P: ISSN NO.: 2394-0344 RNI No.UPBIL/2016/67980 VOL-3* ISSUE-9*(Part-2) December- 2018
E: ISSN NO.: 2455-0817 *Remarking An Analisation*

Policy for Safe Built-up Environment for Pedestrians - A Review

Pankaj Prajapati
Associate Professor,
Deptt. of Civil Engineering,
Faculty of Technology & Engineering,
The Maharaja Sayajirao University of Baroda,
Vadodara, Gujrat, India

Kishan P. Savaliya
Assistant Professor,
Marwadi University,
Rajkot, Gujrat, India

Abstract

Present motorization and urbanization in Indian cities demands for an effective and efficient mass transit system such as road based Bus Rapid Transportation System and rail based Metro system to neutralize traffic congestion problem. However, mass transport systems have been planned and implemented excluding proper road edge infrastructure which has thrown a challenge to the planners and decision makers in favor of conversion of motorized cities to walkable cities. Walking is a socially equitable mode which provides a foundation for a sustainable transportation and most accessible to the masses. Planning and designing for walking is crucial because automobile dependency has degraded the pedestrian environment.

Review of this paper is based on study of developing cities such as GIFT city (West India), New Delhi (Central India), Siliguri (East India), Chennai (South India), Kuala Lumpur (Malaysia) and developed cities like Romanian cities (Italy). The aim of this paper is to suggest policies for Safe Built-up Environment for Pedestrians. In this paper, different issues addressed are; walkability, how it is measured and benefits of walkability and what makes road users to use street has been discussed. Further, People's perception about urban walking environment, behavior of pedestrian in various built-up environments, planning for pedestrians and the negative effects of planning only for personal motorized mobility, a phenomenon currently taking place in Romanian cities is also discussed.

This paper suggests policies which enhance walkability and fulfill criteria for safe built-up environment for pedestrians. Results of these studies suggest short-term and long-term policies such as retrofitting and redeveloping of infrastructure by providing separate motorized and non- motorized lane, proper co-ordination between different modes of transportation system, planning of infrastructure by using Transit Oriented Development approach to meet growing demands of habitat and infrastructure.

Keywords: Built-Up Environment, Walkability, Pedestrian and Transportation Planning.

Introduction

As per annual report published by MoRTH in year 2016-17, Total numbers of registered motor vehicles in India increased from 67 million (2003) to 210 million (2015) given in Table 1.

Aim of the Study

The aim of this paper is to suggest policies for Safe Built-up Environment for Pedestrians. In this paper, different issues addressed are; walkability, how it is measured and benefits of walkability and what makes road users to use street has been discussed.

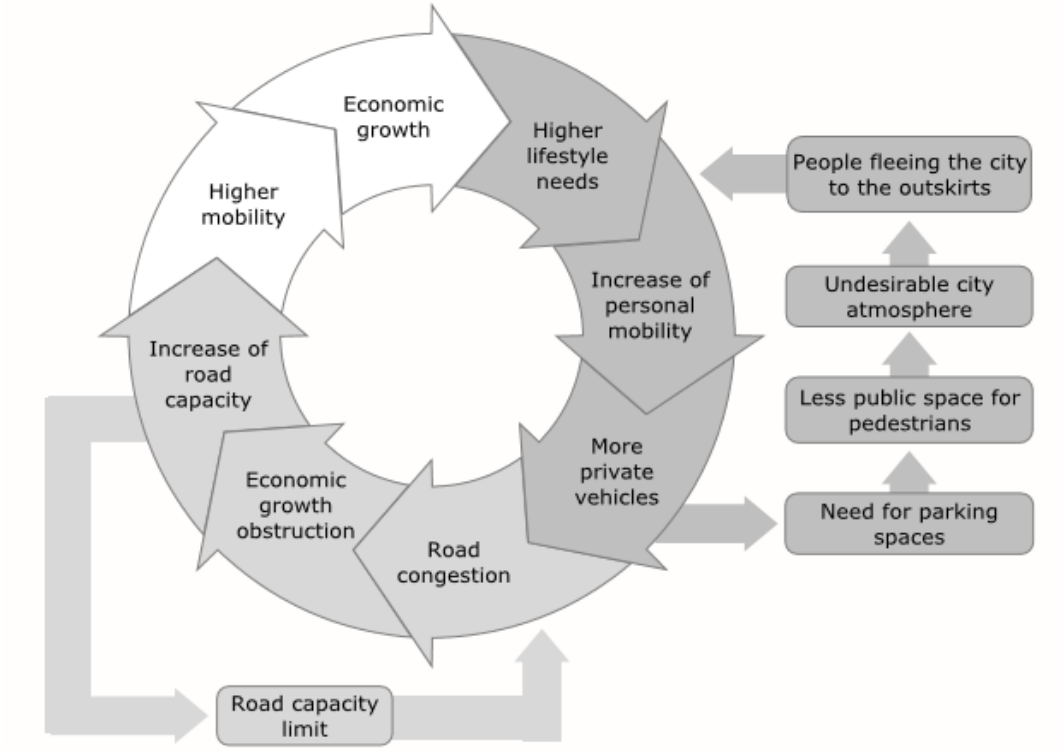
Table 1: Total Number of Registered Motor Vehicles (In Lakhs) In India from Year 2003 – 2015

Year (As on 31st March)	All Vehicles	Two Wheelers	Cars, Jeeps & Taxis	Buses@	Goods Vehicles	Others*
2003	670.07	475.19	85.99	7.21	34.92	66.76
2004	727.18	519.22	94.51	7.68	37.49	68.28
2005	814.99	587.99	103.20	8.92	40.31	74.57
2006	896.18	647.43	115.26	9.92	44.36	79.21
2007	967.07	691.29	126.49	13.50	51.19	84.60
2008	1,053.53	753.36	139.50	14.27	56.01	90.39
2009	1,149.51	824.02	153.13	14.86	60.41	97.10
2010	1,277.46	915.98	171.09	15.27	64.32	110.80
2011	1,418.66	1,018.65	192.31	16.04	70.64	121.02
2012	1,594.91	1,154.19	215.68	16.77	76.58	131.69
2013	1,760.44	1,278.30	240.56	18.14	83.07	140.37
2014	1,907.04	1,394.10	259.98	18.87	86.98	147.12
2015	2,100.23	1,542.98	286.11	19.71	93.44	157.99

*Includes tractors, trailers, three wheelers (passenger vehicles)/LMVs and other miscellaneous vehicles which are not separately classified.
@ Includes Omni buses.

(**Source:** MoRTH, Annual Report 2016-17)

Figure 1: Adverse Effect of Traffic Congestion Generated Due To High Vehicular Ownership



(**Source:** Tudor Morar 2013)

This rapid growth of vehicles in India put tremendous pressure in transportation facilities to counteract traffic congestion problem. Adverse effect of traffic congestion generated due to high vehicular ownership can be understood by the cycle given in Figure 1.

As private vehicle ownership increases, mass transit system such as Bus Rapid Transit System and Metro should be introduced with effective and efficient and effective transportation planning and urban design for safe built-up environment. However, the concerned authorities in charge of transport projects arbitrarily decide to pick and choose the

components of a project and completely neglect the proper infrastructure provision for designing of the road edges during project implementation (Abhijit Datey, 2012). Therefore, walking can be considered as a paramount mode of transportation for sustainable development of urban area. Figure 1 clearly indicates that high vehicular ownership also demands safe built-up environment for both motorized and non-motorized transportation mode. Safe built-up environment means pedestrian-friendly roads that have sidewalks, zebra crossings, pavements and footpaths enhance the walking experience and encourage physical activity. In addition, pedestrian-friendly roads also lead to an increased sense of neighborhood safety.

Walkability: Aspects, Measures and Benefits

As walkability provides a foundation for a sustainable city. Dibyendu Bhattacharyya (2013) in his study analyzed aspects and measures of walkability and issues related with it for a city having streets almost chocked with mix traffic. The aspects that are to be considered while planning for walkable city are effectiveness, limitation and constraints. The effectiveness of walkability is usually linked with socio-economic, environmental and psychological issues. To promote walkable environment in cities, a few limitations and constraints must be kept in consideration. The average speed of a physically fit adult is 4-6 km /hour and the maximum average distance of walking is observed as 500 m. The walking speed usually is reduced in change of elevation in roads. The propensity for walking is reduced considerably by adverse weather. There will be difference in preference of walking, if the commuters carry considerable luggage.

Dibyendu Bhattacharyya (2013) also enlisted five basic parameters to measure walkability as:

1. Connectivity of path network, both locally and in the larger urban setting.
2. Linkages with other modes, bus, streetcar, trains, etc.
3. Fine grained and varied land use patterns.
4. Safety both from exposure to traffic and personal security.
5. Quality of path, including width, paving, landscaping, signage and lighting.

He concluded in his study that “To achieve sustainability, needs of the pedestrians should be addressed properly to reduce dependence on personal motor vehicles. Redesigning of existing arterial and sub-arterial roads to create segregated public transport lane, separate motorized & non-motorized lane, wide footpath and spaces for vendors will benefit all road users which ultimately increase capacity (passengers/hr/lane) of road sections.

Walkability is a concept and it may not be realized till the system is designed. Park S. (2008) in his thesis identified 52 walkability indicators divided into 7 broad segments (i) curb-to-curb roadways (ii) pedestrian crossings (iii) buffer zones (iv) sidewalks (v) sidewalk facilities (vi) street scale and enclosure and (vii) nearby buildings and properties.

The benefits of walking can be discussed from three perspectives: economic benefits, social benefits and environmental benefits (Todd Litman 2004). From the economic perspective, walking can improve accessibilities especially for the non-drivers, hence reducing the transportation cost. In term of social benefits, walking can increase neighbourhood interaction and community cohesion. It also improves the opportunity to preserve cultural resources and preserve the aesthetic of an area. Likewise, walking can be beneficial to the environment by reducing the use of land for roads and parking facilities and reducing energy consumption and pollutions.

What Make People Use the Streets

Streets are an important component of the urban form and the most public of the urban spaces in the city. The street environment is examined by Norhafizah Rahman (2015) in respect of the physical qualities through the analysis of questionnaire surveys, interviews and observations of the users’ activities and physical environment of the street.

Norhafizah Rahman (2015) determined the design criteria of a livable street and listed five main factors that make people used the street namely attractions on the street, activities on street, commute distance (proximity), congestion and Familiarity and length of engagement with respect to supportive factors (public space, greener/trees, public amenities, maintenance and cleanliness and freedom of actions). This factors that need to be considered in future guidelines and policies for planning and design in urban spaces especially streets to create a friendly street environment for the users.

Diyanah Azmi (2012) gives recommendation for increasing walkability toward a sustainable urban neighborhood as:

1. Provision of pedestrian walkways with minimum size of at least 10 feet wide.
2. Provide free barrier design of walkways.
3. Provide more shaded elements and shady trees at pedestrian walkways.
4. Community facilities within neighborhoods should be clustered at the center so it gives comfort and accessible to people.
5. Consider green elements in designing neighborhoods area towards sustainability.
6. Provide beautiful green network with good connectivity between community facilities and spaces.

People’s Perception about Urban Walking Environment

Raja Ariffin (2013) examined the characteristics or attributes that could promote walking activity via people’s perception and conducted questionnaire survey and walkability audit to gauge perception of the urban walking environment. Questionnaire survey and walkability audit include attributes like frequency of walking, proximity, crime issues, weathering condition, motorized users’ behavior, pedestrian facilities, lighting facilities and crossing facilities for pedestrian to examine the influence of built-up environment characteristics, on people perceptions of urban walking environment. Findings indicate that the proximity of destinations, good weather condition, well-designed pedestrian facilities which promote crime prevention and safety

can significantly contribute to better perceptions of the walking environment.

Behavior of Pedestrian in Various Built-Up Environments

Richa Singh (2016) analyzed the walking behavior of pedestrians in a variety of urban built-up environment. A qualitative method is used for the collection of data relating to walking behaviour through an observational site study. The questions were structured in a way that they hinted on obtaining the level to which a persons' decision to be in a particular street, at a particular point of time was affected by the built-up environment as shown in Table – 2 below:

Table 2: Factors considered knowing pedestrian behaviour in various built-up environments

Factor	Purpose
Street width to building height ratio	Indicates the comfort level of people while on that street.
Block length	Indicates the perceived length of a particular street/corridor.
Scale and variety	Indicates the perceived scale of the street.
Detractors	Indicates the perception of safety on that particular street in the minds of the population
Softness	Indicates transparency and transitional space provided by the buildings on the street.
Entries	Indicates the connectivity of the street to the buildings of either side.
Visual complexity	Indicates the amount of variety in the streetscape. Thus implying the degree of interest of people in the street.

(**Source**: Richa Singh, 2016)

Richa Singh (2016) founded in his study that, Optimum enclosure provided pedestrians with a sense of safety which made them stay longer on the street. Smaller block length of the built led to reducing the perceived walking distances thus making these streets look shorter and more frequently used. Also, the Edge condition on these streets was crucial to their walkability. The traditional streets having multiple building entrances saw some kind of informal activity happening on the street throughout the day. Such activity enhanced the walkability on these streets, inviting more and more people to take these routes. On the other hand the streets of the newer development fall short of these aspects thus reducing the public activity on them. The buildings surrounding them are not able to generate any sense of enclosure that can make pedestrians stay longer in that corridor.

Planning for Pedestrians

In transport planning practice, there are three main ways of dealing with traffic congestion, namely improving public transport, planning for cycling and planning for walking (Tudor Morar 2013). He also suggested planning for access to daily facilities based on accessibility as shown in Table 3.

Table 3: Maximum Accessibility Distance for Daily Facilitates

Facility	Maximum accessible distance (m)
Neighborhood public space	800
Local food shop	250
Neighborhood scale food shop	500
Bus stop	400
School	800
Playground	200
Railway station	800
Residential green	150
Neighborhood green (1ha)	400
Quarter green (1-5ha)	800
District green (5-10ha)	1600
Health clinic	3200

(**Source:** Tudor Morar 2013)

However, maximum accessible distance as mentioned in Table 3 may varies as per earlier settlement and existing condition of facilities in urban area especially for developing countries such as India. Transportation Planning Aspects of a Smart City is elaborated by D. Reddy (2016) for a case study GIFT City (Gujarat International Finance Tec-City). GIFT City is being developed as a high quality commercial zone along with an ideal blend of residential and social facilities that optimize land and real estate values with global connectivity and generation next infrastructure. GIFT City transport master plan aims at a Transit Oriented Development (TOD) based on walk to work approach, pedestrian friendly infrastructure with zero fatal accidents, easy and fast mobility with minimum conflicts and efficient public transport systems which reduce the per capita energy basket. The transport infrastructure has been planned to cater to the daily demand as well as that of the peak hour and Multi Level Parking (MLP) lots have been proposed at suitable locations in the GIFT city.

Aspects for transportation planning of GIFT City (D. Reddy 2016) includes Travel demand estimation (Daily trips, Peak hour trips, Modal split public Vs private), public transport, external as well as internal connectivity, pedestrian facilities for walkability influence area, streets cap, signage system and parking philosophy (Multi level parking, Parking guidance systems, Parking management system).

An effective transportation planning can improve transport outcomes such as transport safety,

transport productivity, travel reliability, informed travel choices, environmental performance and network operation resilience. However, poor transportation planning can leads to impact negatively on all aspects of transport outcomes. Tudor Morar (2012) discussed the negative effects of planning for personal motorized mobility, a phenomenon currently taking place in Romanian cities.

Taking a closer look at Romanian cities, we encounter most of the elements shown in Fig. 1, starting with the economic growth and ending with the Romanian capital city of Bucharest investing hundreds of thousands of Euros into road infrastructure because of the constant growth of private vehicles and the risk of permanent traffic jams. Due to traffic jams, Local authority in Romania decided to removal of green space and pedestrian space for mobility and space for parking which leads to unsafe built-up environment for city. The same goes for the other main Romanian cities, but on a lower scale compared to Bucharest, considering the lesser economic development and population number. (Refer: Tudor Morar 2012)

Policy for Safe built-up environment for pedestrians

As walking is paramount mode of transpiration for sustainable and safe built-up environment, while framing guidelines and future policy for safe built-up environment of urban area pedestrian facilities should be at higher priority. Here policy is divided into two categories for short term and long term policies.

Short Term Policies

1. Existing urban area should be retrofitted and redeveloped by providing separate motorized and non- motorized lane which leads to minimize conflict between motorized and non-motorized.
2. As road edge design and facilities is ignored in most of case, more emphasize should be given to them by providing minimum footpath width 3.5 meter feet having three zones (1) shopkeeper zone (2) Pedestrian zone and (3) Tree and plantation zone
3. Improve frequency of public transit system to provide co-ordination between pedestrians and other modes of transportation which enhance mode share of public transit
4. To enhance walkability, public transit stop should be provide at place where more restaurants and shopping centers because people choose that route where basic needs are available.

Long Term Policies

1. In order to provide a secure environment, to optimize natural surveillance such as street light, presence of vendors/Hawkers, mix land use etc., and to optimize mode split ratio, Transit Oriented Development (TOD) approach should be adopted while framing transportation planning for safe pedestrian environment.
2. TOD approach provides good connectivity of road network especially for Non-motorized modes of transportation.
3. To improve safe built-up environment for pedestrian in case of newly developing urban areas, new transit facilities should be provided by considering maximum acceptable distance for pedestrian is 500 m or 10 min of walking
4. TOD approach also includes, proximity of daily facilities within accessible distance for all commuters to reduce mode share of private sector.

References

Abhijit Datey 2012, "Walking and Cycling in Indian Cities: A Struggle for Reclaiming Road Edge", Working paper 18, Centre for Urban Equity, CEPT University, November 2012

D Srinivasa Reddy, K V Ganesh Babu, and D L N Murthy 2016, "Transportation Planning Aspects of a Smart City- Case Study of GIFT City, Gujarat", 11th Transportation Planning and Implementation Methodologies for Developing Countries, TPMDC 2014, 10-12 December 2014, Mumbai, India, Transportation Research Procedia 17 (2016) 134 – 144

DibyenduBikash Bhattacharyya and SoumenMitra 2013, "Making Siliguri a walkable city", 13th COTA International Conference of Transportation Professionals (CICTP 2013), Procedia - Social and Behavioral Sciences 96 (2013) 2737 – 2744

DiyanahInaniAzmi and Hafazah Abdul Karim 2012, "Implications of Walkability towards Promoting Sustainable Urban Neighbourhood", ASEAN Conference on Environment-BehaviourStudies,Bangkok, Thailand, 16-18 July 2012, Procedia - Social and Behavioral Sciences 50 (2012) 204 – 213

MoRTH, Annual report 2016-17, appendix 14, Ministry of Road Transport and Highways (MoRTH), New- Delhi, http://morth.nic.in/showfile.asp?lid=2631

Norhafizah Abdul Rahman, Shuhana Shamsuddin, andIzham Ghani 2015, "What Makes People Use the Street?: Towards a liveable urban environment in Kuala Lumpur city centre", Asian Conference on Environment-BehaviourStudies,Chung-Ang University, Seoul, S. Korea, 25-27 August 2014"Environmental Settings in the Era of Urban Regeneration" ,Procedia - Social and Behavioral Sciences 170 (2015) 624 – 632

Park S. (2008). Defining, "Measuring and Evaluating Path Walkability and Testing its Impacts on Transit Users' Mode Choice and Walking Distance to the Station", A Doctoral Research submitted to University of California, Berkeley, 2008

Raja Noriza Raja Ariffin and RustamKhairiZahari 2013, "Perceptions of the Urban Walking Environments", Asia Pacific International Conference on Environment-Behaviour Studies University of Westminster, London, UK, 4-6 September 2013, Procedia - Social and Behavioral Sciences 105 (2013) 589 – 597

Richa Singh 2016, "Factors affecting walkability of neighborhoods", Urban Planning and Architecture Design for Sustainable Development, UPADSD 14- 16 October 2015, Procedia - Social and Behavioral Sciences 216 (2016) 643 – 654

Todd Litman 2004, "Economic Value of Walkability", World Transport Policy and Practice, 10(1), 5-14.

Tudor Morar and Luca Bertolini, 2013, "Planning for Pedestrian: A Way Out of Traffic Congestion", Procedia - Social and Behavioral Sciences 81 (2013) 600 – 608