A Study to Determine Pedestrian Walkability Index in Mixed Traffic Condition

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Abstract - *Walking is a significant mode of transport. A pedestrian can be defined as "Any person who is a foot or who is on a wheel chair, or by a means of conveyance propelled by human power other than a bicycle". Therefore the needs of the pedestrians, like the needs of motor vehicles, should be considered in the design of the urban environment and transportation facilities. The ability to walk (walkability) in Asian cities has gradually deteriorated due to the increase of motorized vehicles. The study mainly describes about the walkability index values of a particular midblock sections where the pedestrian problem is more and also determines the adequacy of footpath and its Level of Service (LOS) based on HCM 2000. The study stretch is selected in Thrissur city, because it shows a clear picture of intense traffic crisis. Improper and inadequate planning for pedestrians will lead to many negative consequences like unnecessary fatalities and injuries. By doing this it will generate awareness of Walkability as an important issues in developing cities, providing city officials with an incentive to address Walkability issues, helping city planners understand scope and extent of local pedestrian conditions relative to other places.*

***Key Words*: Pedestrian, Walkability index, Midblock Section, Level of Service**

1.INTRODUCTION

Walkability is a measure of how safe an area is for walking. The ability to walk ("walkability") in Asian cities has gradually deteriorated due to the increase of motorized vehicles. A worldwide study of the World Health Organization analyzed the causes of accidents and relevant policies and suggests that: "Our roads are particularly unsafe for pedestrians, cyclists and motorcyclists who, without the protective shell of a car around them, are more vulnerable.

Most of the developing countries do not make pedestrian planning as a pre-requisite and there are a few incentives for them to do so. Helping city planners to understand the scope and extent of local pedestrian conditions, relative to other cities, would be a positive step in the right direction, as it would help them to identify specific counter measures and costs associated with improving pedestrian conditions.

2. LITERATURE REVIEW

Pragia Minhas [1] the Study Area is Lovely Professional University (LPU) and the paper includes an extensive study of important criteria such as the pedestrian facilities, safety, accessibility and aesthetic appearance. According to Ministry of Urban Development (MOUD) method, walk ability index is a function of availability of footpath and pedestrian facility rating. The walkability index is calculated based on the equation given by MOUD. Field Walkability survey will be carried out in each zones. The pedestrians will be asked to rate the factors of design on a scale of 10 point of each attribute 1 being the lowest and 10 being the highest in each of the selected areas. The average field walkability of LPU campus was found to be 51.34.

Parisar [2] on behalf of Clean Air Initiative (CAI) and was done using a toolkit provided by CAI which was adapted from the Global Walkability Index toolkit developed for the World Bank. The survey consists of two components, namely a Field Walkability Survey and Pedestrian Interview Survey. The walkability survey or study was conducted in 4 zones, i.e. residential, commercial, educational and transport terminals. The parameters and the procedure adopted were similar to the CIA. Totally survey was carried out in 28.65km in pune.Of particular concern are issues of non-existent or unreasonably narrow footpaths, obstructions on footpaths,unsafe crossings for pedestrians and lack of sufficient respect for pedestrians. Therefore, the city only scores an average of 54 out of 100 as its walkability score.

Dr. L.B. Zala [3] explained about the measurement of Pedestrian Flow Parameters.The data is being analyzed for the pedestrian speed, pedestrian space, pedestrian flow and pedestrian density and from that the LOS can be defined at the study stretch. The data thus evaluated is then compared with the H C M 2000 Pedestrian Level Of Service (PLOS) criteria for walkway.

Muzamil Rashid [4] determines that for calculating Walkability index we need of footpath and pedestrian facility ratings. Pedestrian facility survey for taking pedestrian ratings is prepared which includes the design and usability factors of pedestrian facilities that are provided in the area. The length of the major roads and pathways in the city is calculated using the city plan or a tape or Google maps. For finding the pedestrian facility rating, a pedestrian survey is to be done considering various factors such as footpath width, footpath length , obstructions, cleanliness of footpath etc.

Pedestrian Walkability Index (PWI) is found out by Ministry of Urban Development (MOUD) method. PWI value is 0.64 for Jalandhar city in Gujarat.

3. STUDY OBJECTIVES

The specific objectives of the study are:

- To calculate the pedestrian walkability index for the proposed study areas.

- To study and evaluate the existing conditions of pedestrian facilities.

- To provide issues related to safe walkability to urban planners.

- To calculate the Level of service for the footpaths in the study areas based on HCM.

- To check the adequacy of footpath in the study locations based on IRC.

- To find out the grade of the section based on pedestrian walkability index value.

4. STUDY LOCATIONS

Areas with more pedestrian problems were identified and chosen for the study. The walkability survey was carried out in Palace road Thrissur and St Thomas college road Thrissur. In these areas, a stretch was selected for the data collection and analysis. The field walkability survey and the pedestrian interview survey was carried out in the selected zone at peak hours. The selected zone is in the core of the city where there is more pedestrian problems.

Fig – 1: Palace Road, Thrissur

Fig – 2: St..Thomas College Road,Thrissur

5. STUDY METHODOLOGY

This work is mainly carried out in three categories :
- Pedestrian Walkability Index

- Pedestrian Level of Service

- Adequacy of footpath

5.1 Pedestrian Walkability Index (PWI)

The walkability survey which was carried out and it consists of field walkability survey for facility rating and Pedestrian interview survey. A short questionnaire that captures the travel and social characteristics is prepared. The interview was conducted in the selected location during peak hours.An adequate sample size of 30 was taken for the pedestrian preferences survey. A proforma sheet for pedestrian interview was developed for pedestrian facility rating. The rating is done as follows:

Table -1: Pedestrian Facility Ratings

Sl.No	Facility Ratings	
	Ratings	Classification
1	0 – 1	Very poor
2	1 – 2	Poor
3	2 – 3	Satisfactory
4	3 – 4	Good
5	4 – 5	Excellent

By knowing pedestrian facility rating , length of the stretch & pedestrian volume the PWI can be found out using Ministry of Urban Development method (MOUD) & the equation is :

Walkability Index = [(W1 x Availability of footpath) +

(W2 x Pedestrian facility ratings)]

Where,

W_1 and W_2 are weights (assumed 50% for both)

Availability of footpath = Footpath length / Length of major roads in the city.

Pedestrian Facility Rating = Score estimated based on opinion on available Pedestrian facility.

After finding out the walkability index value then the section have to grade according to the value. Grading is done as follows:

Table – 2: Grading Based on PWI Value

Values	Descriptions
< 0.4	Poor
0.4 – 0.6	Fair
>0.60	Good

5.2 Pedestrian Level of Service

The Highway capacity manual (HCM) method was used for the analysis of the pedestrian level of service. At the location, the pedestrian walking speed was calculated manually. Pedestrian volume was taken from 9 am to 10 am. By knowing pedestrian volume & walking speed, LOS based on speed, density & flow can be found out by specification given in HCM 2010.

Table – 3: Specifications for pedestrian LOS based on HCM 2010

LOS	Space (sqm/ped)	Flow (ped/min/m)	Average speed (m/s)
A	> 5.6	<16	>1.3
B	3.7 -5.6	16-23	1.27-1.30
C	2.2-3.7	23-33	1.22-1.27
D	1.4-2.2	33-49	1.14-1.22
E	0.75-1.4	49-75	0.75-1.14
F	<.75	<75	<.75

From the studies given by HCM, it is always preferred to obtain the pedestrian LOS based on pedestrian walking speed as the LOS based on pedestrian flow do not quantify the required LOS. However good or bad the condition of the footpath, pedestrians will have to use the same which gives better LOS for flow. Hence it is desirable to consider the LOS based on pedestrian speed rather than flow.

5.3 Adequacy of Footpath

In this part of the work, the width of the footpath in the selected stretch was measured and volume counts were made in peak hours in the same location. Then the footpath is checked for adequacy based on the number pedestrians using it as per the IRC norms. This study also helps in proposing the new width of footpath as per the pedestrian requirement based on the number pedestrians using it as per the IRC norms. This study also helps in proposing the new width of footpath as per the pedestrian requirement based new width of footpath as per the pedestrian requirement based on activities in the area. The Indian road congress (IRC) specifies that:

- A minimum width of 1.8 m footpath should be provided on both the sides of the street.

- A dead width of 0.5m and 1m should be provided along the houses, bus stops, recreational and commercial areas.

- Height of footpath should be above the carriageway supported by un-mountable kerb.

6. DATA COLLECTION AND ANALYSIS

6.1 Calculation for Pedestrian Walkabily Index

The methodology used to calculate the walkability index is adopted from the Ministry of Urban Development Method. The length of the stretch and the pedestrian count taken for about 5 minutes intervals for 1 hour in all the selected stretches are used to calculate the walkability index.

Table – 4: Data Collected And Analysis Of Pedestrian Walkability Index (Pwi), (Palace Road Thrissur)

Sl.No	Parameters considered	Average Facility Ratings	PWI = [(W$_1$ x Availability of footpath) + (W$_2$ x Pedestrian Facility rating)]	PWI value for study area
1	Footpath surface	4.0	0.24	
2	Continuity	3.6	0.22	
3	Obstructions	2.5	0.31	
4	Cleanliness and maintenance	3.5	0.22	
5	Walking environment	3.3	0.24	
6	Lighting facilities	3.9	0.20	0.23
7	Crossing facilities	3.8	0.20	
8	Motorist bahaviour	4.5	0.17	
9	Security from crime	4.0	0.24	
10	Comfort	3.5	0.22	
11	Pedestrian count	644	Average = 0.23	
12	Length of stretch (km)	0.72		

Table – 5: Data Collected And Analysis Of Pedestrian Walkability Index (Pwi) (St.Thomas College Road, Thrissur)

Sl. No	Parameters considered	Average Facility Ratings	PWI = [(W_1 x Availability of footpath) + (W_2 x Pedestrian Facility rating)]	PWI value for study area
1	Footpath surface	2.1	1.51	0.19
2	Continuity	3.5	2.21	
3	Obstructions	3.0	1.96	
4	Cleanliness and maintenance	2.0	1.50	
5	Walking enviroment	2.5	1.71	
6	Lighting facilities	3.0	1.96	
7	Crossing facilities	3.0	1.96	
8	Motorist bahaviour	3.1	2.01	
9	Security from crime	3.5	2.21	
10	Comfort	2.0	1.50	
11	Pedestrian count	430	Average = 0.19	
12	Length of stretch (km)	0.55		

We can see that the obtained PWI values for both locations are 0.23 and 0.19. The obtained PWI values are < 0.4, therefore the grade of the footpath for both locations can be graded as poor based on the PWI values.

6.2 Calculation for Pedestrian Level of Service

The pedestrian level of service was calculated for both of the locations. The pedestrian volume was taken for an interval of 15 minutes for 1 hour in both locations. The walking speed of 10 persons was taken and an average pedestrian walking speed was calculated manually. Then the pedestrian flow, pedestrian density was calculated.

Table – 6: Details of The Stretch (Palace Road, Thrissur

Details	Values
Length of the stretch	720 m
Width of the footpaths	1.58 m
Distance taken to calculate pedestrian walking speed	10 m

Table – 7: Calculations For Speed, Flow And Density (Palace Road, Thrissur

Time	Pedestrian volume	Time (s)	Speed (m/s)	Density (person /sqm)	Flow (person /min/ m)
9:00 - 9:15 am	150	8.51	1.175	9.493	6.360
9:15 - 9;30 am	151	8.83	1.132	9.556	6.402
9:30 - 9:45 am	136	8.01	1.248	8.607	5.766
9:45 – 10:00am	125	8.25	1.212	7.911	5.300
Average			1.191	8.891	5.957

As per HCM 2010, the footpath has,
  LOS – A (Based on flow)
  LOS – D (Based on pedestrian walking speed)

Table – 8: . Details Of The Stretch (St.Thomas College Road, Thrissur

Details	Values
Length of the stretch	550 m
Width of the stretch	1.2 m
Distance taken to calculate pedestrian walking speed	10 m

Time	Pedestrian volume	Time (s)	Speed (m/s)	Density (person /sqm)	Flow (person/min /m)
9:00 - 9:15 am	120	8.21	1.21	10	6.70
9:15 - 9;30 am	115	8.32	1.20	9.58	6.42
9:30 - 9:45 am	100	7.53	1.32	8.33	5.58
9:45 – 10:00am	95	7.66	1.31	7.92	5.31
Average			1.26	7.21	6.00

7. CONCLUSIONS

The walkability index values indicate that, there is a definite shortage of pedestrian facilities in the urban area and the pedestrians are subjected to high risk which is evident from the pedestrian accidents. The studies on walkability will help

the city planners to understand the importance of walkability which can be used to improve the PWI to ensure safety. The footpath width is inadequate for both study locations. LOS of footpath is calculated based on speed, density and flow.

ACKNOWLEDGEMENT

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