The Concept of Walkability as an Alternative form of Sustainable Urban Mobility Planning (SUMP)

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Abstract: *As in continuously the scenario of urban development in India we need to consider that there is also nonstop growth of the amalgamation of problems in transportation sector like the private vehicles, car ownership, congestion on roads, CO2 and GHG emissions, inappropriate land use integration, inappropriate walkways or pedestrian and cycle tracks, road accidents, infrastructure issues etc, in tier 1 and tier 2 cities of India. SUMP is a comprehensive approach to address all those issues and meet the mobility requirements of cities' employees and businesses (GmbH, 2019.). Having thus observed certain elements, the possibilities of walkability for food in the city are urgently needed to be identified. In this article, an attempt was made in order to find ways to turn Tier 1 and Tier 2 cities into a walking city where more people choose to travel as a first option for short trips and for longer journeys by walking and public transit rather than by using personal automated cars (Dibyendu Bikash Bhattacharyyaa, 2013). This paper has a few literature reviews to explain the idea of walking capability for developing SUMPs for Indian contexts and to complete all this literature core problems and challenges. This study shows the possibilities for movement and associated problems were studied and addressed, and there are plenty of ways for cities to move about. This paper provides some guidelines for SUMPs in the cities of India, Tier 1 and Tier 2.*

Keywords: walkable city; pedestrians; mobility solutions; sustainable transport; sustainable development; walk score indicator.

1. Introduction

A strategic and comprehensive approach to urban transport is sustainable urban mobility planning. The move towards urban mobility leads to increased connectivity and quality of life. A current standard for creative transport planning is the Sustainable Urban Mobility Planning. It aims to combine travel modes and fosters urban mobility in cities and regions. SUMPs help to achieve core mobility aims, including improved air quality, connectivity and mobility, increased road safety, reduced traffic noise, increased energy usage, and improved quality of life. SUMP helps in reducing the environmental effect, affected by transportation sector of cities and regions (GmbH, 2019).

The sustainable urban mobility planning may be a big factor. Foundations for a healthy town are Walkability. Walkability success is associated with socio-economic, environmental and psychiatric problems. The protection, safety and convenience of urban travellers, as well as the cleanliness and transparency of traffic by the reduction of road congestion, road emissions and automobile fuel costs and road deaths provide accessibility. Risks and lower mobility are the result of present motorsport and urban development in Indian cities, has placed the planners and decision-makers in a challenge to turn motorised towns and cities on the streets (Dibyendu Bikash Bhattacharyyaa, 2013).

Many Indian cities have recently been deadly caught in accelerated urban development and increased motorisation, which creates unmanageable pressures on urban traffic. Indigenous towns are built mostly for walking and cycling and have narrow roads characterised by a rapid organic growth, the travel situation has rapidly changed because of rapid motorization and expanded ownership of vehicles resulting in high congestion, increasing rates of emissions, fuel consumption, and in particular the death and injury from the lane. In order to arrest this situation, the NUTP stressed the need for more traffic mobility and an integrated infrastructure of public transit in order to achieve a safe basis in cities. The space for footpath movement is part of the principle of footpath (Dibyendu Bikash Bhattacharyyaa, 2013). (Frank L.D., 2007)

Defining Walkability
Walking ability, as developed, supports and fosters the community through the comfort of feet and protection, connects people to various destinations in a reasonable amount of time and effort and offers a visual appeal across the network (Southworth, 2005).

A highly walking atmosphere invites you to walk through a well-connected path network which gives people access to everyday places. It is secure and relaxed with simple road crossing for people of different ages and mobility. Spaces with street trees or other features of vegetation are appealing. Without disruption or risks, the pedestrian network connects well with other modes of transport including buses, minimisation of car dependency by rail or subway. It encourages walking for useful reasons such as shopping or working trips, as well as for fun, leisure and fitness (Southworth, 2005). For transport researchers and even for Indian governments, the importance of walkability is of great importance.

Walkability Concept
Due to low-quality urban spaces for pedestrians, the walkability term has become prominent. City level authorities have also overlooked that the roads have enormous capacity, not only for vehicles and parking spaces, but also for all the pedestrians, even though they use urban transport (Frank L.D., 2007). All urban residents should be open to pedestrian and bicycle models of human mobility (G., 2016). Walking is also linked to (healthy) aspects of quality of life and offers environmental and economic benefits (Frank L.D., 2007). In order to argue that a city is "walkable," four simple requirements need to be met: safety,

accessibility, appeal and comfort (J, 2012).

A modern ethos of mobility was promoted by the idea of walkability in towns, bringing numerous advantages such as (Southworth, 2005):

- Enhancing road safety - Reducing the environmental impact and reducing air, traffic, noise and vibrating air emissions.
- Enhance the appeal of public spaces, which can fund local enterprises and regional tourism and promote investment
- Reduction in expenditure on road building construction and maintenance
- Enhancing and extending resident wellbeing – balancing the burden on the transport system
- Reduce the gap in the use of transport means

However, in order to promote a modern mobility culture, the following five steps must be taken (Berkeley, 2017):

1) Mental transformation and the need to reform the urban paradigm immediately
2) Political intension
3) Arrival of a frontrunner to promote alteration
4) The sensitivity of the public sector workforce
5) Assistance with municipal authorities and local residents to recognise their needs.

In cities there are three scales: planning, road, and data (Berkeley, 2017). The plan scale includes an analysis of the situation and direction of the region, local spatial planning and main investments. Size of the street is connected to tourism, road development, road changes and construction etc. The detailed scale includes the necessities for tenders or agreements to alter roads, squares, interchanges, etc. The detailed scale (Berkeley, 2017). In each size, Table 1 shows those items.

Table 1. Types of scale and actions (UN-Habitat, 2016)

Table 1: Types of Scale and Actions

Type of scale	Actions
Planning scale	- Community design for people with the highest priority - Planning for a streamlined town environment - Standardized green areas - Preventing vast areas that are not open to visitors - Consistency and continuity with walking routes - Clearing the spaces - Development of pedestrian squares - High attractiveness for footpaths - Disabled paths - Avoidance of blind footpaths - Creating hubs of public transit.
Street scale	- Business and Cultural Sites - Wide Footpaths - Increased footpath numbers in good places - Avoid specified foot passes at slow-traffic areas - Slow-distance Streets - Relief in Paved Cars - Reduction of bus lanes - Increment of Footpath Safety - Reduction in the number of traffic lights - Traffic maintenance during emergencies
Detail scale	- Good consistency of flooring surfaces - Proper positioning of professional facilities and minor design features

- Reduction of traffic signals and posts - Growing number of trees, flowers and bays

2. Literature Review

Walkability: Aspects and Measures

Effectiveness

Foundations for a healthy town are Walkability. Walkability typically has a four-fold potency and is tied to socio-economic, environmental and psychological problems. Firstly, the ecosystem is protected and the environment is created greener. Secondly, it encourages neighbourhood sociability among the public. Thirdly, it contributes to the promotion of residents' mental and physical welfare. Fourthly, walking lowers travel expenses (London, 2004)

Limitations and constraints

In order to promote a walkable environment, all associated problems must be taken into consideration. The mean walking speed of an adult is 4-6 km/h, with a medium distance of 500 m as a result of the small quantity of animate energy (TIWARI, 2017). The speed of walking is normally decreased as the altitude of the roads changes. If it's fog, snow and bright light, the tendency to stroll is limited considerably by bad weather. If the passengers bear considerable baggage there would be a gap in preference to driving. Walkability interventions in the vicinity of wholesale markets must also be carefully planned. In particular, there should be appropriate safety arrangements during walking as the lack of sidewalks causes footballers to use the road or narrow shoulders which increases the risk of fatal or injurious accidents (Keil, 2013).

Measuring walkability

Walkability is a principle that cannot be implemented before the device has been designed. A method must be provided for calculating walkingability in communities or neighbourhoods to build the optimal structure over the current situation. A walking audit is one means of evaluating and testing walkability. PERS (Pedestrian Environment Review System) is a developed and commonly-used method for walking assessments that has been widely used in the UK (C.E.Kelly, 2011). Another method is the Walk Score which, however, does not take into consideration factors such as the accessibility of the sidewalk, the protection of the area, and topography, based auf deregutible indices in the distance from the closest facilities in every category. Measures relating to transit and bike score have been established (Seungjae Lee, 2013). In his study Park established 52 measures of walkability grouped into five large sections; (i) road curb-to-curb roads; (ii) crossings for pathways (iii) sidewalks (iv) sidewalk sites (v) street scale and enclosures; (Park, 2008).

The CAI-Asia Center studied wall conditions and highlighted the possibility of walking in six Indian towns in Bhubaneswar, Chennai, Indore, Pune, Rajkot and Surat, pedestrian favourite interviews, assessments of current policy and institutions in cities in relation to pedestrian and walking and comparisons between Indian and other Asian towns (Dibyendu Bikash Bhattacharyyaa, 2013).

Table 2: Walkability Parameters

Parameter	Rating				
	1	2	3	4	5
Walking path modal conflict	Conflict that makes impossible	Conflict that makes walking possible but inconvenient	Some conflict	Minimal conflict	No conflict with other modes
Availability of walking paths	required but not available	Available but highly congested	Available, needs maintenance	Available, sometimes congested	Not required, people an safely walk on roads
Availability of crossings	@ >500m & avg. speed is high	@ 300-500m & avg. speed is 40kmph	@ 200-300m & avg. speed is 20-40kmph	@ 100-200m & avg. speed is 20-40kmph	No need, pedestrians are safe to cross
Grade crossing safety	Very high probability of accidents & crossing time	Dangerous- some risk of being hurt	Difficult to ascertain danger	safe	Very safe
Amenities (benches, light, toilets, trees)	No amenities	Little at some locations	Limited no. provisions	Good amenities for major length	Excellent amenities making pleasant experience
Obstructions	Completely blocked by permanent obstructions	Inconvenience, effective width <1m	Mildly inconvenience, Temporary obstacles	Minor inconvenience, Temporary obstacles, Effective width >1m	No obstructions
Security & Crime	Very dangerous	Feels dangerous	Difficult to ascertain security	Secure – min. criminal risk	Very secure – no risk of crime

Source: Luis Neto. 2015. The Walkability Index. School of Environment, Education & Development

Criteria for Walkable Cities

As the walkability study continues, here are several walkability measurement techniques on different metrics. It have also walkability indices. However, they identify five fundamental dimensions, mostly of which include physical, social, psychological and environmental factors. They also include walkability. These five parameters were selected to minimise statistical stresses and costly surveys. All of them show a preliminary analysis of walkability in a given area and also recognise opportunities for change in order to reach walkability index at higher level. The five criteria are: (1) Route network connectivity, in the wider urban environment and locally. (2) Other types of linkages: bus, road, rail, etc. (3) Fine seeds, different patterns of land use. (4) Traffic exposure and personal safety and safety. (5) Path quality, including distance, pavement, scenery, signs and lights. The three parameters from first show the smoothness of the walking on a zonal scale. The fourth parameter is focused on local people's understanding of such behavioural travel problems. The last is to improve and enhance the walking experience with suitable instruments at the micro-level approach (Bhattacharyyaa Dibyendu Bikash, 2013).

Table 3: Walk Score

Walk score	classification	Remarks
90-100	walkers paradise	most errands can be accomplished on foot without owning a vehicle
70-89	Very walkable	Possible without owning a vehicle
50-69	Some what walkable	Store & amenities may be within walkable distance, but many everyday trips require vehicular transportation.
25-49	Vehicular-Dependent	Only few destinations are with in walking range. But for most errands driving or public transportation is must
0-24	Only Vehicular-Dependent	No neighbourhood destinations are within walking range.

Source: walk score methodology. Retrieved from walkscore.com: https://www.walkscore.com/methodology.shtml

A Walk-Score metric connects the measurement of utility on pedestrian streets. This system, based mainly on data from Google and OSM, offers an overview on the size, accessibility, safety, convenience and appeal of stores. The course is between 0 and 100 points and the mean is:
- 00 to 24 - depending on the driver
- 25 to 49 - depending on the driver
- 50 to 69 - Walkable slightly
- 70 to 89 – More walkable
- 90 to 100 - Paradise of walkers

Walkability Assessment Tools
- MOUD (National Level) & Municipal Corporations are responsible for improving walkability in India (Local level). MOUD uses the walkability index, which depends on accessible footpaths and footpath rankings. It is between 0 and 1. The national overall index was 0.52 in 2008 (CSE, 2009). MOUD has also developed a method

for benchmarking urban transport that uses only 3 markers for calculating footprints:
- Significant delay/footprints intersection
- Street lights

- Percent of cities served by walking paths wider than 1.2 metres. Foothills infrastructure and walking demand in various cities can be compared by means of a standard methodology and a Walkability Index created.

Table 4: Walkability Assessment Tools

Assessment Tool	Scale	Assessing Methodology	Data Collection	Limitations
Walkability index (Qualitative & Quantitative)	Macro & Micro	Availability of footpaths and rating of pedestrian facilities	Field study – rating of pedestrian infrastructure	Difficult to asses which parameter needs improvement
Walk Score (Quantitative)	Macro	Walk time to amenities, density, block length, intersection density.	Data from Online open street maps (google maps)	Qualitative assessment of pedestrian facilities (width, design, traffic & crime safety)
Global Walkability Index (Qualitative & Quantitative)	Macro & Micro	Pedestrian count, Walking conditions including Safety, security & convenience	Field study , Interviews from pedestrians, & policies by administrative institutions GIS for processing spatial data	Difficult to asses which parameter needs improvement Considers only footpaths with >1.2m wide.
Neighbourhood Environment Walkability Scale	Micro	Participants to estimate the frequency and duration of time spent walking in past 7 days using Physical Activity Questionnaire	Field study , Interviews from pedestrians, GIS processing	The modest sample size and the non-probability nature of the sample may reduce generalizability of findings.
Walking and Bicycling Suitability Assessment	Micro	Volume, speed, width, surface quality, curb ramps	Field study	Small sample of road segments are taken => unstable conclusions.
Living Communities – Sidewalks & street Survey	Micro	width, surface quality, maintenance, usage	Field study	Even unused footpaths are considered as good.
Path Environment Audit Tool(PEAT)	Macro & Micro	physical characteristics of community paths used for physical activities	Field study – manual & digital	Require complex training and/or scoring procedures because they were designed for research. Complexity, burden & high auditing cost

Walkability in Different Indian Cities
Walkability evaluation performed in Indian towns – Pune, Bhubaneswar, Chennai, Bangalore by the Clean Air Initiative for Asian Cities, CAI-Asia

People using grade crossing than subways at Chennai central station
https://walkabilityasia.org/Chennai-india

Hawkers on footpath opposite to Pune railway station
https://www.hindustantimes.com/pune-news/punekars forced to walk on roads

Parking on footpaths in front of commercial area
https://www.telegraphindia.com/states/odisha/squatters-back-on-janpath

No footpaths & grade crossings, no proper bus stops at silk road junction
https://www.lequirk.com/016/07/KR-Puram-Traffic

Figure 1: Examples of Indian cities

Table 5: Walkability Index of Indian cities

	Pune	Bhubaneshwar	Bangalore	Chennai
Population (As per Census 2011)	34 Lakhs	8.38 Lakhs	123 Lakhs	70.9 Lakhs
Walkability Index	0.54	0.50	0.46	0.40
Key Parameters with major problems	Paths and Infrastructure at residential & transport terminals	Foot paths & crossings, infrastructure	Motorist Behavior (50% of 900 avg. road accidents are pedestrians)	Grade crossings, foot path width & continuity
Problems Identified	1. Frontage at railway station 2. Damaged foot paths 3. Obstructions by vendors and displays 4. Grade crossing time & lack of safety at signals 5. Cleanliness & odor from adjacent drainages	1. Lack of clear footpaths at transport terminals 2. Lack of pedestrian amenities 3. Crossing on roads with high speeds 4. Obstruction by Parking in commercial areas 5. Trash disposal on foot paths	1. Min. or no space to cross at zebra crossing as vehicles stopping on it. 2. Vehicles driven on footpaths. 3. Disable un-friendly 4. Wide roads with high speed vehicles (mainly airport road)	1. Lack of clear footpaths at transport terminals 2. Uneven & discontinuous paths 3. Not opting of subways & overhead crossings, not secure at night 4. Exposure to air pollution 5. Obstacles & cleaning
Rectifications Proposed	1. Overhead crossings & subways are proposed 2. Up-gradation of public transport 3. Barricades on roads at transit terminals.	1. Safe at grade crossings 2. marked Parking provisions along commercial street	1. Yellow zigzag lines at junctions are provided.	1. Escalators for 20 overhead crossings 2. Width = 1.5m(residential)& 3m(major roads)

Source: Clean Air Initiative for Asian Cities(CAI-Asia) Center. 2011. Walkability in Indian cities. Pasig City, Philippines

Research Gaps

First of all, the literary review supports one of our reasons for the research, i.e. a significant lack of studies of walkability. Second, a preference to use WIs consisting of objective mesoscale variables in a field. While it is theoretically critical that subjective and micro group elements be used to measure walking behaviour, they normally do not form part of the most popular WIs. Third, while many experiments use various methodologies to produce weighted WIs, there is no consistent methodological pattern for estimating the weight of each factor and variable such that a simpler approach cannot be used (i.e. equal weighting). Fourthly, in the literature, there is no agreement that the components and variables of the WI formulation should be used. In WI research, attraction and side walking condition factors are the most frequent elements, which ignore other factors that may be of significance for understanding walking behaviour.

Researchers from different areas have been urged to recognise causes contributing to this shift in behaviour as a result of the plethora of issues related to quality of life. Currently, this research body needs a multi-level theoretical transdisciplinary model which will better understand how physical activity behaviours, group, geographical and physical-environmental influences all influence.

3. Summary

In short, a walking city proposal is one way to incorporate sustainable transport. Given the many advantages, particularly economic, of walkability, local authorities do not have to be persuaded to implement these changes to urban logistics. Analysing the effects of the Walk Score estimates on the basis of examples in polish cities have shown that pro-pedestrian solutions influence whether an environment is viable or not.

4. Recommendations:

- Along with the growth of metropolitan areas Walkability can be viewed as a continuing phenomenon.
- Planners and decision makers should collaborate with a wide base of supporters, through physical and social project to enhance access to amenities within walking distance.

During a thorough examination of the consumer conditions of therapies,
1) Allow more people to gain more resources easily and conveniently.
2) The involvement of people in urban planning spaces.
   - Along with the aspired future, the Indian design guidelines for pedestrians must be amended.
   - Further focus is required in Pedestrian facilities for separate walking trails, accommodation and universal nature.
   - The supply of walks where not needed results in homeless people being invaded / occupied, so after assessment of a connection the arrangement must be made

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