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THE GLOBAL WALKABILITY INDEX

by

Holly Virginia Krambeck

B.A., International Relations and Foreign Affairs
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Submitted to the Department of Urban Studies and Planning and the
Department of Civil and Environmental Engineering
in Partial Fulfillment of the Requirements for the Degrees of

Master in City Planning and Master of Science in Transportation

at the
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February 2006

Signature of Author.....
Departments of Urban Studies and Planning & Civil and Environmental Engineering
January 19, 2006

Certified by.....
Ralph Gakenheimer
Professor, Department of Urban Studies and Planning
Thesis Supervisor

Certified by.....
Kenneth Kruckemeyer
Research Associate, Department of Civil and Environmental Engineering
Thesis Supervisor

Accepted by.....
Langley Keyes
Chair, Master of City Planning Committee
Department of Urban Studies and Planning

Accepted by.....
Andrew J. Whittle
Chairman, Departmental Committee for Graduate Students
Department of Civil and Environmental Engineering

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ABSTRACT

Although a significant number of trips are made by foot in developing cities, pedestrian infrastructure, amenities, and services are often neglected in municipal planning and budgets. Since helping city planners understand the scope and extent of local pedestrian conditions relative to other cities would be a positive step towards improving the quality of the pedestrian environment, I was retained by the World Bank to devise a walkability index, which would rank cities across the world based on the safety, security, and convenience of their pedestrian environments.

To accomplish this task, I first generated a list of Index variables by studying existing tools for evaluating non-motorized transport and by consulting experts from a variety of related fields. After considering different methods for survey area selection, field data collection, and data aggregation, I created prototypes of the index and survey materials and organized field tests in cities throughout the world, including Beijing, Washington, and Delhi. I also oversaw a full-scale pilot in Ahmedabad, India, where 65 volunteers from the Centre for Environmental Planning and Technology (CEPT) conducted physical infrastructure, public agency, and pedestrian surveys in eight neighborhoods, which were selected using a random spatial sampling method.

Results from these tests and pilot were used to refine the Index composition and data collection methodologies, resulting in a two-pronged tool. Since, out of practical necessity, the Global Walkability Index's robustness is limited by its simplicity (the Index is primarily intended to generate awareness of walkability as an important issue), I developed an additional set of Extended Survey Materials that may be used to gather more detailed, site-specific data for use in developing investment and policy proposals.

The Index is burdened by at least two significant limitations, namely that the notion of walkability itself is not well understood, paving the way for widespread misunderstanding and that the Index requires that most of the data be collected in the field, which presents difficulties in terms of funding, translation, and quality assurance.

Thesis Supervisors:
Ralph Gakenheimer, Professor, Department of Urban Studies and Planning
Kenneth Kruckemeyer, Research Associate, Department of Civil and Environmental Engineering

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I thank my very patient and forgiving thesis advisors, **Ralph Gakenheimer** and **Kenneth Kruckemeyer**, for providing invaluable and often intriguing insights on the project, and for helping me turn a mere research paper into a true thesis. I also wish to thank **Karen Polenske** – while she did not help directly with this paper, she has helped me in innumerable other ways during my tenure at MIT, giving me more confidence and savvy in everything I do.

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write down immediately afterwards. Thank you, **Chris Bennett**, for caring so much about my welfare! I was so delighted to find your colleagues waiting for me at the airport in Ahmedabad. I want to thank **Sally Burningham** for helping me understand pedestrian conditions in the cities she has worked in, and I thank **Judy Baker** for helping me develop the random spatial sampling method. I want to thank **Tony Bliss** for providing insights on the safety dimension of the work, and I thank **Mohammad Loutfy** and **Sebastian Veit** for helping me make an Index that would capture the needs of disabled people. Finally, I want to thank **Nona Sachdeva** for my great hat (!) and for making me feel so welcome in the unit.

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Very heartfelt thank you's go to the volunteers who assisted with the first major field test in Washington, DC. Because of these efforts, enough interest was generated in the project to justify further testing around the world. I especially thank **Sarath Guttikunda** for helping me find volunteers, **George Branyan** for his extensive comments and feedback, and everyone else who marched around the city in 95-degree weather, wearing polyester Walk the Talk T-shirts (without complaining even once!): **Sharon Gulick, Nick Bowden, Sebastian Anapolsky, Youjin Choi, Maria Fenanda "Nanda" Miralles Gasparini, Fareehia Iqbal, Silvana Kostenbaum, Matthew Lesh, the Milantes, Boris Mircheva, Julia Podevin, Cornelia Simpson,** and **Rezida Zakirova.**

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And finally, I thank **Thomas Lee**, for putting up with me during this whole process (especially all the walking) and providing love, encouragement, support, and humor at all the right moments. 我爱你!

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1.0 Introduction

> "Isn't it really quite extraordinary to see that, since man took his first steps, no one has asked himself why he walks, if he has ever walked, if he could walk better, what he achieves in walking...questions that are tied to all the philosophical, psychological, and political systems which preoccupy the world?"
>
> *--Honoré de Balzac, Théorie de la Démarche*

Every trip begins and ends with a walking trip. Whether in a developed or developing city, nearly all trips will require some walking, either directly to a destination or to another mode of transport. How well the pedestrian environment can service these trips will impact the overall quality and efficiency of the urban transportation network, and in turn, overall mobility and accessibility for residents and visitors.

The modal share of pedestrians in developing cities tends to be very high. For example, between 25 and 50 percent of trips in major Indian cities and about 50 percent of all trips in major African cities are made entirely on foot. In medium and smaller developing cities, the share of all-walking trips can be as high as 60 to 70 percent (Gwilliam 2002). But, although a significant number of trips are made by foot in developing cities, pedestrian infrastructure, amenities, and services are often neglected in municipal planning and budgets (Fang 2005).

Faced with rapid rates of motorization and the need to accommodate growing congestion, cities will typically make improvements in vehicular rights of way at the expense of pedestrians. For example, it is not untypical for a city to eliminate at-grade crosswalks in between blocks to improve traffic flows (as in Beijing) or to construct new roads without any allocated space for walkers (as in New Delhi). Further, with what little paved walking space developing cities have, cities rarely designate adequate resources to regulate and

maintain walking paths, resulting in chaotic pedestrian environments, where deteriorating walking paths are encroached upon by vendors, parked vehicles, or even make-shift dwellings. Scarce financial resources, lack of political will, and simple unawareness are among the many reasons why such counter-productive practices persist.

Inadequate planning for pedestrians has many negative consequences, the most notable being unnecessary fatalities and injuries. Pedestrians in developing countries are much more likely to be injured or killed than they are in developed countries, even at equal vehicle flow rates. For example, in a British study completed in 1991, researchers found that at a rate of 1,500 vehicles per hour, risk rates in Nairobi and Surabaya were 86 and 172 percent greater than in urban areas in the UK (Downing 1991). Further, according to another study conducted by Transportation Research Laboratories (TRL), pedestrians can represent more than half of all traffic-related fatalities in developing countries (Sayer 1997).

Beyond these safety implications, there are other negative consequences from insufficient pedestrian planning. For example, economic and social mobility can be impeded by lack of physical mobility -- traveling long distances along physically daunting corridors reduces the time and energy residents can spend on jobs, families, studies, and other productive activities. Further, there are opportunity costs from lost tourism and investment opportunities -- pedestrian facilities play a significant role in the way outsiders perceive a city's image.

World Bank transportation specialists Ke Fang and Sally Burningham have stated that most Bank clients do not make pedestrian planning a priority and note that there are few

incentives for them to do so. Helping city planners understand the scope and extent of local pedestrian conditions, relative to other cities, would be a positive step in the right direction, as would helping them identify specific countermeasures and costs associated with improving pedestrian conditions.

To this end, the World Bank hired me as a consultant to devise a kind of "walkability index," which I decided would rank cities across the world based on the safety, security, and convenience of their pedestrian environments.

The following sections describe how I developed the Index and data collection methodologies, present findings from initial field tests and full-scale pilot I had organized, and discuss next steps.

2.0 Research Objectives

The overarching goal of this approach is to improve the walkability of developing cities. Key objectives include:

- Generate awareness of walkability as an important issue in developing cities;
- Provide city officials with an incentive to address walkability issues;
- Help city planners understand scope and extent of local pedestrian conditions, relative to other cities; and
- Provide city planners with the information necessary to identify specific pedestrian-related shortcomings, as well with recommendations for next steps.

3.0 Research Scope and Organization

3.1 Definition of Walkability

There are many different ways to consider "walkability." For example, in many developed countries, walkability discussions focus on encouraging mode shifts from motorized to non-motorized vehicles for short trips, or on promoting walking as a healthy leisure activity. In developing cities, walking is often considered in terms of providing mobility for the poorest residents. Some urban planners tend to think of walkability in terms of a city's spatial land use arrangement, favoring mixed-use zoning over segregated uses. Despite all of these possibilities, in this project we shall consider walkability only in its most basic sense: the safety, security, economy, and convenience of traveling by foot. Our goal is to develop a project that targets those aspects of walkability that can be improved upon in the short and medium terms (e.g., availability of infrastructure and relevant policies), as opposed to those that may only be affected in the long term (e.g., prevailing land uses).

3.2 Phasing

I initially conceived the Walkability Index as a multi-phase research effort, as outlined below:

Phase I

Step 1	Conduct background research and literature review
Step 2	Draft survey methods and survey implementation guidebook. Test survey materials in developed and developing countries to refine methodology.
Step 3	Use refined survey materials to conduct full-scale pilot in a select developing city. Analyze results.
Step 4	Finalize survey methodology and implementation guidebook.

Phase II

Step 5 Complete rough method for data aggregation – that is, transforming the data into index rankings (to be further refined as data is collected).

Step 6 Promote widespread implementation of Index survey materials. Begin to construct Global Walkability Index.

Step 7 Develop generic counter-measure guidebook that outlines steps (additional studies, resources that may be consulted, etc.) city planners and leaders can take to improve upon areas deemed insufficient by the Index

Step 8 Analyze Index data and produce final report. Establish mechanism for on-going implementation.

The work discussed in this paper focuses solely on Phase I, with some reference at the conclusion of this paper (*Section 12.0: Conclusion and Next Steps*) about next steps for Phase II.

3.3 Selected Cities

The Index has been designed such that it may be universally applicable to developed and developing cities alike. Cities selected for the development of the index methodology itself are further described in *Section 7.0: Field Tests.*

3.4 Tie-ins to Broader Context

Although this project focuses exclusively on the development of a Walkability Index, it should be noted that the tools and survey methodologies developed herein may also be used to accompany other initiatives, such as local pedestrian advocacy movements, urban transport infrastructure upgrading projects, or individual grant programs.

What follows is a discussion of the Index's foundation – a foundation that may be altered to suit the specific needs of a non-Index project, such as devising an investment proposal.

Section 10.0: Extended Index Surveys shows how Index tools may be used to derive investment and policy-making programs.

4.0 Index Components

The Walkability Index, designed around the aforementioned project objectives, comprises three components: safety and security, convenience, and degree of policy support.

Component 1: Safety and Security

This first component is intended to determine the relative safety and security of the walking environment. For example, what are the odds a pedestrian will be hit by a motor vehicle? What safety measures are in place at major crossings and intersections? How safe from crime do pedestrians feel along walking paths?

Component 2: Convenience and Attractiveness

The second component reflects the relative convenience and attractiveness of the pedestrian network. For example, do pedestrians have to walk a kilometer out of their way just to cross a major road? Is there sufficient coverage from weather elements along major walking paths? Are paths blocked with temporary and permanent obstructions, such as parked cars or poorly placed telephone poles?

Component 3: Policy Support

Finally, the third component reflects the degree to which the municipal government supports improvements in pedestrian infrastructure and related services. Is there a non-motorized planning program? Is there a budget for pedestrian planning? Are pedestrian networks included in the city master plan?

In a previous iteration of the Index, these three components were further subdivided into 22 indicators and 45 variables. These components, indicators, and variables were the final product of a substantial amount of research that included:

- Evaluation of more than 20 different established methodologies for evaluating urban non-motorized transport (*Appendix A: List of Indices and Evaluative Methodologies Reviewed*);
- Evaluation of three different econometric methods for compiling indices (*Appendix A*);
- Consultations with experts from a multitude of fields, including urban planning, pedestrian planning, transportation engineering, urban transport policy, pedestrian safety, accessibility for disabled persons, urban design, and economics (*Appendix B: List of Consulted Experts*); and
- Comments from field testers in Alexandria, VA; Washington, DC; Hanoi, Manila, Bangkok, Beijing, and Delhi (*Section 7.0: Field Tests*).

Table 1 illustrates the original Index's formulation[1]. I presented this form of the Index at the Association of Bicycle and Pedestrian Professionals annual conference in Chicago in October 2005. The overwhelming response from conference participants (and other audiences) was that the methodology, while appropriate for developing targeted investment programs, was far too complicated for practical implementation purposes.

[1] Note that the "Source" column refers to where the data is collected from.

Table 1: Original Global Walkability Index: Summary of Components, Indicators, and Variables (2005)

Component		Indicator		Variable	Source
Safety & Security	1	Pedestrian Fatalities and Injuries	1	Proportion of road accidents that resulted in pedestrian fatalities (most recent year aval.)	2
			2	Proportion of road accidents that resulted in pedestrian injuries (most recent year avail.)	2
	2	Modal Conflict	3	5-minute interval count of pedestrians walking in street among other modes	1
			4	Pedestrians concerned about modal conflict on walking path	3
			5	Walking path modal conflict Level of Service from 1 to 5 (1-5 LOS)	1
			6	Pedestrians who do not feel safe from road accidents	1
	3	Crossing Safety	7	Crossing safety 1-5 LOS (surveyed crossings = sc)	1
	4	Crossing Exposure	8	Average time waiting to cross (sc)	1
			9	Judgement: sufficient time given for healthy adult to cross (sc)	1
			10	Judgement: sufficient time given for person with small children to cross (sc)	1
			11	Judgement: sufficient time given for elderly / disabled people to cross (sc)	1
	5	Traffic Management at Crossings	12	Type (e.g., ped-phase signal) as function of # lanes and avg. traffic speed (sc)	1
	6	Security	13	Perception of security from crime 1-5 LOS	3
			14	Proportion of walkable roads with street lights	3
			15	Pedestrians who do not feel streets are well lit at night	3
			16	Security of crossings (particularly subways) 1-5 LOS	1
	7	Safety Rules and Laws	17	Existence of relevant pedestrian safety laws and regulations	2
			18	Enforcement of relevant pedestrian safety laws and regulations	2
	8	Pedestrian Safety Education	19	Presence of pedestrian safety education programs	2
	9	Motorist Behavior	20	Yielding to pedestrians	3
			21	Safe driving speed in heavily pedestrianized areas	3
			22	Running red traffic lights and stop signs	3
Convenience & Attractiveness	10	Trees	23	Average number of trees per km of road	1
	11	Cleanliness	25	Cleanliness of walking paths 1-5 LOS	1
			25	Pedestrians inconvenienced by lack of cleanliness of walking paths	3
			26	Presence of open sewers along walking paths	1
	12	Quality and Maint. of Walking Path Surface	27	Quality and maintenance of walking path surface material 1-5 LOS	1
			28	Pedestrians inconvenienced by poor walking path surface quality and maintenance	3
			29	Proportion of roads without sidewalks	1
	13	Disability Infrastructure	30	Existence and quality of facilties for blind and disabled persons 1-5 LOS	1
	14	Coverage	31	Proportion of walking paths that are covered (e.g., arcades) with climate weight	1
	15	Obstructions	32	Permenant and temporary obstacles on walking paths 1-5 LOS	1
			33	Pedestrians inconvenienced by obstructions	3
	16	Availability of Crossings	34	Sufficeint safe and convenient opportunities available to cross streets	3
	17	Walking Path Congestion	35	Pedestrian congestion 1-5 LOS	1
	18	Pedestrian Amenities	36	Amenities (e.g., benches, public toilets) 1-5 LOS	1
			37	Pedestrian wayfinding signage 1-5 LOS	1
	19	Connectivity	38	Connectivity between residential and employment centers 1-5 LOS	2
	20	Overall Convenience	39	Pedestrian perception of convenience -- rating	3
Policy Support	21	Planning for Pedestrians	40	Presence and quality of pedestrian planning program	2
			41	Incorporation of pedestrian plans in transportation or city master plan	2
			42	Relative importance of pedestrians in city planning (agency self-rating)	2
			43	Degree of centralization among bodies responsible for different aspects of ped. planning	2
	22	Relevant Design Guidelines	44	Presence of relevant urban design guidelines	2
			45	Presence of relevant building design guidelines	2

Data Sources: 1 Physical Infrastructure Survey; 2 Public Agency Survey; 3 Walker Survey; 4 City Background Research

I based the simplification of the Index on feedback from previous Index and included those elements deemed the most important indicators of walkability. The new Index compromises thoroughness for practicality, yet still stands as a plausible indicator of walkability in cities throughout the world. The simplified Index variables are presented in Table 2.

Table 2: Global Walkability Index – Summary of Components and Variables (2006)

Component	Variable	
Safety and Security	1	Proportion of road accidents that resulted in pedestrian fatalities (most recent year avail.)
	2	Walking path modal conflict
	3	Crossing safety
	4	Perception of security from crime
	5	Quality of motorist behavior
Convenience and Attractiveness	6	Maintenance and cleanliness of walking paths
	7	Existence and quality of facilities for blind and disabled persons
	8	Amenities (e.g., coverage, benches, public toilets)
	9	Permanent and temporary obstacles on walking paths
	10	Availability of crossings along major roads
Policy Support	11	Funding and resources devoted to pedestrian planning
	12	Presence of relevant urban design guidelines
	13	Existence and enforcement of relevant pedestrian safety laws and regulations
	14	Degree of public outreach for pedestrian and driving safety and etiquette

Unless otherwise specified, each of these variables is in the form of a Level-of-Service (LOS) unit, on a scale from 1 to 5. Calculation of the Index based on these variables is discussed in *Section 8.0: Converting Data into Index Rankings.* A full description and justification of the Index variables may be found in *Appendix C: Global Walkabilty Index Survey Materials and Implementation Guide.*

One unusual feature of the Index variables is that cities are not punished for the absence of traditional raised sidewalks. This is because the absence of sidewalks does not necessarily imply an unwalkable environment. For example, through careful urban design, the Dutch

have created *woonerfs*[2], neighborhoods that are very walkable yet lack raised sidewalks. Further, it makes little sense to penalize a city for not providing sidewalks in areas where demand is minimal. Finally, unless sidewalks are well maintained and free from obstructions, their mere presence is not a guarantor of walkability. Thus, variables measuring the quality of dedicated pedestrian *walking paths* have been included in lieu of the presence traditional sidewalks.

5.0 Data Collection Methodology

The quality of the data collection methodology will largely determine the overall quality and usefulness of the Walkability Index. That said, while it is desirable that the data collection methods are thorough, they should also be very simple to ensure widespread, error-free implementation. To this end, I developed a set of two surveys for collecting the data described in Table 2: a public agency survey and a field survey (*Appendix C: Index Survey Materials*).

It is important that these surveys are conducted by local populations to prevent undue bias in results. We are more interested in attaining a walkability index that ranks cities on pedestrian facilities and services, *relative to their local political and economic conditions*, rather than an index that merely mirrors GDP rankings. To illustrate the problem of non-local persons conducting surveys, consider this: an American conducting a walkability survey in Washington, DC, may give the city very low marks for safety and security, while an Indian

[2] "*Woonerf*: A street in which, unlike in most streets, the needs of car drivers are secondary to the needs of users of the street as a whole. It is a space designed to be shared by pedestrians, playing children, bicyclists, and low-speed motor vehicles." (Wickipedia: "Woonerf" <http://en.wikipedia.org/wiki/Woonerf>)

from Mumbai might give Washington very high marks, given the substantial different levels of infrastructure development between the two cities.

5.1 *Implementation Guide*

I developed a simple guidebook to help teams in different cities conduct the surveys in a consistent manner (*Appendix C: Index Survey Materials*). Early versions were tested by persons in the US and overseas to determine relative ease and feasibility of the survey methods.

6.0 Survey Area Selection and Time-of-Day Considerations

6.1 *Survey Area*

It is important that selected survey areas within cities provide comparable results, and it is important that the areas surveyed are representative of a large cross-section of cities' varied neighborhoods and districts. Establishing a survey area selection methodology that suits these criteria is quite difficult, given I call the *Alexandria Effect.*

Alexandria, Virginia, is famous for its historic district, which features a very pleasant, pedestrian-friendly environment (Figure 1). Few people realize, though, that Alexandria's walkable streets comprise only a fraction of the entire city (both spatially and in terms of population), which is, in fact, very unwalkable (Figures 2 and 3). Traffic speeds tend to be

Figure 1: Alexandria, Virginia – Total Population and Historic District

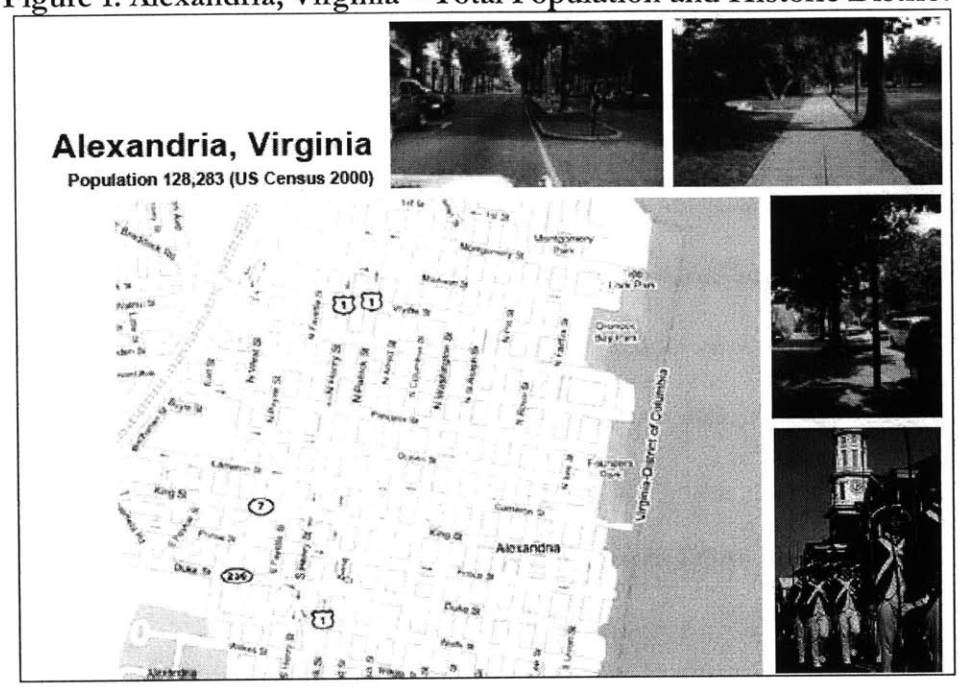
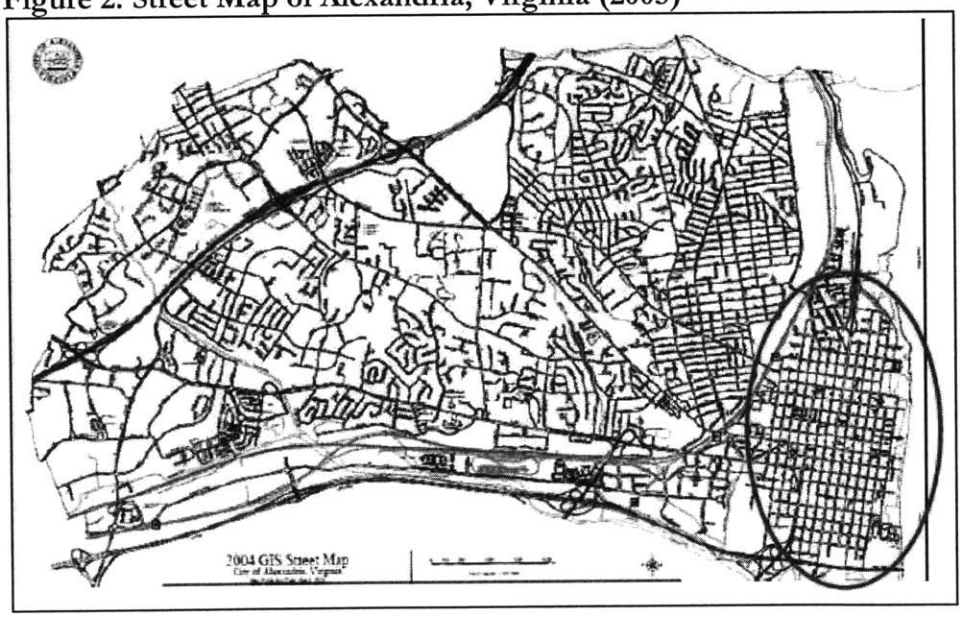


Figure 2: Street Map of Alexandria, Virginia (2005)

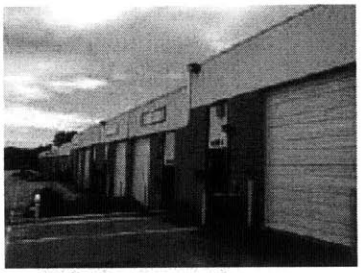


relatively fast (40 – 55 mph), there are few pedestrian crossings, and many corridors lack continuous, well maintained sidewalks, despite an apparent need. So, the question is, is Alexandria a walkable city? How can we devise a survey area selection method that would

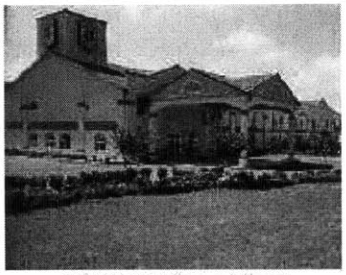
both capture the walkability of the historic district while at the same time both capturing the unwalkabity of greater Alexandria and giving that area an appropriate weight?

Figure 3: Alexandria, Virginia – Beyond the Historic District

67-6800 Richmond Highway



4574 Eisenhower Avenue



6017 Old Boyce Road

Bearing this issue in mind, I considered at least five different survey area selection methodologies:

a) Method 1: Street Typology

After deriving a list of different street typologies (e.g., low-income residential street, central commercial street, etc.), one would elect to survey at least ***n*** of each different street type in each city. This method has a few distinct advantages. First, assuming that city transportation planners can estimate the number of each type of street within the municipality, we can use data collected from each street survey to generate city-wide estimates. Second, this method lends itself to more acceptable comparisons across cities, since typologies are by definition the same across different locations. Problems with this method include the difficulty in deriving universally applicable street typologies and in retaining the expertise required to identify which roads within a city fall into the established typologies.

b) Method 2: Street Location

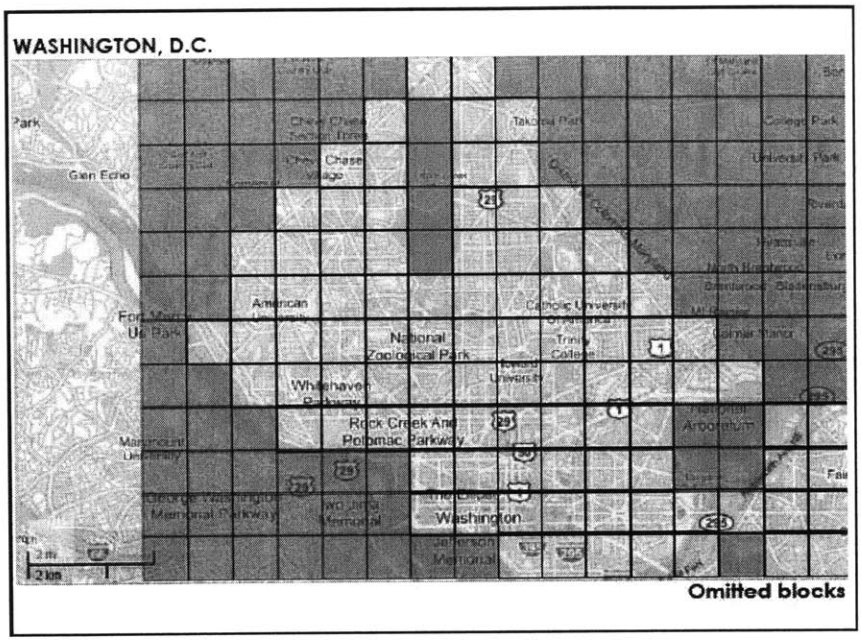
Rather than derive a list of different street typologies, one would generate a list of typical districts (e.g., low-income residential, middle- and high-income residential, central commercial district, industrial district, etc.). Then, one could survey ***n*** streets of varying widths and uses in each district in each city. This method may be executed more quickly than the street typologies method, since it is easier to pinpoint districts than street typologies. But at the same time, this method would not provide the same degree of standardization across cities for a few reasons. First, the typical districts would be arbitrarily chosen, lending bias to the selected survey areas. Second, the selection of streets within the districts would be arbitrarily chosen, as would the district boundary. For the results to be widely acceptable, one needs to consider methodologies that incorporate some greater degree of objectivity.

c) Method 3: Arbitrary Bounded Area

An arbitrary buffer zone with a predetermined radius could be drawn around a universal landmark, such as a town hall or central bus station. All streets (excluding alleys) within the analysis zone would be included in the survey. Although this method enables the survey team to get started relatively quickly, it also poses a few distinct disadvantages. First, data collected from the survey areas cannot be used to generate estimates at a city-wide level. Second, analysis zones would not necessarily be comparable across different cities.

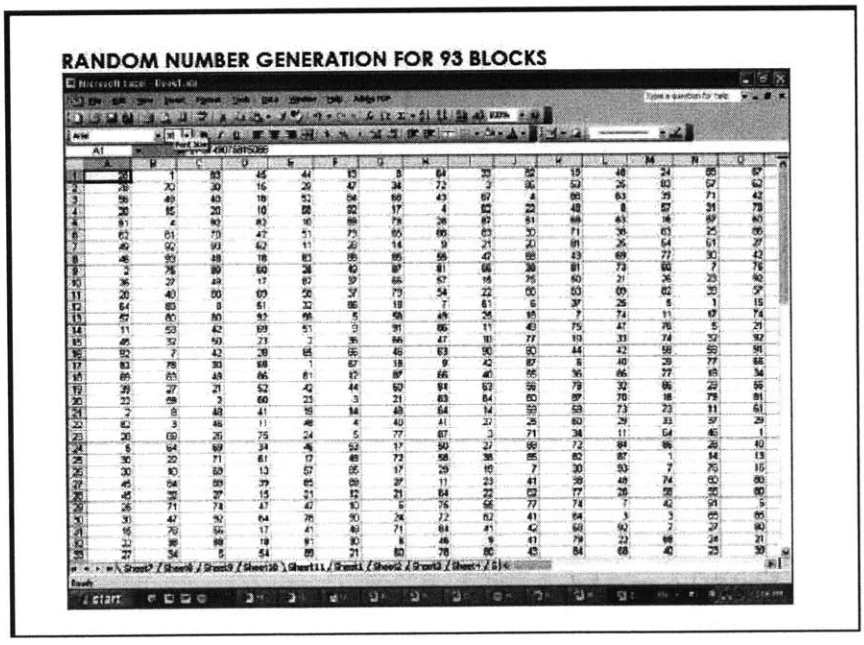
d) Method 4: Spatial Random Sample

In survey work, econometricians typically prefer to use random samples to avoid as much bias as possible. While the previously outlined methods have their merits, none include a random component that would lend credibility to survey results. One way to insert randomness into the survey area selection would be to obtain a random spatial sample, as described below. This method was initially proposed by Judy Baker, an economist at the World Bank.



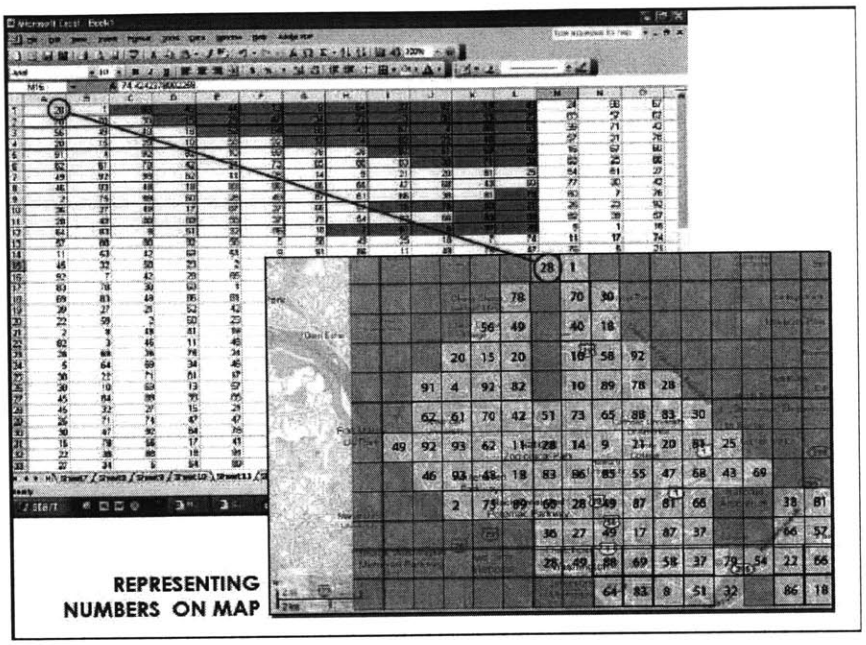
Step 1

Lay a 500 meter by 500 meter grid on top of a city map. Map and grid scales shall be uniform across cities – in this case, we have used 1km x 1km squares for illustrative purposes. Block out squares that fall beyond the city border or in areas inappropriate for conducting surveys (e.g., lakes, parks, private property, etc.).



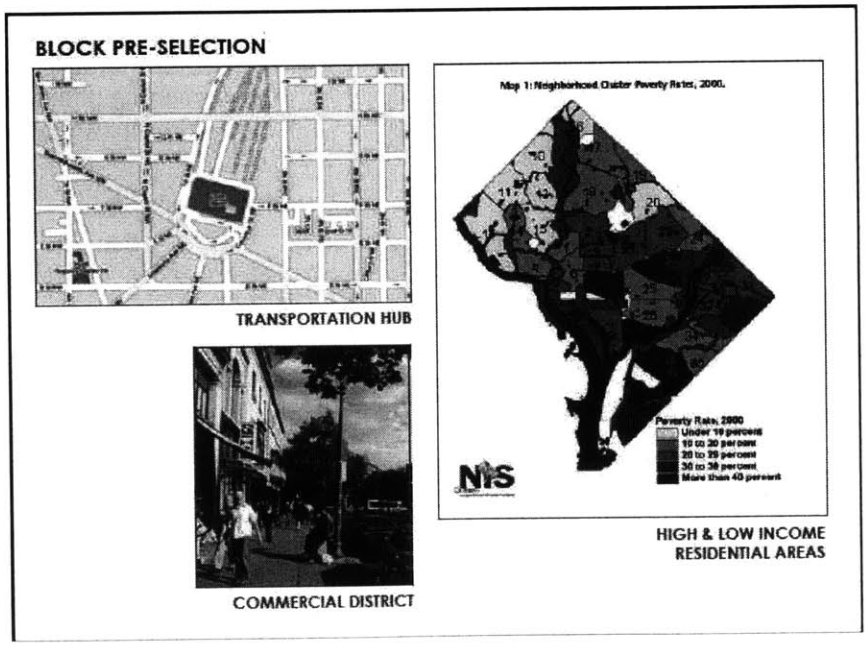
Step 2

Generate a random number table. In this example, we generated numbers along a normal distribution from 1-93 (there are 93 unblocked squares on our map).



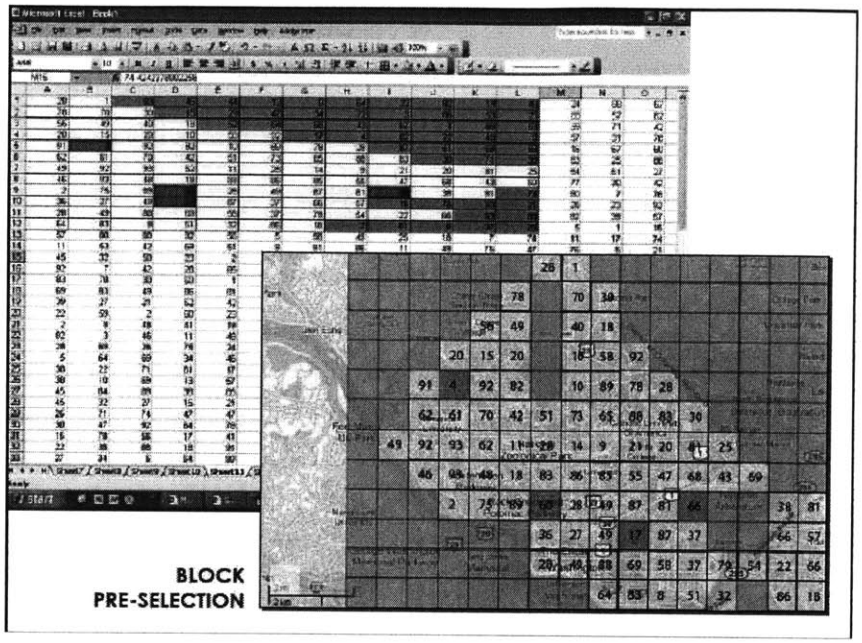
Step 3

Transpose randomly generated numbers from table to the map, as shown in the diagram.



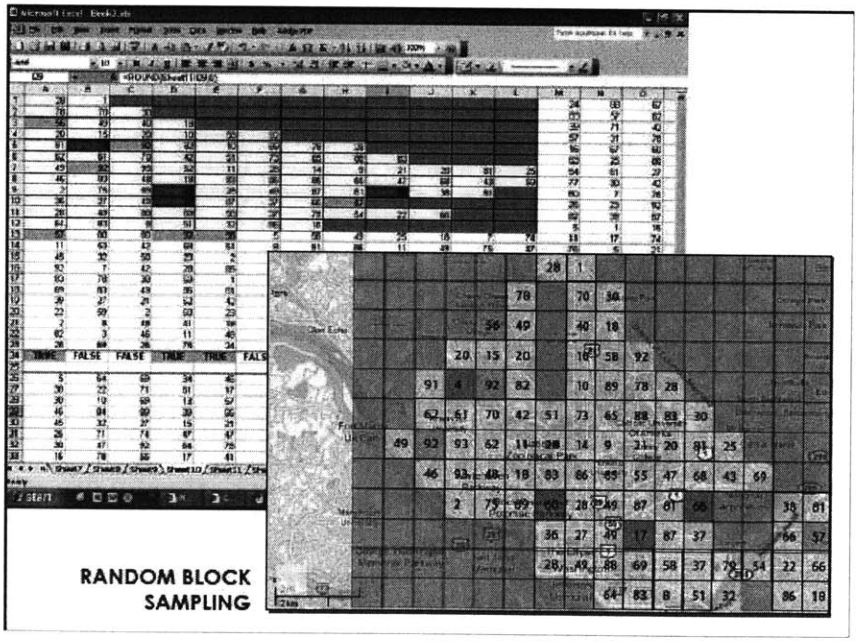
Step 4

Although the sampling method will have a random component, we want to be certain that specific types of neighborhoods are covered by the survey. Pre-select four survey squares that fall within: 1) A high-income neighborhood with mostly housing; 2) A low income neighborhood with mostly housing, a transport hub (e.g., rail station), and a commercial district.



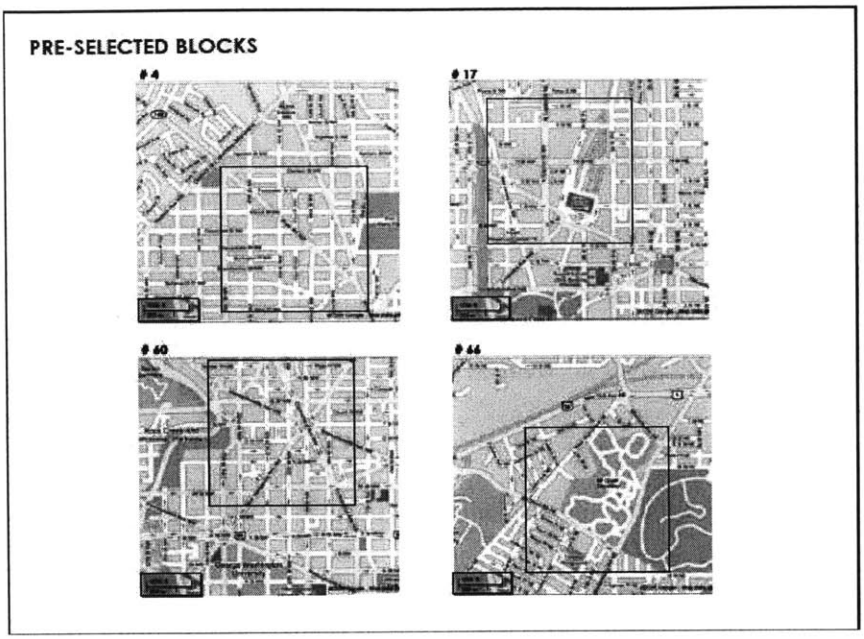
Step 5

Mark these pre-selected areas on the city map.



Step 6

To ensure that the Index is fair, the remaining squares shall be randomly selected. We used the same random number table we had generated previously. Starting from the left, if a number on the table appeared in our map, than that corresponding square would be selected (see diagram). The number of additional squares should equal the total number of available squares divided by 10 (the answer is rounded down), minus the four pre-selected squares. (Note: technically, in the case, then, there should be five additional squares)



Step 7

Based on selections, make individual maps that can be used in the field to conduct surveys. For the purposes of constructing Index rankings and identifying general strengths and weaknesses, every major public road within each square should be surveyed — alleys, private drives, very minor residential roads, etc. are excluded.

This method is advantageous in that: 1) the random component mitigates some bias from the results, therefore making the survey data more readily comparable across cities; and 2) surveying a square area rather than a selection of single streets ensures issues such as connectivity can be captured in the data – that is, surveying whole areas give is a sense of general walkability for a whole neighborhood, as opposed an isolated road that may or may not be of import. One drawback is that a random spatial sample, inherently, will not cover all areas in the city and may miss important corridors. But, since this is the case for all cities, and since these surveys are conducted for the purposes of constructing an index, as opposed to an investment program, this loss may be considered acceptable. The more areas that are selected (and therefore the less-detailed the surveys are), the more this issue may be mitigated.

e) Method 5: Random Sample of Streets

This method requires a list of all streets in a city, which should be obtainable from the municipal agency responsible for transportation planning. The Consultant shall assign randomly generated numbers to each street and then select a sample of streets. The survey teams shall then survey typical one-kilometer stretches on selected streets. Although relatively simple, this method poses at least one key difficulty, namely, in some developing cities, no such master list of street names exists for all or most major and minor roads.

In terms of drawing a city boundary, we shall consider developed areas contiguous to the city center. That is, satellite neighborhoods and neighborhoods separated from the city by agricultural land or significant natural or manmade barriers shall not be considered.

6.2 Time of Day

In addition to location considerations, there are also time-of-day issues to bear in mind. For example, a street that seems very safe at 9:00 a.m. may seem much less so at 9:00 p.m. Or, a sidewalk that seems perfectly walkable on a Sunday afternoon may be impossible to navigate during Monday rush hour. Under ideal conditions, all surveyed areas would be visited at least twice – during peak and a non-peak traffic times (note that the specific peak times of day will vary from city to city) However, should limited resources prove multiple visits unfeasible, then conducting surveys in all cities only during local peak hours may be an option.

7.0 Field Tests

The form and content of these surveys have been refined though field tests in cities throughout the world, including Beijing, Hanoi, and Washington D.C. Test cities were chosen based on accessibility – that is, cities where volunteers were willing to examine the methodology and provide feedback. Table 3 summarizes these efforts:

Table 3: Global Walkability Index: Field Test Record

Time	Location	Organizer	Work Completed
6.2005	Alexandria, VA	Holly Krambeck *Author*	Physical: 2 km road length surveyed
7.2005	Beijing, PRC	Yang Chen *World Bank Intern*	Physical: 1 km road length surveyed Pedestrian: 10 people surveyed
7.2005	Washington, DC	Holly Krambeck *Author*	Physical: 7.5 km road length surveyed Pedestrian: 44 people surveyed Public agency survey completed
7.2005	Hanoi, Vietnam	Le Sy Hoang *World Bank Consultant*	Physical: 1 road surveyed
7.2005	Bangkok, Thailand	Pat Suwanathada *World Bank Consultant*	Physical: 2 roads surveyed
8.2005	Manila, Philippines	Herbet Fabian *Asian Development Bank*	Physical: 10 roads surveyed
8.2005	Karachi, Pakistan	Ahmad Saeed *IUCN Pakistan*	Physical: 1.5 km road length surveyed Public agency survey completed
8.2005	Delhi, India	Jacob Wegmann *MIT*	Physical: 4 km road length surveyed Pedestrian: 4 people surveyed
8.2005	Ahmedabad, India	Holly Krambeck *Author*	Physical: 20 km road length surveyed Pedestrian: 342 people surveyed Public agency survey completed
10.2005	Chicago, IL	Holly Krambeck *Author*	Physical: 2.5 km road length surveyed Pedestrian: 12 surveyed

A selection of materials from these field tests may be found in *Appendix E: Selection of Field Test Materials.* It is important to note that the tests were conducted for the purposes of refining the Index methodology, rather than to merely collect data, in which case the sample sizes would have needed to be larger in most cases. Testers submitted hundreds of comments on the materials, which I drew upon to make the following changes in the methodology and composition of the Index.

7.1 Simplified Survey Format

The Alexandria pilot revealed that the original physical infrastructure survey was too cumbersome and difficult to complete within a reasonable amount of time. Changing the

order of questions, format of the survey, and question content are among the many changes that were made over time to overcome this hurdle.

Initial tests of the pedestrian survey conducted among World Bank staff at its headquarters in DC and Beijing office revealed that the questions were not intuitive and not all respondents understood the questions being asked. To remedy this, 1) some questions were accompanied by multiple-choice response fields, rather than fill-in blanks; 2) some questions deemed redundant were dropped; and 3) an instructional guide for persons conducting the pedestrian surveys was developed.

The Washington pilot conducted among pedestrians in eight randomly selected neighborhoods revealed that the language of the pedestrian survey is too formal/academic and not necessarily suitable for survey work in diverse contexts, such as low-income neighborhoods. To remedy this, the language was simplified and an additional note on this issue was included in the survey guide.

7.2 Design for Simplified Data Entry

Physical infrastructure data entry from the DC pilot was cumbersome, largely because the volunteers had too much freedom in deciding how to fill in responses. To remedy this, most of the questions were rewritten as multiple choice, rather than fill-in-the-blank. Also, fill-in PDF files have been developed, so that data may be entered directly into the PDF sheet and then saved as a ".csv" file, rather than a more cumbersome, less-intuitive spreadsheet template.

7.3 Changes in Survey Content

Tests in Hanoi, Beijing, Manila, Delhi, and Bangkok revealed that not all important pedestrian-related problems are covered by the survey questions. For example, a tester in Hanoi noted that at crossings, it is not enough to measure the amount of time given to cross a street – one must also note whether that time is sufficient. Comments such as these were used to further refine the survey content, such that the questions are more universally applicable, and such that they capture a significant proportion of pedestrian issues faced throughout the world.

8.0 Converting Data into Index Rankings

Without data from a selection of cities, it is difficult to develop an Index methodology in specific terms. Thus, the following paragraphs describe how one might go about constructing the Index once more data is gathered.

For the public agency portion of the survey, points are assigned to each response, summed, and then normalized across results from all cities with a z-score. To illustrate, Figure 4 shows a filled-in public agency form. Point allocation is summarized in Table 4.

Figure 4: Sample Filled-In Public Agency Survey

1) Please rate degree of municipal funding and resources devoted pedestrian planning.

- ○ Enough to sustain a high-quality progr am in long-term
- ○ Sufficient for short term, but not the long term
- ○ Neutral
- ◉ Insufficient to acheive meaningful goals
- ○ Non-existant

2) Please check the pedestrian-related urban design guidelines that are already well-established. Feel free to add any relevant guidelines that are not included in the list.

- ☒ Sidewalk pavement type
- ☐ Placement of benches and similar amenities on walk paths
- ☐ Sidewalk widths
- ☐ Design for disabled persons
- ☐ Other _____
- ☐ Other _____
- ☐ Other _____

3) Attach available data on pedestrian fatalities and injuries to survey materials. Enter estimated proportion of traffic fatalities involving pedestrians in 2004.

25 %

4) Have there been public outreach efforts (by this or other agency) to educate pedestrians or drivers on road and pedestrian safety?

- ☐ Yes
- ☒ No

5) Is there a law or regulation for any of the following items? If so, is the law or reguulation enfoced? Feel free to add any relevant laws or regulations that are not included in this list.

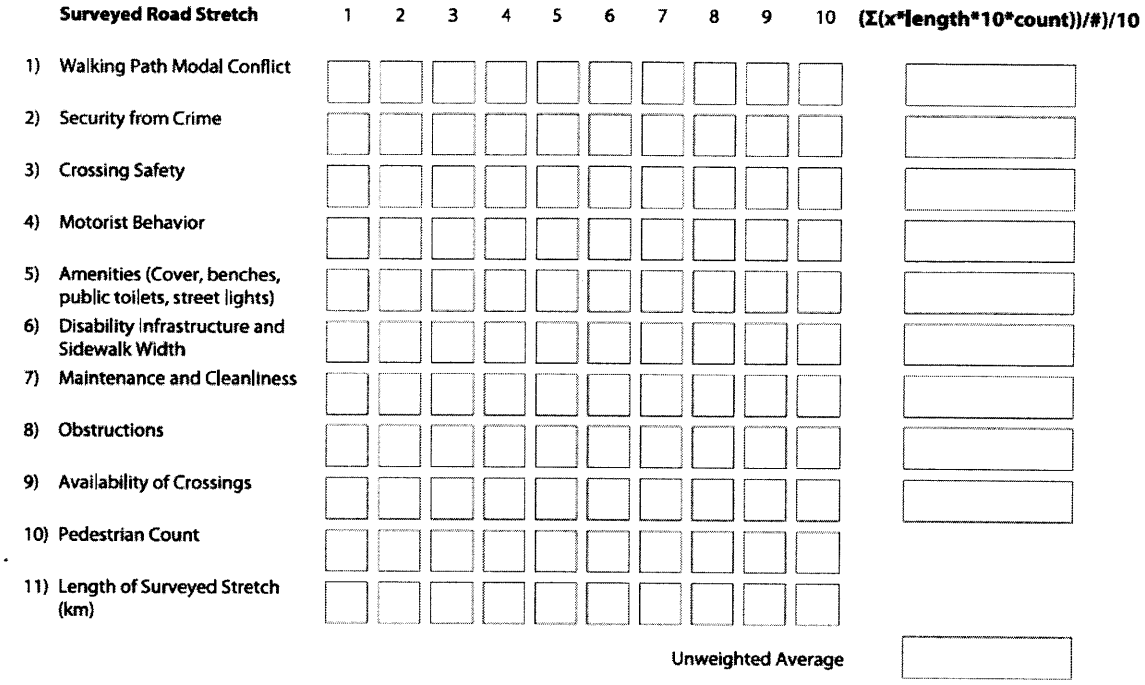
		Enforced?		
Is there a law or regulation for:	Usually	Sometimes	Rarely
☒ Jaywalking	☐	☐	☒
☒ Vendors on sidewalks	☐	☐	☒
☒ Parking on sidewalks	☐	☐	☒
☒ Driving / riding on sidewalks	☐	☒	☐
☐ Drunk driving	☐	☐	☐
☒ Other Littering	☐	☐	☒
☐ Other _____	☐	☐	☐
☐ Other _____	☐	☐	☐

Table 4: Point Allocation for Public Agency Surveys

Question	Point Assignments	Sample (Figure 4)
1	1-5 Scale; Non-Existent = 1	2
2	One point for each box checked	1
3	Divide percentage by 10	2.5
4	Yes = 5, No = 1	1
5	3 for each 'usually' to 1 for each 'rarely', divided by 2.	3
Total		9.5

Figure 5, which is taken from the survey materials in *Appendix C*, shows a blank field data collection form.

Figure 5: Field Data Collection Form



For each surveyed area, up to 10 stretches of road may be surveyed (this number was derived based on field tests, in which there were, on average, 8 stretches per surveyed area). If more than 10 stretches are present, additional sheets may be used. The surveyor records a Level-of-Service (LOS) measurement into each square, on a scale of 1-5, according to principles laid out in the survey implementation guidebook, which may be found in *Appendix C*. To normalize LOS inputs, each LOS is multiplied by the length of surveyed road and the pedestrian count (x10). The results are then summed up across rows 1-9 and averaged by the number of stretches surveyed. The resulting number is divided by 10 for simplicity. A final average is then calculated and used in the derivation of the Index. Note that all of the

calculations are done automatically using a dynamic PDF form, which is supplied to all surveyors. Figure 6 presents an example of a filled out Field Data form:

Figure 6: Example of Filled-In Field Data Collection Form for One Survey Area

Surveyed Road Stretch	1	2	3	4	5	6	7	8	9	10	(Σ(x*length*10*count))/#)/10
1) Walking Path Modal Conflict	3	4	4	3	4	5	4				51.1
2) Security from Crime	5	5	5	4	4	5	4				58.9
3) Crossing Safety	2	2	1	5	4	3	1				40.6
4) Motorist Behavior	2	2	2	3	4	2	1				34.4
5) Amenities (Cover, benches, public toilets, street lights)	4	4	4	3	3	2	3				40.8
6) Disability Infrastructure and Sidewalk Width	1	1	1	1	1	1	1				13.1
7) Maintenance and Cleanliness	3	3	2	3	3	4	3				41.6
8) Obstructions	2	5	4	3	3	2	2				38.6
9) Availability of Crossings	3	4	5	2	4	2	3				40.9
10) Pedestrian Count	25	62	3	30	46	50	10				
11) Length of Surveyed Stretch (km)	0.5	0.25	0.25	0.45	0.55	0.35	0.65				
										Unweighted Average	40

A final average is derived from the sum of the unweighted averages for each survey area, divided by the total number of survey areas. The final average is then added to the average from the public agency survey. The total is assigned a z-score to avoid problems of scale in cross country comparisons (the statistical z-score is obtained by subtracting the observations from the mean and dividing by the standard deviation of the variable).

The variables may or may not be weighted equally – this is an important issue for discussion. Weights ensure that variables of less import do not skew the overall index rankings. The

problem lies in determining which issues are most important. For example, some women's groups might believe that variables related to security should receive the greatest weights, whereas groups representing disabled persons might believe that variables related to infrastructure such as ramps and blind paths should be weighted more heavily. I found that a number of global indices, such as the respected Yale Environmental Sustainability Index, assign equal weights to all its variables to overcome this very issue. Thus, for the time being, the Global Walkability Index shall also assign equal weights. Ideally, in the future, the Index will be available on-line, and users would have the ability to adjust the weights to see how different emphases impact rankings.

The issue of weights for the variables and possibly components will require more research and discussion. Also, further work would require a full discussion of different kinds of Index approaches and their relative merits, solving problems indicative to this kind of work, and mapping out more specific details for the Index's construction. But again, to pursue this path of inquiry, data from at least two cities must be obtained.

9.0 Index Presentation

The Index format will largely dictate its function. For example, an index that comprises a single ranking number would primarily be useful for encouraging low-ranking cities to take action. But such a format would not be useful for helping cities identify specific areas for improvement. Following are three Index presentation methods that have been considered[3]:

[3] Note that for each method, scores would have to be standardized across cities, since different groups would be carrying out the surveys at different times of the year. Also, where appropriate, consensus would need to be reached to determine appropriate weights for each category.

a) Method 1: Categorical

A separate number or letter is assigned to different Index categories, as in the following example (categories are used for purposes of methodology illustration only):

Table 5: Categorical Walkability Index (A = highest)

City	Safety	Security	Health	Convenience	Policy
City A	E	E	E	E	E
City B	C	D	D	C	D
City C	A	B	E	C	B
City D	A	A	A	A	A

Just as bonds can have AAA or CCC ratings, cities would have AAAAA or ABECB rankings. In this case, City A ranks lowest in all categories, with an EEEEE ranking.

The advantage of this method is that it helps city planners readily identify areas for improvement and rewards them for areas where they are doing well. A disadvantage is that, particularly with letter scores, it is not immediately evident what the scores mean without some further inspection, and it is somewhat more difficult to give cities numerical rankings.

b) Method 2: Ordinal Ranking

With ordinal ranking, only the final ranking score is published. The advantage of this kind of index is that it is very simple to read and understand.

Table 6: Walkability Index by Rank (1=highest)

City	Rank
City A	4
City B	3
City C	2
City D	1

So, according to this table, City D is the most walkable, ranking number 1, and city A is the least walkable. The disadvantage of this method is that it does not reveal very much information about how the score was derived. Further, this method does not reveal the interval between ranked cities – for example, while cities ranked 1 though 3 may be somewhat walkable, the city ranked fourth may be terrible.

c) Method 3: Combined

Another option is to combine both categories and rankings, such as in the following example (note: categories and weights used in the example are for illustrative purposes only):

Table 7: Combined Walkability Index (Individual Scores Based on 1-20 Point Scale)

	Safety	**Security**	**Health**	**Convenience**	**Policy**	**Overall**
(weight)	*0.3*	*0.2*	*0.1*	*0.3*	*0.1*	*1.0*
City A	1	1	1	1	1	1.0
City B	10	8	8	9	5	8.6
City C	18	12	3	10	14	12.5
City D	20	20	20	20	20	20.0

Each column contains the normalized, unweighted score for each category. The "Overall" column is the weighted sum across each row. In this case, City A ranks the lowest, because it has the lowest overall score, and City D ranks the highest overall. In terms of individual categories, City C ranks second in Safety, while City B ranks second in Health. With more cities, the scale would be increase from 1-20 to perhaps 1-100.

The combined method features the advantages of the previous two -- it helps city planners readily identify areas for improvement, rewards cities for areas where they are doing well, and provides a readily understandable final ranking. This method also has challenges, however. One challenge would be assigning rankings to cities that have "missing" categories (due, for example, to sampling error or general non-applicability). Further, the issue of weights could be highly contentious.

Given the advantages and disadvantages outlined above, Method 3 has been selected as an effective way to present Index rankings.

10.0 The Next Step: Extended Survey Materials

As mentioned previously, while the Global Walkability Index serves to raise awareness of walkability as an important issue, it is too general for use in devising an investment or policy strategy. Thus, I developed a set of *Extended Survey Materials*, which would enable cities to pinpoint specific infrastructure and policy needs, in addition to deriving the simple Index ranking.

10.1 *Composition of the Extended Survey Materials*

The extended materials comprise three sets of surveys: a physical infrastructure survey, a questionnaire to be administered to pedestrians, and a public agency interview form. Each survey is described in greater detail below and may be found, with complete instructions and **implementation guide**, in *Appendix D: Extended Survey Materials.*

The physical infrastructure survey is a "supply side" tool used to collect raw data on the availability and quality of pedestrian infrastructure. The survey is relatively simple and could be conducted by volunteers with minimal training (*Appendix D*).

The public agency survey is used to collect important data that is not obtainable through physical infrastructure surveys, such as pedestrian fatality statistics and pedestrian-related laws and regulations (*Appendix D*).

The pedestrian survey is used to collect "demand side" data and enables residents most impacted by the walkability of a city to voice their opinions on current conditions and to suggest improvements. Topics covered in this survey include: perception of safety, quality of mode transfers, accessibility of low-income neighborhoods to places of work and public services, and general convenience afforded by the walking environment (*Appendix D*). As with the physical infrastructure surveys, these may be conducted by volunteers with minimal training.

10.2 *Role of Extended Surveys in the Global Walkability Index*

To reiterate, in practice, the Global Walkability Index survey materials are simple and general, giving cities only a vague picture of their strengths and weakness and some sense of how their walkability compares to that of other cities. This process serves to generate awareness of walkability as an important issue and provides justification for more a more in-depth examination. The Extended Surveys are a simple tool cities can use to collect quantitative and qualitative data about existing pedestrian infrastructure conditions, feedback from residents on relevant pressing concerns, and a clear assessment of exiting institutional capacity and policies for ensuring safe, secure, and convenient pedestrian environments.

11.0 Full-Scale Pilot

11.1 *Overview*

After incorporating field test results into the Index methodology and survey materials, I conducted a full-scale pilot in Ahmedabad, India, in August 2005, using the extended survey materials. Ahmedabad was selected as the pilot city because: 1) a colleague at the World Bank, Ke Fang, had close ties with local non-profits and urban planning professors who could both assist with the survey work and advocate for implementation of its results; 2) there is a pending Bank-led urban development and upgrading project that, if successful, will begin in 2006, for which it may be possible to incorporate survey results as an investment component; and 3) Ahmedabad planners and officials are unusually receptive to this kind of non-motorized travel advocacy. For example, in 2005, the government has begun a bicycle-lane construction program at the behest of 12,000 petitioners.

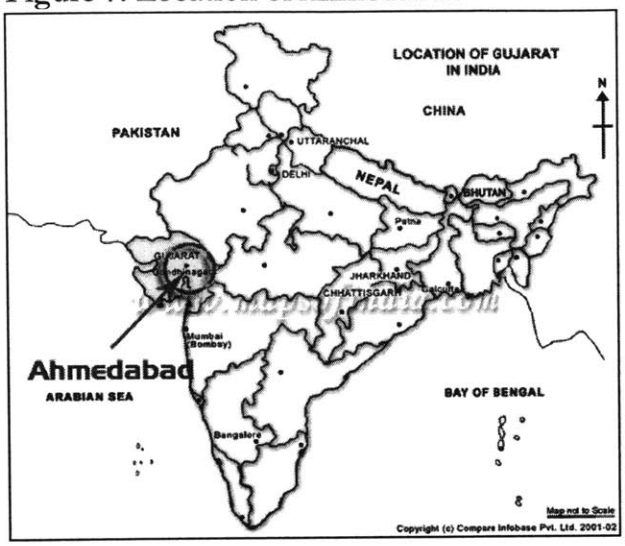
The Ahmedabad pilot was neither funded nor supported by the World Bank – funds came from a grant – the Claire Barrett Memorial Scholarship, given by the Women's Transportation Seminar.

I had hoped that at best, the work completed in Ahmedabad would result in a targeted investment program and, hopefully, act as a catalyst for Index survey implementation in other cities. The work would be published, and project participants would be credited for their pioneering efforts. At least, planners and non-profit organizations in Ahmedabad would have been given a set of simple tools to use for selecting target areas for pedestrian infrastructure investment, and sufficient data would have been collected to move the Index project closer to a wide-scale implementation phase.

11.2 Pilot City Background

Ahmedabad, a city of 4.6 million people (150 people per hectare), is the commercial capital of one of India's wealthiest states, Gujarat (see Figure 7). The local economy is primarily based on light industry and academic institutions, though there is an unusually large informal sector, comprising 77% of the workforce (SEWA 2005).

Figure 7: Location of Ahmedabad



In 2004, there were 1,490,000 registered motorized vehicles in Ahmedabad (including private automobiles, taxis, two-wheelers, etc.), and this number is expected to increase, on average, by 13% over the next few years (CEPT 2005). In terms of public transport provision, there were 540 public buses covering 150 routes and serving 385,682 passengers per day in 2003 (CEPT 2005). The modal split of all trips in Ahmedabad is summarized in Table 8.

Table 8: Ahmedabad Modal Split for All Trips (2000)

Mode	Share
Automobile	3%
Motorized two-wheeler	25%
Rail-based transport	<1%
Public bus	8%
Informal transit	8%
Bicycle	18%
Walking	38%

Source: Louis Berger IDTS Study (2000)

11.2.1 Institutional Framework

At present, pedestrian networks are not considered in the city master or transportation plans. There is no specific non-motorized planning program or coordinator in the Ahmedabad Municipal Corporation, even though there are at least seven different agencies in charge of various aspects of the pedestrian environment (Table 9). Urban design guidelines do not exist for such pedestrian facilities as sidewalk pavement type, placement of benches and similar amenities on walking paths, walking path widths, or deign for disabled persons, and according to Abhijit Lokre of the Environmental Planning Collaborative in Ahmedabad, there have been no efforts made to introduce such guidelines. Finally, although various pedestrian-related laws and regulations exist, they are rarely enforced (Figure 8), largely due to insufficient resources devoted to the traffic police force. In a city of 4.6 million people, there are less than 250 traffic police on duty at any given time.

Table 9: Institutional Responsibilities for Pedestrian Environment in Ahmedabad

Responsibility	Agency
Licensing of street activities	Ahmedabad Municipal Corporation (AMC)
Sidewalk construction	AMC – Engineering
Sidewalk infrastructure maintenance	AMC – Engineering
Sidewalk cleaning	AMC – Maintenance
Street lighting	AMC – Electricity
Pedestrian amenities	ANC – Engineering
Tree planting	AMC – Parks and Gardens
Road safety	Traffic Police
Pedestrian network planning	AMC – Planning (in theory)
Obstructions / public space policy	AMC – Real Estate

Source: Krambeck 2005

Figure 8: Pedestrian-Related Laws and Regulations in Ahmedabad

Is there a law or regulation for:	Enforced? Usually	Sometimes	Rarely
☒ Jaywalking	☐	☐	☒
☒ Vendors on sidewalks	☐	☒	☐
☒ Parking on sidewalks	☐	☐	☒
☒ Driving / riding on sidewalks	☒	☐	☐
☒ Drunk driving	☒	☐	☐
☒ Other Mobile use while driving	☐	☒	☐
☒ Other Driving on wrong side	☐	☒	☐
☐ Other _____	☐	☐	☐

Source: Ahmedabad Public Agency Survey -- Krambeck 2005

11.2.2 The Pedestrian Environment

As a result of this fragmented institutional structure and lack of priorities for pedestrian planning, in general, Ahmedabad is a very inhospitable place for pedestrians. There are few existing walking paths, and new roads are typically constructed without any walking paths at all. Traffic management at intersections (e.g., traffic lights, stop signs, policemen, etc.) is sparse, and pedestrian exposure time at crossings (the time during which most pedestrian fatalities and injuries occur) tends to be very high. An abundance of animal waste, unpaved surfaces, poor drainage, and litter make the pedestrian environment both unattractive and impractical. Finally, according to researchers at the Center for Environmental Planning and Technology, pedestrian-related accidents account for nearly 20% of all traffic accidents (2005). Figures 9 through 12 illustrate the extent of the degraded pedestrian environment in Ahmedabad.

Figure 9: Pedestrians Mix with Bicycles and Motorized Transport at Intersections

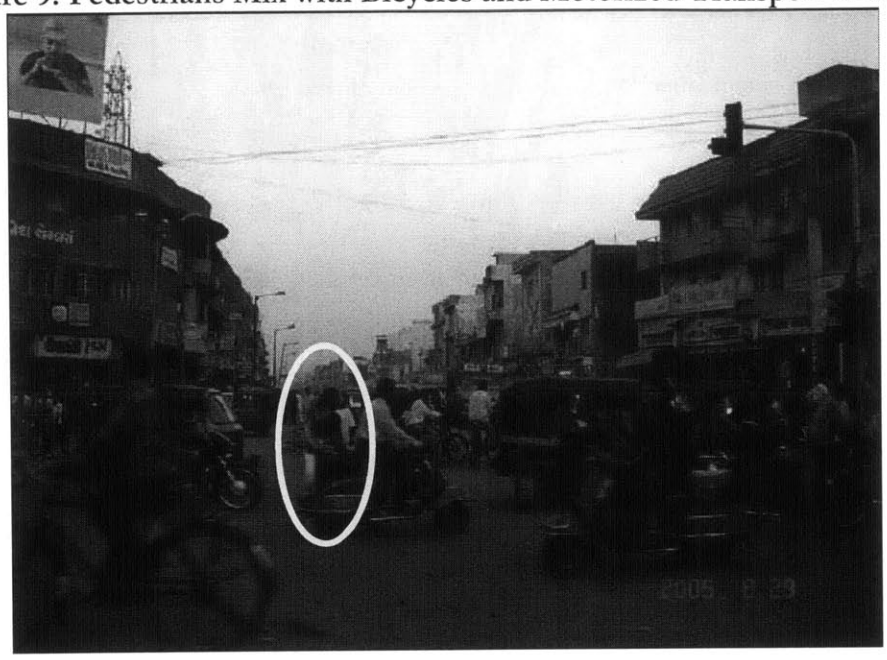


Figure 10: Pedestrian Walks alongside Motorcycles in Center of Road

Figure 11: Parked Motorcycles Obstruct Walking Paths

Figure 12: Unmanaged Roundabouts are Very Common in Ahmedabad

It should also be noted that in addition to lack of any kind of coordinated policy program or investment plan for the pedestrian environment in Ahmedabad, the large proportion of the modal share dedicated to motorized two-wheelers, 25%, exacerbates walking conditions tremendously. Two wheelers can invade sidewalks, substitute for walking, threaten crossings because of their inherent maneuverability, make bicycle-use very difficult for other, cause pollution with their two-stroke engines, and generate a substantial amount of noise pollution. The key problem, though, is despite all of these negative side effects of motorized two-wheeler-use, these vehicles provide a substantial amount of mobility to large numbers of people – thus, since these vehicles are here to stay, it is imperative that their use must be better regulated.

In August and September of 2005, more than 340 pedestrians in Ahmedabad were surveyed using the extended Global Walkability Index survey materials and asked about walkability conditions in their neighborhoods, revealing a number of pressing concerns. For example, of the respondents, 43% stated that walking paths in the city are often congested with non-pedestrian traffic, 49% said walking paths are often covered with litter, and 42% believed that existing walking paths are uneven and difficult to walk on. Further, respondents tended to rate general motorist behavior, as well as the safety, security, and convenience of the pedestrian environment as "poor."

11.2.3 Improving Pedestrian Conditions in Ahmedabad

Pedestrian infrastructure, as far as transport infrastructure is concerned, is relatively simple and inexpensive to build, yet its impact on the quality of life and functioning of the whole urban transport system can be quite significant. Given this, we might assume that reasons

for pedestrian planning neglect rest more closely with unawareness and lack of incentive than with any kind of inability or gross fiscal constraint. So, a logical first step towards improving walkability in Ahmedabad would be to clearly define the problem and generate awareness of walkability as an important issue among city residents and officials. The data generated to define the problem (collected through physical infrastructure, public agency, and pedestrian surveys) could then be used towards developing a targeted investment program to improve walkability in select, high-profile areas, such as areas around schools or transport hubs. The support of local stakeholders should be solicited, to ensure light pressure is continuously applied to city officials to sustain walkability efforts. Also, ideally, a pedestrian infrastructure investment program would be tied to a larger existing project, such as a road upgrading project, or in this case, a pending World Bank urban development and upgrading loan package. Finally, an investment program should also include a policy component to ensure that the infrastructure is maintained, kept clear of obstructions, and so forth.

11.3 Pilot Process

Most of these tasks have recently been completed in Ahmedabad – walkability surveys have been conducted in 8 square kilometers of the city with 65 student volunteers from the Centre for Environmental Planning and Technology; presentations have been made to local and state government officials; and the efforts of three local organizations, the Self-Employed Women's Association (SEWA), the Environmental Planning Collaborative (EPC), and the Center for Environmental Planning and Technology (CEPT) have been coordinated to oversee the development of the initial investment proposal, which will target walking conditions around schools, informal markets (where there tend to be large numbers of

pedestrians), and transport hubs. Finally, the project will be tied to two larger, already established investment projects – a proposal for a BRT corridor, and a 125 kilometer road upgrading project. A selection of materials from this pilot may be found in *Appendix E: Selection of Field Test Materials.*

11.4 *Preliminary Results of Pedestrian and Physical Infrastructure Surveys*

Over a period of one week, 65 graduate planning student volunteers conducted over 350 pedestrian surveys (of which 341 were usable) and conducted physical infrastructure surveys in 8 different parts of the city, covering about 2000 square kilometers of urban area and 33 kilometers of road length. Tables 10 and 11 summarize key survey sample characteristics.

Table 10: Key Characteristics of Pedestrian Survey Sample

Characteristic of Sample	Value
Number of Usable Pedestrian Surveys	341
Percent Female	38.4%
Percent Disabled	2.6%
Percent with Small Children in the Household	43.7%
Average Age of Respondents	20-39 years old
Approx. Percent Low Income*	24.6%
Approx. Percent Medium Income*	67.4%
Approx. Percent High Income*	3.2%
Percent Own Bicycle	25.5%
Percent Own Motorcycle	58.7%
Percent Own Car	9.4%
Average Minutes Spent Walking per Day	16-30 minutes

*Relative to local median income

Table 11: Key Characteristics of Physical Infrastructure Survey Sample

Characteristic of Sample	Value
Total Surveyed Area*	2000 square km
Total Number of Road Stretches Surveyed	118
Length Surveyed Road Stretches**	33 km
Percent with Commercial Uses	87.3%
Percent with Industrial Uses	3.4%
Percent with Political Uses	4.2%
Percent with Other Uses***	33.9%
Percent with High Income Housing	30.0%
Percent with Medium Income Housing	37.3%
Percent with Low Income Housing	46.6%
Percent with Slum Dwellings / Informal Housing	33.1%

* Eight 500 meter by 500 meter square survey areas
** There are typically multiple stretches surveyed per road
*** Other uses include: vacant land, temple, railway station, public space

Typical respondents were between the ages of 20-39, of middle income, and had small children in their household. More than half owned motorcycles, while only about 26% owned bicycles and 9% owned cars. Interestingly, the average time respondents spent walking per day closely mirrored that found in more car-dependent, industrialized nations – this might be an indication of the in hospitability of the pedestrian environment.

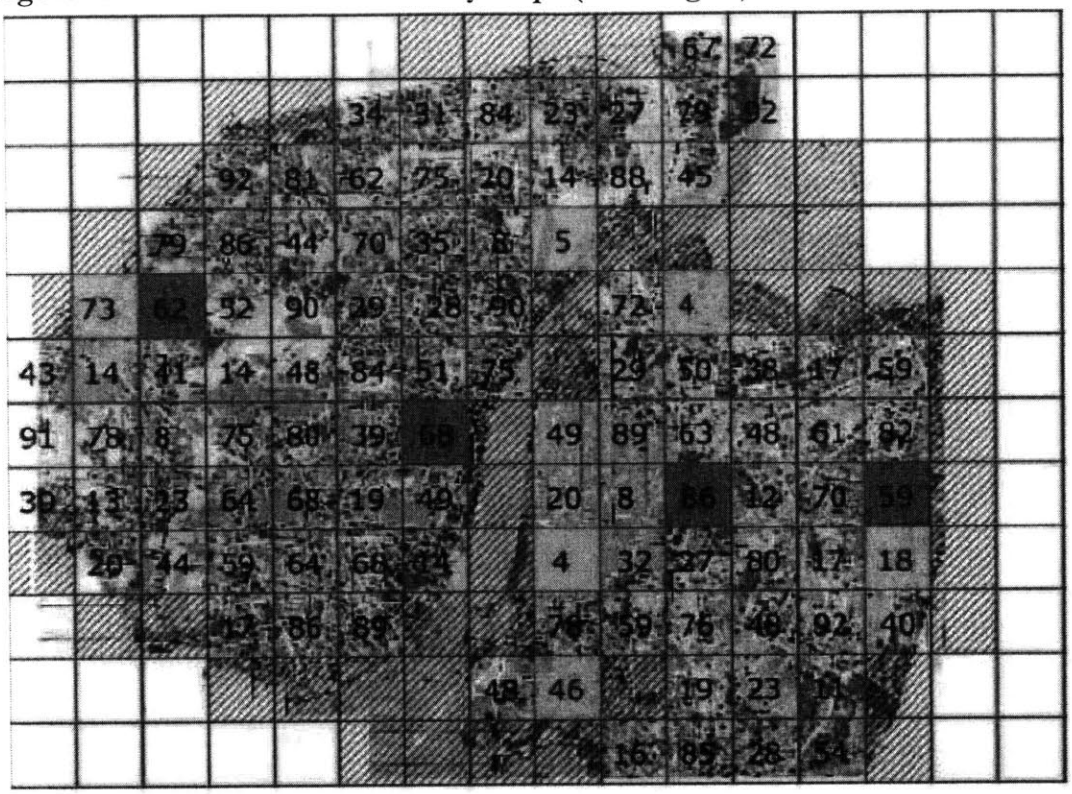
Ahmedabad streets feature a very high degree of mixed use, hence the high proportion of commercial uses, 86%, on surveyed corridors. Also, the city has a healthy, interspersed mix of different housing levels (e.g., low-income and median-income), unlike in many North American or European cities. Note, though, that 33% of the streets surveyed have some form of informal housing – a very high figure that is indicative of the local economy's dependency on the informal sector.

Since a full analysis of all survey areas is beyond the scope of this paper, two illustrative survey areas are presented: CG Road, a commercial and retail center located in the more

recently developed portion of the city, and Bapu Nagar, a relatively low-income neighborhood in Old Ahmedabad. We might hypothesize, given the socio-economic makeup of these two districts, that walkability will be much better in CG Road. For comparative purposes, data for these areas are presented alongside data from an early field test in DC, specifically from Dupont Circle, a commercial and retail center, and a lower-income neighborhood in the southeast (Figures 13 and 14)[4]. Note that the DC data was collected for the purposes of refining the Index methodology rather than be used for other purposes (hence the small sample sizes) – thus, these results are only presented as a frame of reference for interpreting the Ahmedabad data and not for any other quantitative or qualitative purpose.

[4] Note that the surveys used in DC were earlier iterations from the ones used in Ahmedabad.

Figure 13: Ahmedabad Index Survey Maps (1x1 km grid)



#59: Bapu Nagar
(Low-Income Mixed Use)

#68 CG Road
(Commercial District)

Figure 14: Washington, DC Index Survey Maps (1x1 km grid)

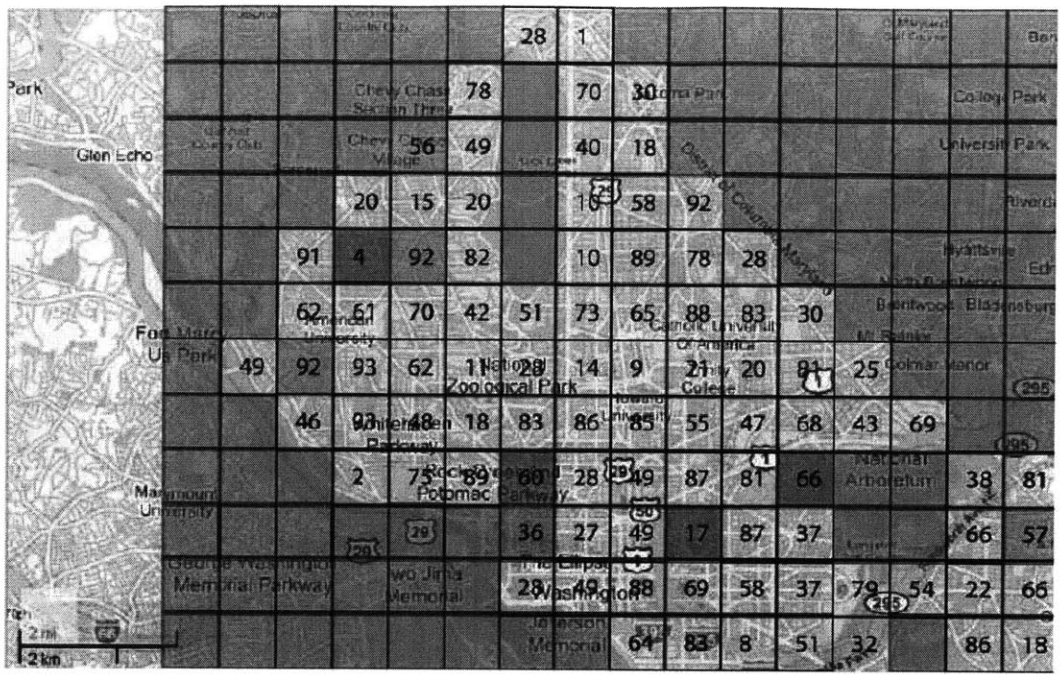


Table 12 summarizes the characteristics of the Ahmedabad and DC commercial and low-income survey areas.

Table 12: Select Survey Area Characteristics

	CG Road	Bapu Nagar	Dupont	S.East DC
Pedestrians				
# Surveys	36	35	12	5
% Low Income	19%	29%	25%	80%
% Median Income	58%	71%	42%	20%
% High Income	3%	0%	33%	0%
% Own Bicycle	22%	20%	83%	40%
% Own Motorcycle	56%	71%	17%	0%
% Own Car	8%	0%	67%	20%
Avg. Time Spent Walking per Day	16-30	31-60	16-30	>60
Road Stretches				
# Surveys	7	6	4	5
Length Surveyed Road Stretches (km)	2.7	4.4	3.9	1.8
Avg. Number Pedestrians per Surveyed Meter	0.11	0.12	0.01	0.00
Percent with Commercial Uses	100%	83%	50%	20%
Percent with Industrial Uses	0%	17%	0%	0%
Percent with Political Uses	57%	0%	0%	0%
Percent with Other Uses	100%	67%	0%	20%
Percent with High Income Housing	57%	0%	50%	0%
Percent with Medium Income Housing	71%	50%	25%	20%
Percent with Low Income Housing	14%	33%	0%	80%
Percent with Slum Dwellings / Informal Housing	0%	0%	0%	0%
Crossings				
# Surveys	12	8	22	2%
% Marked Crossing	67%	0%	100%	100%
% Pedestrian Bridge	0%	0%	0%	0%
% Pedestrian Subway	0%	0%	0%	0%
% Pedestrian-Phase Signal	42%	0%	73%	50%
% No Markings or Pedestrian Signals	33%	100%	0%	0%

Not surprisingly, in both Ahmedabad and Washington, incomes, motorized vehicle ownership, and provision of pedestrian infrastructure such as crossing signals tend to be much greater in commercial areas than in low-income districts, even though the average time spent walking per day tends to be much higher in lower income areas.

Table 13 summarizes a selection of survey findings from commercial and low-income districts in both cities.

Table 13: Select Survey Results

	CG Road	Bapu Nagar	Dupont	S.East DC
Walking Path Perceptions from Ped. Survey				
Often Blocked with Obstructions	28%	29%	0%	0%
Often Congested with Non-pedestrian Traffic	44%	51%	8%	0%
Often Inadequate for Blind or Disabled People	89%	89%	n/a	n/a
Often Poorly Lit at Night	8%	6%	0%	0%
Often Covered with Litter	22%	11%	0%	0%
Often Uneven and/or Difficult to Walk On	28%	49%	17%	20%
Sufficient Crossing Opportunities (1-3)*	1.9	1.9	n/a	n/a
Degree of Convenience (1-5)	3	1.9	4.3	3.6
Degree of Safety (1-5)	3.4	2.1	4.3	3.4
Degree of Security (1-5)	3.6	3.0	4.3	2.6
Motorists Often Fail to Yield to Pedestrians	39%	23%	58%	20%
Motorists Often Drive Too Fast	67%	11%	75%	20%
Motorists Often Drive Through Stops	28%	43%	42%	20%
Physical Infrastructure Survey				
Average # Trees per kilometer	50	10	39	33
Average # Street Lights per kilometer	30	20	18	30
Cleanliness Index (1-5)**	3.87	2.92	4.75	4.00
Maintenance Index (1-5)**	1.37	1.31	5.00	3.72
Disability Infrastructure Index (1-5)**	1.00	1.00	4.50	3.45
Permanent Obstructions Index (1-5)**	5.00	5.00	n/a	n/a
Proportion Surveyed Road w/out Sidewalks	52%	84%	0%	0%
Proportion S'd Crossings w/out Traffic Mgmt	42%	100%	0%	0%
Crossings Safety Index (1-5)	3.00	2.00	3.95	3.00
Crossings Security Index (1-5)	4.08	3.50	3.91	3.00

* For all scale results, the lowest number is the worst ranking, while the highest number is the best.
**Data Normalized by Pedestrian Count and Surveyed Road Length
$\Sigma ((X_i*Length_i*(PedCount_i*10)/\Sigma(X_i*Length_i*(PedCount_i*10))$

Comparing CG Road, the commercial district, to Bapu Nagar, we find that in general, pedestrian perceptions of walkability tend to be very similar, expect for a few select criterion:

- 49% of respondents in Bapu Nagar believed that surfaces were often uneven or difficult to walk on, while on CG road, only 28% felt this was the case;
- In the commercial district, perceptions of motorist behavior tend to be worse: while 39% of respondents in CG Road felt that motorists often fail to yield to pedestrians and 67% felt that motorists drive too fast, only 23% and 11% of respondents in Bapu

Nagar felt similarly. This may be a reflection of infrastructure provision in these two areas. CG Road was designed with automobiles in mind, with wide roads and intersections designed for the faster movement of automobiles, while Bapu Nagar, located in the Old City, features narrower streets and less separation of pedestrian traffic from automobile traffic, resulting in more pedestrian-friendly behavior.

- Not surprisingly, more trees and streetlights per kilometer are provided in the commercial district than in the lower-income area, and the cleanliness index in the commercial area is higher.
- Also not surprisingly, since there is no traffic management at intersections and fewer street lights, respondents in Bapu Nagar felt crossings were less safe and secure than respondents in CG Road.

11.5 Final Remarks on the Ahmedabad Pilot

11.5.1 Value of the Work

This analysis only represents a fraction of the full dataset compiled during the pilot in Ahmedabad. Because the dataset is site specific (physical infrastructure data is collected per road stretch and intersection, and pedestrian data is collected per survey area), it is very useful for developing targeted investment programs and generating rough cost estimates for infrastructure development. Further, when the pedestrian and infrastructure survey results are combined with results from the public agency survey, decision-makers have a valuable tool for developing effective, long-term policies directed at improving and maintaining the pedestrian environment.

The survey work was relatively simple and inexpensive. Most survey teams were able to complete the survey work and data entry in one day. Costs, including survey materials for 65 volunteers, T-shirts, transportation, and a volunteer dinner totaled USD 222. Use of volunteers for survey work and data entry both kept costs down and generated visibility and excitement for the cause of improving walkability.

The Ahmedabad Pilot may be considered a success, because Index did exactly what it was supposed to do – generate awareness of walkability as an important issue. After the Walkability Workshop, a reporter from the Times of India published an article about the Walkability Index (*Appendix E: Selection of Field Test Materials)*, which led the state secretary for urban development to invite me to his office in Ghandi Nagar to learn more about the work. Two students from CEPT have decided to write their theses on pedestrian infrastructure upgrading, and a collaboration of the Self-Employed Women's Association, the Centre for Environmental Planning and Technology, and the Environmental Planning Collaborative was established to write an investment proposal based on survey findings.

11.5.2 Shortcomings

Despite these successes, there were also some problems with the pilot. The quality of the data collected varied considerably – while some student teams produced results of very high caliber, one team went so far as to submit fake results. It took over one month of additional follow-up to correct for these gaps in the data. Further, the pilot, as carried out in Ahmedabad, might be difficult to replicate in other cities, since it the project's success is so dependent on the drive and character of the project organizer. For example, the investment proposal-writing collaborative, once so eager to begin work, ran out of steam only one

month after my departure –the collaborative has not yet produced a proposal as of time of writing (about 5 months later).

Based on these experiences, I have tried to redesign the Global Walkability Index survey materials such that implementation and quality assurance would be easier to manage (via a vastly simplified data collection and entry process). I have also added more detail to the Index implementation guide, such that the questions and goals are more self-explanatory.

12.0 Conclusion and Next Steps

12.1 *Summary of Research*

To generate awareness of walkability as an important issue in developing cities, the World Bank (the Bank) hired me as a consultant to develop a walkability index. To accomplish this task, I first generated a list of Index components and variables by studying existing tools for evaluating non-motorized transport and for constructing indices (*Appendix A: List of Indices and Evaluative Methodologies Reviewed*) and by consulting experts from a variety of related fields (*Appendix B: Select List of Consulted Experts*). I then created prototypes of the index and survey materials and organized short, initial field tests in Alexandria, VA, and Beijing. Drawing upon lessons learned from these tests, I then organized a *Walk the Talk* event in Washington, DC, where 17 volunteers and the DC Department of Transportation Pedestrian Planning Coordinator, George Branyan, tested the survey tools in eight different neighborhoods. I then organized an additional field test in Delhi, and with the help of the Bank, I was able to organize tests in Hanoi, Bangkok, Manila, and Karachi. Volunteers provided invaluable feedback from these tests, which were used to further refine the Index components and methodology.

Next, using a grant from the Women's Transportation Seminar, I took the suggestion of a Bank colleague and organized a full-scale pilot in Ahmedabad, India, in which I enlisted the help of 65 student volunteers from the Centre for Environmental Planning and Technology to conduct survey work in eight neighborhoods. Students presented their findings at a Walkability Workshop, with members from the Self-Employed Women's Association (SEWA) and the Environmental Planning Collaborative (EPC) in attendance. An article about the Index was published in the Times of India, and a collaborative partnership was formed between CEPT, EPC, and SEWA to use survey findings to draft an investment proposal for incorporation in an upcoming World Bank urban development and upgrading loan project in Gujarat State.

Finally, I organized a four-hour walkability workshop at the Association of Pedestrian and Bicycle Professionals Conference in Chicago, held in October 2005. During this workshop, attendees field tested the revised survey materials and commented on the Index. Combining their feedback with everything I had learned through the field tests and consultations with professors, government officials, and professionals, I have designed the Global Walkability Index as well as a set of extended survey materials for use in devising policy and investment programs, as presented in this thesis. The extended materials arose out of a need to take the results of the walkability index, which are general and used merely to generate awareness of walkability as an important issue, and use them to leverage a more thorough survey of pedestrian conditions, such that results could be used to address real problems.

12.2 *Limitations of the Index*

In my view, the Global Walkability Index is burdened by at least three significant limitations: 1) The notion of walkability itself is not well understood, paving the way for widespread misunderstanding; 2) The Index requires that most of the data be collected in the field, which in itself presents a myriad of difficulties; and 3) The data collection methodologies had to be kept simple for practical implementation purposes, but their simplicity results in a less-robust Index, diminishing its usefulness as a tool for investment and policy reform.

Limitation 1: What is Walkability?

Something I learned early on in the course of the research is that walkability is itself a nebulous term, and thus its measurement is inherently prone to contention and debate. I remember during one presentation I gave at the World Bank headquarters in DC, there was tremendous debate among the attendees as to what should and should not be included in the Index – a debate which, quite accurately, reflected the tremendous diversity of professional interests represented in the room: air quality management, energy, rights of disabled people, urban planning, transit infrastructure, road safety, and so on. Out of a desire to be able to stand in front of any audience and confidently defend the index's foundations, I made it a point to consult people from as many different backgrounds as possible, to consult as many evaluative tools as possible, and to conduct as many field tests as possible such that the Index would be not only be applicable in any kind of city throughout the world, but also such that it would *stand up to any debate.* Needless to say, this has proven impossible -- since everyone who approaches the Index has a different interpretation of walkability, everyone will have a different opinion as to whether the Index truly captures "walkability." One of the only ways to overcome this issue would have to be through widespread promotion of the

Index and its principles, with a strong education bent on just what it is the Index is trying to achieve: safer, more secure, and more convenient pedestrian environments.

Limitation 2: The Downside of Field Work

Many global indices allow for some degree of armchair calculation – that is, they draw upon data that has already been collected for other purposes. But with the Global Walkability Index, data must be collected in the field from every city, since the data necessary to evaluate pedestrian infrastructure in cities is simply not otherwise available. This field work component creates a myriad of challenges in terms of funding, translation, quality assurance, establishing local partners, and keeping the Index up-to-date.

Funding is an issue, because field work requires printing of materials (which may need to be translated), compilation of survey kits, and the work of volunteers (who should be thanked, at the very least, with a dinner or T-shirts) or paid-consultants. Quality assurance, as was discovered during the Ahmedabad pilot, can be a tricky issue. As mentioned previously, data collection materials have been vastly simplified to avoid quality issues – but I would recommend additional testing to determine the effectiveness of the new materials. It may be necessary to assign a paid-consultant to each field project to ensure that data is collected correctly.

Global indices such as the Yale Environmental Sustainability Index or the Economist's Big Mac Index can be easily conducted without any kind of local buy-in – such is not the case when field work is involved. The field work component means that a local partner must be

established to conduct the survey work, greatly restricting the ease and speed with which the Index can be constructed and updated over time.

Ideally, in the long run, cities will voluntarily provide funding and minor logistical support for Index efforts, thereby side-stepping many of these difficulties. But in the short run, securing funding and promoting the index will be challenging, but necessary priorities.

Limitation 3: Sacrifice

One of the most notable limitations in the Index is rooted in the need to sacrifice robustness for simplicity. Earlier iterations of the Index involved detailed survey work that provided valuable data for devising targeted investment programs, but the overwhelming response to these surveys was, despite their value, their resource-intensiveness may preclude many cities from participating in the Index project. Thus, I re-worked the Index surveys to be far simpler, and I redesigned the original survey materials as Extended Surveys -- a simple tool cities can use to collect quantitative and qualitative data about existing pedestrian infrastructure conditions, gather feedback from residents on relevant pressing concerns, and create a clear assessment of exiting institutional capacity and policies for ensuring safe, secure, and convenient pedestrian environments.

12.3 *Current Stage in Project Development*

In *Section 3.2: Phasing,* I outlined the scope of this work:

Phase I

Step 1 Conduct background research and literature review

Step 2 Draft survey methods and survey implementation guidebook. Test survey

materials in developed and developing countries to refine methodology.

Step 3 Use refined survey materials to conduct full-scale pilot in a select developing city. Analyze results.

Step 4 Finalize survey methodology and implementation guidebook.

This paper represents the completion of Phase I, with the additional development of Extended Surveys – tools that enable cities to identify very specific actions that may be taken to improve walkability. The next steps for the Index work, Phase II, may be summarized as follows:

Phase II

Step 5 Complete rough method for data aggregation – that is, transforming the data into index rankings (to be further refined as data is collected).

Step 6 Promote widespread implementation of Index survey materials. Begin to construct Global Walkability Index.

Step 7 Develop generic counter-measure guidebook that outlines steps (additional studies, resources that may be consulted, etc.) city planners and leaders can take to improve upon areas deemed insufficient by the Index

Step 8 Analyze Index data and produce final report. Establish mechanism for on-going implementation.

12.4 *Recommendations for Phase II Project Development*

The most crucial first steps in moving from the concept of a Global Walkability Index to its implementation are to generate awareness of the project and to secure funding and support from a large organization. Current initiatives underway include a World Bank proposal for incorporation of the Index tools into Bank transport infrastructure and urban development projects (I have been retained by the Bank to write a project proposal in this regard) and a proposal for incorporation of an Index component in a pan-Asia Global Environment

Facility (GEF) grant project (currently under consideration), to be implemented by the World Bank. Other avenues for advancement include presentations at conferences (the Index is slated to be presented at the Vélo Mondial 2006 conference in South Africa), and heavily promoted pilot projects.

One idea for a pilot comes from the Environmental Planning Collaborative (EPC), based in Ahmedabad. EPC has expressed interest in using the Index tools to carry out a Six-Mega-City study in India. Should grant funding become available to compensate EPC for its efforts, the results of this work could be widely promoted and sold to other governments as a means to push lagging cities to improve pedestrian infrastructure or as a means for other cities to showcase their formidable efforts in improving walkability.

Regarding the Extended Survey Materials, these tools were originally designed expressly for use by World Bank Task Team Leaders working on non-motorized transportation projects, such as Shomik Mehndiratta, who at the time was managing a non-motorized transport infrastructure upgrading project in Hanoi. But because the survey tools are simple to use, publishing them for widespread use would be suitably helpful for a number of cities to use on their own. In fact, representatives from the Clean Air Initiative (Asia) and Gtz Sustainable Urban Transport Program (SUTP) have already offered to post these materials on their websites.

After my contract for the Global Walkability Index work expires in June 2006, I will pass the torch onto someone else, who will work under the direction of Jitendrea (Jitu) Shah, Lead Environmental Specialist with the World Bank East Asia Environmental Services Unit.

12.5 Final Remarks

In sum, the Global Walkability Index is the first attempt at creating a universal tool for evaluating pedestrian environments in cities throughout the world. I am very grateful for having been given the opportunity to take a lead role in the Index's development, and although there are some limitations with the materials presented (as discussed), I am satisfied with the outcome. That said, if I could do things all over again, knowing what I know now, I might have done a few things differently.

First and foremost, I would have started the project by stating I would be developing a simple set of survey tools for a Walkability Index in addition to a more detailed set of tools for use in developing investment and policy proposals – by not starting with this objective from the beginning, much confusion ensued about the role of the index, how detailed it should be, and so on.

Second, the development of the Index was an iterative process, its foundations constantly being re-shaped by feedback and comments -- I feel this process could have been more systematically managed from the beginning, with standardized questionnaires and a greater degree of transparency.

Third, I would have liked to have looked further into incorporating other non-motorized modes of transport into the project (e.g., the Bikability Index) – these ideas were discussed, but dismissed early on because the complexity they would add.

Fourth, I would have liked to have completed an additional full-scale pilot – then, results could have been combined with the Ahmedabad results to develop the first, concrete Index rankings. Though, given time and funding constraints, an additional pilot would not have been possible – unless there had been another person assigned to do this work.

Finally, during the course of the research, I worked as a full-time research assistant on an unrelated project, and I took on a full graduate course load – not that it would have been possible to do things any differently in this regard, it would have been beneficial for the project if I could have devoted more of my energies to its development – for example, I would have been able to organize a full-scale pilot in Boston. Nevertheless, I have learned a great deal through this work and will carry the experience with me long after I graduate.

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APPENDIX A

List of Indices and Evaluative Methodologies Reviewed

Reviewed Pedestrian Audit and Index Methodologies

Most of the methodologies reviewed were based on either quantitative or qualitative data and reflected either supply side factors (e.g., infrastructure provision) or demand side concerns (e.g., surveys of pedestrians). Very few of the methodologies combined all four of these aspects in a way that would be suitable for the Global Walkability Index (GWI).

In *Appendix A*, comments have been provided on the viability of existing methodologies for use in generating a GWI. The comments are not intended to show inherent weaknesses in the methodologies themselves – each was designed for a specific purpose other than the GWI – rather, the comments are intended to show how the study of each methodology contributed to the development of the final GWI.

ID	Instrument Name	Purpose	Method	Comments	Source	Reference
1	Pedestrian Location Identifier	Tool that assists state and local jurisdictions in identifying suburban locations where investments in pedestrian infrasturcture improvements will yield the highest increases in pedestrian travel	Specific GIS tasks are described for using spatial data to identify areas with potentially high demand for pedestrian infrastructure.	The level of GIS data necessary to complete the analysis is often unavialble in developing cities.	Washington State DOT	1
2	Pedestrian Potential Index	Used to prioritize pedestrian improvement projects. Measures potential pedestrian demand	Points are added together. 7 variables focus on proximities and policies.	Quality of exisiting infrastructure not considered.	Portland Planning Dept.	1
3	Pedestrian Environmental Factor	Measure of pedestrian friendliness	Add up points for a total score out of 12 points. There are four variables: sidewalk continuity, ease of street crossing, distance between intersections, and grade.	Demand side factors, such as how heavily used the studies corridors are, are not considered.	Parsons Brinkerhoff	1
4	Pedestrian Performance Measures	LOS evaluations that describe the degree of accomodation for pedestrians along a given corridor	Points are added together and then coverted to LOS using a scale. 16 variables include crossing width, auto LOS, miantenance, barriers, etc.	LOS can be too subjective for an index -- some quantitative factors should be included.	Linda Dixon, TRB	1
5	Walking Permeability Indices	Assesses degree to which walking is a significant mode of transport	Direct distance between origin and destination divided by actual distance between origin and destination.	Results may be difficult to translate into investment or policy decisions.	Allen Andrew, World Transprot Policy and Practice	1
6	Walkability Index	Measures neighborhood walkability	Add up points and divide by 20. Index will be between 0.45 and 2.00. 13 variables include population density, benches, sociability, curb cuts, width, etc.	Includes both demand and supply side factors, quantitative and qualitative measures. A good basis. Additional variables may be needed.	Chris Bradshaw, International Pedestrian Conference	1
7	Walkability Checklist	Used to decide whwther a neighborhood is pedestrina-friendly	Points are added together. 5 variables / survey questions include: "Do you have enough room to walk safely," "Was it easy to cross streets," "Did drivers behave well," etc.	Entirely demand-side survey -- lacks supply-side analysis or quantitative factors.	US DOT	1
8	Pedestrian Level-of-Service	Provides pedestrian LOS.	A matrix is used to determine an LOS (A-F) for each criterion. 8 criteria include security, directness, sidewalk, etc.	LOS can be too subjective for an index -- some quantitative factors should be included.	City of Fort Collins	1
9	Qualitative LOS	Measures the qualitative aspects of environment that affects pedestrian experience to supplement more quantitative approaches	Each variable is weighted using constant-sum comparison method. Method is baed on a survey asking respondents to rank he relative importane of each variable. Weighted variables are combined to produce a rating from 0-5, corresponding to LOS A-F.	Data dervied entirely from pedestrian surveys -- more supply-side analysis would be welcome.	Jotin Khisty, TRB	1
10	Pedestrian Deficiency Index	Used to prioritize pedestrian environment improvement projects. Measures facilities' current deficiencies.	Most questions are based on a point system -- points are added together.Variables include 85th percentile speed and roadway width.	Supply-side analysis, lacking demand-side inputs.	Portland Planning Dept.	1
11	Pedestrian Sketch-Plan Method	Develop sketch-plan method for estimating pedestrian travel-demand projects for links, nodes, amd zones, based on vehicle volumes.	Peak people per hour (PPH) = (peak vehciles per hour - through movement trips) = [(VPH turning movements)*(1.5 default average vehicle occupancy)*(5 trips per person) - 20 percent drive-through, etc.)]	May not be universally suitable in cities in all countries; lacks factors relating to pedestrian infrastructure provision.	James Ercolano, TRB	1
12	Work Mode-Choice Model	Examines mode choice between bus, walk, bicycle, ride-sharing, and drive alone.	Complex statistical formula, based on such variables as walkng distance to work, season, volume, etc.	Mode choice would be a small component of a GWI	George Kocur, TRB	1
13	Pedestrian Infrastructure Prioritization Decision System	Ranks and prioritizes areas that have latent pedestrian demand.	Comprises open-ended responses and user-weighted scores. Variables include population density, land use types, and ease of walking.	Open-ended responses would be difficult to incorporate into an index	Washington State DOT	1

ID	Instrument Name	Purpose	Method	Comments	Source	Reference
14	Florida Pedestrian Level of Service	Measures factors that correlate with pedestrians' perceptions of safety and comfort for street segments (not intersections).	Regression analysis used to weight the variables, which include width of sidewalk, vehcile traffic volume, vehicle speed, presence of on-street parking, etc.	Quantitative supply-side analysis without incorporation of demand-side factors.	Florida DOT	1
15	Community Assessment Tool	Data used to develop plan for improving cyclability and walkability of communities.	Comprises open-ended responses and user-weighted scores. Elements include transportation, land-use development, schools and crime-prevention.	Open-ended responses would be difficult to incorporate into an index	National Center for Bicycling & Walking	2
16	Walkability Checklist	Determines how walkable a community is.	Comprises open-ended responses and user-weighted scores. Elements include room for walking, crossings, motorist behavior, etc.	Open-ended responses would be difficult to incorporate into an index	US DOT	3
17	Space Syntax	Pedestrian volume modeling tool for pedestrian safety	Special software intended to be used with Icoal GIS base maps, census data, and crash data.	Data required for this analysis may not be readily available in many cities.	University of Califormia Traffic Safety Center	4
18	PedSafe	Audit tool for pedestrian safety	Responses are given weights, which are then summed. Variables include presence of footpaths, vehcile speeding, etc.	Safety is one of a few factors to be considered in the GWI.	University of Queensland	5
19	Fort Collins Level of Service	Performance-based LOS measures for pedestrian mode of travel	LOS is based on five standards: directness, continuity, street crossings visual interest and amenities, and security.	All good componets for the GWI, though, lacks safety. More quantitative components would be helpful.	Fort Collins, CO	6
20	Kansas City Walkability Plan	Performance-based LOS measures for pedestrian mode of travel	LOS is based on same five standards as Fort Collins model. Incorporates diagrams and figures to assist with evaluation work.	LOS can be too subjective for an index -- some quantitative factors should be included.	Kansas City, MO	6
21	Gainesville LOS Performance Measures	Pedestrian LOS evaluations	Methodology applicable to corridors. Criteria include provision of basic facilities, conflicts, amentities, motor vehicle LOS, etc.	LOS can be too subjective for an index -- some quantitative factors should be included.	Gainesville, FL	6
22	Sweden Acessibility Index	Accessibility index for pedestrians	GIS data incporporated. Factors include sidewalk type, amenities, presence of stairs, onclination of sidewalk segement, directness, etc.	Sufficient GIS data can be difficult to obtain in many cities.	Chalmer Univeristy	6
23	2005 Environmental Sustainability Index	Benchmarks the ability of nations to protect the environment over the next several decades.	ESI score is the equally weighted average of 21 indicators (comprising 76 variables)	Methodology for aggregating data as Index rankings may be suitable for GWI	Yale University	7
24	Economist Intelliegence Unit's Quality-of-Life Index	Index that ranks cities based on their quality of life	Subjective life-satisfaction surveys are linked to objective determinants of the quality if life across countries. Regression analysis of qualitiative survey responses are used to generate coefficients that are used for quantiative data. There are 9 quality-of-life factors.	Both quantitative and qualitative elements are effectively combined.	Economist Intelligence Unit	8

References for Indices and Evaluative Methodologies Reviewed

1) Moudon, Anne Vernez. 20 June 2002. "WBC Project: Environmental Audit Instrument Review." Seattle: University of Washington Urban Form Lab.

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3) United States Department of Transportation -- Partnership for a Walkable America. Accessed 8 June 2005. "Walkability Checklist." <http://www.walkableamerica.org/checklist-walkability.pdf>.

4) Raford, Noah. 1 August 2003. "Space Syntax: An Innovative Pedestrian Volume Modeling Tool for Pedestrian Safety." Berkely: University of California Traffic Safety Center.

5) Lillis, James and Sam Pourmoradian. 2001. "PEDSAFE – Development of a New Pedestrian Auditing Method." University if Queensland. Paper presented at the CAITR-2001 Conference.

6) Tumlin, Jeff and Jessica ter Schure. 13 July 2005. "Pedestrian Level of Service Literature Review." Nelson Nygaard Consulting Associates – Internal Memo.

7) Esty, Daniel C., Marc Levy, Tanja Srebotnjak, and Alexander de Sherbinin. 2005. Environmental Sustainability Index: Benchmarking National Environmental Stewardship. New Haven: Yale Center for Environmental Law and Policy.

8) Economist Intelligence Unit. 2005. "The Economist Intelligence Unit's Quality-of-Life Index." < http://www.economist.com/media/pdf/QUALITY_OF_LIFE.pdf>.

APPENDIX B

Select List of Consulted Experts

Walkability Project: Consulted Experts (Contact Info Omitted)

Last	First	Organization	Type of Assistance
Baker	Judy	World Bank TUDDR	Random spatial selection methodology
Blaire	Robin	Los Angeles County MTA	Urban planning
Bliss	Tony	World Bank TUDTR	Pedestrian and road safety
Branyan	George	District of Columbia DOT	Municipal pedestrian planning programs
Briggs	Erica	Ann Arbor Chamber of Commerce	Pedestrian planning and advocacy
Burningham	Sally	World Bank SASEI	Practical implementation issues
Carruthers	Robin	World Bank TUDTR	Theoretical perspective
Chavez	Roberto	World Bank TUDUR	Link to Bank urban development initiatives
DelVecchio	Regina	Michael Baker Jr., Inc.	Urban planning
Fang	Ke	World Bank SASEI	Incorporation into India urban dev't project
Gakenheimer	Ralph	Massachusettes Institute of Technology	Urban planning perspective
Graftieux	Pierre	World Bank LCSFT	Urban public transport
Guttikunda	Sarath	World Bank ENV	Assistance with Washington pilot
Harshadeep	Nagaraja Rao	World Bank SASES	General help and support
Jones	Michael	Alta Planning and Design	Urban planning
Kessides	Christine	World Bank TUDUR	Urban Transport Indicator Project
King	Michael	Nelson Nygaard	Professional pedestrian planning
Knecht	Barbara	Barbara Knecht Inc.	Disabled pedestrians; photos
Kosteler	Don	Ada County Highway District, Boise, ID	Transportation planning
Kruckemeyer	Ken	Massachusettes Institute of Technology	Urban spatial layout and design
Landman	Wendy	WalkBoston	Pedestrian planning and advocacy
Lewis	Jennifer	The Louis Berger Group	Transportation planning
Lockre	Abhijit	Environmental Planning Collaborative	Urban planning in developing cities
Loutfy	Mohammed	World Bank (JPA)	Disability accessibility
Mehndiratta	Shomik	World Bank EASTR	Practical implementation issues
Pardo	Carlos F.	GTZ SUTP	General assistance and SUTP support
Penalosa	Enrique	Former Mayor of Bogota	Comments on index principles
Roberts	Peter	World Bank TUDTR	Analytical perspective
Ryz	Karyn	City of Carmel, Indiana	Urban planning
Schipper	Leon (Lee)	World Resources Institute	Global and environmental persepctive
Shah	Jiterndra	World Bank EASES	Index concept and project management
Swami	Shivanand	Centre for Environmental Planning and Tech.	Transportation planning in developing cities
Veit	Sebastian	World Bank EWDEN	Disability accessibility
Wineberg	Jessica	Bicycle Federation of WI	Pedestrian and bicycle planning professoinal
Zhang	Zhihong	World Bank GEF	Global Environment Facility (GEF)

APPENDIX C

GWI Survey Materials and Guidebook

GLOBAL WALKABILITY INDEX

SURVEY IMPLEMENTATION GUIDEBOOK

SURVEY MATERIALS and IMPLEMENTATION GUIDE

The Global Walkability Index (GWI) comprises two kinds of surveys — a public agency survey, to be administered to department(s) responsible for urban and transportation planning, and a set of field surveys. These surveys may be conducted in any order.

Use provided survey forms to collect data. For your convenience, all of these forms may be filled electronically (using provided dynamic PDF files), should you choose to enter the data using a tablet PC or PDA. Regardless of data recording method (paper or electronic), results must be submitted electronically.

Upon completion of the data collection work, survey teams should submit the following:

1) Consultant Contact Information
One contact information form for each survey team member.

2) Public Agency Survey
Single public agency data collection form.

3) Field Surveys
At least 8 separate forms, one for each survey area.
City map that indicates survey areas and individual surveyed road stretches.
Photographs of each surveyed stretch (for quality assurance purposes).

Questions about the physical infrastructure survey may be directed to: _____ at the following e-mail address: _____.

PUBLIC AGENCY SURVEY

Agency Selection

The survey team may use its best judgment to determine which public agencies would be most able to answer the five survey questions. Most likely, the urban and transportation planning agencies would be the most helpful.

Calculation of Results

Results are assigned points as according to the following table:

Question	Point Assignments
1	1-5 Scale; Non-Existent = 1
2	One point for each box checked
3	Divide percentage by 10
4	Yes = 5, No = 1
5	3 for each 'usually' to 1 for each 'rarely', divided by 2.

Quality Assurance

Using the space provided, survey teams should provide contact information for all persons interviewed. Additional sheets may be used, if necessary.

Materials

Survey teams will need to take the following materials with them to the data collection sites.

- Map outlining the survey area and proposed survey stretches;
- Camera (preferably digital);
- Extra data collection forms;
- Piece of 1-meter length string (to estimate walking path widths);
- Clipboard and pencils; and
- Implementation guidebook.

Survey Area Selection

Survey areas are 500m by 500m, and are selected using a random spatial sampling method, which is described in the following pages. One sheet per survey area should be used. Within each survey area, all main public roads (excluding roads such as alleys, relatively minor residential streets, etc.) should be surveyed. Each lengths (or stretch) of surveyed road receives an individual ID number, as indicated on the data collection form. If the character of a single road changes dramatically along its length, it may be divided up into sub-stretches. If there are more than 10 stretches in a survey area, additional field data collection sheets may be used.

Time of Day Considerations

For consistency, all surveys should be conducted during local peak travel times, to be predetermined by the survey team leader.

Filling in Data Collection Forms & Performing Calculations

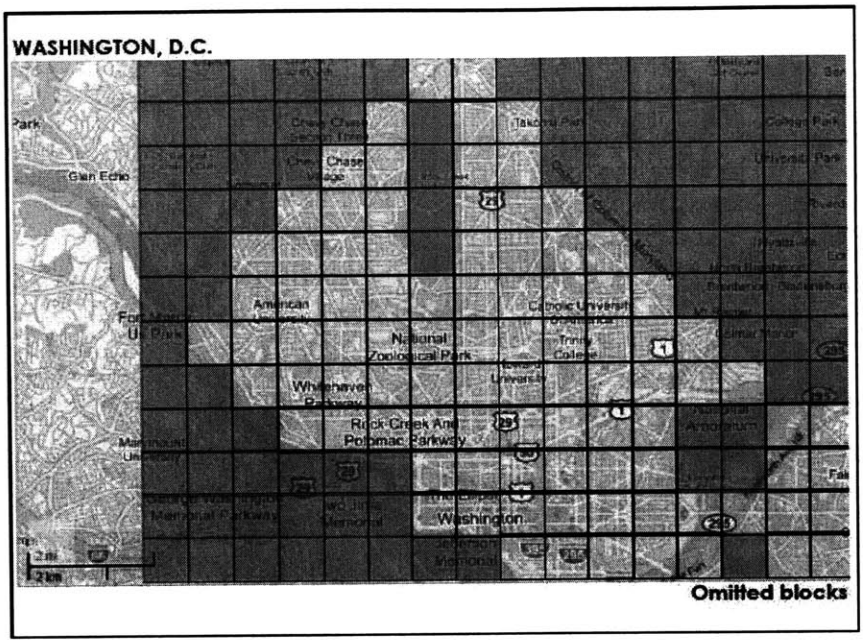
Each square on the data collection form should be filled in with a Level-of-Service (LOS) measurement (scale of 1 to 5), according to the principles laid out in this implementation guide. The dynamic PDF file provided will automatically calculate the results and present a final average for each survey area.

A Notes box is provided on each form for survey teams to note any usual findings or potential sources of bias.

Quality Assurance

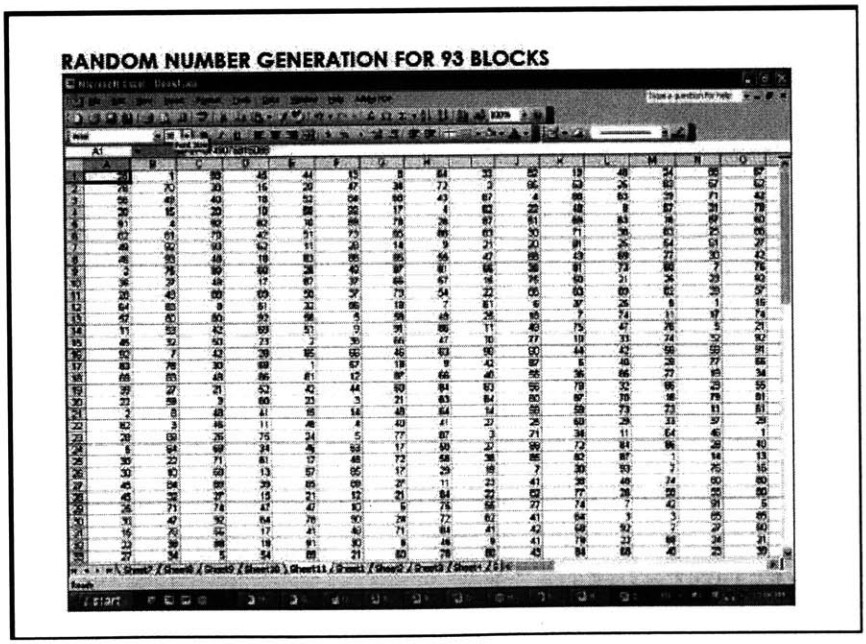
For quality assurance purposes, teams are asked to photograph a cross section each surveyed stretch of road.

FIELD SURVEYS — SURVEY AREA SELECTION



Step 1

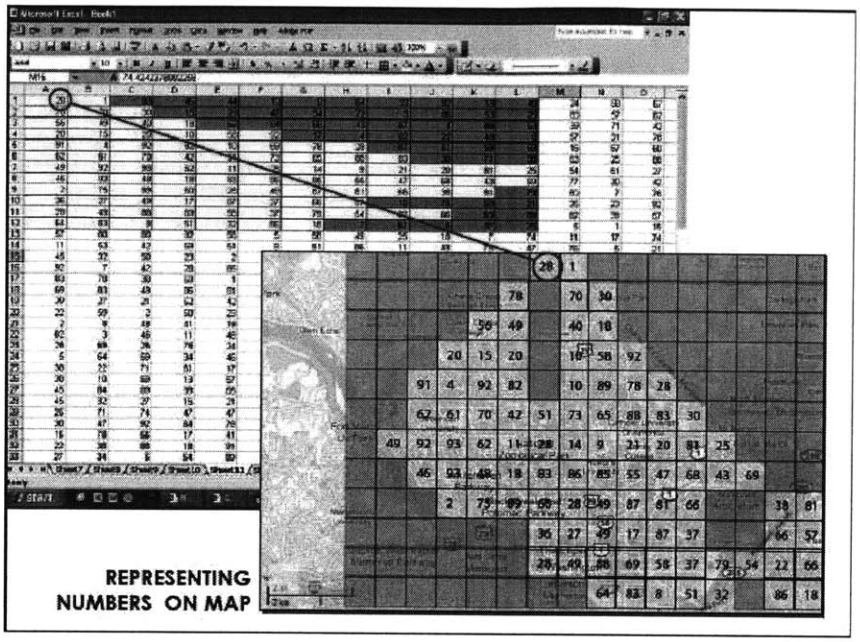
Lay a 500 meter by 500 meter grid on top of a city map. Map and grid scales shall be uniform across cities – in this case, we have used 1km x 1km squares for illustrative purposes. Block out squares that fall beyond the city border or in areas inappropriate for conducting surveys (e.g., lakes, parks, private property, etc.).



Step 2

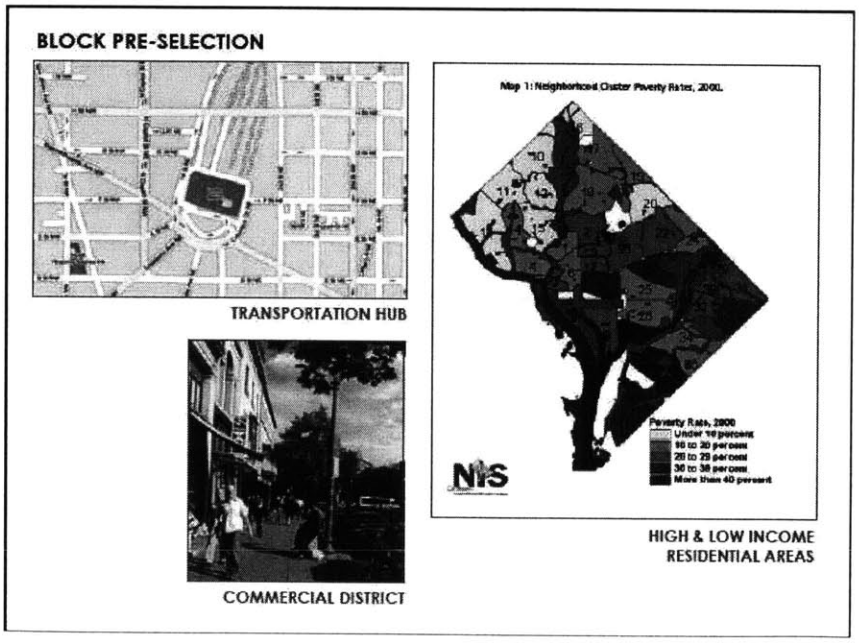
Generate a random number table. In this example, we generated numbers along a normal distribution from 1-93 (there are 93 unblocked squares on the map).

FIELD SURVEYS — SURVEY AREA SELECTION



Step 3

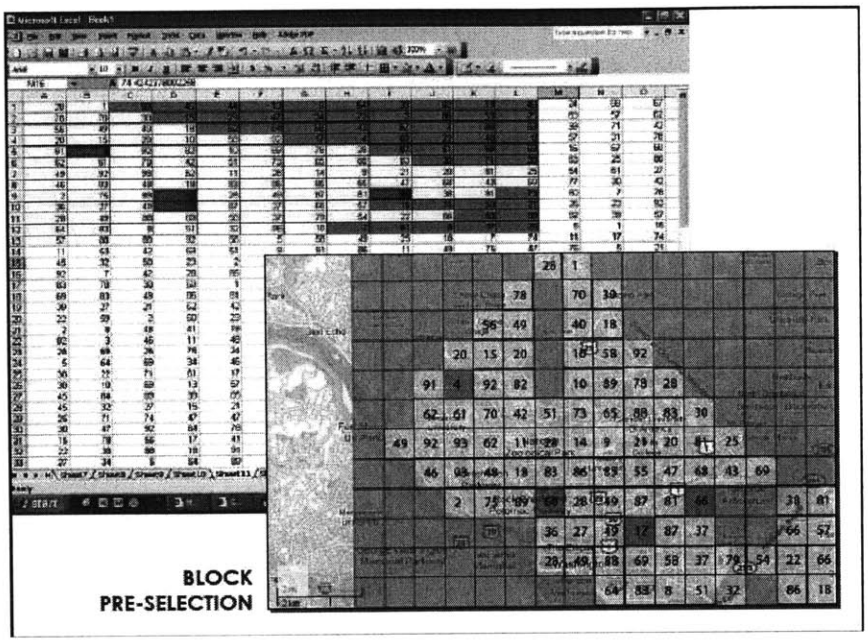
Transpose randomly generated numbers from table to the map, as shown in the diagram.



Step 4

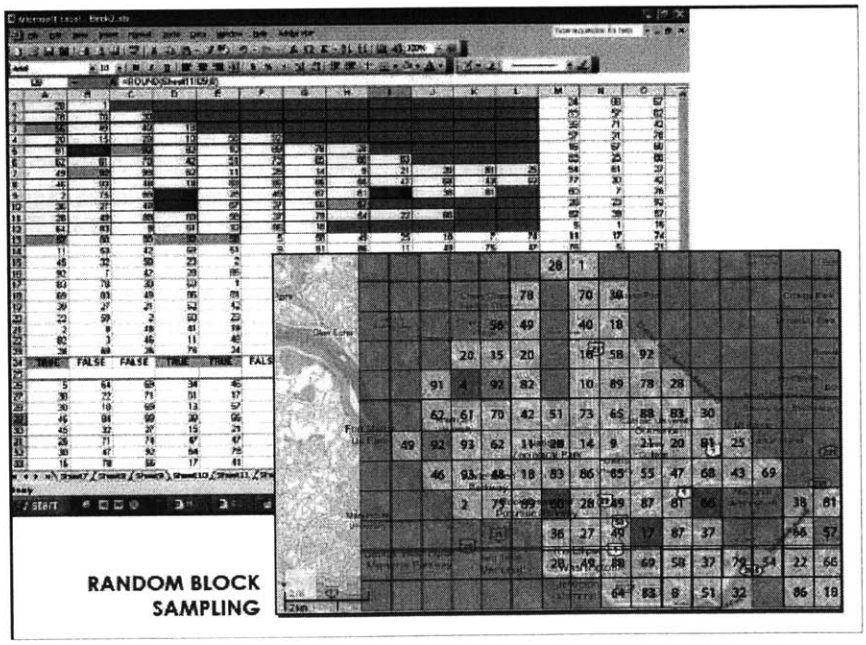
Although the sampling method will have a random component, we want to be certain that specific types of neighborhoods are covered by the survey. Pre-select four survey squares that fall within: 1) A high-income neighborhood with mostly housing; 2) A low income neighborhood with mostly housing, a transport hub (e.g., rail station), and a commercial district.

FIELD SURVEYS — SURVEY AREA SELECTION



Step 5

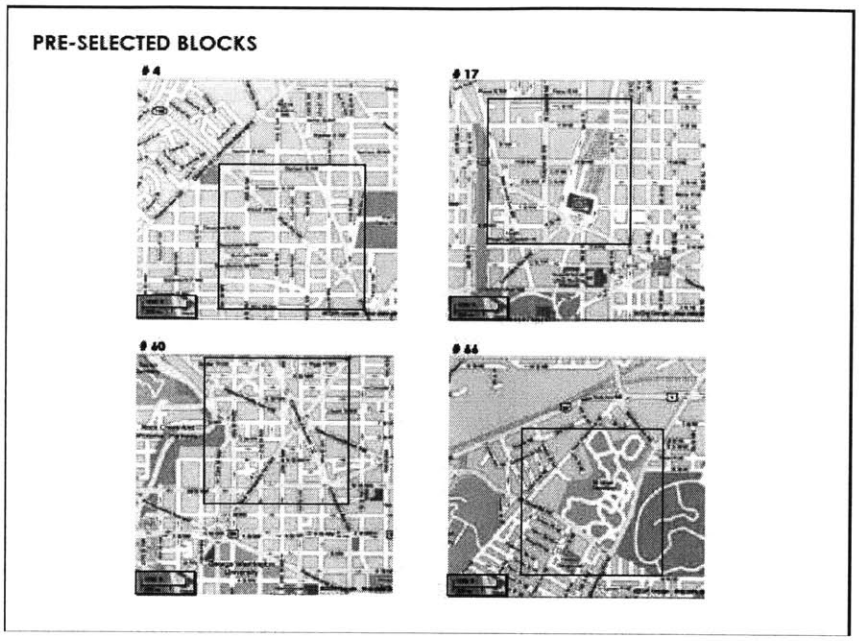
Mark these pre-selected areas on the city map.



Step 6

To ensure that the Index is fair, the remaining squares shall be randomly selected. We used the same random number table we had generated previously. Starting from the left, if a number on the table appeared in our map, than that corresponding square would be selected (see diagram). The number of additional squares should equal the total number of available squares divided by 10 (the answer is rounded down), minus the four pre-selected squares. (Note: technically, in the case, then, there should be five additional squares)

FIELD SURVEYS — SURVEY AREA SELECTION



Step 7

Based on selections, make individual maps that can be used in the field to conduct surveys. For the purposes of constructing Index rankings and identifying general strengths and weaknesses, every major public road within each square should be surveyed — alleys, private drives, very minor residential roads, etc. are excluded.

❶ Walking Path Modal Conflict

To what extend to pedestrians mix with other modes, such as bicycles, motorcycles, or cars?

Points	Description
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

❷ Security from Crime

To what degree are the walking paths, pedestrian bridges, and pedestrian subways *perceived* to be secure from crime (pick-pocketing, mugging, unprovoked attack, etc.)? To answer this question, it may be helpful to ask a few pedestrians, vendors, policemen, etc. in the area what their perceptions are, particularly at night.

Points	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

❸ Crossing Safety

There are three key factors to consider when evaluating how safe it is to cross the street:

- Exposure to other modes
  - ◊ Are **all** other modes at a complete stop when pedestrians are crossing?
- Exposure time
  - ◊ This refers to the amount of time spent waiting and crossing the street — it is during this time that a pedestrian will most likely get hurt. The longer this time is, the less safe the environment is for pedestrians.
- At signalized intersections, the degree to which sufficient time is allocated for pedestrians (including persons with children and the elderly) to cross.

The following tables are intended to provide some guidance in assigning a LOS measurement to this variable.

Exposure to Other Modes

Points	Description
1	Very dangerous – there is significant risk of accident with other modes
2	Dangerous – pedestrian faces some risk of being hurt by other modes
3	Difficult to ascertain dangers posed to pedestrian
4	Safe – pedestrian is mostly safe from accident with other modes
5	Very safe – other modes present no danger to pedestrian

Exposure Time

Points	Description
1	Maximum – Extremely long waiting period, crossing time greater than 40 seconds
2	Relatively long – Long waiting period, crossing time between 20 and 30 seconds
3	Difficult to ascertain dangers posed to pedestrian
4	Relatively short – Reasonable waiting period, crossing time between 10 and 20 seconds
5	Minimal – Virtually no time spent waiting, crossing time less than 10 seconds

Sufficient Time to Cross at Signalized Intersections

Points	Description
1	Not enough time – No pedestrian has sufficient time to cross
2	Not quite enough time – Barely enough time for most people, insufficient for elderly
3	Sufficient time for most pedestrians to cross, not quite enough time for elderly.
4	Just enough time – Just enough time for elderly or persons with children to cross
5	Ample time – More than enough for elderly or persons with children to cross

❹ Motorist Behavior

Motorists (drivers of cars, buses, motorcycles, auto-rickshaws, etc.) pose the greatest danger to pedestrians. Thus, the degree to which cities can manage motorist behavior will largely impact the safety of the pedestrian environment. The following table may be used as a guide for this variable.

Points	Description
1	Motorized travel is totally chaotic; vehicles *never* yield to pedestrians.
2	Most motorists cannot be expected to obey traffic laws and rarely yield to pedestrians.
3	Motorists sometimes obey traffic laws and may yield to pedestrians.
4	Motorists usually obey traffic laws and sometimes yield to pedestrians
5	Motorists obey traffic laws and almost always yield to pedestrians.

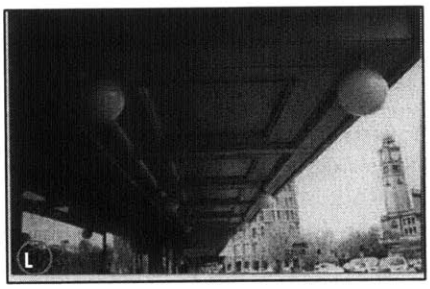
❺ Amenities

Pedestrian amenities, such as benches, street lights, public toilets, and trees greatly enhance the attractiveness and convenience of the pedestrian environment, and in turn, the city itself. When assigning an LOS measure to this variable, consider the following factors:

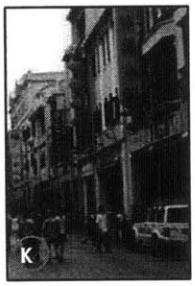
Coverage

If the local climate calls for such measures (e.g., sub-tropical), are there awnings, arcades, trees, or other forms of coverage that protect pedestrians from the elements? Following are some examples (letters in circles represent photo credits, which are placed at the end of this guide):

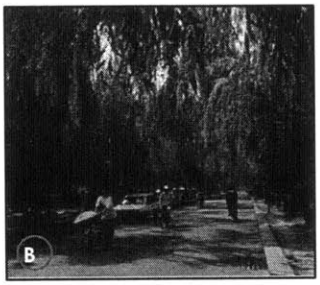
Temporary Awning



Permanent Awning



Arcade



Trees

Trees and Street Lights

Are there trees and street lights at regular intervals? Street lights ensure safety at night (if lights are present, survey team may wish to question pedestrians as to whether the lights actually work), and trees provide a natural barrier from traffic, improve air quality, provide some degree of shelter from the elements, and improve the attractiveness of the pedestrian environment.

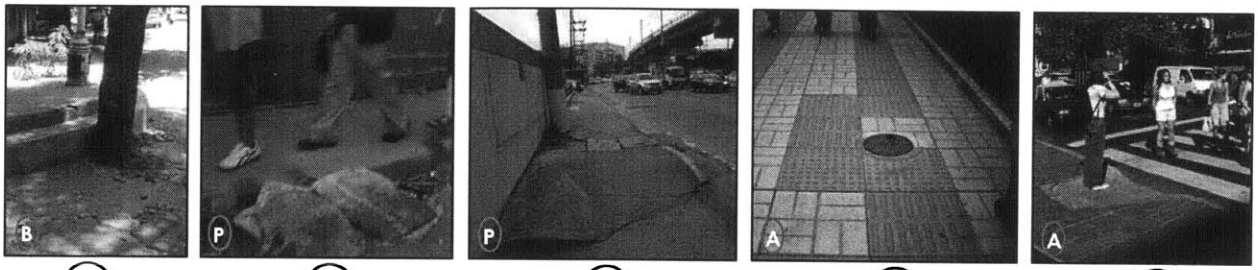
Benches, Public Toilets, Pedestrian Signage, and Other Amenities

The degree to which the municipal government provides pedestrian amenities reflects the degree to which it respects the pedestrian environment's role in the smooth functioning of the city. Thus, roads that are well-endowed with amenities should receive higher scores for this variable than those without.

❻ Disability Infrastructure and Sidewalk Width

Disability infrastructure typically services all pedestrians, not just those who are disabled. For example, curb ramps are convenient not just for wheel chair access, but also for persons with baby carriages, shopping carts, or luggage. Similarly, for wheelchair access, effective walking path width (net of obstructions or portions of disrepair) should be, at a minimum, 1 meter wide. This minimum width services all pedestrians, alleviating bottlenecks; easing access for those with small children, parcels, or walking canes; and improving the overall convenience of the walking path. The following tables and diagrams provide some guidance on how to evaluate disability infrastructure and sidewalk width.

Disability Infrastructure
The following diagrams provide some guidance on how to judge disability infrastructure provision. Acoustic pedestrian signals might also be considered.



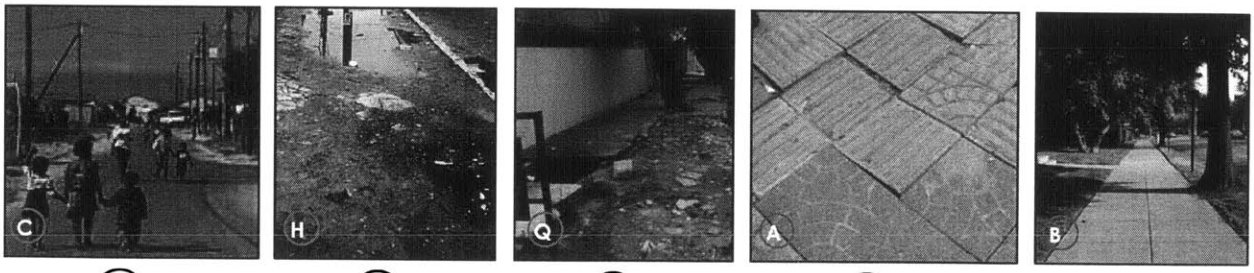
1	2	3	4	5
No infrastructure for disabled persons is present.	Limited infrastructure for disabled persons is available, but is not in usable condition.	Infrastructure for disabled persons is present but in poor condition and not well placed.	Infrastructure for disabled persons is present, in good condition,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

Effective Width
Use a 1-meter piece of string to determine whether effective width (net of obstructions) is sufficient.

❼ Maintenance and Cleanliness

Maintenance of pedestrian infrastructure is just as important as having any infrastructure at all, since, for example, poorly maintained sidewalks can be completely unusable. A clean pedestrian environment is not only more pleasant and convenient for pedestrians (no need to circumnavigate piles of rubbish, for example), but it also shows the city's respect for the pedestrian.

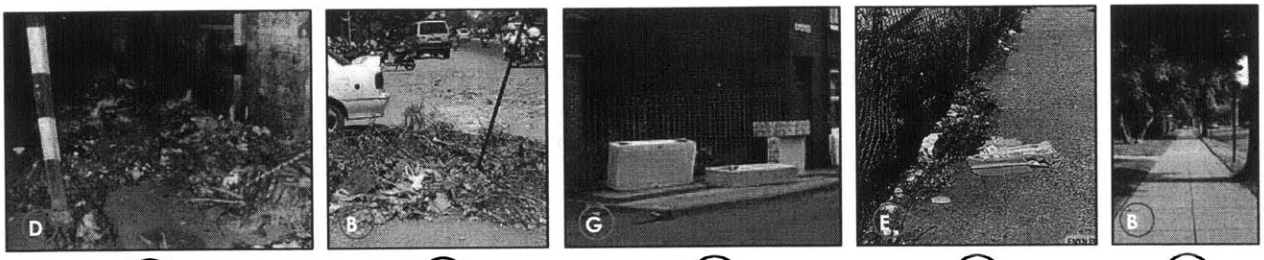
Maintenance and Pavement Quality



1	2	3	4	5
Separate paving for walking path is not present.	Paving is mostly dirt, covered with mud, very poorly maintained.	Some paving is present and provides a somewhat smooth walking surface in some areas. Not particularly well-maintained.	Walking path is paved and walkable, but not very well maintained. Tiles missing, very uneven surface, etc.	Provides a smooth walking surface and is very well maintained.

FIELD SURVEYS — DATA COLLECTION GUIDELINES

Cleanliness



1. Rubbish completely obstructs walking path, making walking impossible. Rubbish significantly degrades surrounding environment.

2. Rubbish partially obstructs walking path, making walking difficult and significantly degrades surrounding environment.

3. Some rubbish degrades quality of walking environment and is a minor obstacle to walking.

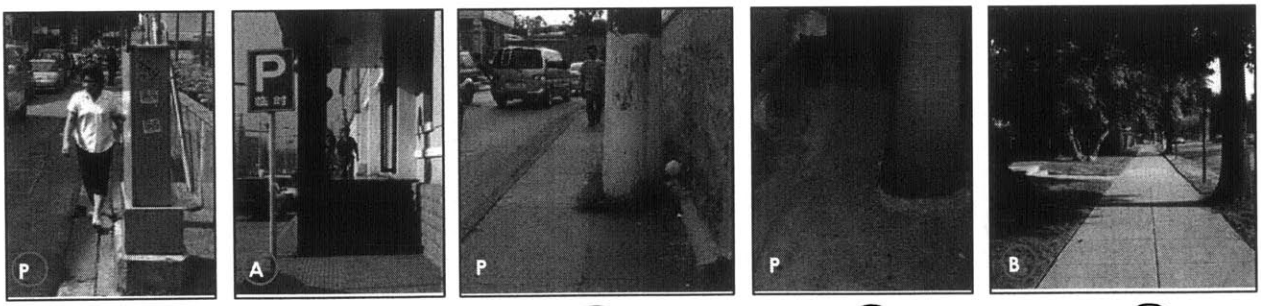
4. Some rubbish degrades quality of walking environment but is not an obstacle.

5. Walking path is clean.

8 Obstructions

Permanent obstructions (e.g., telephone poles or trees placed in the center of the walking path), are typically the result of insufficient or ineffective urban design guidelines. Unwelcome temporary obstructions (e.g., parked cars) are often the result of insufficient or ineffective public space policy. Welcome temporary obstructions (e.g., vendors, sidewalk cafes) should be allocated space such that they both enhance the pedestrian environment without restricting the effective width of walking paths. All obstructions, to some degree, impact effective width and thus should be regulated. The following images provide some guidance on how to evaluate obstructions.

Permanent Obstructions



1. Pedestrian traffic is completely blocked by permanent obstructions.

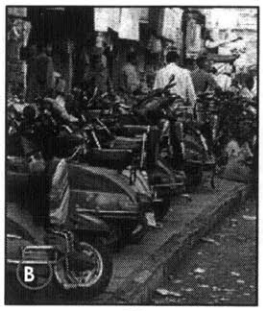
2. Pedestrians are significantly inconvenienced. Effective width <1m.

3. Pedestrian traffic is mildly inconvenienced; effective width is < or = 1 meter.

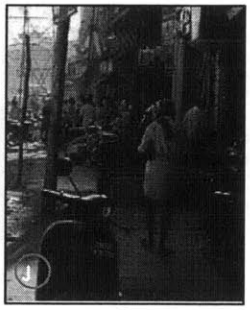
4. Obstacle presents minor inconvenience. Effective width is >

5. There are no permanent obstructions.

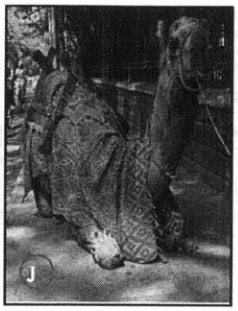
Temporary Obstructions



① Pedestrian traffic is completely blocked by temporary obstruction.

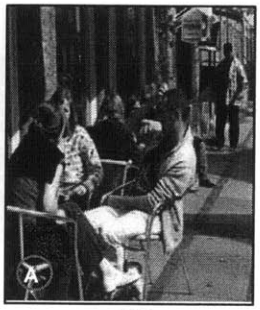


② Pedestrian traffic is significantly inconvenienced by obstruction but can still walk on walking path. Effective width is <1m, preventing wheel-



③ Pedestrian traffic is mildly inconvenienced; effective width is < or = 1 meter.

④ Obstacle presents minor inconvenience and *may* be welcomed by some residents.



⑤ Obstruction is welcomed by most and enhance pedestrian activity

⑨ Availability of Crossings

When there are no opportunities provided for crossing streets, pedestrians tend to jaywalk, increasing their risk of injury or harm. Ideally, crossing opportunities, when in the form of pedestrian bridges or subways (less desirable for elderly and the disabled), signalized crossing, or other form, there should be crossings at least every 300 meters to be considered acceptable. A LOS rating of 5 means that there are ample opportunities to cross the street, and a rating of 1 means that there are no opportunities for very long distances.

⑩ Pedestrian Count

Count the total number of people walking in the street (alongside other traffic modes) and on walking path using a traffic counting method. Stand in one place (mark this place on a map), and count the number of pedestrians on one side of the street over a period of 5 minutes. Record number.

⑩ Length of Surveyed Stretch

Measure the surveyed length of street in kilometers, using your map.

NOTES

Photographs and Images

a) Knecht, Barbara. Barbara Knecht, Inc.
b) Krambeck, Holly (Author).
c) Dickerson, Leanne. The Panos Institute. <http://www.panos.org.uk/>
d) Nina Paley. NinaPaley.com. <http://www.ninapaley.com/>
e) Freeport New York News. <http://www.freeportnynews.com/Vil%20News%202002/020716_Mayor%20ignores%20mess.htm>
f) Australia Highway Capacity Manual (Compliments of Michael King, Nelson\Nygaard Consulting Associates).
g) Dept of Housing Renewal & Environmental Health Services, Leeds, UK. <http://www.healheadingley.org.uk/contacts/envthealth.htm>.
h) Northwest South Philly – Neighborhood Organizations and Resources for Southwest Center City. <http://www.southphillyblocks.org/christianstreet/michelle_cutner/>
i) Purser, Robert. http://www.citymayors.com/development/india_urban1.html. **May not be reprinted without permission – e-mail: editor@combatlaw.org**
j) Göhler, Lars. India Picture Community. <http://www.india-picture.com/index.html>
k) A Journey to Katie. <http://www.katieadoption.us/Day%202-4%20pictures.htm>
l) Wunderlite Pressed Metal Panels. <http://www.wunderlite.com.au/sydneytech.html>
m) MetroPole Paris. <http://www.metropoleparis.com/1996/60603015/street.html> **May not be reprinted without permission – e-mail: erickso@worldnet.fr**
n) Pedestrian and Bicycle Information Center Image Library. <http://www.pedbikeimages.org/index.cfm>
o) Suwanathada, Pat. Consultant, World Bank.
p) Fabian, Herbert. Asian Development Bank.
q) Wegmann, Jake. Massachusetts Institute of Technology

GLOBAL WALKABILITY INDEX

CONSULTANT CONTACT INFORMATION

Submit by Email

First Name _____

Family Name _____

Organization _____

Street Address _____

City _____

State / Province _____

Country _____

Postal Code _____

Phone Number _____

E-mail Address _____

Prepared by Holly Krambeck
krambeck@mit.edu

GLOBAL WALKABILITY INDEX

PUBLIC AGENCY DATA COLLECTION

City: _____

Survey Team Names: _____

1) Please rate degree of municipal funding and resources devoted pedestrian planning.

- ○ Enough to sustain a high-quality progr am in long-term
- ○ Sufficient for short term, but not the long term
- ○ Neutral
- ○ Insufficient to acheive meaningful goals
- ○ Non-existant

2) Please check the pedestrian-related urban design guidelines that are already well-established. Feel free to add any relevant guidelines that are not included in the list.

- ☐ Sidewalk pavement type
- ☐ Placement of benches and similar amenities on walk paths
- ☐ Sidewalk widths
- ☐ Design for disabled persons
- ☐ Other _____
- ☐ Other _____
- ☐ Other _____

3) Attach available data on pedestrian fatalities and injuries to survey materials. Enter estimated proportion of traffic fatalities involving pedestrians in 2004.

_____ %

4) Have there been public outreach efforts (by this or other agency) to educate pedestrians or drivers on road and pedestrian safety?

- ☐ Yes
- ☐ No

5) Is there a law or regulation for any of the following items? If so, is the law or reguulation enfoced? Feel free to add any relevant laws or regulations that are not included in this list.

Is there a law or regulation for:	Enforced? Usually	Sometimes	Rarely
☐ Jaywalking	☐	☐	☐
☐ Vendors on sidewalks	☐	☐	☐
☐ Parking on sidewalks	☐	☐	☐
☐ Driving / riding on sidewalks	☐	☐	☐
☐ Drunk driving	☐	☐	☐
☐ Other _____	☐	☐	☐
☐ Other _____	☐	☐	☐
☐ Other _____	☐	☐	☐

GLOBAL WALKABILITY INDEX

FIELD DATA COLLECTION

City:

Survey Area Name _____ Survey Area # _____ Peak Hour ○ Yes ○ No

Survey Team Names: _____

Surveyed Road Stretch	1	2	3	4	5	6	7	8	9	10	**(Σ(x*length*10*count))/#)/10**
1) Walking Path Modal Conflict											
2) Security from Crime											
3) Crossing Safety											
4) Motorist Behavior											
5) Amenities (Cover, benches, public toilets, street lights)											
6) Disability Infrastructure and Sidewalk Width											
7) Maintenance and Cleanliness											
8) Obstructions											
9) Availability of Crossings											
10) Pedestrian Count											
11) Length of Surveyed Stretch (km)											
										Unweighted Average	

NOTES

GLOBAL WALKABILITY INDEX

PUBLIC AGENCY CONTACT INFORMATION

City:

Public Agency Contact #1

Agency Name

Agency Address

Contact Name

Contact Position

Contact Phone

Contact E-mail

Notes

Public Agency Contact #2

Agency Name

Agency Address

Contact Name

Contact Position

Contact Phone

Contact E-mail

Notes

Public Agency Contact #3

Agency Name

Agency Address

Contact Name

Contact Position

Contact Phone

Contact E-mail

Notes

GLOBAL WALKABILITY INDEX

SURVEY MATERIALS SUBMISSION CHECK LIST

City:

- ☐ Contact Information Form for Each Survey Team Member
- ☐ Public Agency Survey and Contact Information Form
- ☐ 8+ Field Survey Forms
- ☐ Map Indicating Surveyed Areas
- ☐ Photographs of Surveyed Area Cross Secetions and Walking Paths

APPENDIX D
Extended Survey Materials

EXTENDED SURVEY MATERIALS

In this section, you will find a Physical Infrastructure Survey, Public Agency Survey, and a Pedestrian Survey.

Each survey is preceded by implementation guidelines and directions. Although you may conduct these surveys in any order you wish, we do ask that you adhere to the following guidelines:

1) Use provided field recording sheets to collect data. For your convenience, all of these forms may be filled electronically (using the attached files), should you choose to enter the data using a tablet PC or PDA.

2) Regardless of data recording method (paper or electronic), you must submit your results electronically. The survey data may be typed into the provided, user-friendly PDF sheets. By clicking the "Submit by E-mail" button that appears on each PDF sheet and then selecting "Send Data File" from pop-up menu, your computer will automatically send our analysts the data files they need to process the collected data.

3) By the end of the survey, you should submit the following:

   a. Consultant Contact Information
      i. PDF Form, submitted via "Submit by E-mail" button that appears at top of form.

   b. Physical Infrastructure Survey
      i. Individual field data PDF forms, submitted via "Submit by E-mail" button that appears at top of forms. It is important that the survey area be indicated in the e-mail subject heading or in the data file name.
      ii. City map with clearly identified surveyed areas.
      iii. City map with special points drawn on surveyed areas (or list of points and their GPS coordinates)
      iv. Digital photos, with clearly identifiable file names

   c. Public Agency Survey
      i. Individual field data PDF forms, submitted via "Submit by E-mail" button that appears at top of forms. It is important that the survey area be indicated in the e-mail subject heading or in the data file name.
      ii. Additional data or maps collected from agencies (optional)

   d. Pedestrian Survey
      i. Individual field data PDF forms, submitted via "Submit by E-mail" button that appears at top of forms. It is important that the survey area be indicated in the e-mail subject heading or in the data file name.
      ii. Map with survey locations clearly marked (include GPS coordinates, when possible)

GLOBAL WALKABILITY INDEX

CONSULTANT CONTACT INFORMATION

Submit by Email

First Name _____

Family Name _____

Organization _____

Street Address _____

City _____

State / Province _____

Country _____

Postal Code _____

Phone Number _____

E-mail Address _____

PART I: PILOT PHYSICAL INFRASTRUCTURE SURVEY

Introduction
The attached survey is one component of a larger study that comprises three parts: 1) a physical infrastructure survey; 2) a public agency survey; and 3) a qualitative survey to be administered to city residents.

The physical infrastructure survey shall be used to collect raw data on the availability and quality of pedestrian infrastructure. The survey may be filled out by hand (one sheet per street), or using a portable electronic device, such as a tablet PC or a Palm PC. Regardless of recording method, we expect that all data eventually be entered in the Excel spreadsheet provided.

In addition to filling out the survey, we ask that the Consultant also provide feedback on how the physical infrastructure survey could be improved.

Tools
The following tools will be necessary to complete the attached survey:
* Map that can be drawn on to mark observations;
* Tape measure or laser measuring device (e.g., meter-long piece of string);
* Digital camera;
* Street map marked with survey area;
* Clipboard, writing instrument, and enough survey sheets for each street covered in the study, **or** portable tablet computer / Palm PC.

Study Area
The Consultant shall select the survey area based on an arbitrarily drawn boundary, which in this case would be a 1.0 km by 1.0 km square around a pre-selected landmark, such as City Hall, as its center. The consultant selects 5 km of street length within the survey area, ensuring that street sample features a variety of widths and uses. Minor alleys, parks, cemeteries, etc. should be excluded from the survey sample. Crossings are evaluated using a separate form. Choose sample crossings that fall along surveyed corridors. Aim to survey as many crossings as possible.

Time of Day
All surveys must be conducted during peak travel hours, unless otherwise indicated.

Time Frame
We do not expect completion of this pilot physical infrastructure survey to take more than two business days.

Final Products
Although the Consultant shall record field data using the field data template provided, we expect final results to be recorded in the provided PDF form. The Consultant shall also submit a street map with the survey area clearly marked.

Questions
Should the Consultant have any questions about the physical infrastructure survey, please contact: _____ at: _____

1 - 5) Before you begin...

Use a separate field data recording sheet for each stretch of road surveyed. Should the character of a road change dramatically within the survey area (such that final results may be skewed), additional sheets may be used for each portion of road. For each surveyed stretch, indicate the name of the road (when available) and the surveyed portion's beginning and ending GPS coordinates (when available). Also, mark the surveyed portion of the streets on a map. For each sheet, indicate the time of day and the date, as well as whether the survey is being conducted during peak travel hours.

6) Adjacent Land Use

Indicate the **primary** use of adjacent land: commercial / retail, industrial, political / cultural (e.g., museums), high/medium/low-income residential, informal settlement, or other.

7) Road Length

Measure road length in meters using a reliable map.

8) Average Traffic Speed

Points	Speed	Description
1	0 – 10 km / hour	Gridlock
2	10 – 30 km / hour	Very slow moving traffic
3	30 – 70 km / hour	Traffic moving at reasonable speed
4	70 – 120 km / hour	Fast moving traffic
5	120 + km / hour	Very fast moving traffic

9) Cross Section

Count the number of driving lanes (for cars, buses, trucks, etc.), car parking lanes, bicycle or motorcycle lanes, and median strips.

10, 12) People Walking in Street / on Walking Path

Count the number of people walking in the street (alongside other traffic modes) / on walking path using a traffic counting method. Stand in one place (mark this place with GPS unit or draw on a map), and count the number of pedestrians on one side of the street over a period of 5 minutes. Record number.

11) Walking Path Width

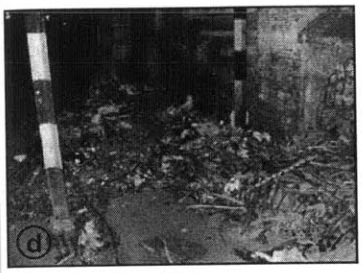
Using a tape measure or other measuring device, record the most common width of the walking path (sidewalk, special pedestrian pavement, lane, etc.). If no sidewalk or similarly marked walking path is present, simple write "0" on the field data sheet.

13, 14) Trees and Street Lights

As you walk, count the number of trees (public and private) and street lights you pass on one side of the street and write the total count on the field data sheet. In the end, these numbers will be divided by the total surveyed segment length to derive a figure for Index calculations. If tree and street light placement seems consistently repetitive, you may estimate the total number.

15) Cleanliness

Rate the general cleanliness of the surveyed street area based on the following 5-point scale (if quality varies, use your best judgment to determine which rating would best help identify areas that need improvement):



1

Rubbish completely obstructs walking path, making walking impossible. Rubbish significantly degrades surrounding environment.

2

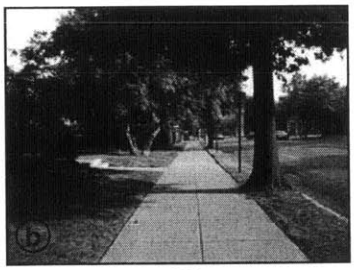
Rubbish partially obstructs walking path, making walking difficult and significantly degrades surrounding environment.

3

Some rubbish degrades quality of walking environment and is a minor obstacle to walking.

4

Some rubbish degrades quality of walking environment but is not an obstacle.



5

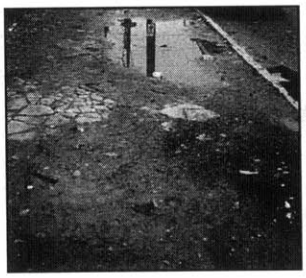
Walking path is clean.

16) Maintenance and Pavement Quality

Photograph and rate the pavement quality of the surveyed walking paths based on the following 5-point scale (if quality varies, use your best judgment to determine which rating would best identify areas needing improvement)

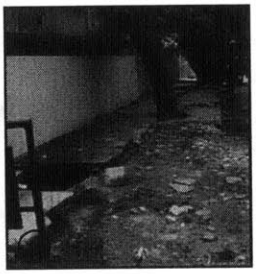
1

Separate paving for walking path is not present.



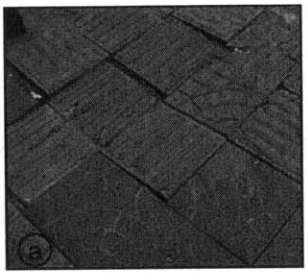
2

Paving is mostly dirt, covered with mud, very poorly maintained.



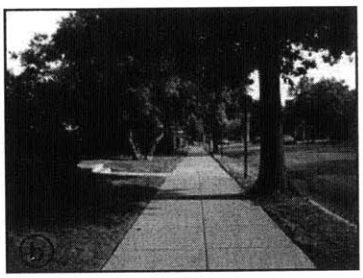
3

Some paving is present and provides a somewhat smooth walking surface in some areas. Not particularly well-maintained.



4

Walking path is paved and walkable, but not very well maintained. Tiles missing, very uneven surface, etc.

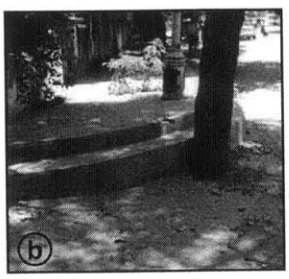


5

Provides a smooth walking surface and is very well maintained.

17) Pedestrian Infrastructure for Disabled Persons

Rate the quality of infrastructure for blind persons (e.g., acoustic signals and textured blind paths) and wheelchair-bound persons (e.g., curb ramps) based on the following 5-point scale:



1

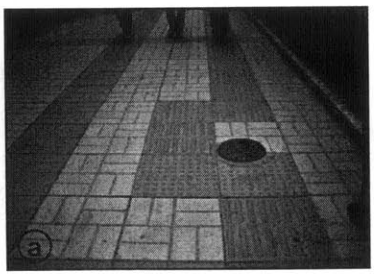
No infrastructure for disabled persons is present.

2

Limited infrastructure for disabled persons is available, but is not in usable condition.

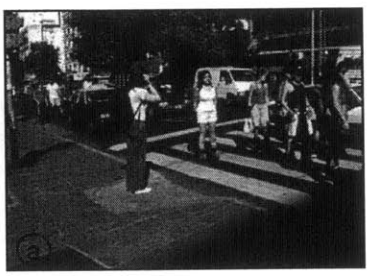
3

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.



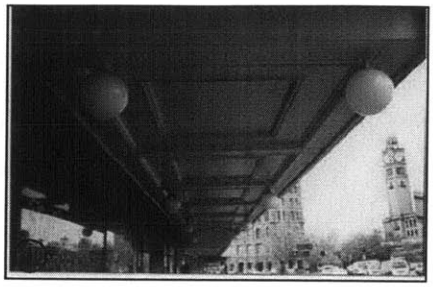
5

Infrastructure for disabled persons is present, in good condition, and well placed.

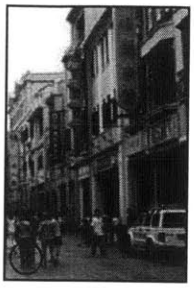
18) Coverage

Are there awnings or arcades that protect pedestrians from the sun and rain (see examples below)? If so, estimate what proportion of the surveyed area (one side of the street) has such coverings. A typical response might be: "Arcade: 25%"

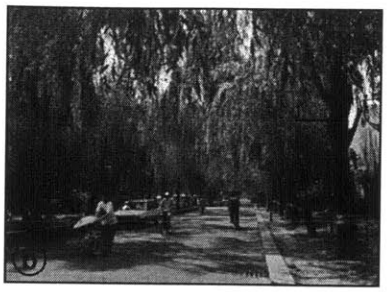
(1) Temporary Awning



(2) Permanent Awning



(3) Arcade



(4) Trees

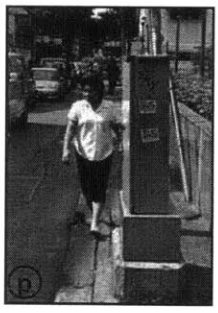
19) Road Length without Sidewalks

On map, mark stretches of road where there are no sidewalks, as well as which side(s) these stretches fall on (a GPS device may also be used, where appropriate).

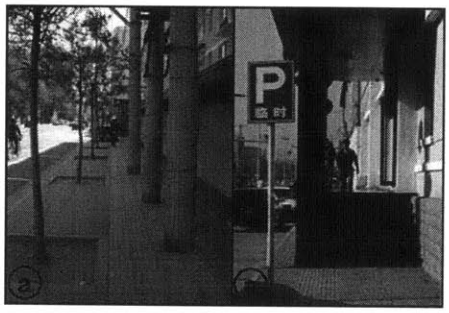
20) Permanent and Temporary Obstructions / Obstacles

Permanent obstacles, such as telephone poles planted directly in the center of the walking path or electric transformers that block pedestrian traffic should be carefully noted. Similarly, temporary obstacles, such as parked cars on walking path that block pedestrian traffic should be carefully noted. The following pictures may be used as guides.

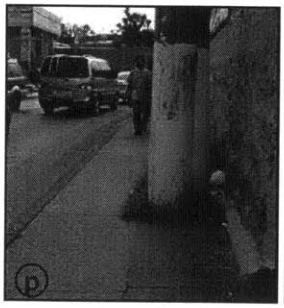
Permanent Obstacles



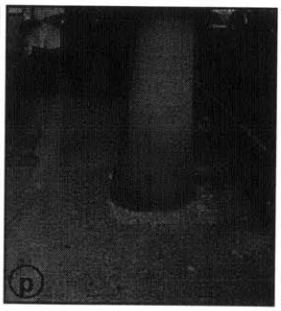
(1) Pedestrian traffic is completely blocked by permanent obstructions.



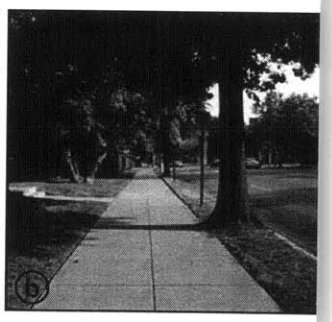
(2) Pedestrian traffic is significantly inconvenienced by obstruction but can still walk on walking path. Effective width is <1m, preventing wheelchair access



(3) Pedestrian traffic is mildly inconvenienced; effective width is < or = 1 meter.

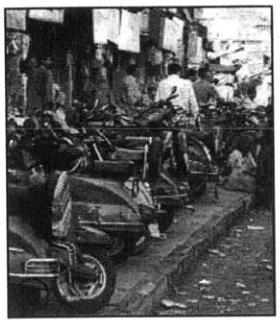


(4) Obstacle presents minor inconvenience. Effective width is > 1 meter.



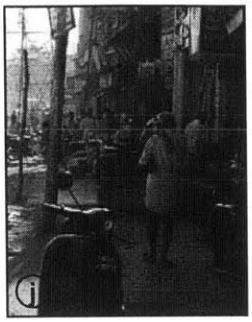
(5) There are no permanent obstructions.

Temporary Obstacles



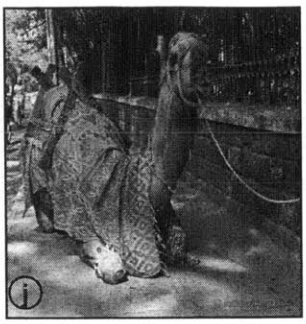
1

Pedestrian traffic is completely blocked by temporary obstruction.



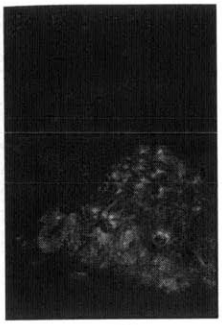
2

Pedestrian traffic is significantly inconvenienced by obstruction but can still walk on walking path. Effective width is <1m, preventing wheelchair access



3

Pedestrian traffic is mildly inconvenienced; effective width is < or = 1 meter.



4

Obstacle presents minor inconvenience and *may* be welcomed by some residents.

5

Obstruction is welcomed by most and enhance pedestrian activity

21) Conflicts between Pedestrians and Other Modes

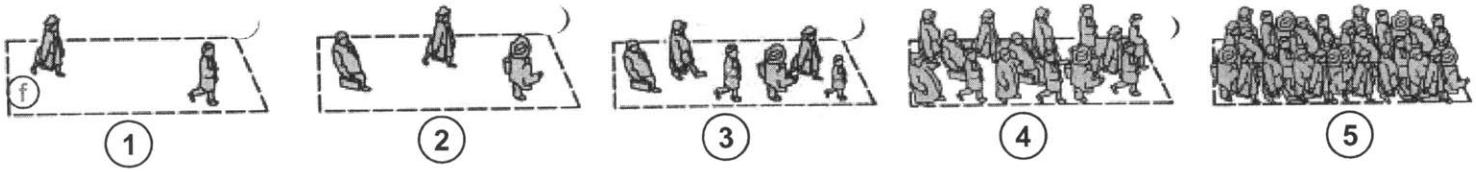
Photograph and assign a rating to degree of pedestrian conflict with other modes (e.g., bicycles, buses, cars, motorcycles, rickshaws), according to the following 5-point scale:

Points	Description
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

Be sure to photograph the conflict, such that analysts can understand the source of the modal conflict.

22) Pedestrian Congestion

Rate the degree of pedestrian congestion on the walking path, using the following 1-5 point scale:



1 2 3 4 5

23) Pedestrian Signage

Are there pedestrian-oriented way-finding signs, such as maps? Respond by writing "none" or "some," or "ample." Use your best judgment.

24) Other Pedestrian Infrastructure Amenities

List available amenities that are provided at regular intervals along surveyed road segment. Examples include; rubbish bins, benches, and public toilets.

25) Open Sewers

Note whether there are open sewers along the surveyed road by writing "yes" or "no."

CROSSINGS SURVEY

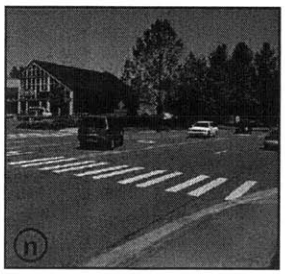
In addition to walking corridors, crossings play an important role in pedestrian safety and convenience. The Consultant shall select crossings (at intersections or along road stretches) on surveyed corridors and answer the following questions about them. Although it is not necessary to survey every crossing, we ask that the Consultant survey a significant proportion of them.

a-d; 1) Before you begin...

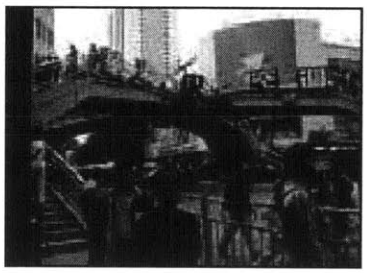
As with the previous survey, indicate the time of day and the date, as well as whether the survey is being conducted during peak travel hours. Number the crossings you will evaluate and indicate their location on a map.

2, 3) Types, Locations

Note the type of all surveyed crossings (even those not at road intersections). The following photos illustrate the basic types of intersections:

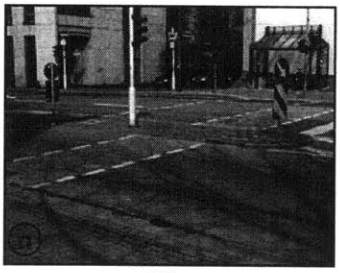


Ⓩ Zebra Crossing

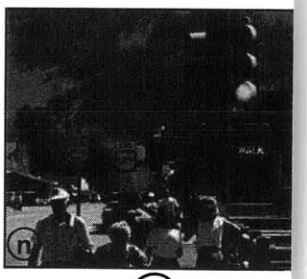


Ⓞ Cross Over

Ⓤ Underground Subway



Ⓜ Refuge Median



Ⓛ Traffic Light

Also, Indicate whether the crossing is at a road intersection or between road intersections.

4) Average Traffic Speed

Average traffic speed affects the risk of fatality and injury of the pedestrian. Estimate the actual (as opposed to posted) speed based on the following criteria:

Points	Speed	Description
1	0 – 10 km / hour	Gridlock
2	10 – 30 km / hour	Very slow moving traffic
3	30 – 70 km / hour	Traffic moving at reasonable speed
4	70 – 120 km / hour	Fast moving traffic
5	120 + km / hour	Very fast moving traffic

5) Number of Lanes to Cross

Indicate the total number of motor-vehicle traffic lanes, including parking lanes, that must be crossed (across widest road segment, if there is more than one to choose from).

6, 7) Average Time Spent Waiting and Crossing

Indicate the average time the pedestrian is made to wait and **given** (as opposed to actual time spent) to cross the street. If there are multiple crossings at an intersection, evaluate the crossing that spans the widest street.

Points	Description
1	30 seconds – 1 minute
2	1 – 2 minutes
3	2 – 3 minutes
4	3+ minutes

8) Sufficient Time to Cross

Sometimes the amount of time available to cross a street (break between cars, time allotted by traffic signal, etc.) is insufficient, particularly for people with small children or elderly. Indicate whether time available to cross is sufficient for a typical healthy adult; elderly person, disabled person, or person with small children; or no one at all to cross.

9) Safety

Describe the quality of each crossing in terms of safety from traffic accidents, using the following criteria:

Points	Description
1	Very dangerous – there is significant risk of accident with other modes
2	Dangerous – pedestrian faces some risk of being hurt by other modes
3	Difficult to ascertain dangers posed to pedestrian
4	Safe – pedestrian is mostly safe from accident with other modes
5	Very safe – other modes present no danger to pedestrian

10) Security

Describe the quality of each crossing in terms of security from crime (mostly applies to subways), using the following criteria:

Points	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

11) Traffic Management

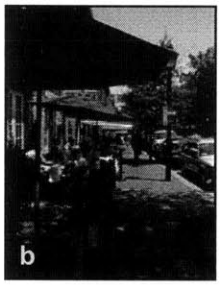
Indicate whether there is a traffic signal, pedestrian phase signal, traffic police, or no traffic management system at the crossing (across widest road).

DIGITAL PHOTOGRAPH CHECK LIST

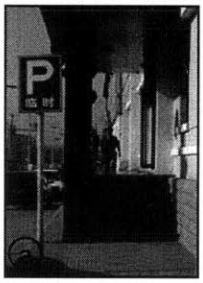
For each surveyed street, you should **at least** have photographs of all of the following items:

❑ Pavement

❑ Street Cross Section (taken from center of road crossing)

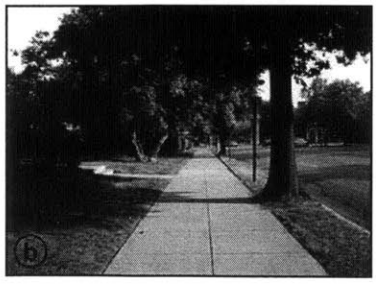


❑ Walking Path Cross Section (taken from center of walking path)



❑ Permanent Obstructions

❑ Temporary Obstructions



❑ Modal Conflict (or lack thereof)

Photographs and Images

a) Knecht, Barbara. Barbara Knecht, Inc.
b) Krambeck, Holly (Author).
c) Dickerson, Leanne. The Panos Institute. <http://www.panos.org.uk/>
d) Nina Paley. NinaPaley.com. <http://www.ninapaley.com/>
e) Freeport New York News. <http://www.freeportnynews.com/Vil%20News%202002/020716_Mayor%20ignores%20mess.htm>
f) Australia Highway Capacity Manual (Compliments of Michael King, Nelson\Nygaard Consulting Associates).
g) Dept of Housing Renewal & Environmental Health Services, Leeds, UK. <http://www.healheadingley.org.uk/contacts/envthealth.htm>.
h) Northwest South Philly – Neighborhood Organizations and Resources for Southwest Center City. <http://www.southphillyblocks.org/christianstreet/michelle_cutner/>
i) Purser, Robert. http://www.citymayors.com/development/india_urban1.html. **May not be reprinted without permission – e-mail: editor@combatlaw.org**
j) Göhler, Lars. India Picture Community. <http://www.india-picture.com/index.html>
k) A Journey to Katie. <http://www.katieadoption.us/Day%202-4%20pictures.htm>
l) Wunderlite Pressed Metal Panels. <http://www.wunderlite.com.au/sydneytech.html>
m) MetroPole Paris. <http://www.metropoleparis.com/1996/60603015/street.html> **May not be reprinted without permission – e-mail: erickso@worldnet.fr**
n) Pedestrian and Bicycle Information Center Image Library. <http://www.pedbikeimages.org/index.cfm>
o) Suwanathada, Pat. Consultant, World Bank.
p) Fabian, Herbert. Asian Development Bank.
q) Wegmann, Jake. Massachusetts Institute of Technology

Submit by Email

GLOBAL WALKABILITY INDEX

PHYSICAL INFRASTRUCTURE SURVEY (roads, walking paths, amenities)

Part I: Survey Area

1) Survey area # _____

2) Date (dd/mm/yyyy) _____

3) Time
- ○ 6:00 - 9:00
- ○ 9:01 - 12:00
- ○ 12:01 - 15:00
- ○ 15:01 - 18:00
- ○ 18:01 - 21:00

4) Peak travel time?
- ○ Non-Peak
- ○ Peak

5) Road name (or other identifier) (mark on map) _____

6) Surrounding land use (check all that are the **most** prevelant)
- ☐ Commercial / Retail
- ☐ Industrial
- ☐ Political / Cultural
- ☐ High Income Residential
- ☐ Medium-Income Residential
- ☐ Low-Income Resudenrtial
- ☐ "Slum" / Informal Settlement
- ☐ Other _____

Part II: Road

7) Length (meters) _____

8) Average traffic speed
- ○ 0 - 10 km / hour (gridlock)
- ○ 10 - 30 km / hour (very slow moving traffic)
- ○ 30 - 70 km / hour (traffic moving at reasonable speed)
- ○ 70 - 120 km / hour (fast moving traffic)
- ○ 120 + km / hour (very fast moving traffic)

9) Number of driving lanes  _____

Number of parking lanes _____

Number of bicycle / motorcycle lanes _____

Number of median strips _____

10) People walking in street (not on walking path) -- 5 minute count _____ (mark location on map)

Part III: Walking Path

11) Width (most commonly occuring) in meters _____

12) People walking on walking path -- 5 minute count _____ (mark location on map)

13) Trees (total number on one side) _____

14) Street lights (total number on one side) _____

15) Cleanliness 
- ○ 1 -- Rubbish makes walking impossible; ruins enivronment
- ○ 2 -- Rubbish makes walking difficult; degrades environment
- ○ 3 -- Minor obstacle; degrades environment
- ○ 4 -- Degardes quality of environment, but not obstacle
- ○ 5 -- Walking path is clean

16) Maintenance and Pavement Quality 

- ○ 1 -- Separate paving for walking path not present
- ○ 2 -- Paving is mostly dirt, covered with mud; poor condition
- ○ 3 -- Some paving; partly smooth; poor condition
- ○ 4 -- Paved and walkable; not well maintained
- ○ 5 -- Smooth walking surface; well maintained

17) Infrastructure for disabled (ramps, blind paths, etc.)

- ○ 1 -- No infrastructure for disabled persons available
- ○ 2 -- Limited infrastructure available, not in usable condition
- ○ 3 -- Infrastructure present but in poor condition
- ○ 4 -- Infrastructure present, in good cond., but poorly placed
- ○ 5 -- Infrastructure is present, in good condition, well placed

18) Coverage type (check all that apply)

- ☐ Temporary awning Proportion of road (%) _____
- ☐ Permenant awning Proportion of road (%) _____
- ☐ Arcade Proportion of road (%) _____
- ☐ Trees Proportion of road (%) _____
- ☐ None

19) Road length without sidewalk

Length (meters) _____

○ One side ○ Both sides

20) To what degree do obstructions (items that make effective walking path width less than 1 meter wide) affect overall walkabiility of road? List types of obstructions (e.g., parked cars). 

- ○ 1-- Walking is compoletely impossible
- ○ 2 -- Pedestrians are very inconveninced
- ○ 3 -- Pedestrians are mildy inconvenienced
- ○ 4 -- Minor inconvenience, but obstruction may be welcome
- ○ 5 -- Pedestrian environment is enhanced by obstructions
- ○ There are no obstructions

_____

_____

_____

Part IV: Amenities and Environment

21) Conflicts between pedestrians and other modes (bicycles, etc.) 

- ○ 1 -- Significant conflict; walking is impossible
- ○ 2 -- Significant conflict; walking possible, but dangerous
- ○ 3 -- Some conflict -- walking is possible, but not convenient
- ○ 4 -- Minimal conflict, mostly btw. pedestrians and bicycles
- ○ 5 -- No conflict between pedestrians and other modes

22) Pedestrian congestion (1-5 point scale -- see guide) ○ 1 (empty) ○ 2 ○ 3 ○ 4 ○ 5 (gridlock)

23) Pedestrian signage (crossings, maps, directions) 1-5 point scale. ○ 1 (none) ○ 2 ○ 3 ○ 4 ○ 5 (ample)

24) List available amenities (e.g., rubbish bins, benches, toilets, etc.)  _____

25) Open sewers? ○ Yes ○ No

GLOBAL WALKABILITY INDEX

PHYSICAL INFRASTRUCTURE SURVEY (crossings)

a) Survey area # _____

b) Date (dd/mm/yyyy) _____

c) Time ○ 6:00 - 9:00 ○ 9:01 - 12:00 ○ 12:01 - 15:00 ○ 15:01 - 18:00 ○ 18:01 - 21:00

d) Peak travel time? ○ Peak ○ Non-Peak

---

1) **Crossing ID #** _____

2) Type (s) ☐ Zebra / other marking ☐ Overpass ☐ Subway ☐ No marking

3) Location ○ Road intersection ○ Non-Intersection

4) Avg. Traffic Speed ○ 0 - 10 km / hr ○ 10 -30 km / hr ○ 30 - 70 km / hr ○ 70-120 km / hr ○ 120 + km

5) Number of lanes to cross (across widest road segment) _____

6) Average time spent waiting to cross the street (across widest road segment) ○ 0 - 1 min. ○ 1 - 2 min. ○ 2 - 3 min. ○ 3+ min.

7) Average time given to cross the street (across widest road segment) ○ 0 - 1 min. ○ 1 - 2 min. ○ 2 - 3 min. ○ 3+ min.

8) Time is sufficient for **X** to cross -- check all that apply. ☐ Typical healthy adult ☐ Person with small children ☐ Disabled/eldrely person ☐ No one

9) Safety from traffic accident ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

10) Security from crime ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

11) Traffic Management ○ Regular Traffic Signal ○ Pedestrian Phase SIgnal ○ Traffic Police ○ None

GLOBAL WALKABILITY INDEX

1) **Crossing ID #** _____

2) Type (s) ☐ Zebra / other marking ☐ Overpass ☐ Subway ☐ No marking

3) Location ○ Road intersection ○ Non-Intersection

4) Avg. Traffic Speed ○ 0 - 10 km / hr ○ 10 -30 km / hr ○ 30 - 70 km / hr ○ 70-120 km / hr

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10) Security from crime ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

11) Traffic Management ○ Regular Traffic Signal ○ Pedestrian Phase Signal ○ Traffic Police ○ None

---

1) **Crossing ID #** _____

2) Type (s) ☐ Zebra / other marking ☐ Overpass ☐ Subway ☐ No marking

3) Location ○ Road intersection ○ Non-Intersection

4) Avg. Traffic Speed ○ 0 - 10 km / hr ○ 10 -30 km / hr ○ 30 - 70 km / hr ○ 70-120 km / hr

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8) Time is sufficient for **X** to cross -- check all that apply. ☐ Typical healthy adult ☐ Person with small children ☐ Disabled/eldrely person ☐ No one

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10) Security from crime ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

11) Traffic Management ○ Regular Traffic Signal ○ Pedestrian Phase Signal ○ Traffic Police ○ None

GLOBAL WALKABILITY INDEX

1) **Crossing ID #** _____

2) Type (s) ☐ Zebra / other marking ☐ Overpass ☐ Subway ☐ No marking

3) Location ○ Road intersection ○ Non-Intersection

4) Avg. Traffic Speed ○ 0 - 10 km / hr ○ 10 -30 km / hr ○ 30 - 70 km / hr ○ 70-120 km / hr

5) Number of lanes to cross (across widest road segment) _____

6) Average time spent waiting to cross the street (across widest road segment) ○ 0 - 1 min. ○ 1 - 2 min. ○ 2 - 3 min. ○ 3+ min.

7) Average time given to cross the street (across widest road segment) ○ 0 - 1 min. ○ 1 - 2 min. ○ 2 - 3 min. ○ 3+ min.

8) Time is sufficient for **X** to cross -- check all that apply. ☐ Typical healthy adult ☐ Person with small children ☐ Disabled/eldrely person ☐ No one

9) Safety from traffic accident ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

10) Security from crime ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

11) Traffic Management ○ Regular Traffic Signal ○ Pedestrian Phase Signal ○ Traffic Police ○ None

---

1) **Crossing ID #** _____

2) Type (s) ☐ Zebra / other marking ☐ Overpass ☐ Subway ☐ No marking

3) Location ○ Road intersection ○ Non-Intersection

4) Avg. Traffic Speed ○ 0 - 10 km / hr ○ 10 -30 km / hr ○ 30 - 70 km / hr ○ 70-120 km / hr

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7) Average time given to cross the street (across widest road segment) ○ 0 - 1 min. ○ 1 - 2 min. ○ 2 - 3 min. ○ 3+ min.

8) Time is sufficient for **X** to cross -- check all that apply. ☐ Typical healthy adult ☐ Person with small children ☐ Disabled/eldrely person ☐ No one

9) Safety from traffic accident ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

10) Security from crime ○ 1 -- Very dangerous ○ 2 -- Dangerous ○ 3 -- Unsure ○ 4 -- Safe ○ 5 -- Very safe

11) Traffic Management ○ Regular Traffic Signal ○ Pedestrian Phase Signal ○ Traffic Police ○ None

GLOBAL WALKABILITY INDEX

PART II: PUBLIC AGENCY SURVEY

Introduction

The attached survey is one component of a larger study that comprises three parts: 1) a physical infrastructure survey; 2) a public agency survey; and 3) a qualitative survey to be administered to city residents.

The public agency survey shall help us gather information about walkability that is not obtainable through physical infrastructure surveys or interviews with pedestrians, such as pedestrian fatality statistics and institutional capacity for pedestrian planning.

There are three different kinds of agencies included in the survey (in some cities, these may overlap):

- Agency responsible for transportation planning
- Agency responsible for city planning
- Agency responsible for traffic safety

The Consultant shall approach all four types of agencies and ask the questions provided in the attached survey. Questions denoted by a * may be appropriate only for cities in more developed countries. We ask that the Consultant use his or her best judgment in determining which questions to ask.

In addition to filling out the survey, we ask that the Consultant also provide feedback on how the survey could be improved.

Time Frame

We do not expect completion of the public agency surveys to take more than three business days.

Final Products

Regardless of field recoding method, the final survey (which may be filled in electronically) and additional data sets must be submitted electronically to: _____

Questions

Should the Consultant have any questions about the physical infrastructure survey, please contact: _____

GLOBAL WALKABILITY INDEX

PUBLIC AGENCY SURVEY

Submit by Email

Part I: Agency Responsible for Transportation Planning

1a) Is there a specific non-motorized planning program / department?

- ◯ Yes
- ◯ No

1b) If there is a specific non-motorized planning program / department / point person , then please provide a brief description. Include activities and number of full and part time staff.

*2) If there is a specific non-motorized planning program / department, please rate program funding.

- ◯ Enough to sustain high-quality progr am in long-term
- ◯ Sufficient for short term, but not the long term
- ◯ Neutral
- ◯ Sufficient only to meet very few program goals
- ◯ Totally insufficient

*3) Are pedestrian networks included in the city master plan or transportation plan?

- ◯ Yes
- ◯ No

4a) Please state the proportion of all trips (to work, shopping, school, etc.) that are made via:

Automobile	____ %	Year(s):	____
Motorized two-wheeler	____ %		
Rail-based public transit	____ %		
Public bus	____ %		
Informal transit	____ %		
Bicycle	____ %		
Walking	____ %		
Other	____ %		

4b) How were above proportions derived (rough estimates based on visual observations, traffic counts, surveys, etc.)?

Part II: Agency Responsible for City Planning

1) Please check the pedestrian-related urban design guidelines that are already well-established. Feel free to add any relevant guidelines that are not included in the list.

- ☐ Sidewalk pavement type
- ☐ Placement of benches and similar amenities on walk paths
- ☐ Sidewalk widths
- ☐ Design for disabled persons
- ☐ Other _____
- ☐ Other _____
- ☐ Other _____

2) Please check the building front guidelines that are already well-established. Feel free to add any relevant guidelines that are not included in the list.

- ☐ Strict build-to lines
- ☐ Arcade / sidewalk coverage requirements
- ☐ Other _____
- ☐ Other _____

3) Which public agency/agencies are responsible for:

Licensing of street activities (e.g., vending, busking) _____

Sidewalk construction _____

Sidewalk infrstructure maintenance _____

Sidewalk cleaning _____

Street lighting _____

Pedestrian amenities (e.g., benches) _____

Tree planting _____

Road safety _____

Pedestrian network planning _____

Obstructions / publi c space policy _____

4) Please rate the relative importance of the provision of pedestrian infrastructure and services in your agency.

- ◯ Very important -- walking is a high priority
- ◯ Somewhat important
- ◯ Neutral
- ◯ Somewhat unimportant
- ◯ Not important -- walkability is almost never ocnsidered

5) On a city map, please indicate concentrations of employment, low income residences, and high income residences. Please describe the connections between these areas, noting any particular barriers such as highways with few crossings

Part III: Agency Responsible for Traffic Safety and Law Enforcement

1) Does the agency maintain data on pedestrian fatalities and injuries? If so, please attach.

- ☐ Yes
- ☐ No

2) Is there a law or regulation for any of the following items? If so, is the law or reguulation enfoced? Feel free to add any relevant laws or regulations that are not included in this list.

Is there a law or regulation for:	Enforced? Usually	Sometimes	Rarely
☐ Jaywalking	☐	☐	☐
☐ Vendors on sidewalks	☐	☐	☐
☐ Parking on sidewalks	☐	☐	☐
☐ Driving / riding on sidewalks	☐	☐	☐
☐ Drunk driving	☐	☐	☐
☐ Other _____	☐	☐	☐
☐ Other _____	☐	☐	☐
☐ Other _____	☐	☐	☐

3) Have there been public outreach efforts (by this or other agency) to educate pedestrians or drivers on road and pedestrian safety? If so, please describe.

- ☐ Yes
- ☐ No

4) Does the department maintain location data for pedestrain fatalities / road accidens? If so, please describe and attach for most recent year available.

- ☐ Yes
- ☐ No

*5) Does the department maintain location data for street crimes (coule the agency, for example, pinpoint specific high crime locations on a map based on data inputs)?

- ☐ Yes
- ☐ No

Part IV: Contact Information

Agency Responsible for Public Transportation

Agency Name _____

Agency Address _____

Contact Name _____

Contact Position _____

Contact Phone _____

Contact E-mail _____

Notes _____

Agency Responsible for City Planning

Agency Name _____

Agency Address _____

Contact Name _____

Contact Position _____

Contact Phone _____

Contact E-mail _____

Notes _____

Agency Resonsible for Traffic Safety

Agency Name _____

Agency Address _____

Contact Name _____

Contact Position _____

Contact Phone _____

Contact E-mail _____

Notes _____

Part V: Notes

PART III: PEDESTRIAN SURVEY

Introduction

The attached survey is one component of a larger study that comprises three parts: 1) a physical infrastructure survey; 2) a public agency survey; and 3) a qualitative survey to be administered to city residents.

The pedestrian survey shall help us gather information about walkability that is not obtainable through physical infrastructure surveys or interviews with public agencies, such as nighttime lighting conditions, walking trip purposes, etc.

Implementation

To avoid complications with printed survey translation and illiteracy, these surveys shall be conducted verbally. Surveys shall be conducted directly with the target population – walkers – by conducting spot-interviews in select locations. Clipboard teams of at least two local Consultants shall conduct surveys together.

The surveyed population might include: pedestrians, vendors, local merchants, traffic safety police, office workers, maintenance workers, etc. Surveys may be conducted on the street, in offices and shops, etc. Surveys may also be sent to people via e-mail, should those persons work or reside in the surveyed area.

Be certain to mark survey locations on map.

It is **very important** that the pedestrian survey questions pertain to the roads studied in the Part I Physical Infrastructure survey.

In addition to filling out the pilot survey, we ask that the Consultant also provide feedback on how the survey could be improved.

Time Frame

We do not expect completion of the pedestrian surveys to take more than two business days.

Final Products

Regardless of field recoding method, the final survey results must be submitted electronically to _____, using the provided Excel sheet.

Questions

Should the Consultant have any questions about the pedestrian survey, please contact: _____at: _____

Date _____ Time _____ Initials _____ Survey Location ID# _____

GLOBAL WALKABILITY INDEX

PEDESTRIAN SURVEY

Submit by Ema

Part I: Respondent Description

Answer the first three questions using visual inspection:

1) Gender: ○ Female ○ Male

2) Disabled: ○ Yes ○ No

3) Have small children (living wiht you at present) ○ Yes ○ No

Ask the respondent the following questions (may ask these questions last):

4) Age ○ 10 - 19 ○ 20 - 39 ○ 40-59 ○ 60+

5) Income Level (do you earn significantly less or more than local median?) ○ Low ○ Medium ○ High

6) Neighborhood where home is located (currently): _____

7) Do you own (in this city): ☐ Bicycle ☐ Motor two-wheeler ☐ Car

Part II: Walking Profile

8) How much time do you spend per day walking (minutes)? ○ 0 - 15 ○ 16 - 30 ○ 31 - 60 ○ 60+

9) How long, on average do you spend walking to work each day? ○ 0 - 15 ○ 16 - 30 ○ 31 - 60 ○ 60+ ○

10) How long does it take you to take transit to work (total trip) ? ○ 0 - 15 ○ 16 - 30 ○ 31 - 60 ○ 60+ ○

11) How long does it take to walk to nearest transit stop from home ? ○ 0 - 15 ○ 16 - 30 ○ 31 - 60 ○ 60+ ○

12) List top three places you usually walk to: _____ _____ _____

Part III: Convenience

Show respondent map with 0.5 km radius drawn around survey point. The following questions refer to this area:

13) On a scale of 1-5, how convenient are walk paths in this area (1= very bad)? ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

14) Are walking paths in this area:

	Rarely	Sometimes	Often
a)	☐	☐	☐ Blocked with obstructions (e.g., poles, parked cars)
b)	☐	☐	☐ Congested with non-pedestrian traffic (e.g., bicycles)
c)	☐	☐	☐ Adequate for blind or disabled people
d)	☐	☐	☐ Poorly lit at night
e)	☐	☐	☐ Covered with litter
f)	☐	☐	☐ Uneven and hard to walk on

15) Do you have to walk very far out of your way just to cross the str eet: ○ Rarely ○ Sometimes ○ Often

Part IV: Safety and Security

Show respondent map with 0.5 km radius drawn around survey point. The following questions refer to this area:

16) On a scale of 1-5, how **safe** is it to walk in this area? (1 = dangerous) ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

17) On a scale of 1-5, how **secure** is it to walk in this area? (1 = dangerous) ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

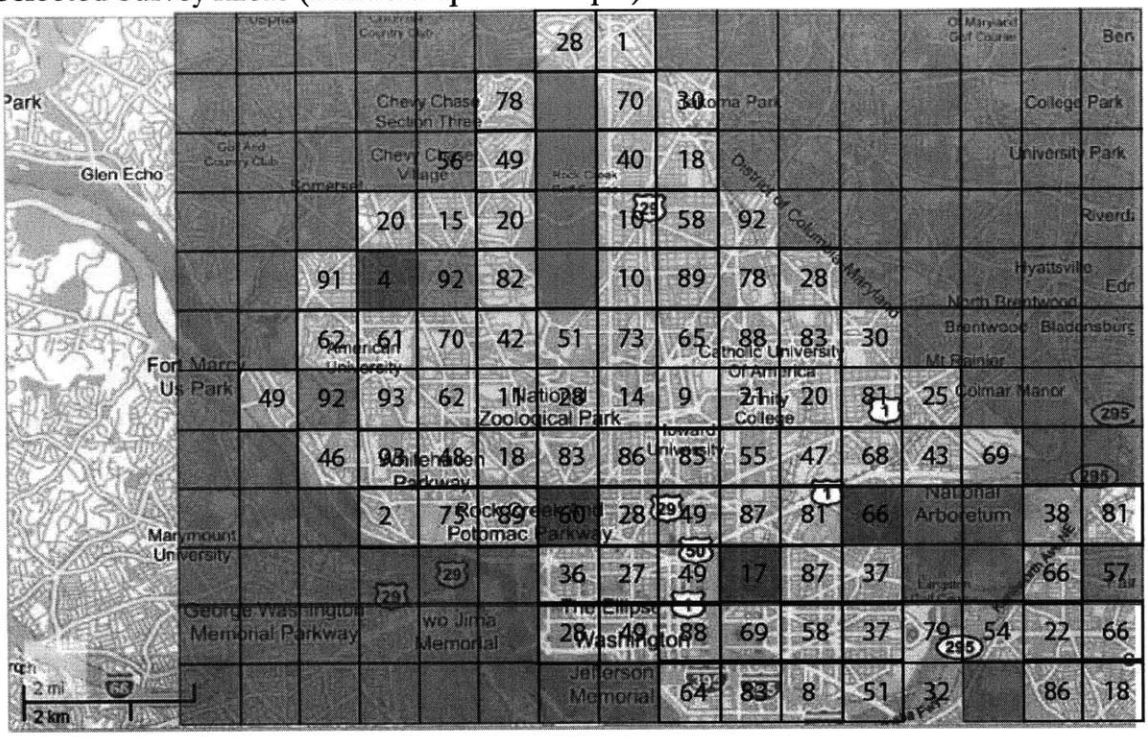
18) Do motorists in this area:

	Rarely	Sometimes	Often
a)	☐	☐	☐ Fail to yield to people crossing the street
b)	☐	☐	☐ Drive too fast
c)	☐	☐	☐ Drive through red traffic lights and stop signs

19) List three things the city should do to improve walkability _____ _____ _____

APPENDIX E
Selection of Field Test Materials

WASHINGTON, DC: FIELD TEST
Selected Survey Areas (Random Spatial Sample)



WASHINGTON, DC: FIELD TEST
Survey Volunteers

Enjoy & Until Next time...

- *Tina George & Samantha Constant*
Y2Y Communications Chairs 2005

Y2Y August Events Calendar

1) SpeakOut! Session with Jim Adams, VP, OPCS When: Monday, August 8, 2005, 12:30-2:00 pm
Where: MC-8-W150
Thank you for signing up for the Jim Adams Speak Out session last week. Mr. Adams had to rearrange due to an unforseen scheduling conflict. We hope you can make the alternative date. Once again, Mr. **Jim Adams**, VP, OPCS will be speaking to the community about his long and accomplished career at the Bank, including his role as Country Director for Uganda and Tanzania during formative years in their development, and how young people such as ourselves should approach a career in this field. This session is a great opportunity for the Community to speak freely to a member of the senior management who is always full of intelligent insight, witty stories and sage advice. The **new date will be August 8th 12:30- 2:00pm.** Please RSVP here to attend the session.

2) Next Y2Y Steering Committee Meeting When: First Wednesday of the Month: Aug 3, 6:30-7:30 pm Where: MC-9-401

Y2Y invites members to attend Steering Committee meetings every first Wednesday of the month. The second meeting in the series will be held on Wednesday Aug 3, 2005 from 6:30 pm to 7:30 pm at MC-9-401. These meetings will provide an update on the progress of initiatives over the previous month and upcoming projects. It will also provide a platform to learn more about how you can get involved with existing Y2Y activities or start up new initiatives. Please RSVP here to attend the session.

* If you would like to be involved with these events, please contact Divya Gupta

Pilot in DC: 'Walk the Talk!'

Did you know that as many as 50% of all work trips are made by foot in developing cities? Or in some cities, that more than 65% of all urban traffic accidents result in pedestrian injuries and fatalities?

Although a significant number of trips are made by foot in developing cities, pedestrian infrastructure, amenities, and services are often neglected in municipal planning and budgets. As a first step towards encouraging and helping city planners understand the scope and extent of local pedestrian conditions, the TUDTR Unit has been developing a Global Walkability Index, which would reveal not only which developing cities are doing a good job and which ones require significant improvements, but also identify specific actions cities can take to improve their pedestrian infrastructure, as well as related policies and services.

To get the project off the ground, Y2Y and TUDTR organized a 'Walk the Talk' pilot survey event on Saturday, July 23, where Y2Y Members, and volunteers from across the Bank and DC learned how walkability indexes of cities are created. After a scrumptious breakfast of mango lassis, french toast, and cilantro scrambled eggs at Teaism, volunteers (who also received Walk the Talk T-Shirts) were sent out to eight very different DC neighborhoods. Volunteers used GPS units, powers of observation, and...strings...to evaluate the quality of pedestrian infrastructure in each neighborhood (within a preselected 1km x 1km block), in addition to conducting interviews with people on the street. At the end of the day, when volunteers reported back at Teaism, they were remarkably (and unbelievably) excited about finding things like discontinuous sidewalks or particularly dangerous intersections.

George Branyan, the D.C. Department of Transportation Pedestrian Planning Coordinator (and former Peace Corp. volunteer), also joined the group and, so impressed was he with the caliber of the volunteers and the surveys, that he has asked to use data we collected to improve walking conditions in DC. Go volunteers!

Should anyone be interested in learning more about the Global Walkability Index project or wish to contribute, dash an e-mail to: Holly Krambeck, TUDTR or Jitu Shah, Lead Env Specialist, EASEN.

-- Contributed by Holly Krambeck, TUDTR

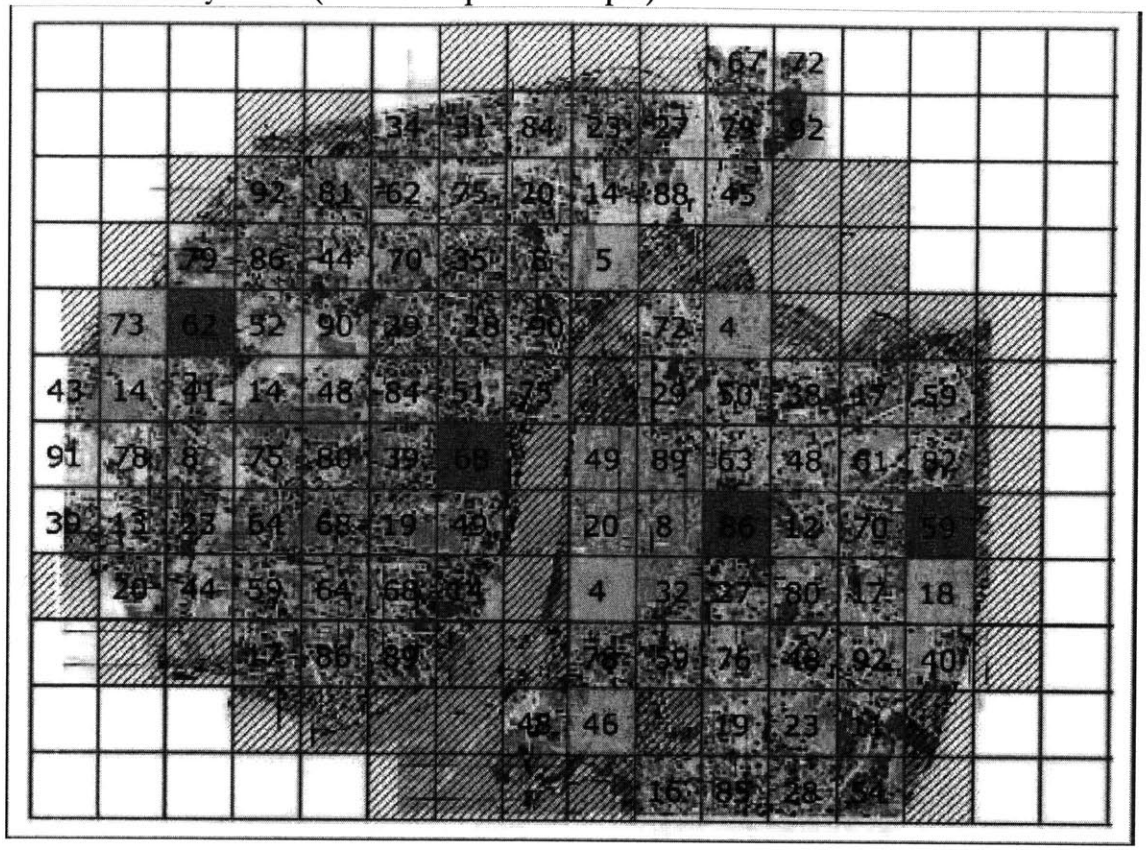
Get Involved

1) Join the Y2Y Team for Youth, Sport Development & Peace

The UN has for many years understood the importance that sport can play as a development tool and has attempted to mainstream sport in its programs and activities. An inter-agency working group on the issue was set up recently, and 2005 was named the UN International Year of Sport. Y2Y's Youth, Sport, Development & Peace Team will work to raise awareness of the positive impact that sport can play in the Bank's work and develop new ideas for potential implementation. Click here for the Terms of Reference (TOR)

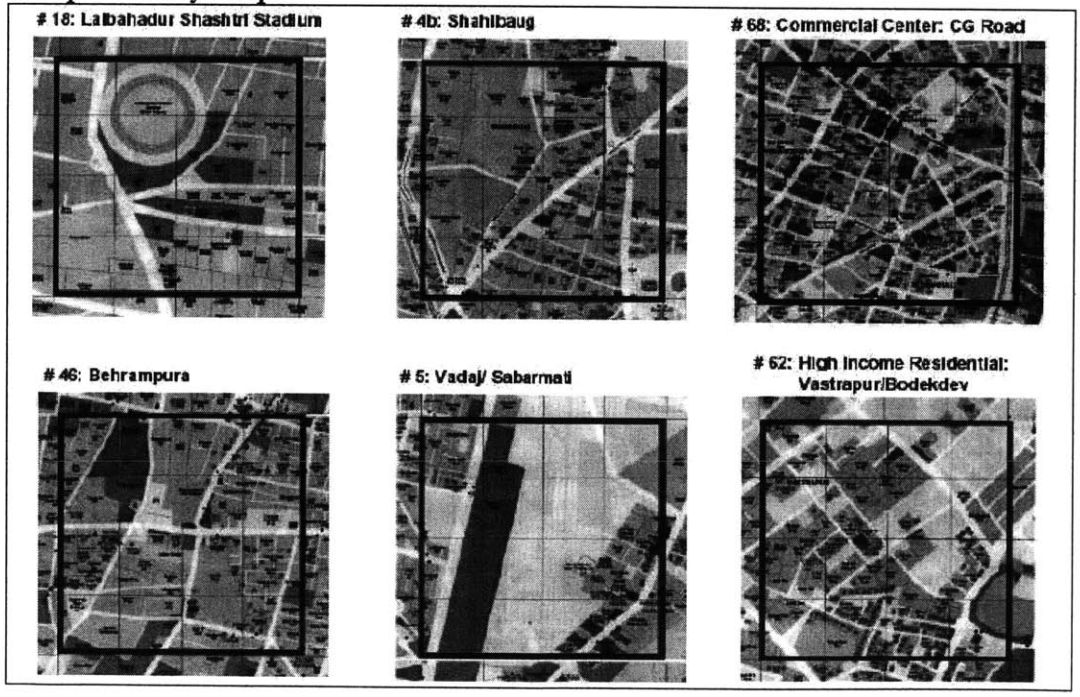
AHMEDABAD, INDIA: PILOT

Selected Survey Areas (Random Spatial Sample)



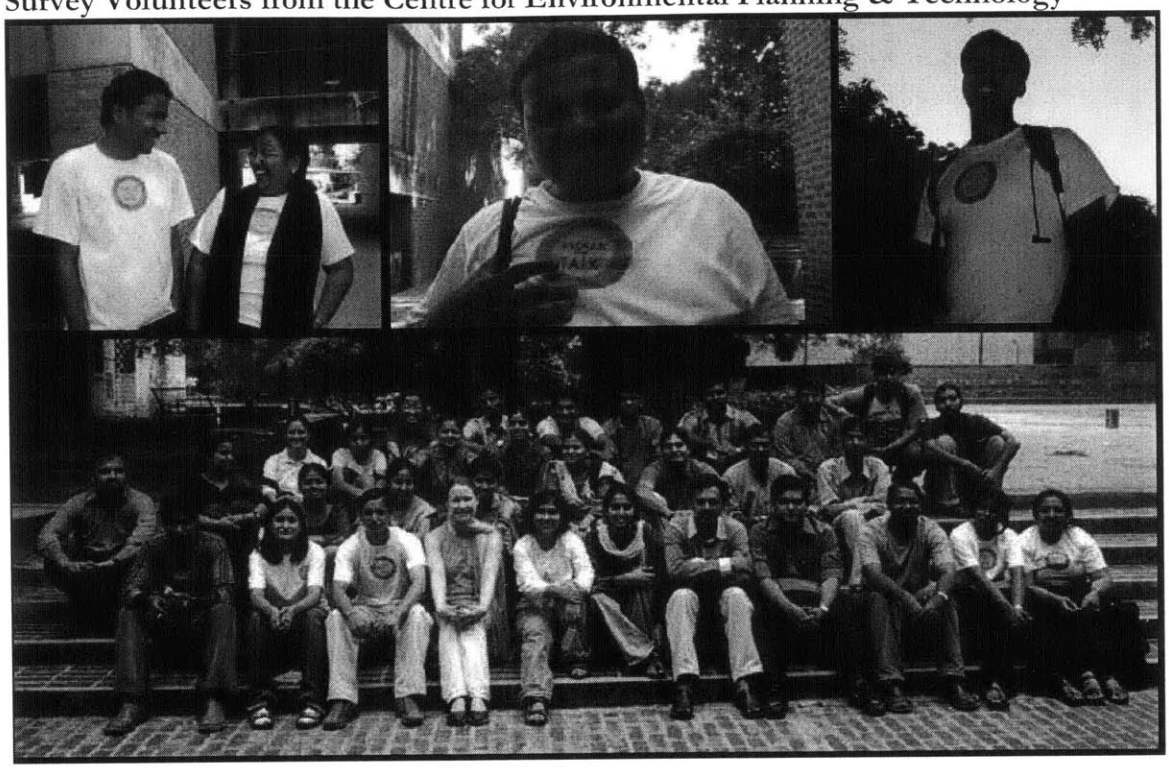
AHMEDABAD, INDIA: PILOT

Sample Survey Maps



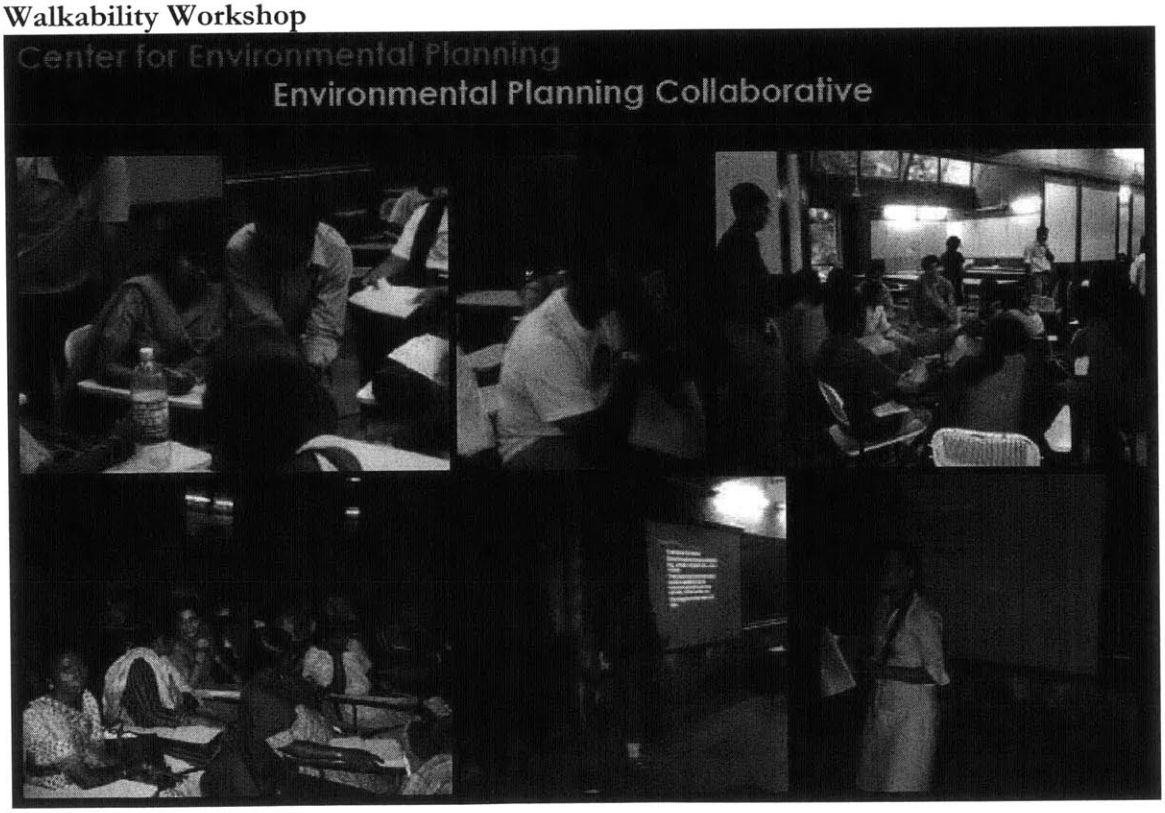
AHMEDABAD, INDIA: PILOT

Survey Volunteers from the Centre for Environmental Planning & Technology



AHMEDABAD, INDIA: PILOT

Walkability Workshop



AHMEDABAD, INDIA: PILOT

Investment Proposal Collaboration

Self-Employed Women's Association (SEWA)

- Information, data, and expertise related to vendor rights campaign
- Logistical support in turns of conducting additional surveys
- Advocacy and publicity support
- Review of final proposal

Environmental Planning Collaborative (EPC)

- Assurance that project complimentsroad improvement project
- Cost estimates for infrastructure proposal
- Review of final proposal

Center for Environmental Planning and Technology (CEPT)

- Organize and implement phases I and II of proposed project, under guidance of Prof. Swamy.

World Bank Intern (Holly Krambeck)

- Report on progress of project for Bank and thesis advisors
- Walkability Index results and analyses

AHMEDABAD, INDIA: PILOT
Article from the Times of India (4 September 2005; Page 3)

In A'bad, taking a walk can be torturous

'Walkability index' shows congested roads, no space for pedestrians

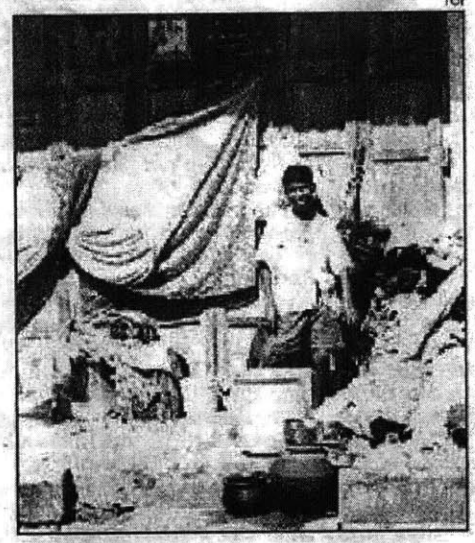
By Tina Parekh
TIMES NEWS NETWORK

Ahmedabad: Have you ever considered walking a 10-minute distance in the city? Don't be embarrassed if you haven't. Most areas have no footpaths, and on the ones which have, you would have to jostle for space with stray cattle and garbage!

To know exactly how much the city lacks in terms of walking spaces, a student of Massachusetts Institute of Technology (MIT) Holly Krambeck interning with the World Bank is now determining its 'walkability index'.

"As a first step towards encouraging and helping cities improve their pedestrian infrastructure, the World Bank has developed a walkability index (WI), which would reveal not only which developing cities are doing a good job and which ones require significant improvements, but also identify specific actions cities can take to improve their pedestrian infrastructure, as well as related policies and services," Krambeck told TNN.

But why Ahmedabad? "The World Bank team has chosen to begin work in Ahmedabad, because there is a pending Bank-led urban development and upgrading project that will begin later this year, for which it may be possible to incorporate survey results as an investment component and because Ahmedabad planners and officials are unusually receptive to this kind of non-motorised travel advocacy," Krambeck explained.



TOI

Pavement-dwellers have encroached on pedestrian territory.

She is getting assistance from students of planning of Centre for Environmental Planning & Technology (Cept) University. Cept students divided themselves in nine teams. Among areas surveyed were CG Road, Kalupur, Bapunagar, Vastrapur, Bodakdev, Shahibaug and Vadaj where they examined physical infrastructure, interviewed pedestrians and civic bodies' officials.

On Saturday, a 'walkability workshop' was organised at Cept where students presented their survey findings and general pedestrian conditions and needs in the city discussed.

Most of them found that roads are congested, with non-existent parking area and pedestrian walkways or footpaths.

The footpaths have been badly damaged, with most of them occupied with garbage and cattle, deterring people from walking across them.

A student Karamchand Nanta, who surveyed Kalupur said, "The Relief Road is completed congested and so is the road outside the railway station. People told us they couldn't risk walking on these roads."

Those who surveyed upmarket Shahibaug too had the same story to tell. "Footpaths have become virtual dumpyards. There are no control on traffic movement," a student of the team said.

"The share of pedestrians in Indian cities, particularly in Ahmedabad, is very high. Although a significant number of trips are made by foot, pedestrian infrastructure, amenities and services are typically neglected in municipal planning," Krambeck said.

"Inadequate planning for pedestrians has many negative consequences, the most notable being unnecessary fatalities and injuries. In fact, pedestrians are victims of 70 per cent of traffic casualties in developing countries."

She will work out the index on the basis of various indicators after compiling the survey results.

CHICAGO, IL: FIELD TEST
Event Logo

CHICAGO, IL: FIELD TEST
Selected Survey Areas (pre-selected by Chicago Planning Commission)

CHICAGO, IL: FIELD TEST

Sample Survey Maps – Area #1 Harrison Street