



Need for Qualitative Evaluation Model for Existing Sidewalks of Roads in Indian Cities

KEYWORDS

Global Walkability Index, Pedestrians' Comfort Needs, Pedestrian level of Service, Qualitative Evaluation Methods

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ABSTRACT *Walking is one of the most sustainable forms of transport, cheap and contributing to safe and liveable environment. Eventually increase in vehicular traffic for faster connectivity has led to the widening of roads and subsequently degradation of walking environment. Urban sidewalks are the spaces provided for the pedestrians and their varied activities but are undervalued in terms of pedestrians' needs such as comfort, mobility, safety and convenience. The quantitative dimensions of sidewalk elements addressed in the Indian road standards are somehow implemented as per the guidelines mentioned. However qualitative dimensions of the pedestrian environment are neither assessed nor addressed in these national standards and lack the sidewalk evaluation tools and techniques as per the pedestrians' needs. Thus there is need to develop the qualitative evaluation model for assessing the sidewalk elements and facilities as per pedestrians' comfort needs which this paper aims at. This evaluation tool will not only help in assessing the pedestrian level of service in terms of sidewalk walkability indices but also serve as pioneer model for identifying the existing sidewalk issues which will help the local government in formulating the design standards, policies and the implementation strategies to improve the sidewalk walkability index and generate pedestrian responsive street environment.*

I. INTRODUCTION

The act of walking is most reliant and predominant activity, its dominance dating back to early civilizations. Streets, throughout history have been a place for pedestrian mobility, community gatherings, processions, identity of expressions, and place for protest and shelter for the homeless and so on. Decade after decade as the settlements eventually were exposed to rapid urbanization, the definition of street life underwent transformation. Large scale industrialization led to the increase in vehicular traffic, the mode of walking being shifted to the background and has become the most neglected in current urban scenario. Streets today are merely treated as vehicular conduits than pedestrian corridors. These vehicle dominated streets have led to the evolution of concept of sidewalks as a space for pedestrians' movement and are originally a western invention.

1.1 BACKGROUND

The first sidewalk was said to have been built in Pompeii in 200 B.C. However, the earliest written laws regarding street design dated back to 100 B.C. wherein Roman street width was fixed at a minimum of 4.5 m and had elevated sidewalks on both sides. This became the prototype for modern street design in Europe until the late 18th century. These standards were eventually adopted in the United States, Europe and Asia. The U.S. Department of Transportation developed Federal Highway Administration Road standards fifty years ago and became the guiding principle in the design of sidewalks. Over the time, western governments have mechanically adopted these standards out of fear of liability thereby undermining the quality of life in American communities. [1]

Today with the advent of motor vehicle and fast speeding life dominating the Indian streets, development of sidewalks and pedestrians' needs have been shredded off in the background. The reinstating of sidewalks to encourage pedestrian life and provide them with comfortable and pleasant walking environment is today's urgent need of Indian cities, mostly the commercial streets, where multipurpose activities and varied users dominate the area.

Eventually the uncontrollable vehicular growth on city roads has given rise to the various issues related to the sidewalks

and pedestrian infrastructure facilities. Such issues need to be evaluated for assessing the quality of the sidewalks. Also the pedestrians' comfort such as convenience, safety, security, accessibility etc. is the most basic concern which needs to be addressed. Currently there are various qualitative and quantitative evaluation methods of street sidewalks developed by western countries as per their contextual requirements so as to create pleasant walking environment. However Indian government is lacking such evaluation tools for Indian streets and needs to develop an evaluation method for qualitative assessment of the street environment. This will allow the city planners to effectively assess the pedestrian environment qualitatively as well as quantitatively, identify lacunas and suggest and prioritize the improvements in pedestrian infrastructure facilities. Hence this paper attempts to put forth the issues and lacunas at government policy level and pedestrian infrastructure planning level, which emphasize the need for formulation of qualitative evaluation model for sidewalks in any Indian city. It also discusses the walkability measurements and evaluation methods adopted in the western countries as well as the in Indian context and their pros and cons.

II. EVALUATION METHODS OF WALKABILITY IN WESTERN COUNTRIES

In foreign countries such as USA, New Zealand, Australia a significant amount of research related to the quantitative and qualitative evaluation of sidewalks and experiments to create 'Ideal' Pedestrian environment has been conducted and issues related to pedestrian behavior, pedestrian quality needs, pedestrian amenities and facility design etc. have been addressed in these methods. Diverse Walkability audit tools such as 'Pedestrian Environment Quality Index', 'Pedestrian Level of Service Standards' are developed and applied by these nations with regards to their city context to assess pedestrian facilities and identify specific improvements that would make routes more attractive and comfortable to pedestrians. Some of the evaluation methods are discussed below.

The origin of evaluation method dates back to the concept of 'Pedestrian Level of Service Standards' (PLOS) first introduced by John Fruin [2] which is an observation tool focusing

on 'Sidewalk Capacity'. It measured the adequacy of pedestrian facilities during peak periods, speed-density relationships, personal body shape and dimensions, and combined quantitative-qualitative approach for evaluating sidewalks.

Later in 1974, Lautso and Murole [3] attempted this PLOS study to find out the influence of environmental factors on pedestrian facilities.

This concept of PLOS was later incorporated in Highway Capacity Manual (HCM) [4] in 1985 for quantifying sidewalk capacity which recommended that environmental factors contributing to the walking experience such as comfort, convenience, safety, security, and attractiveness, should also be considered. HCM (2000), later became one of the most influential manual in the development of transport facility design guidelines in different countries. It developed six Pedestrian Levels of Service (LOS) from LOS 'A' to LOS 'F' where in LOS 'A' indicates free flow condition and LOS 'F' indicates a stand-still condition of pedestrian flow.

In 1993 Sarkar [5] proposed a qualitative method to compute pedestrian LOS based on six factors: safety, security, convenience and comfort, continuity, system coherence, and attractiveness. Qualitative attributes of pedestrian environments are described, but not quantified, in Sarkar's work. Since it is a qualitative method, the measurement of each factor is not easy in reality and also most of the factors are linked with each other. [6]

Khisty [7] developed a quantitative method to determine the pedestrian LOS based on almost same criteria proposed by Sarkar. Although Khisty's method provides a quantitative measure of pedestrian LOS on a point scale, the results from this scale is not easy to interpret. A fundamental question remains as whether these scaling systems really address the pedestrian facilities, i.e. do pedestrians agree with these scaling systems. [6]

Another popular method developed by Holly Krambeck of World Bank in 2008 was the 'Global Walkability Index' (GWI) [8] to facilitate the comparison of walkability scenario of different cities in Asian countries, the basic objective being to raise awareness about deteriorating walkability conditions and promote better air quality and liveable cities. It facilitated in measuring and analysing eleven factors of walkability: availability of crossings, pedestrian count, and length of surveyed stretch, obstructions, maintenance and cleanliness, amenities, disability infrastructure, sidewalk width, motorist behaviour, walking path modal conflict, security from crime, and crossing safely. The Clean Air Initiative for Asian Cities Centre (CAI-Asia) [9], established by the Asian Development Bank, World Bank, and the United States conducted pilot walkability survey using GWI method in nine Asian countries including India.

However The GWI had three significant limitations [9]: 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, and their simplicity results in a less-robust Index, which may diminish its usefulness as a tool for investment and policy reform. 4) Further, the issue of weights could be highly contentious. [10]

Later in 2008, The San Francisco Department of Public Health [11] developed Pedestrian Environment Quality Index (PEQI), a quantitative observation tool to prioritize improvements in pedestrian infrastructure during the planning process. It facilitated in quantifying street and intersection factors empirically known to affect people's travel behaviors and was categorized into five components: intersection safety, traffic, street design, land use and perceived safety with their indica-

tors reflecting the quality of street environment.

Another system developed was the Scottish Walkability Assessment Tool (SWAT). This method covered three main themes [12]: Functional safety, aesthetic, and destination. Under each theme are elements and items such as type of path, pedestrian signage, and directness of path, type of pedestrian crossings, crossing aids, driveway crossovers, and many more are measured.

In 2010, the latest development in the pedestrian environment analysis method is Pedestrian Environment Review System (PERS), [13] a walkability audit tool developed by Transport Research Laboratory, London for assessing and rating street environments quantitatively as well as qualitatively and identifying improvement measures for the pedestrians. They deal with the six distinct elements: crossings, public transport, waiting areas, public spaces, interchange spaces between different modes of transport and links such as footways, footbridges and subways.

III. PROS AND CONS OF THESE WESTERN METHODS:

All the above mentioned different methods and tools of assessing PLOS are very simple and appealing to many municipalities and local planning authority from data collection point of view and their assessment. [14] Secondly, the standardization of the pedestrian LOS that assesses flow, movement and capacity characteristics in the HCM allows planners and decision-makers to utilize pre-developed ways of assessing data and allows for easy comparison of LOS ratings from a certain place and time and other location [15]. All these are widely applied in foreign countries, with their application unknown to Asian countries and unsuitable for their context. 'Global Walkability Index' is the only method devised to suit the Asian scenario.

Although this method is simple and easily utilized, not all the parameters of sidewalk elements regarding the measurement of the environmental factors for assessing pedestrian facilities are mentioned and lack qualitative aspect. Even so, this method devised was useful in monitoring and comparing the performance of such facilities as well as allocating the budget for changes and improvements in pedestrian amenities.

By following these methods, PLOS framework used, only reinforces the plans, policies and strategies of sidewalk planning and helps the planning authorities to build up such sidewalks but these do not address the pedestrians' comfort needs such as safety, security, climatic protection and do not favour walking as a mode of transportation. These PLOS framework does not take into account pedestrian amenities such as street furniture elements, signages, street facades and landscape environment which influence the pedestrians' needs and their walking environment. Also these methods lack the tool of defining how walkable an environment is from pedestrians' perspective.

A complete shift in the focus of thinking about the pedestrian environment from quantitative to qualitative is required on the part of municipalities and planning authorities to develop and use more accurate and appropriate LOS measurements. Global Walkability Index method applied in Asian cities is the only method which has taken into account the pedestrians' comfort needs in terms of security from crime, vehicular safety and pedestrian amenities and facilities. However this method is too subjective and has a tendency to have biased observations and results.

IV. WALKABILITY SURVEY METHODS AND PEDESTRIAN INFRASTRUCTURE PLANNING SCENARIO IN INDIAN CITIES

The Clean Air Initiative for Asian Cities Centre(CAI-Asia) in 2011 [16] conducted walkability survey of sidewalks in six Indian cities- Pune, Chennai, Bhubaneswar, Rajkot, Indore and

Surat based on GWI method and derived walkability indices of streets in respective cities, the basic objective being to understand the current state of walkability and its improvement needed by identifying key strengths and weaknesses and areas for improvement. However In this survey large variation was found in quality of pedestrian infrastructure in Indian cities and these indices were very less robust.

Another recent benchmarking tool developed by Ministry of Urban development of India [17] used three indicators to calculate pedestrian facility rating- signalized intersection delays/ pedestrians, street lighting and percentage of city covered with footpaths more than 1.2 m wide. These indicators are incomprehensive and do not include parameters to measure the quality of pedestrian environment.

Discussing about the existing standards for pedestrian facilities, Indian Road Congress guidelines has limited provisions for pedestrian needs and the sidewalk capacity and footpath height are the only two physical characteristics addressed. Guidelines addressing the pedestrian amenities and facilities are not mentioned in this and lack comprehensiveness to make complete walkable streets. The government bodies of various foreign countries such as Transportation Research Board, London, U.S. Department of Transportation and Federal Highway Administration, American Association Of State Highway And Transportation Officials, New Zealand Transportation Agency have designed the manuals and user guides providing information regarding guidelines for pedestrian facilities, pedestrian crashes and their countermeasures, engineering improvements, and appropriate methods for accommodating pedestrians to make the street environment walkable. However Indian Road Congress Guidelines lack qualitative evaluation methods of pedestrian infrastructure.

IV. GOVERNMENT AND NON-GOVERNMENT INSTITUTIONAL POLICIES AND STRATEGIES AND THEIR BARRIERS

Ministry of Urban Development (MoUD) of India [17] has formulated The National Urban Transport Policy (NUTP) in 2006 to transform the current urban transport system into a safe, convenient and efficient transportation across all urban areas in India. At the same time large amount of funds are made available for urban infrastructure and their improvement under Jawaharlal Urban Renewal Mission (JNNURM) by the Central Government. Provision of Pedestrian facilities such as footpaths, pedestrian zones and crossing facilities is planned to be done at State and Urban level. However the State government and urban local bodies have not used these opportunities under JNNURM and their initiative has not yielded constructive results. Also non-motorised transport (NMT) management has been allotted only 4% of the total urban transport investment by the Central government which is inadequate. More investments and funds are required to prevent the decline of NMT modes.

Also City Development Plans (CDP) are prepared for more than million population cities covered under JNNURM to identify the infrastructure projects for planning and development of comprehensive vision for the city. However these plans do not discuss about the liveable cities and improved walkability, of which the basic requirements are accessibility, healthy safe and green environment, sufficient public spaces for recreation and security. Hence new CDPs have not considered priority pedestrian mobility as visualised by NUTP. From the initiatives achieved as mentioned in CDPs it is clear that cities are not doing enough to rejuvenate the pedestrian space and improving walking facilities. [17]

Also Comprehensive Mobility Plans (CMP) are prepared by various Indian cities that focus on mobility of people rather than vehicles and accordingly given priority to pedestrians, NMT, all modes of public transport and IPT.

Additionally In India, there exist three main institutions- Pune Non- motorized Transport Cell, Urban metropolitan transport Authority in Guwahati, and Unified Traffic and Transportation Infrastructure Planning and Education Centre (UTTIPEC) set up by Delhi Development authority to make Indian cities walkable, safeguard pedestrians' interest and provide them with amenities and facilities. UTTIPEC has developed progressive pedestrian design guidelines in 2009 as an alternative to existing Indian Road Congress Guidelines to improve walkability ratings of Indian streets. [16]

Recently in 2011, Environmental Planning Collaborative and Institute for Transportation and Development Policy (ITDP) [18] designed a manual 'Better Streets Better Cities' a guide to street design in Urban India which aimed to facilitate the design of beautiful, safe, walkable, and liveable streets. The manual identified the different functions of streets and emphasized the need to design complete streets and put forth design criteria and standards for all street elements for improving the quality of the street environment in Indian cities.

However all these guidelines and policies neither mention the pedestrian environment evaluation method nor does it discuss the parameters of spatial quality of the street environment and their performance indicators. Also there is lack of pedestrian policy and political support that cater to the needs of pedestrians at local, state and national level.

Only few cities such as Bangalore have pedestrian master plan. Also there is serious disconnect between existing transport plans and walkability. Current city mobility plans emphasize on high cost transport project while pedestrian facilities are not included as infrastructure as mentioned by Planning Commission. In the recent analysis conducted on walkability in twenty Indian cities by Clean air Initiative, only Ten Indian Cities have some provisions for pedestrians in long term plan. [16]

Thus the main weakness is the lack of relevant policies and political support at the state and local level that need to cater to the pedestrians' needs. The national policies and guidelines put forth are generic and disregard the quality aspect of the street environment. Pedestrians' needs are not assessed in detail and are neglected during formulation of sidewalk design guidelines, the main reason being lack of evaluation methods from pedestrian point of view. Currently walkability audit tools for Indian streets are lacking. Though audit tools are developed in western countries, they are not well suited to Indian settings and there is need to develop a new audit tool to assess the pedestrian amenities and facilities that affect walking for transportation and recreation on existing Indian streets.

The sidewalk evaluation methods applied in Indian cities indicate that a more comprehensive walkability survey is required and should encompass micro level qualitative analysis of the pedestrian environment and can be objectively measured. With the identification of contextual performance indicators and constructs, an appropriate method that can be used and replicated by other studies needs to be developed. This will help further studies to use a standardized method of measuring the qualitative and quantitative indicators of the sidewalks and build on the existing measures using improved technology that can be universally applied in any cities with certain alterations and modifications. Thus walkability study should attempt to derive performance indicators for qualitative measurement of pedestrian environment variables that can be contextually applied in any city.

V. SIGNIFICANCE OF WALKABILITY AUDIT TOOLS IN INDIAN CONTEXT

The walkability audit tools in India can be used to make the local government bodies and policy makers aware of the lacunas in pedestrian amenities and facilities on Indian streets and how their decisions affect or influence the pedestrian

environment quantitatively in terms of physical dimensions of sidewalk, qualitatively in terms of safety, comfort, convenience and attractiveness and also in monetary terms. It will also provide information on the present pedestrian infrastructure in any Indian cities and can be used to develop pedestrian-oriented policies and budgetary allocation for pedestrian facilities and help them to improve walking environment in cities.

VI. CONCLUSIONS

There appears to be government's perception that walking does not constitute a mode of travel, hence does not need any planning. The sidewalks are often considered as part of road furniture and always planned as a secondary element. There is a tendency of the local authority to underestimate the pedestrian infrastructure needs when compared to the needs of the motorists. This is one of the major drawbacks on the part of governments' responsibility.

The quantitative aspect regarding the physical dimension of sidewalks is partially fulfilled by guidelines put forth by Indian Road Congress. However they lack the quantitative as well as the qualitative guidelines regarding pedestrian infrastructure facilities. In some of the city sidewalks, though the pedestrian facilities and amenities such as street furniture, street lighting etc. are provided, they lack aesthetic and visual quality. The qualitative evaluation method of the street sidewalks and pedestrian infrastructure facilities is not addressed in any of the guidelines and policies. There is the need to develop qualitative evaluation method which will not only help the local government authorities to assess the prevailing side-

walk conditions but also derive the pedestrian level of service provided by the sidewalks as per pedestrians' comfort needs. This evaluation method will also serve as base model for assessing and addressing urgent pedestrians' needs and proposing the implementation strategy as per the budgetary provisions.

Various foreign countries have developed evaluation methods such as PERS, PLOS, GWI etc. for the assessment of pedestrian environment in their cities. With the help of NGO's such as 'CAI- Asia Centre', walkability ratings for Pedestrian facilities and environment have been derived and analysed using GWI method, modifying it to suit the Indian context.

However there are multiple variables defining the spatial quality of the street environment whose performance indicators have not been measured to monitor existing pedestrian facilities, their quality and quantify it. The Global Walkability Index technique applied in India is incomprehensive to address pedestrians' needs quantitatively as well as qualitatively and does not address all sidewalk elements and rate the walkability scenario inconsistently. The pedestrian facilities are provided for the sake of applying the byelaws designed by the government planning bodies which are also majorly inadequate. Hence there is urgent need to develop a more accurate and pedestrian sensitive evaluation tool that would incorporate the various micro-scale sidewalk factors analyzing the walking environment qualitatively. This will not only serve as an advanced tool to Global Walkability Index method but will also be precise, valid and reliable for analyzing walkability of the Indian sidewalks.

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