless cities make a concrete action plan pedestrian and walkability problems will not be solved.

4. **Data on Pedestrians in Planning** - Walking as such is not considered as a "trip" by many and many cities undercount walking trips while developing four-step transport-land use models. [29] Also there are many issues with forecasting pedestrian trips by conventional transport modeling tools.

5. **Capacity** - Inadequate capacity in local institutions and urban bodies. One of the medium to educate and improve capacity is to create and show good examples and case studies and hope for inspiration and thus the domino effect. However, there is lack of local best practices which can demonstrate the benefits of walkable cities.

6. **Budget for Walkability** - Review of the city expenditures has proved that there is a huge problem of insufficient funding which is further exacerbated when the funding for pedestrian facilities is allocated for ineffective, improperly located and/or for extravagant projects. For example in Bangalore – The Comprehensive Traffic and Transportation Study (CTTS) envisage an investment of about 12 billion USD over the 15 years time frame. The percentage share allocated to pedestrian projects is only 0.6% of total while 60% is allocated to mass transport. Majority of mass transport users need good access facilities to use such transport. Further, 75% of the funds allocated to the pedestrians are reserved for "overhead crossings" while 25% is allocated for footpaths.

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26   The discussion is accessible at http://right2walk.com/?page_id=17

27   Planning Commission (India) Definition of Infrastructure. See http://infrastructure.gov.in/pdf/doi.pdf

28   The alternative urban futures report urbanisation & sustainability in india: an interdependent agenda (wwf-India 2009).

29   In case of multi model trip chains, often shorter trips are neglected. There are also issues with definition of trip. Does walking for 100m constitute a trip? What is the minimum trip length that should be considered? These questions remain unanswered.

7. **Design Standards**- Lack of national good design standards for complete streets is one the biggest barriers to improve walkability in India. The current standards have some limited provisions for the pedestrians. Many concepts for pedestrian infrastructure are designed on the assumption that pedestrian behaviour mimics that of vehicles, for example travelling in a linear path, with faster movement indicating efficient flow. What analysts often forget is that walking is a complex movement pattern, which involves activities such as waiting, shopping and meeting people. Thus, it is wrong to design a facility that assimilates people to vehicles travelling at a uniform speed, as often envisioned in capacity analysis. There is a need for designs which accommodates and prioritizes non motorized transport movements.

8. **Indicators/Benchmarks** - In order to quantify the improvements, there are insufficient indicators to measure and monitor improvement in walking facilities. The recent benchmarking tool developed by MOUD for urban transport also uses only three indicators to calculate the pedestrian facility rating - signalized intersection delay(s)/pedestrian, street lighting (Lux) and % of city covered with footpaths wider than 1.2 m. In reality, walkability is more than just footpaths, crossings or lightings. The indicators selected should be comprehensive enough to measure all parameters. A use of indicator such as WI based on either qualitative or quantitative surveys is a good start.

Street vendors constitute nearly 2% of the city population. Since it requires minor financial input and the low quotient on skills, majority of urban poor find hawking as a means to earn a livelihood. The average daily income is about 1 to2 $. Street vendors operate from footpaths and thus considered as a necessary evil by the authorities and the general public. They provide valuable services but offer restriction to the movement of the pedestrians. They make the shopping trips shorter, save time and provide security by their mere presence.

The following Supreme Court comment provides insights on the relationship between street vendors and pedestrians

"If properly regulated according to the exigency of the circumstances, the small traders on the sidewalks can considerably add to the comfort and convenience of the general public, by making available ordinary articles of everyday use for a comparatively lesser price. An ordinary person, not very affluent, while hurrying towards his home after a day's work can pick up these articles without going out of his way to find a regular market. The right to carry on trade or business mentioned in Article 19(1) (g) of the Constitution, on street pavements, if properly regulated cannot be denied on the ground that the streets are meant exclusively for passing or re-passing and no other use (Sodhan Singh vs NDMC, 1989)".

After years of discussion as to how best to include the vendors in the transport system, the government of India framed the National Policy on Urban Street Vendors. Central government introduced the National Policy on Urban Street Vendors in 2004 and immediately revised it in 2009 to make it more comprehensive. This policy promotes 'win-win' solution where the positive benefits of vendors are appreciated but reducing the competition for space with pedestrians by spatial design. This policy promotes three zones – 'restriction free vending', 'restricted vending zone' and 'no vending zone' taking into account the natural propensity of street vendors to locate in certain places at certain times in response to patterns of demand for their goods/services or the formation of "natural markets" or traffic congestion and other factors. Other features of this policy are - census of street vendors, provision of ID cards and license to them, allotment of proper place and shops for transacting business, extension of loans at low interest rate.

Box 3. National Policy on Urban Street Vendors

7. Removing Barriers to Improve Walkability

In order to realize and influence a paradigm shift in raising the quality of walking facilities and as well as developing actual on-the-ground projects some strategies have been explored in detail. These are:

(i)   improving institutional arrangements and creating dedicated institutional support for pedestrians;

(ii)   developing mandatory complete streets design guidelines;

(iii)   setting stringent walkability improvement targets including pedestrian mode share and pedestrian fatality reduction

(iv)   conducting annual pedestrian benchmarks;

(v)   integrating walkability to improve city plans;

(vi)   promoting applied research on walkability; and

(vii)   making allies for improving walkability in India.

Promoting more centers of excellence on walkability would provide the bottom-up thrust in improving walking. Setting annual targets on mode share, walkability and fatality reduction would not only provide insights on improving walkability but also a measurement tool to measure the progress.

It is not that Indian cities do not know how to create good pedestrian infrastructure but such infrastructure is available in only few areas where only the elite reside. A large variation in the quality of infrastructure was found in cities. The majority of streets in Indian cities had lower ratings for disability infrastructure, amenities and obstructions thus indicating that streets are a mobility barrier for pedestrians and especially for the disadvantaged. The following section describes few strategic approaches which will improve walkability in Indian cities.

7.1 Institutional Arrangements to Promote Walkability

Dedicated institutions can provide major thrust in improving the walking facilities in India It is essential to create a healthy communication mechanism between the dedicated institutions and pedestrians thus creating transparency in the transport sector decision making. The best approach to improve walkability is to provide pro-active institutional support to the most vulnerable segment in the transport system i.e. pedestrians. Entrusting responsibility of pedestrians on a single institution to safeguard their interest and provide adequate facilities and coordinate with various agencies can create a significant change in the entire transport system. Dedicated institutions can make use of latest information and communication technology to create a two way communication medium with the people who actually walk thereby creating transparency. In this chapter three different institution models that exist in India are summarized which can help in making cities walkable.

a. Pune NMT Cell[30]

Pune was one of the pioneer cities in India which established a NMT cell in 2008 to address NMT related issues. This cell was established under the Pune Municipal Corporation and various NGO's like Parisar, Pedestrians First supported the cell.

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30   The discussion on PUNE NMT cell has been captured based on literature available @ parisar.org, http://government.wikia. com/wiki/N.M.T(Non-Motorized_Cell) and personal discussions with NMT cell members

The following were the objectives of the Cell

1. Act as the coordinator between various departments on all NMT related matters

2. Propose and monitor budgetary allocations for NMT

3. Plan for NMT related infrastructure in the city and ensure their execution

4. Put in place design and standards specifications and guidelines for NMT related infrastructure and ensure that all PMC works adhere to them

5. Establish visibility for walking and cycling by creating distinct signages and ensure their consistent usage

6. Undertake regular surveys of all NMT related infrastructure and ensure their maintenance and usability

7. Work with the police to ensure enforcement of rules and regulations that impact pedestrians and cyclists and increase awareness about their rights

8. Make sure that all complaints and suggestions related to walking and cycling are taken up by the relevant authority and follow up on them

9. Promote walking and cycling in the city through outreach and awareness programs and special events

10. Publish an annual report of all NMT related data for inclusion in the Environment Status Report

The various departments having stakes on NMT issues and projects provide data, information and other staff support to the NMT cell and NMT cell based on the review provide feedback to the municipal commissioner. The municipal commissioner reviews the feedback and relays his judgment to the concerned departments. The NMT cell creation had some resistance from the ward officials. However, the cell members consider that the repeated exposure and conditioning lead to some success and change in the mindset. However, transfer of the municipal commissioner and lack of renewed interest from the municipal authorities has led to NMT cell being made inactive.

b. Urban Metropolitan Transport Authority

Suggestions to establish an Urban Metropolitan Transport Authority (UMTA) began over thirty years ago when Justice B N Pande Committee report strongly recommended setting up of UMTA for all million- plus population cities to provide an integrated and coordinating institutional mechanism[31]. However, only in that past decade some degree of success has been achieved. The first UMTA was established in 1999 in Guwahati. One of the recommendations of the NUTP was to establish UMTA in all million plus cities-

"The current structure of governance for the transport sector is not equipped to deal with the problems of urban transport. These structures were put in place well before the problems of urban transport began to surface in India and hence do not provide for the right co-ordination mechanisms to deal with urban transport. The central government will, therefore, recommend the setting up of Unified Metropolitan Transport Authorities (UMTA's) in all million plus cities, to facilitate more coordinated planning and implementation of urban transport programs and projects and an integrated management of urban transport systems. Such Metropolitan Transport Authorities would need statutory backing in order to be meaningful."

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31   http://www.medcindia.org/Digest/july10/Mokashi.pdf

Main functions of UMTA can be:

1. Coordinate with city planning authority in the preparation of city Master/Development Plan providing professional inputs as related to city transport sector

2. Prepare integrated multi-modal transport plan

3. Ensure that effective public transport systems are in place

4. Facilitate participation of private sector

5. Formulate fare policy for the integrated public transport system and function as Tariff Regulatory Authority

6. Prepare Transport System Management Plans on an area or corridor basis and facilitate their implementation

7. Maintain and disseminate city level urban transport information system

8. Coordinate the working of all component participant agencies

9. Approve traffic and transportation proposals/projects from any agency

Currently the experience suggests that local officials have not been proactive in creating and empowering the UMTA's. Consider the case of Bangalore Land transport Authority, which was established on 9 March 2007, but has no statutory authority, regular executive body or independent secretariat. Similar is the experience from other cities. It is to be noted that all UMTA's are essentially recommendatory and coordination bodies – not implementing agencies. Thus, pedestrian concerns are not considered comprehensively by UMTA's and thus empowering UMTA's and entrusting the responsibility of improving walkability on UMTA's can lead to effective solutions.

c. Unified Traffic and Transportation Infrastructure Planning and Engineering Center

UTTIPEC was developed on similar lines to UMTA. Unified Traffic and Transportation Infrastructure (Planning & Engineering) Centre was set up by Delhi Development Authority. It was made mandatory that all transportation projects in Delhi by any agency having road engineering/infrastructure implication require clearance of the centre (UTTIPEC). This centre was established in 2008 to fast track the rapid developments in infrastructure due to commonwealth games and to prevent the coordination mismatch mistakes that occurred in Delhi BRTS.

The objective of UTTIPEC was:

1. To study and coordinate the norms and standards for Planning and Engineering Practices in Traffic and Transportation.

2. Engineering Aspects of Implementation of National Transport Policy- 2006 & Master Plan of Delhi -2021 Transportation proposals.

3. Traffic Road Safety Audit Guidelines (TRSAG).

4. To coordinate the Engineering and Infrastructure aspects of sustainable public transportation system.

5. To evolve a parking policy and evolve parking solutions.

6. Inventory of corridor-wise Traffic & Transportation issues, Traffic Management Strategies and Enforcement Guidelines.

7. To act as a repository for sharing of traffic and transportation plans/ database/information/digitization and website development.

8. Evolving Environmental Impact Assessment Guidelines for Traffic & Transportation Projects.

9. Developing protocols and norms for signages, street furniture, lighting, signals, hoardings, trees,

roadside landscapes, zebra crossing, pedestrian passages, commuter facilities etc.

10. Evaluation–Public participation-Feedback.

11. To take up other related activities as may be considered appropriate by the 'TT Centre' including co-ordination, capacity building and training

UTTIPEC has developed progressive pedestrian design guidelines. Indian cities can adopt such guidelines for creating and maintaining pedestrian infrastructure. This centre comprises representatives of all stakeholders on board: the PWD, DDA, MCD, NDMC, and DIMTS among others. However, the Delhi Cabinet now has cleared a bill to set up the umbrella body UMTA for solving all issues related to transport, infrastructure development and traffic management. With such a development, it remains to be seen as to what would be the role of UTTIPEC.

7.2 Mandatory Complete Streets Design Guidelines

In order to create livable cities, one needs to create an optimal infrastructure for walking which necessitates adopting complete streets design guidelines. In India, while code provisions aimed at catering for people who walk do exist; they are not often based on sound principles. Many concepts for pedestrian infrastructure are designed on the assumption that pedestrian behaviour mimics that of vehicles, for example travelling in a linear path, with faster movement indicating efficient flow. What analysts often forget is that walking is a complex movement pattern, which involves activities such as shopping and meeting people, congregate along the street corners etc.

Thus, it is wrong to design a facility that assimilates people to vehicles travelling at a uniform speed, as often envisioned in capacity analysis. Table 9 below summarizes the Indian design guidelines for pedestrians and normal practice as found during walkability surveys.

Clearly, there is a need to change the character of Indian streets by giving due consideration to pedestrians as the primary consumers of the road space, rather than retrofitting to their needs at a later stage. Similarly, it is imperative to adopt guidelines that are better suited to the full context and character of pedestrian needs, and the land use choices required to address them equitably and effectively. Many Indian cities still need to develop well-designed, shared roads, with traffic calming facilities, in order to give due priority to pedestrians and provide complete streets.

Table 9. Indian Design Guidelines (IRC 103-1988): Issues and Actual Practices

Design	Common practice	Remarks
Footpaths should have a minimum width of 1.5m on both sides. The LOS (Level Of Service) concept dictates the maximum width. The result of such a school of thought is that pedestrians are provided only a minority share of space (most often less than 10% of road space) and in many instances no space at all!		Footpaths are frequently burdened with materials, utilities and encroachments.

Design	Common practice	Remarks
Dead width of 0.5m and 1m to be added to sidewalks running alongside houses and commercial areas.		Very often footpaths are not extended in commercial and residential areas.
Footpath width to be increased at bus stops and recreational areas.		Bus stops provide a classic case of conflict between pedestrians waiting to catch a bus and pedestrians walking to reach their destinations.
Height of footpath to be above that of the carriageway, and supported by an unmountable kerb.		In order to prevent vehicles from encroaching the space, sidewalks are frequently seperated by barriers which do not allow access to disadvantaged groups. Note the quality of footpaths and roads.
Mid-block pedestrian crossings should be provided when the distance between intersections is a minimum of 300m		Mid-block crossings are rarely found on streets.

Design	Common practice	Remarks
Controlled mid-block crossings should be provided where peak hour volumes of pedestrians and vehicles are such that PV^2 (crossing pedestrians multiplied by vehicles) > 1 million (for undivided carriageway) or 2 million (for divided carriageway);where the stream speed of traffic is greater than 65 km/h; and where the waiting times for pedestrians/vehicles have become inordinately long		Cities need to have a greater number of controlled crossings in order to ensure priority for pedestrians. Overhead crossings and subways are not accessible or efficient for pedestrians

As an alternative to IRC guidelines, UTTIPEC has developed pedestrian design guidelines for Indian cities. These guidelines are more progressive than the IRC guidelines and thus can be used as a ready reference by the authorities. UTTIPEC guidelines lays down three main goals for "integrated" streets in Delhi: a) mobility and accessibility – maximum number of people should be able to move fast, safely and conveniently through the city; b) safety and comfort – make streets safe, clean and walkable, create climate sensitive design; c) ecology – reduce impact on the natural environment; and reduce pressure on built infrastructure. By making these guidelines mandatory and carrying out audits at design and during implementation stage, the walkability ratings of the streets can be improved.

7.3 Annual Pedestrian Benchmarks/Targets

In Indian cities, the municipal authority proposes the improvement measures based on various factors. The primary factor is available funding, requests from the local councillors and their political clout. Based on the consultations between the councillor and the city engineers, a local annual improvement plan is proposed which gets approved by the municipal authority. Such improvement plans consists of physical infrastructure improvements and with limited funding available, the majority gets allocated for road works for various reasons. The key to improve the streets is to set annual targets and to create plans and projects for achieving them. The targets should ideally be for pedestrian mode share, fatality reduction and walkability ratings. Currently cities like Bangalore and Pune have adopted targets for pedestrian/NMT mode shares with Bangalore having targeted 20% by 2025 (pedestrians) and Pune 50% for NMT by 2030 respectively. Similarly, consider the case of Delhi (see figure 20). Targets have been established for construction of walkways, public transport mode share, speeds and accident reductions. It is clear from the figure that sidewalk construction target is not ambitious and is very lenient when compared to targets for speed or public transport mode share which would require huge magnitude of the investment. Without improving accessibility, the other targets cannot be secured and thus the need for pedestrian accessibility to be the basis for urban transport planning. There is an essential need for more stringent pedestrian targets. As shown in Figure 19, as pedestrian mode share and walkability ratings go up, pedestrian fatalities go down.
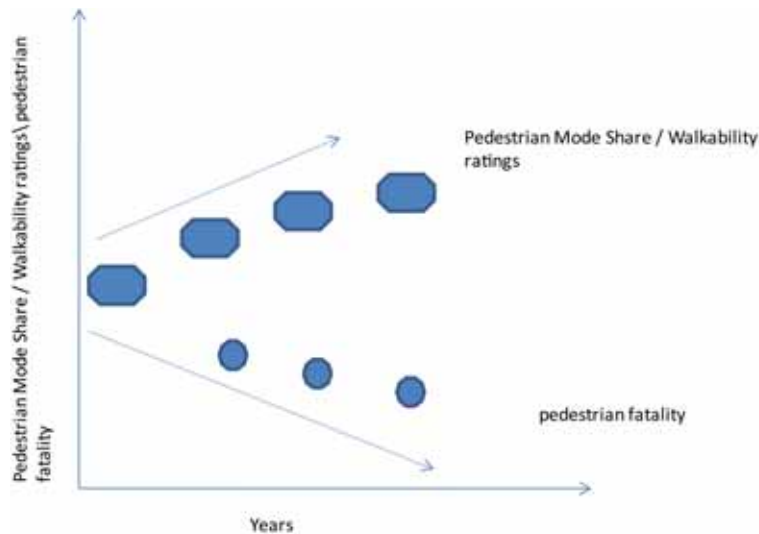
Figure 19. Annual Targets for improving Walkability

By adopting stringent annual mode share, walkability and fatality reduction targets, the streets can be made people friendly and cities livable. Having an institution as a watch dog for this target implementation can allow quick progress. Funds from the central government can be tied to achieving such targets. In fact NUTP/JNNURM suggested framing of comprehensive development and mobility plans based on the city vision which unfortunately in many cities was targets only for the infrastructure. By making concrete annual targets, the cities can account its improvement in walkability.
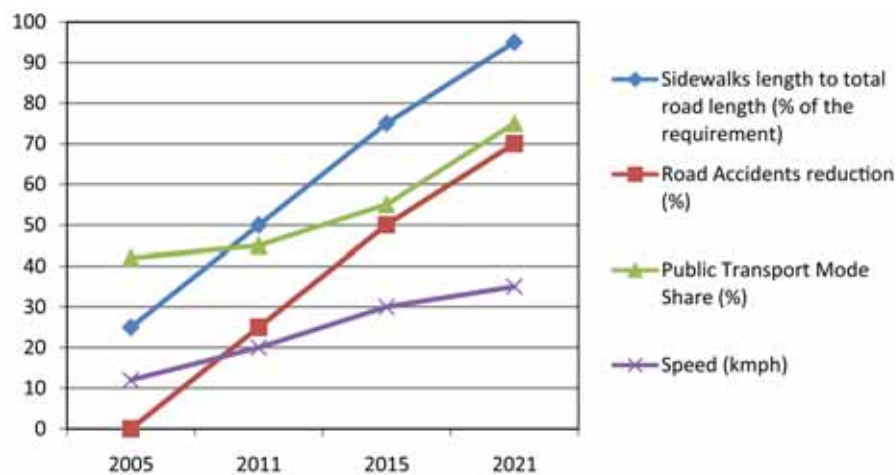
Figure 20. Targets for Delhi based on CDP[32]

7.4 Promote Applied Research on Walkability

Recently, the Ministry of Urban Development established the Center of Excellence for Urban Transport Planning and Development.[33] To begin with the Ministry signed MoUs with IIT Delhi, IIT Chennai, NIT Warangal and CEPT University Ahmedabad. These institutes have been assigned specific areas of focus as follows:

1. The center of excellence at IIT-Delhi will work mainly on areas of public transit planning, design and optimization.

2. The centre of excellence at IIT-Chennai will work in areas of ITS application in Urban Areas, Urban Transport Systems Planning and Urban Transportation Infrastructure Management.

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32   Derived from CSE Presentation at Hyderabad see http://www.cseindia.org/node/1792

33   http://pib.nic.in/release/release.asp?relid=62692

3. The centre of excellence at NIT-Warangal will work in areas of Mass Transit Patronage, Modeling Urban Growth Land use-Transport Integration, and Development of Capacity Analysis for Urban Streets.

4. The centre of excellence at CEPT University-Ahmedabad would work in areas of Land use-Transport Integration, Transit Oriented Development, BRT planning and management, Fiscal tools for Urban Transport Management, Transit Impact Assessment, Social and Environmental aspects of urban transit and Sustainable Urban Transport.

However, in order to promote walkability and create livable cities there is a need to establish center of excellence for Walking in India in many cities. Creating such centers would allow multiple benefits. Students would not only work on research on pedestrian behavior, network with various stakeholders and experts on improving walkability but also work with city officials in improving actual walkability in neighborhoods. This action research would be mutually beneficial as officials would improve their capacity and students would become better officials and citizens in future.

7.5 Making Allies for Improving Walkability in India

Based on the above discussion, it is imperative that a network of allies is created to build a favorable environment for improving the walking infrastructure. Some of the allies for improving walkability are

1. Ministry of Urban Development
2. Institute of urban transport
3. City municipal corporation
4. City Unified Metropolitan Transport Authority (Chennai UMTA)
5. Traffic police
6. Public work department
7. Public Transport authority
8. Pollution control board
9. Private builders
10. Media agencies
11. Transportation consultants
12. Donor Agencies like World Bank, ADB, SIDA, Shakti Sustainable Energy Foundation, GIZ etc.
13. Local and International NGO's

As discussed earlier, there are multiple agencies having stakes in urban transport and especially walkability. By getting all the agencies, dedicated institutions and stakeholder representatives and creating an opportunity for partnerships and networking by annual summit would be ideal. Thus, an annual summit on Walkability[34] can be organized for networking and capacity building activities in India for local walkability promotion. In this summit, activities by various organizations can be showcased and a common position of the future of walkability in India can be developed. Follow up activities for the next year can be developed during the summit based on the discussions. This event would accelerate the development of capacity for walkability in India. Active participation by officials, students, NGO's and experts would provide impetus to the concept of walkability in India.

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34   A similar model exists in developed countries i.e walk 21 conference. This conference has been established based on the vision - "To support, encourage and inspire professionals to evolve the best policies and implement the best initiatives, which create and promote environments where people choose to walk as an indicator of livable communities"

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Annexes

Annex A - Walkability Field Survey Guide

Parameter: Walking Path Modal Conflict
Parameter Number: 1
Description: The extent of conflict between pedestrians and other modes, such as bicycles, motorcycles and cars on the road.
Rating Guide:

Rating	Description	Example
1	Significant conflict that makes walking impossible	
2	Significant conflict that makes walking possible, but dangerous and inconvenient.	
3	Some conflict – walking is possible, but not convenient	
4	Minimal conflict, mostly between pedestrians and non-motorized vehicles	
5	No conflict between pedestrians and other modes	

Parameter: Availability of Walking Paths (with maintenance and cleanliness)

Parameter Number: 2

Description: It reflects the need for, availability and condition of walking paths.

Rating Guide:

Rating	Description	Example
1	Pedestrian walkways required but not available	
2	Pedestrians walkways available but highly congested, badly maintained and not clean	
3	Pedestrians walkways available but congested, needs better maintenance and cleanliness	
4	Pedestrians walkways available which are sometimes congested and are clean and well maintained	
5	Pedestrian walkways not required as people can safely walk on roads	

Parameter: Availability Of Crossings (count the number of crossings available per stretch)

Parameter Number: 3

Description: The availability and distances of crossings to describe whether pedestrians tend to jaywalk when there are no crossings or when crossings are too far in between.

Rating Guide:

Rating	Description	Example
1	Average distance of controlled crossings is greater than 500 m and average speed is high	
2	Average distance of controlled crossings is between 500 m-300 m and average speed is around 40 kmph	
3	Average distance of controlled crossings is between 200 m -300 m and average speed is 20-40 kmph	
4	Average distance of controlled crossings is between 100 m-200 m and average speed is 20-40 kmph	
5	There is no need of controlled crossings as pedestrians are safe to cross wherever they like and vehicles and pedestrians co-exist	

Parameter: Grade Crossing Safety

Parameter number: 4

Description: This refers to the exposure of pedestrians to other modes while crossing, the time spent waiting and crossing the street and the sufficiency of time given to pedestrians to cross signalized intersections.

Rating Guide:

Rating	Description	Example
1	Very high probability of accident with very high crossing time	
2	Dangerous- pedestrian faces some risk of being hurt by other modes and crossing time is high	
3	Difficult to ascertain dangers posed to pedestrians but the time available for crossing is less and people have to hurry	
4	Safe – pedestrian is mostly safe from accident with other modes and exposure time is less and time available for crossing more.	
5	Very safe – other modes present no danger to pedestrians	

Parameter: Motorist Behavior

Parameter Number: 5

Description: The behavior of motorists towards pedestrians which may well indicate the kind of pedestrian environment there is in that area.

Rating Guide:

Rating	Description	Example
1	High traffic disrespect to pedestrians	
2	Traffic disrespect and rarely pedestrians get priority	
3	Motorists sometimes yield	
4	Motorists usually obey traffic laws and sometimes yield to pedestrians	
5	Motorists obey traffic laws and almost always yield to pedestrians	

Parameter: Amenities

Parameter Number: 6

Description: The availability of pedestrian amenities such as benches, street lights, public toilets and trees. These amenities greatly enhance the attractiveness and convenience of the pedestrian environment and in turn, the city itself.

Rating Guide:

Rating	Description	Example
1	No amenities	
2	Little amenities at some locations	
3	Limited number of provisions for pedestrians	
4	Pedestrians provided some good amenities for major length	
5	Pedestrians have excellent amenities such as lighting, cover from sun and rain making walking a pleasant experience	

Parameter: Disability Infrastructure

Parameter Number: 7

Description: The availability, positioning and maintenance of infrastructure for the disabled.

Rating Guide:

Rating	Description	Example
1	No infrastructure for disabled people is available	
2	Limited infrastructure for disabled persons is available, but is not in usable condition	
3	Infrastructure for disabled persons is present but in poor condition and not well placed	
4	Infrastructure for disabled persons is present, in good condition, but poorly placed	
5	Infrastructure for disabled persons is present, in good condition, and well placed.	

Parameter: Obstructions

Parameter Number: 8

Description: The presence of permanent and temporary obstructions on the pedestrian pathways. These ultimately affect the effective width of the pedestrian pathway and may cause inconvenience to the pedestrians.

Rating Guide:

Rating	Description	Example
1	Pedestrian infrastructure is completely blocked by permanent obstructions	
2	Pedestrians are significantly inconvenienced. Effective width <1m.	
3	Pedestrian traffic is mildly inconvenienced; effective width is < or = 1 meter.	
4	Obstacle presents minor inconvenience. Effective width is > 1m	
5	There are no obstructions	

Parameter: Security from Crime

Paremeter Number: 9

Description: The general feeling of security against crime in the street.

Rating Guide:

Rating	Subjective Description
1	Environment feels very dangerous – pedestrians are highly susceptible to crime
2	Environment feels dangerous – pedestrians are at some risk of crime
3	Difficult to ascertain perceived degree of security for pedestrians
4	Environment feels secure – pedestrians at minimal crime risk
5	Environment feels very secure – pedestrians at virtually no risk of crime

Annex B - Summary of Walkability Session at BAQ 2010 Conference

Improving Walkability in Asian Cities:
Summary of the Walkability Surveys Breakout Session at the Better Air Quality 2010 Conference
9-11 November 2010, Singapore

Introduction

Improving walkability and pedestrian facilities is one of the less prioritized measures for sustainable urban transport by policymakers and development organizations. Fortunately, several NGOs and other local organizations, particularly in India, have been raising awareness and lobbying for more actions on this issue. The Clean Air Initiative for Asian Cities Center with support from the Asian Development Bank and the Fredkorpset conducted walkability surveys in various Asian cities to better understand the state of walkability in Asian cities. As a follow-up work, the CAI-Asia Center with support from the Shakti Sustainable Energy Foundation is looking at this issue more closely in Indian cities.

The Better Air Quality Conferences is a biennial event organized by the CAI-Asia Center, its country networks and various partners. In BAQ 2010, for the first time, a session solely focused on this issue was organized. This session attracted nearly 40 participants from different countries. The session was designed with two tier approach:

1. Discussion on the use and results of walkability surveys; and

2. To the get the feedback from city representatives as to how such surveys can be used and what needs to be done at the city level to create changes in walking environment.

Mr.Kamal Pande,Ministry of Physical Planning, Nepal and Mr. Bert Fabian from CAI-Asia Center moderated the session.

The speakers on walkability surveys were Mr. Sudhir Gota (CAI-Asia Center), Mr. Phil Sayeg (Policy Appraisal Services) and Ms. Shreya Gadepalli (ITDP).

City Stakeholders were Mr. Ranjit Gadgil (Pune), Mr. Raj Cherubal (Chennai), Mr. Piyush Ranjan Rout (Bhubaneshwar), Mr. Noppadol Sawat (Chiang Mai), and Ms. Chin Cabrido (Kathmandu).

Walkability Surveys

The breakout session started with discussion on comprehensive walkability surveys with both, qualitative and quantitative approaches discussed by the speakers. The general opinion was that both such surveys have their own pros and cons. The experts argued that any survey which is either qualitative or quantitative should be comprehensive enough for effective evaluation. The selection of the survey methodology should be based ideally on the 'purpose' of measurement. In fact, some argued that for advocacy and awareness, qualitative surveys work better and during the actual improvement stage quantitative surveys can provide better insights. However, whether be qualitative or quantitative surveys, the experts agreed that 'walkability' needs to be measured and sometimes both can be combined to suit the requirement.

By using such surveys one can evaluate:

1.   What needs to be done to improve walkability?

2.   What kind of quick fix solutions are people demanding?

3.   How does one city compare with other cities?

4.   How does landuse and walking environment impact each other?

5.   The impact of improvement measure or investment made

During the session, there was a suggestion of lack of accessibility to people of different abilities in all cities thus creating a universal bias in the score. Some argued that such walkability ratings can be effectively used when we benchmark cities and compare each other. There was a suggestion on using appropriate 'weights' for various parameters to make the score more effective and using interview surveys to determine the weights of the parameters.

Some of the survey applications in various Asian cities provided following insights

1.   Walking environment varies significantly depending upon the location

2.   Walking trip mode share is significant in the surveyed Asian cities

3.   Walkability survey results showed public transport terminals and educational areas having the lowest ratings among the surveyed cities

4.   Top most priority of people is access to clean and wide pedestrian space

5.   "Security from crime" or "personal safety" parameter was highly rated in several surveys. Experts argued that it may be due to eyes on the street or survey being done by young people.

6.   "Crossings" was the most debated aspect. Many surveys showed that not many people (85%) would walk more than 100m to access to formal crossing points.

City Dialogue

Different cities and stakeholders have the same kind of issues with pedestrian infrastructure yet they are taking different approaches.

For example, in Bhubaneshwar city many roads are getting widened and thus the officials are using this window of opportunity by providing exclusive secure pedestrian path along new roads. The authorities are integrating the business areas with public walk facilities and integrating informal street funding with pedestrian and cycling facilities. Bhubaneshwar is also using "wall paintings" as a medium to improve the walking environment.

Kathmandu stakeholders have used walkability survey findings to create local pressure on the authorities. The results of the Walkability Study contributed to the development of a pedestrian improvement project in the Kathmandu Sustainable Urban Transport project of the Government of Nepal supported by the Asian Development Bank. The municipal authorities have recently closed the Hanumandhoka Durbar Square from all kinds of vehicles as part of the government's initiative to preserve the monument zones and re-establish the World Heritage Site as pedestrian friendly area. Also, in the Bhaktapur officials have extended the vehicle free zone area in Durbar Square to attract more tourists in the area.

Pune city stakeholders are using the national schemes and policies such as National Urban Transport Policy and J*n*NURMwith local policies and issues like public cycle scheme, NMT cell and Comprehensive Mobility Plan (CMP). The city currently has approximately 53% of roads with some kind of footpaths and CMP proposes a target of 50% of trip mode share for NMT in future. This target has been used by stakeholders to pursue NMT improvement in the city without much success. The NMT cell which was created as an official 'watchdog' for NMT facilities by the Municipal Commissioner with an agreement with an International NGO has been inactive after the transfer of the Municipal Commissioner.

Chennai city stakeholders are using different approach. They suggest that there are plenty of funds and plenty of regrets for ignoring pedestrians and there is official willingness to change but the problem is of capacity and weak institutions. There is no ability to plan and design, no standards, no single plan to coordinate different agencies - electricity, corporation, highways, traffic police etc. The city connect is using Pilot projects (one example is of 80 KM footpath project) and using a Street Development Manual to convince the other stakeholders.

Stakeholders from Chiang Mai suggested that the biggest barrier for walking in their city is climate. The temperature is so high that pedestrians find it difficult to walk. As such, protection from such weather can provide improved walkability in their city.

The presentations during the forum can be found at http://baq2010.org/node/1486

Annex C – Detailed Information on the City Surveys

This annex shows the results of the field walkability surveys and interviews with pedestrian. The field walkability survey involves a field testing of the different Levels of Services (LOS) in pedestrian walkways in different types of areas: residential, commercial, public transport terminal and educational. The pedestrian interviews focus on the travel characteristics and the preference of the pedestrians when it comes to walking. This study was supported by the Shakti Foundation and the ClimateWorks Foundation.

a. Bhubaneswar City

General Information

Bhubaneswar is the capital of the Indian state of Odisha with an area of 124.74 sq. km. The city has a population of 19,00,000 wherein males constitute 56% of the population and females 44%. The city is subdivided into a number of townships and housings.

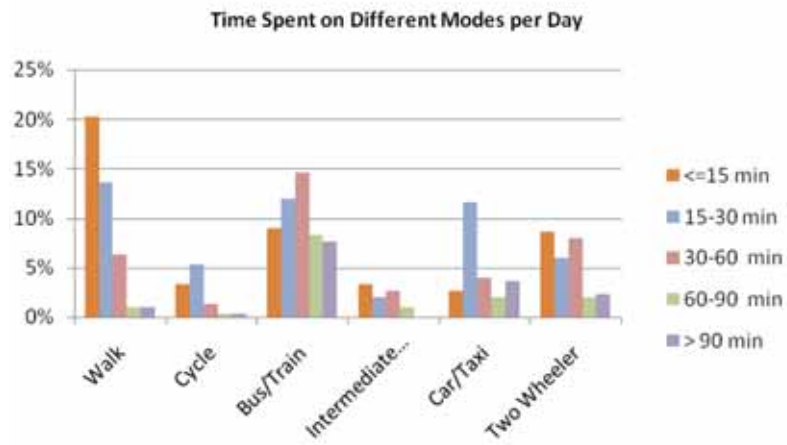### Field Walkability Survey Results
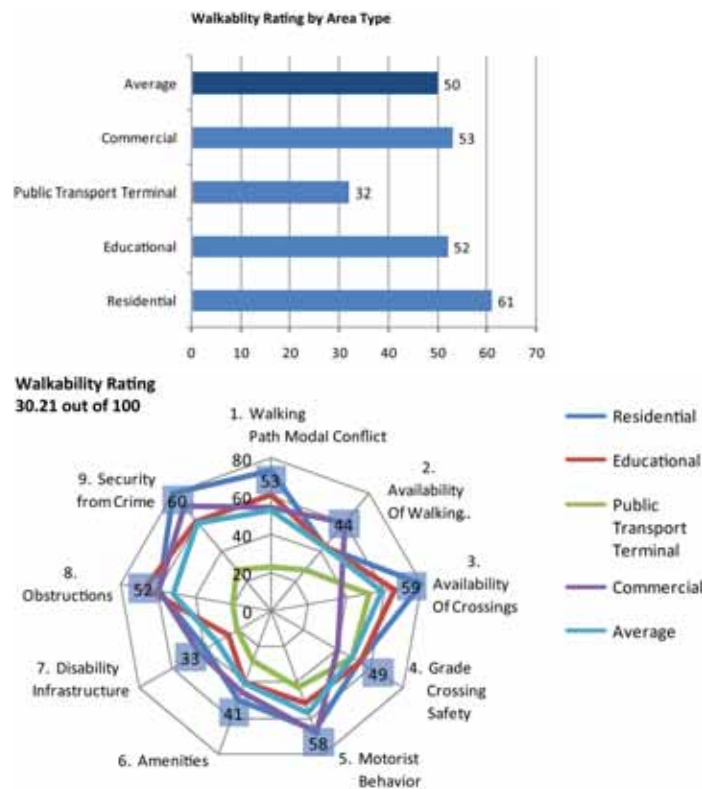
Note: The figures in the light blue boxes are the average score of the city for the individual parameters

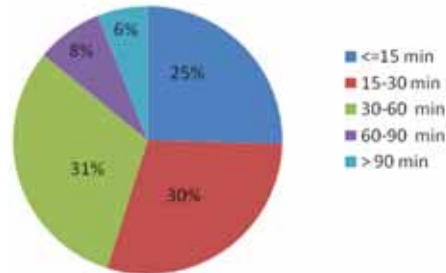|	Pedestrian Count	Length Surveyed (km)
Residential	0	0
Educational	138	3.435
Public Transport Terminal	209	2.46
Commercial	37	1.15

Pedestrian Interview Results

299 pedestrian interviews were conducted to analyze travel behavior (time that pedestrians spend for each travel mode), pedestrian preference in terms of infrastructures, degrees of exposure to air pollution and socioeconomic profiles. Out of the 299 respondents, 76% are male and 23% are female. Most of the respondents are 15-30 years old (59%), followed by 30-50 years old (32%)
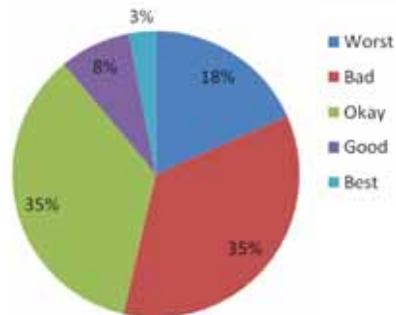
Travel Characteristics
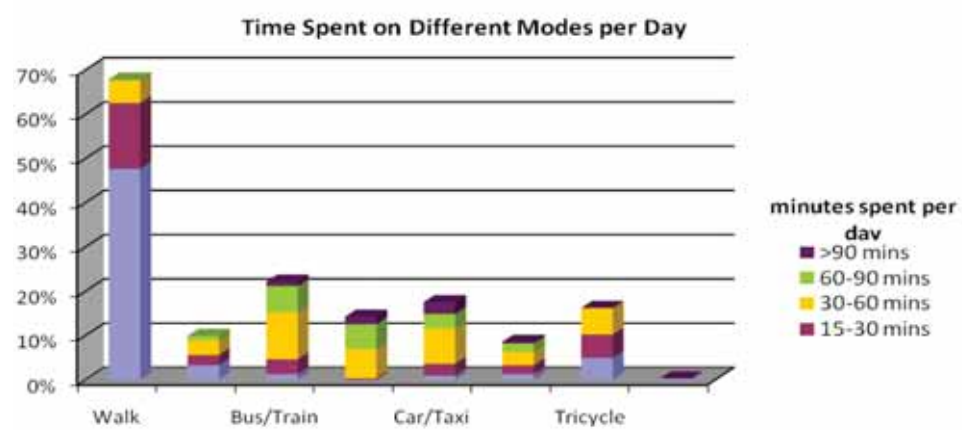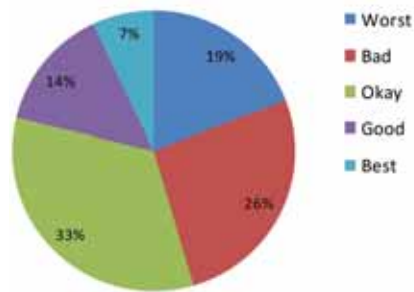
Time Spent on Different Modes per Day

Pedestrian Preference

Rating of Pedestrian Facilities

- Worst — 19%
- Bad — 26%
- Okay — 33%
- Good — 14%
- Best — 7%

Ranking if given opportunity to improve pedestrian facilities (%)

Category	%
Wider, Level and clean sidewalks/footpaths	14.6
Improved street lighting	14.8
Easy access for people with special abilities	15.6
Reduced and slow traffic on road	16.9
Remove obstacles/parking from footpath	17.4
More crossing points	20.6

Preference for Crossing

- At Grade — 45%
- Skywalk — 22%
- Subway — 33%

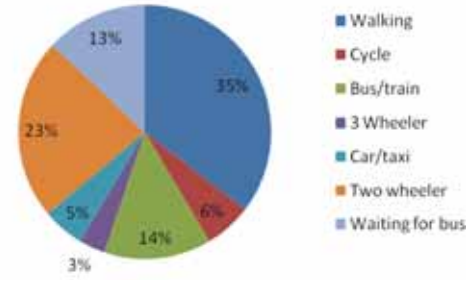#### Willingness to walk to access crossing

- <50 m — 14%
- 50-100 m — 23%
- 100-200 m — 21%
- 200-300 m — 22%
- >300 m — 20%

Shift to other modes if pedestrian facility improvement is done

Taxi
Tricycle
Two Wheeler
Car
Jeepney
Bus/Train
Cycle

Perception on exposure to air pollution to different modes

Walking
Cycle
Bus/Train
Jeep
Car/Taxi
2 Wheeler
Waiting for bus
Tricycle
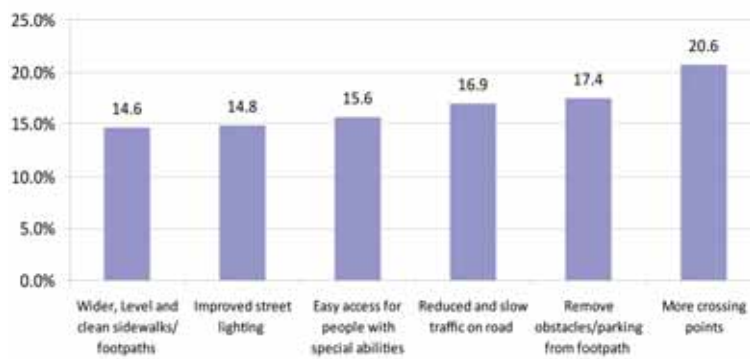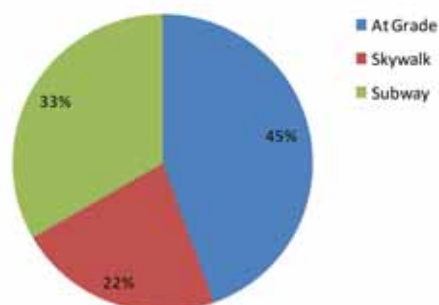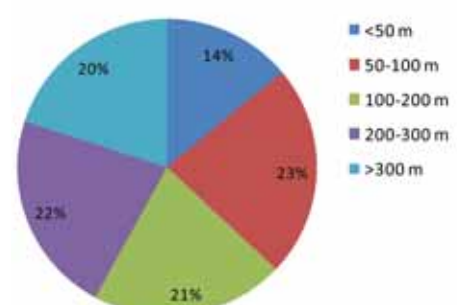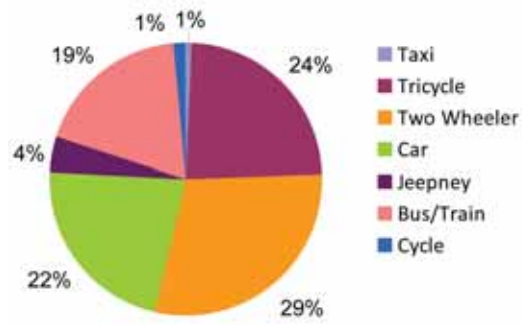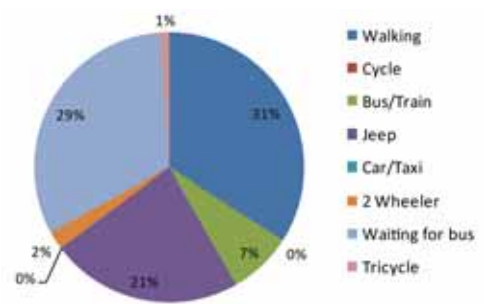
Survey Area Map

b. Chennai City

General Information

Chennai is the capital city of the Indian state of Tamil Nadu and is the fifth most populous cities in India. The urban agglomeration of metropolitan Chennai has an estimated population over 8.2 million people

Field Walkability Survey Results
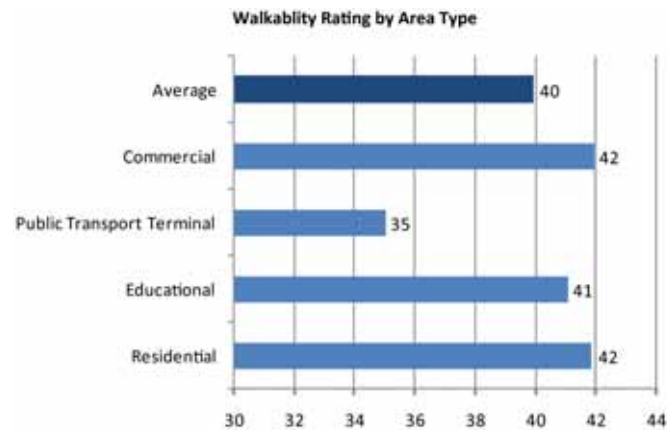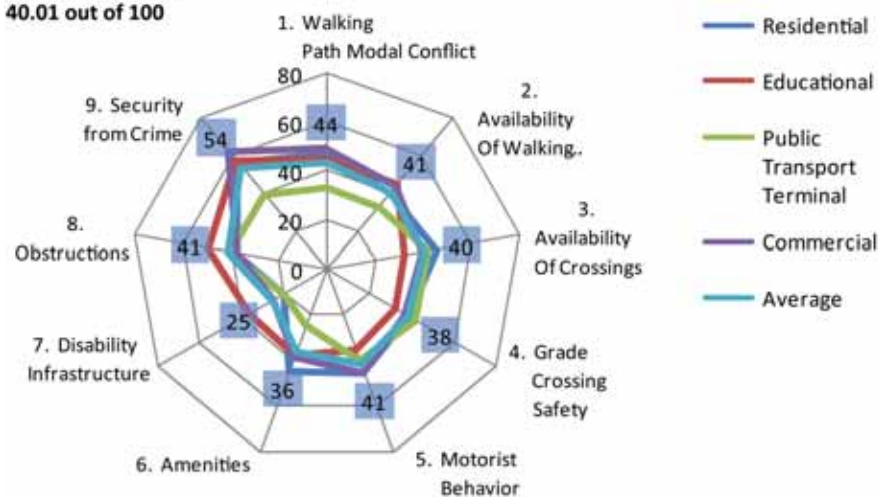
Note: The figures in the light blue boxes are the average score of the city for the individual parameters

	Pedestrian Count	Length Surveyed (km)
Residential	187	12.88
Educational	52	4.02
Public Transport Terminal	177	5.98
Commercial	284	7.23

Pedestrian Interview Results

300 pedestrian interviews were conducted to analyze travel behavior (time that pedestrians spend for each travel mode), pedestrian preference in terms of infrastructures, degrees of exposure to air pollution and socioeconomic profiles. Out of the 300 respondents, 60% are male and 40% are female. Most of the respondents are 15-30 years old (63%), followed by 30-50 years old (18%).

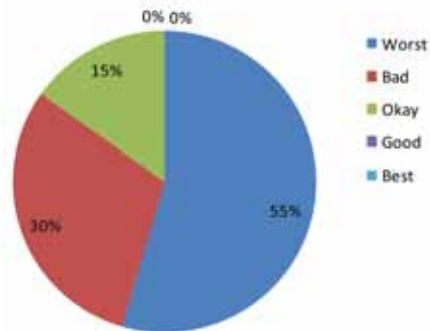## Travel Characteristics

Time Spent on Different Modes per Day

Legend: ■ <=15 min ■ 15-30 min ■ 30-60 min ■ 60-90 min ■ >90 min

X-axis: Walk, Cycle, Bus/Train, Intermediate..., Car/Taxi, Two Wheeler

Average travel time from residence to main destination in minutes

- 25% ■ <=15 min
- 30% ■ 15-30 min
- 31% ■ 30-60 min
- 8% ■ 60-90 min
- 6% ■ >90 min

Pedestrian Preference

Rating of Pedestrian Facilities

- 18% ■ Worst
- 35% ■ Bad
- 35% ■ Okay
- 8% ■ Good
- 3% ■ Best

Ranking if given opportunity to improve pedestrian facilities (%)

Wider Level and Clean sidewalks	Improved street lighting	Easy access for people with special abilities	Reduced and slow traffic	Remove obstacles/parking from footpath	More Crossing points
84.06%	88.05%	92.10%	83.71%	84.38%	59.36%

Preference for Crossing

- 48% ■ Ground Crossing
- 23% ■ Skywalk
- 29% ■ Subway

Willingness to walk to access crossing

- 40% ■ <50 m
- 33% ■ 50-100 m
- 19% ■ 100-200 m
- 4% ■ 200-300 m
- 3% ■ >300 m

Shift to other modes if no pedestrian facility imporvement is done

- Cycle — 12%
- Bus/train — 19%
- 3 wheeler — 6%
- Car — 30%
- 2 wheeler — 31%
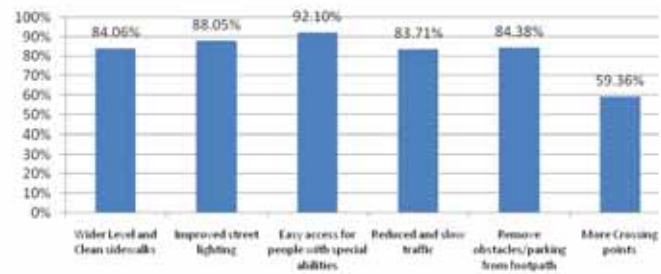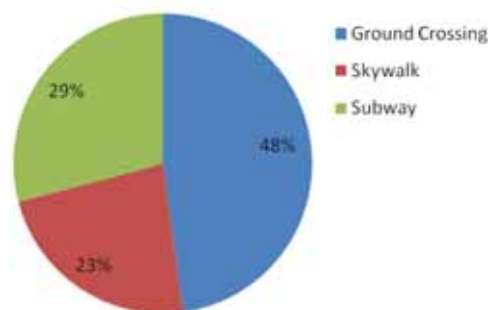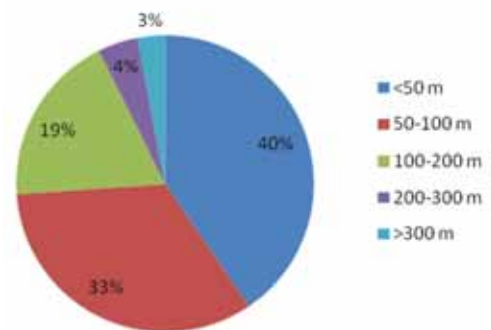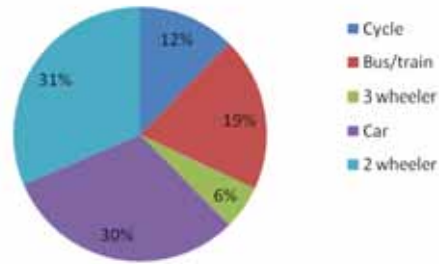
Perception on the exposure of air pollution to different modes

- Walking — 35%
- Cycle — 6%
- Bus/train — 14%
- 3 Wheeler — 3%
- Car/taxi — 5%
- Two wheeler — 23%
- Waiting for bus — 13%

Survey Area Map
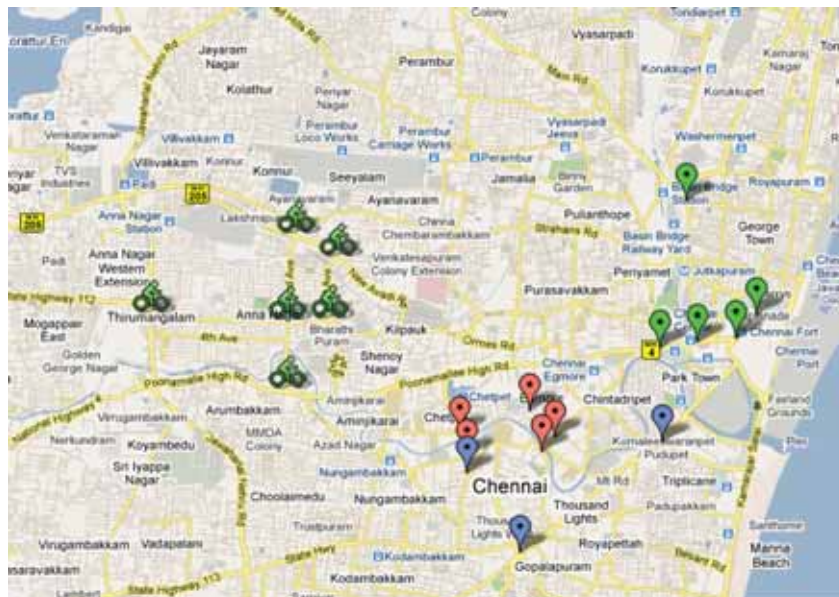
c. Indore City

General Information

Indore is the commercial center of the state of Madhya Pradesh in central India. Indore's total population in 2009 was reported to be 1,912,000. Males constitute 53% of the population and females 47%.

Field Walkability Survey Results
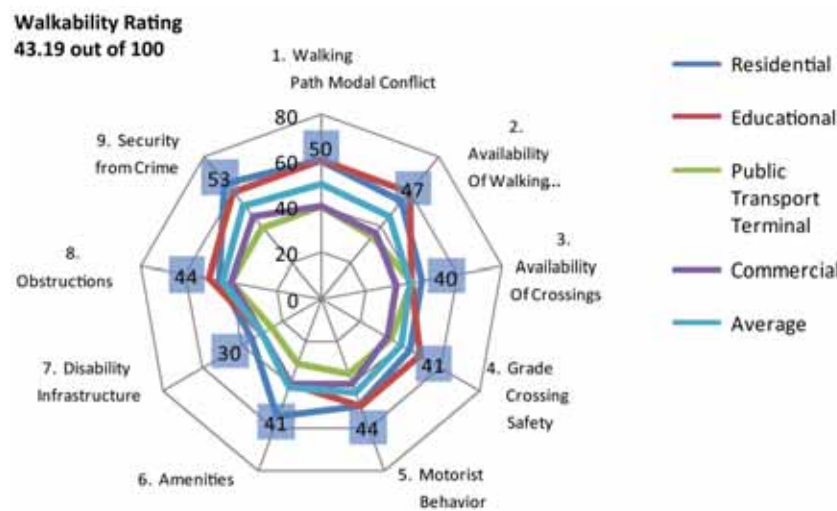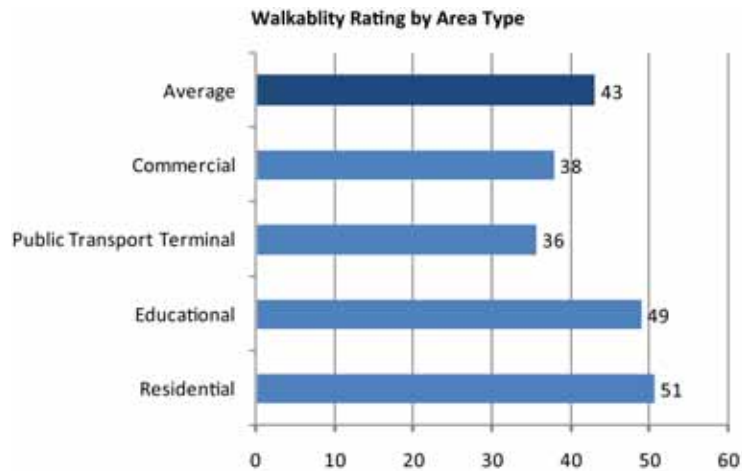
Note: The figures in the light blue boxes are the average score of the city for the individual parameters

	Pedestrian Count	Length Surveyed (km)
Residential	110	7.1
Educational	65	6.1
Public Transport Terminal	175	3.1
Commercial	314	8.15

Pedestrian Interview Results

300 pedestrian interviews were conducted to analyze travel behavior (time that pedestrians spend for each travel mode), pedestrian preference in terms of infrastructures, degrees of exposure to air pollution and socioeconomic profiles. Out of the 300 respondents, 69% are male and 31% are female. Most of the respondents are 15-30 years old (48%), followed by 30-50 years old (40%).

Travel Characteristics

Time spent on different modes per day

Average travel time from residence to main destination (minutes)

Pedestrian Preference

Rating of Pedestrian Facilities

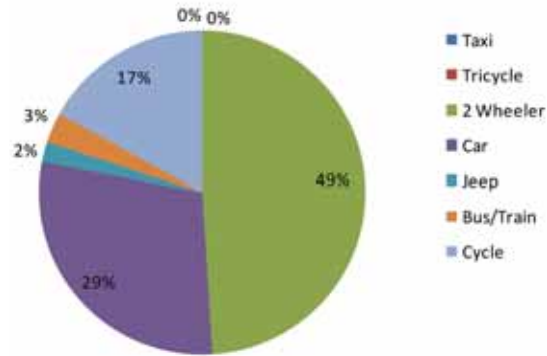Ranking if given opportunity to improve pedestrian facilities (%)
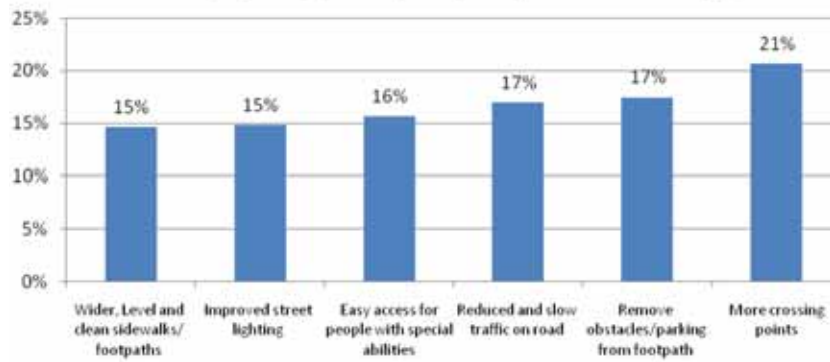
Preference for Crossing
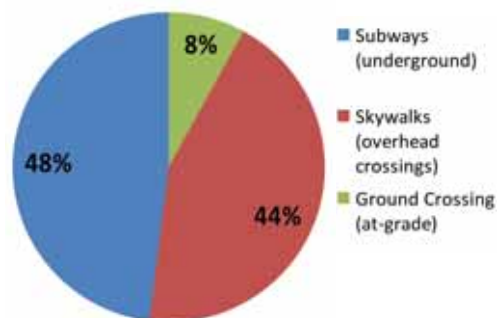
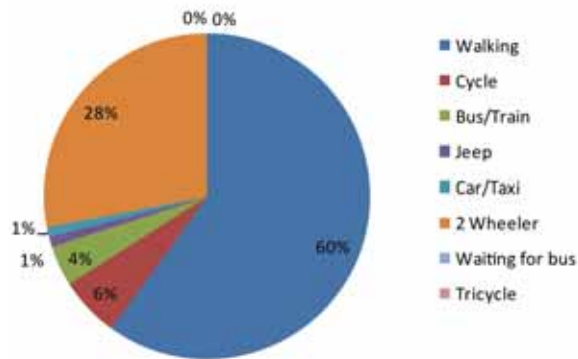### Willingness to access crossing

Shift to Other Modes if no Pedestrian Facility Improvement is Done

- Taxi
- Tricycle
- 2 Wheeler
- Car
- Jeep
- Bus/Train
- Cycle

0% 0%
17%
3%
2%
49%
29%

Perception on the ecposure to air pollution in different modes

- Walking
- Cycle
- Bus/Train
- Jeep
- Car/Taxi
- 2 Wheeler
- Waiting for bus
- Tricycle

0% 0%
28%
1%
1% 4%
6%
60%

Survey Area Map

d. Pune City

General Information

Pune is the eighth largest metropolis in India with a geographical area of 450.69 sq. km. Pune City is the administrative capital of Pune district with a population of approximately 3.5 million inhabitants.

Field Walkability Survey Results

Note: The figures in the light blue boxes are the average score of the city for the individual parameters

	Pedestrian Count	Length Surveyed (km)
Residential	514	15
Educational	1,140	12.5
Public Transport Terminal	911	13.2
Commercial	2,362	16.2

Pedestrian Interview Results

309 pedestrian interviews were conducted to analyze travel behavior (time that pedestrians spend for each travel mode), pedestrian preference in terms of infrastructures, degrees of exposure to air pollution and socioeconomic profiles. Out of the 309 respondents, 53% are male and 47% are female. Most of the respondents are 15-30 years old (45%), followed by 30-50 years old (35%).
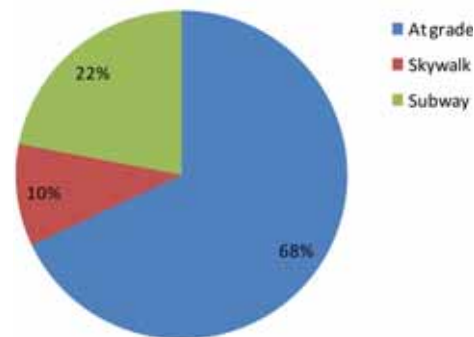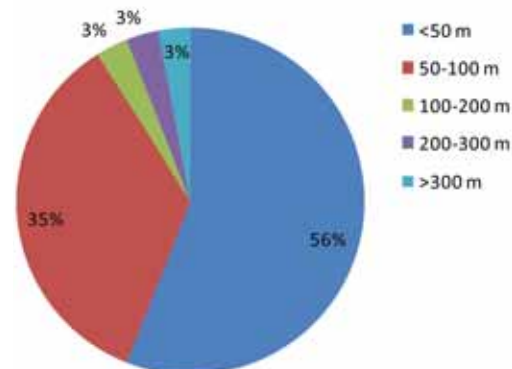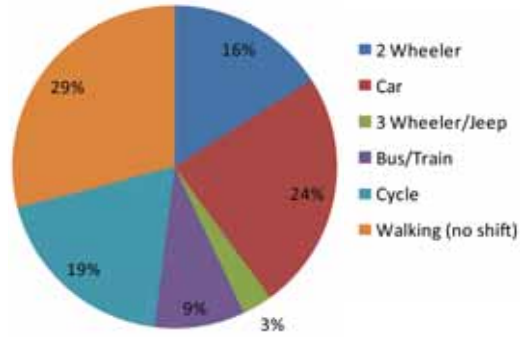
Travel Characteristics
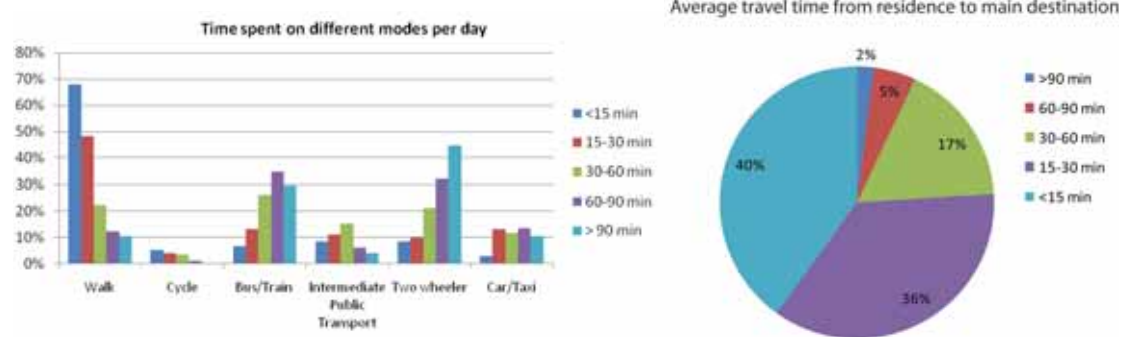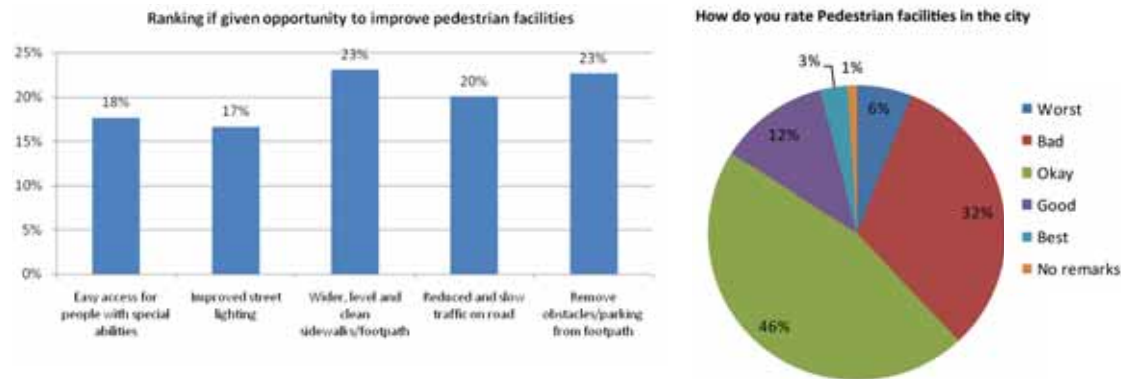
Time spent on different modes per day

Average travel time from residence to main destination

Pedestrian Preference

Ranking if given opportunity to improve pedestrian facilities

How do you rate Pedestrian facilities in the city

Preference for Crossing

Willingness to walk to access crossing

Shift to other modes if no pedestrian facility improvement is done

- 2 Wheeler — 16%
- Car — 24%
- 3 Wheeler/Jeep — 3%
- Bus/Train — 9%
- Cycle — 19%
- Walking (no shift) — 29%

Perception on exposure to air pollution to different modes

- Walking — 46%
- Cycle — 5%
- Bus/Train — 14%
- 3 Wheeler/Jeep — 6%
- Car/Taxi — 0%
- 2 Wheeler — 19%
- Waiting for bus — 10%
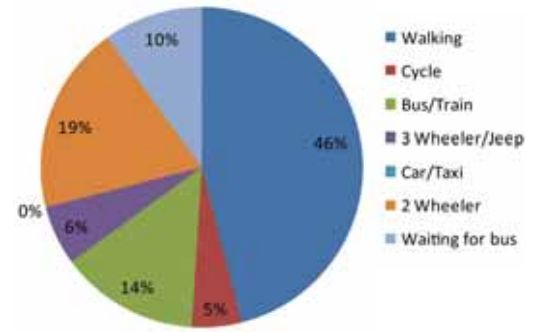
Survey Area Map

e. Rajkot City

General Information

Rajkot is one of the fastest developing cities located at in the center of Saurashtra region of Gujarat State situated on western part of India. The city has geographical area of 104.86 sq. km and has a population of one million plus (Census, 2001).
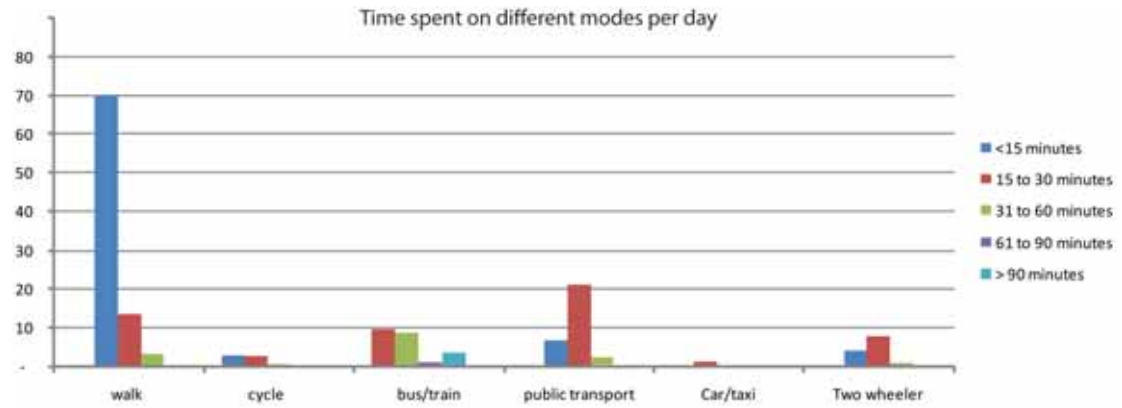
Field Walkability Survey Results
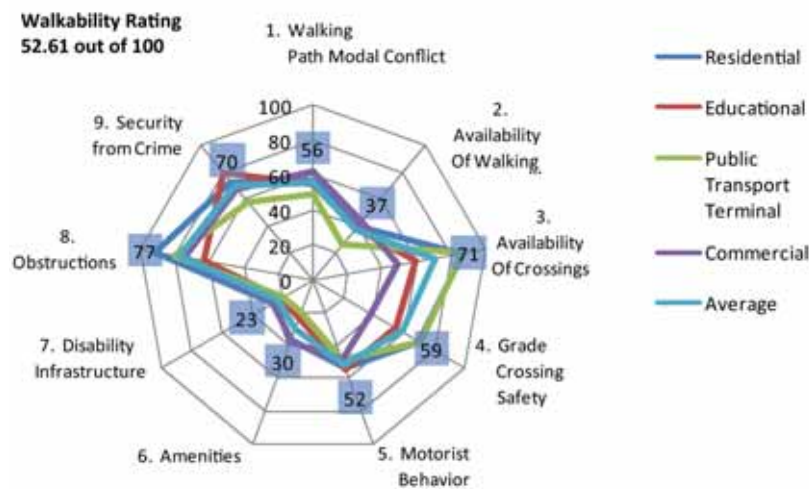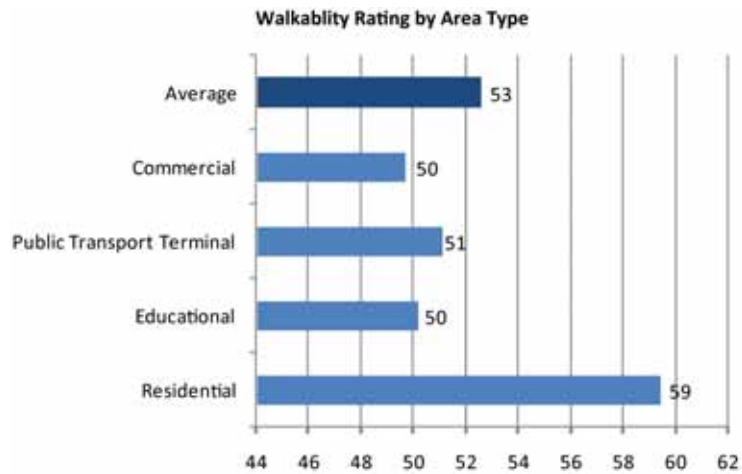
Walkablity Rating by Area Type

Area Type	Rating
Average	53
Commercial	50
Public Transport Terminal	51
Educational	50
Residential	59

Walkability Rating 52.61 out of 100

Note: The figures in the light blue boxes are the average score of the city for the individual parameters

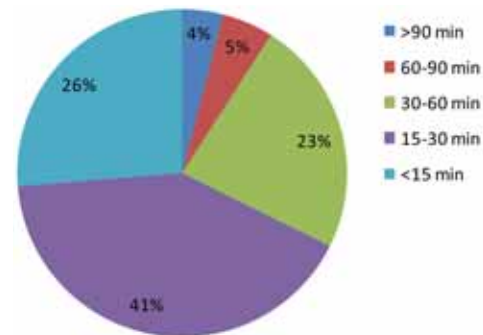|	**Pedestrian Count**	**Length Surveyed (km)**
Residential	80	5.52
Educational	112	4.37
Public Transport Terminal	88	4.68
Commercial	130	8.18

Pedestrian Interview Results

370 pedestrian interviews were conducted to analyze travel behavior (time that pedestrians spend for each travel mode), pedestrian preference in terms of infrastructures, degrees of exposure to air pollution and socioeconomic profiles. Out of the 370 respondents, 82% are male and 18% are female. Most of the respondents are 15-30 years old (66%), followed by 30-50 years old (30%).
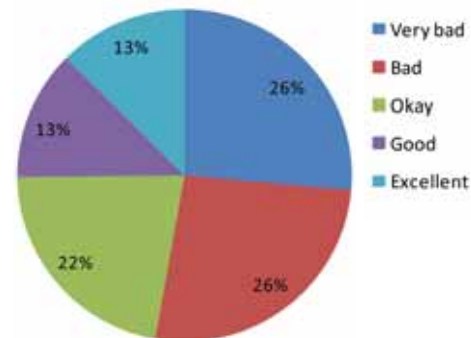
Travel Characteristics

Time spent on different modes per day

Legend: <15 minutes, 15 to 30 minutes, 31 to 60 minutes, 61 to 90 minutes, > 90 minutes

Average travel time from residence to main destination

Legend: >90 min, 60-90 min, 30-60 min, 15-30 min, <15 min

Values: 4%, 5%, 26%, 23%, 41%

Pedestrian Preference

Rating of Pedestrian Facilities

Legend: Very bad, Bad, Okay, Good, Excellent

Values: 26%, 26%, 22%, 13%, 13%

Ranking if given opportunity to improve pedestrian facilities (%)

Values: Wider Level and Clean… 81%, Improved street lighting 55%, Easy access for people with … 53%, Reduced and slower traffic 93%, Remove obstacles/parking… 95%, More Crossing Points 57%

Preference for Crossing

Legend: At grade, Skywalk, Subway

Values: 42%, 29%, 29%

Willingness to walk to access crossing

Legend: <50 m, 50-100 m, 100-200 m, 200-300 m, >300 m

Values: 1%, 0%, 23%, 50%, 26%

Shift to other modes if no pedestrian facility improvement is done

- 2 Wheeler
- Car
- Jeep
- Bus/Train
- Cycle
- Walking (no shift)

30%
51%
14%
5%
0% 0%

Perception on exposure to air pollution to different modes

- Walking
- Cycle
- Bus/Train
- Jeep
- Car/Taxi
- 2 Wheeler
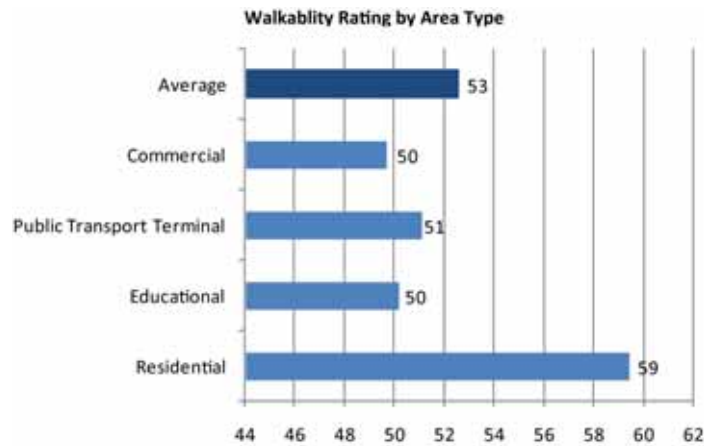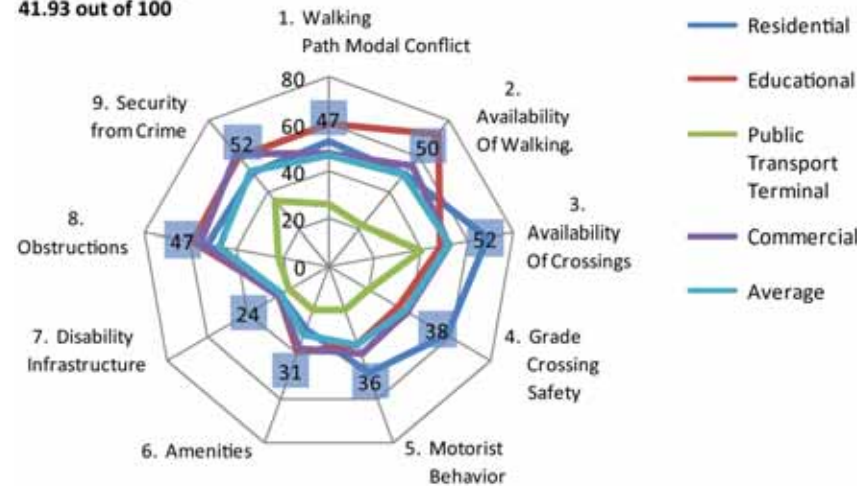- Waiting for bus

5% 13% 0% 1%
24%
4%
53%

Survey Area Map

f. Surat City

General Information

Surat is Commercial Capital of Gujarat and also one of the economic hubs of India. It is the administrative capital of Surat district and one of the fastest growing cities in India with a population of 47,06,429.

Field Walkability Survey Results

Note: The figures in the light blue boxes are the average score of the city for the individual parameters

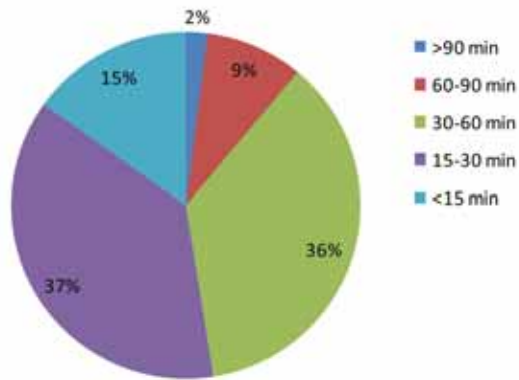|	Pedestrian Count	Length Surveyed (km)
Residential	135	6.16
Educational	102	4.92
Public Transport Terminal	186	3.37
Commercial	172	8.91

Pedestrian Interview Results

337 pedestrian interviews were conducted to analyze travel behavior (time that pedestrians spend for each travel mode), pedestrian preference in terms of infrastructures, degrees of exposure to air pollution and socioeconomic profiles. Out of the 337 respondents, 81% are male and 19% are female. Most of the respondents are 15-30 years old (65%), followed by 30-50 years old (31%).
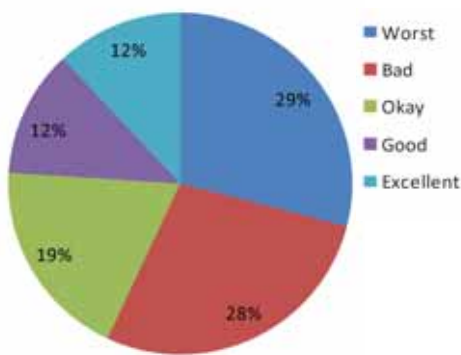
Travel Characteristics
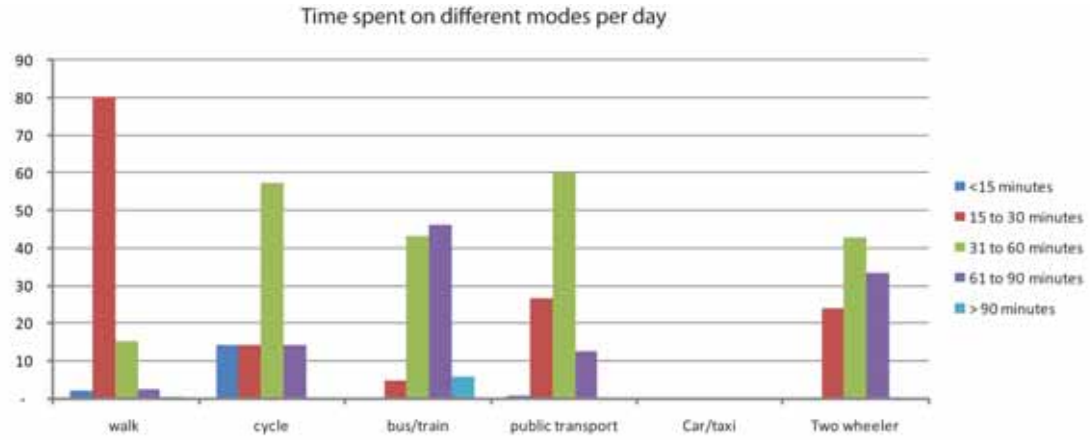
Time spent on different modes per day

Average travel time from residence to main destination

- >90 min
- 60-90 min
- 30-60 min
- 15-30 min
- <15 min

Pedestrian Preference

Rating of Pedestrian Facilities

- Worst
- Bad
- Okay
- Good
- Excellent

Ranking if given opportunity to improve pedestrian facilities (%)

Preference for Crossing

- At grade
- Skywalk
- Subway

Willingness to walk to access crossing

- <50 m
- 50-100 m
- 100-200 m
- 200-300 m
- >300 m

Shift to other modes if pedestrian facility improvement is done

- Taxi — 22%
- Tricycle — 19%
- 2 Wheeler — 17%
- Car — 14%
- Jeep — 11%
- Bus/Train — 8%
- Cycle — 6%
- Walking (no shift) — 3%

Perception on exposure to air pollution to different modes

- Walking — 23%
- Cycle — 6%
- Bus/Train — 19%
- Jeep — 5%
- Car/Taxi — 35%
- 2 Wheeler — 0%
- Waiting for bus — 12%
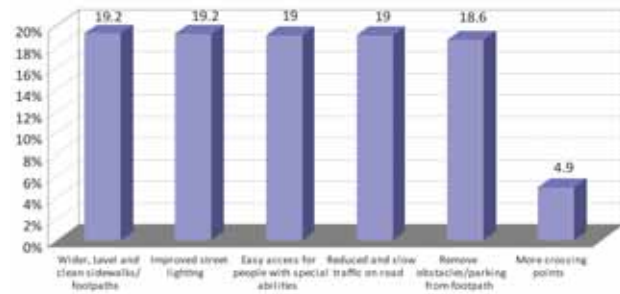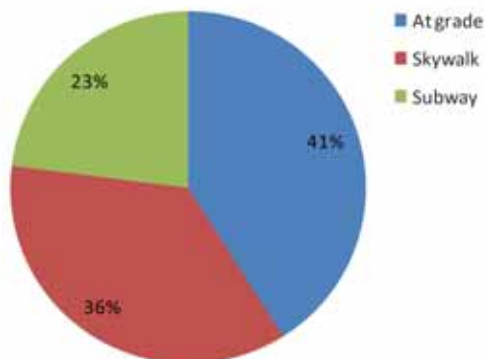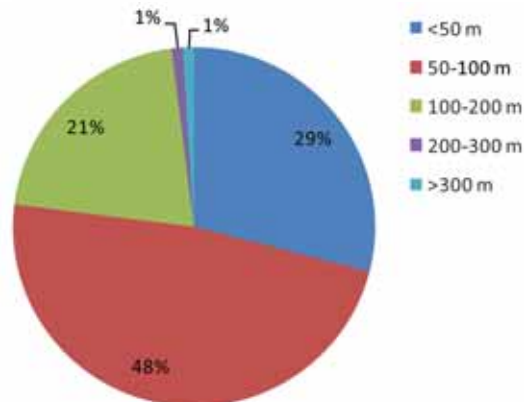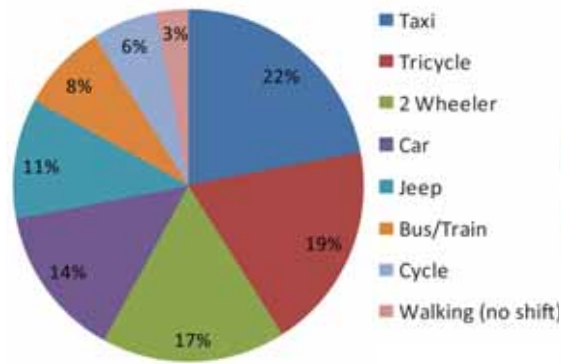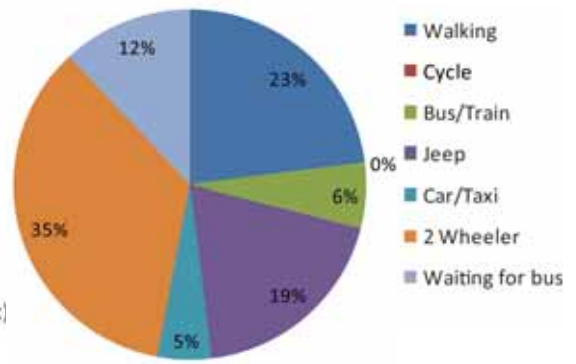
Survey Area Map

About CAI-Asia

The Clean Air Initiative for Asian Cities (CAI-Asia) promotes better air quality and livable cities by translating knowledge to policies and actions that reduce air pollution and greenhouse gas emissions from transport, energy and other sectors. CAI-Asia was established in 2001 by the Asian Development Bank, the World Bank and USAID, and is part of a global initiative that includes CAI-LAC (Latin American Cities) and CAI-SSA (Sub-Saharan Africa).

Since 2007, this multi-stakeholder initiative is a registered UN Type II Partnership with more than 200 organizational members and eight Country Networks (China, India, Indonesia, Nepal, Pakistan, Philippines, Sri Lanka, and Vietnam). The secretariat of the Partnership is CAI-Asia Center, a non-profit organization headquartered in Manila, Philippines, with offices in China and India. Individuals can join CAI-Asia by registering at the Clean Air Portal: www.cleanairinitiative.org. Its flagship event, the Better Air Quality conference, brings together over 500 air quality stakeholders.