A review on pedestrian safety

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Abstract- **In the urban transport version of India, traffic planners primarily emphasize the motorized movement mode. All types of road development steps are taken in terms of safety, speed or interval of time at intersections in the case of a motor vehicle. But in the current traffic condition, the non-motorized traffic mode is also increasing. Pedestrians and cyclists are occupying the track of the motor vehicle since they are not provided with separate grades. It leads to traffic congestion and the pedestrian safety factor. According to the Highway Capacity Manual (HCM) 2010, for this heterogeneous traffic, we cannot simply increase the level of service by developing the quality of the roads for vehicles. Steps have been taken to reclaim pavement for pedestrians by removing the encroachment on footpath. A study was carried out in TirahaSandila Road, Sandila, Uttar Pradesh, where about 260 meters of path surrounded it and separated from the road by a divider along the road. Users were asked to answer questions about the quality of service provided by the system in terms of the questionnaire formed. The format of the questionnaire was based on the factors that the user perceives. Based on the ratings, an analysis was carried out to find the level of service based on the perception of the interviewers. The analysis consisted of five factors: safety, level of comfort, invasion of the supplier, accessibility, performance of the sidewalk and climatic conditions. The analysis was performed in SPSS and the area was categorized at a specific service level of 6 service level grades (LOS). It is difficult to have a LOS value for an area based on perception, since it varies from person to person. Therefore, the tour is performed at its best possible LOS value depending on the majority of the majority of the user's perception.**

Index Terms- **Road safety,Transportation Engineering, Reliability test, kmo (kieser–Meyerolkin's) test, consistency limit, chronbach'salpha test.**

I. INTRODUCTION

Due to rapid urbanization in India, the traffic volume is increasing on the roads. The motor vehicle industry is demanding with an annual production rate of 5 million vehicles. This leads to clumsiness on roads giving an unsuitable condition for movement. For some time, transportation engineers and planners have focused on the development vehicular transportation system.

Even today, the motorized transport system receives overwhelming priority over systems that meet the needs of non-motorized users, such as pedestrians and cyclists However, in recent years, emphasis has been shifted towards multimodal approaches for improvement in pedestrian facilities and operations in order to counteract the challenges of congestion, air quality, improving safety and quality of life. The researchers are promoted to step forward in improvements of traffic behaviour in all aspects. There has been progress in measuring quality-off life of pedestrian facilities and in walkability. For example Saelensetal.(2003) mentioned this from the way of users‟ walking decision and neighbouring environmental conditions such as population density, connectivity to different transitions ,land use pattern are also the factor of influence.

II. OBJECTIVE & SCOPE

The objective of this study is to develop an instrument to determine the factors that affect the performance of the sidewalk based on the perception of pedestrians. "A questionnaire with different items is developed to measure pedestrian perception in five different areas: (a) safety, (b) comfort/convenience, (c) vendors presence, (d) movement easiness and accessibility, (e) environmental condition. It is believed that each item could potentially impact on sidewalk performance. The main objectives are: To provide higher safety to pedestrians without obstructing/hampering the inflow and outflow of traffic. To devise a yardstick for calming the traffic

and to design the streets in such a way that it improves the pedestrian walking environment. Very few studies have been carried out to encourage the pedestrian environment and the factors that define it.

III. CONCEPT OF LEVEL OF SERVICE

The level of service is defined as the measurement of the level of satisfaction that the traffic system provides to the user in terms of density, speed, congestion, etc. The HCM 2010 incorporates tools for the multimodal analysis of urban streets to encourage users to consider the needs of all travellers. Separate chapters for bicycles, pedestrians and transit have been removed, and the methods applicable to them have been incorporated into the analysis of the various road facilities.

The Highway Capacity Manual has defined levels of service (LOS) as "qualitative measures that characterize operational conditions within a traffic stream and their perception by motorists and passengers." LOS (designated as A to F, with LOS F as the least desirable) includes speed, travel time, freedom of maneuver, interruptions in traffic, comfort and convenience. The concept of LOS was introduced to qualify the characteristics associated with various levels of vehicles and people who pass a specific point during specific time periods. Therefore, LOS has been a qualifier of the conditions related to the vehicle or the person in any place instead of a qualifier of the conditions related to the individual comfort level. According to HCM-2010, the level of service can be classified into 6 categories LOS-A to LOS-F.

Factors affecting Pedestrian Level of Service

Traffic volume: It is observed that as the volume of traffic increases, the PLOS tends to decrease. One can easily observe that during heavy traffic, pedestrians are more apprehensive of their safety than at another time.

On street parking: This factor has a positive influence on LOS, as it acts as a buffer between traffic and pedestrian, thus providing a sense of security. As people perceive that they are safe, there results a greater LOS.

Sidewalk width: The greater the width of the sidewalk, the greater the level of safety perceived by pedestrians, as they feel more comfortable which results in a greater LOS.

Width of the road: With the increase in the width of the road, the pedestrian feels that it is more difficult to cross the road from one end to the other, thus decreasing the LOS. Normally, today to accommodate traffic, we find carriage forms of large widths that result in a lower LOS.

Speed limits:The speed limit for the inspected road was 40 km / h. With the increase in speed, there is a drastic decrease in the level of pedestrian service. It is due to the fact that at higher speeds, pedestrians perceive higher threat levels in their lives, resulting in a decrease in LOS.

Number of lanes:With the increase in the number of lanes, there is an increase in the total width of the road, so there is a greater likelihood of pedestrian-vehicle interaction leading to lower safety levels and therefore leading to a lower LOS score.

Encroachment by vendors: The pedestrian path in India is mostly occupied by vendors that cause traffic congestion, so the user has to take the road for the movement that leads to exposure to risk.Reduce LOS.

Condition of the pavement:The good condition of the pavement leads to a comfortable movement that increases Los.

Several other factors such as lighting, marking (pedestrian crossing), presence of buffers (trees, logging wells), accessibility to traffic areas, driveway, space between the road and the speed of the vehicle on the road also affect pedestrians LOS.

Factor affecting sidewalk performance

1. Traffic volume: we would observe that traffic volume is inversely proportional to the PLOS. it can easily observe that when traffic on the road is increasing the pedestrian movement is restricted
2. on-street parking: It acts as a buffer for the PLOS thus it positively affects the PLOS hence it increases the PLOS

3. Sidewalk width: As the sidewalk width increases the PLOS is also increased
4. Roadway width: As roadway width increase it more difficult to have to cross the pedestrian the road from one side to another thus PLOS is decreases. To increase the PLOS road should have provision of zebra crossing
5. Speed limits: As increase the speed limit PLOS is decreases. A proper Speed control board should install on road in order to safe pedestrian movement
6. Number of lane: As the number of lane increases the width of the road is also increased thus it impacts negatively on PLOS
7. encroachment by Vendors: Footpath in India is mostly reserved by the vendors as it cause traffic congestion on road thus it will affect the PLOS
8. Pavement conditions: it is the important factor which affect both pedestrian and Wheeler road user. As the condition of road is damaged like pot holes on road, free aggregate on road, lighting on road, sight distance etc these are the factor which decrease the movement of road user on road and it affect the PLOS.

IV. RESULTS AND ANALYSIS

After analyzing using the inverse variance method, the results were acquired. From the data, the (Pedestrian Level of Safety) PLOS of the road was determined by adequately determining the range of each LOS. The obtained result can be used by a traffic engineer to improve current roads and a better passable environment can be provided to the pedestrians in the future by adopting appropriate design methods to road.

The majority of the subjects were male (60%). Respondents grouped under 18 (32%), 18 to 30 years (61%) and 31 to 56 years (7%). Walking behaviour included 2 people (45%) walking only (29%), walking in a group with 3 people (12%) and walking group with more than 3 people (10%). Around 67% of respondents He stated that walking was his main mode during the survey. most of users used carriage way (40%) instead of footpath due to the concern of the sellers. Most of the users were using carriageway (40%) rather than footpath due to the preoccupation by vendors.

Factor Determination: The proposed solution has five factors and is accounted for 71% of the total variance. Inspection of the output confirms that the four-factor structures make conceptual sense and that each factor accounts for a substantial portion of the overall variance.

We arbitrarily name these four factors as comfort, vendor's attraction, safety, and movement easiness. Factor 1, Comfort (6 items, variance = 31.054%), refers to minimize obstructions at the sidewalk, such as physical features, vendors and other pedestrian's obstructions. Also, sidewalks cleanness increases comfortable feelings. Factor 2, Vendor's Attractions (5 items, variance = 17.533%), refers to street vendors existence in the sidewalks, intention to look around and buy something on street vendor's commodities. Factor 3, Safety (4 items, variance = 8.67%), includes items that assess pedestrian perceptions regarding vehicle traffic danger, sidewalk surface conditions, and crime attacking. This factor refers to effective sidewalk width as well. Factor 4, Movement Easiness and accessibility (4 items, variance = 9.525%), refers to pedestrian freely to choose their speed, and space availability for their movement. Factor 5, environmental condition (2 items, 4.17%)

V. SUMMARY

This study was carried out to find the LOS qualitatively. The qualitative method is a better method to determine LOS, since it enters the response of people in real time, thus providing an option of achieving a better and more accurate result. The data was analyzed using the inverse variance method and the LOS score table was determined by determining the ranges for each level of service that helped estimate the PLOS of the study area.

VI. CONCLUSION

After analyzing the data, we reached the following conclusions:

The LOS score obtained by inverse variance analysis was found to be 5.08 that was within the range of LOS D, that is, between 4,435-5. 293.This meant that the PLOS of the road segments in the study area do not provide a good quality of service to pedestrians in the predominant geometry and the surrounding environmental characteristics.

REFERENCES

[1] Burde, A.: A Study on Road Users' Overall Perceptions of Highway Maintenance Service Quality and the Variables that Define the Highway Maintenance Service Quality Domain, Dissertation, Virginia Polytechnic Institute, Blacksburg, Virginia, 2008.

[2] Field, A.: Discovering Statistics Using SPSS, Second Edition, SAGE Publications Ltd., London, 2005.

[3] Hair, J.F., Anderson, R.E., Tatham, R.L., Black, W.C.: Multivariate Data Analysis, 6th Edition, Prentice Hall, New Jersey, 2006.

[4] Huang T. H., Chen-Jr C.: Modelling Level of Service on Pedestrian Environment, Journal of the Eastern Asia Society for Transportation Studies, Vol. 7, 2007.

[5] Landis, Bruce, et al.: Modelling the Roadside Walking Environment: A Pedestrian Level of Service, Transportation Research Board 1773, Washington DC, 2001.

[6] Parasuraman, A., Zeithaml, V.A., Berry, L.L.: SERVQUAL: A Multiple-Item Scale for Measuring Consumer Perceptions of Service Quality, Journal of Retailing, Volume 64, Number 1, 1988.

[7] Tan D, Wang W, Lu J, Bian Y.: Research on Methods of Assessing Pedestrian Level of Service for Sidewalk, Journal of Transportation Systems Engineering and Information Technology, Volume 7, 2007.

[8] TRB: Highway Capacity Manual, Transportation Research Board, National Research Council, Washington, 2000.

[9] Zhang, X.: Factor Analysis of Public Clients" Best-Value Objective in Public–Privately Partnered Infrastructure Projects, Journal Of Construction Engineering And Management ASCE, pp, 956-965, September 2006.