

STUDY OF PROBLEM FACED BY PEDESTRIANS ON BRTS INDORE

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Abstract

Pedestrian walking is a major mode of transportation in Indian cities and also effective mode of transportation for short trips. In this study pedestrian sidewalk data was collected from three locations in Indore city in India. The obtaining three locations data was collected by survey forms along BRTS sidewalks. These data was analyzed for finding Factors characteristics are depends on gender of the pedestrian, age of pedestrian and type of facilities (sidewalks, wide sidewalks and prescient's). which affect pedestrians. like safety, comfort and time delay as well as obstructions causing problems.

Keywords: pedestrians, factors (safety,comfort etc), sidewalks, pedestrian. characteristics.

1. INTRODUCTION

Pedestrian walking is a mode of travel to a given destination on foot. In transportation this type of mode are effectively used for short trips. Walking is a major mode of transportation in middle and low class cities. In transportation many trips are originated and ended walking only. Developing country like India pedestrian walking is a major mode of transportation. The urban population in India was increased year by year; in 2001 the urban population was 27.81% after 10 years in 2011 this population reached to 31.16% because better facilities for pedestrians have been provided by us. One study told that Tiruchirapalli city 64.7% of the total trips are made on foot (arasan et al., 1994). Another study conducted in Mumbai they can told that all persons walk in a day irrespective of their income (Montgomery, 2006). Because better facilities have been provided for pedestrians are important criteria in urban areas. Now a day the local authorities are interested to provide good pedestrian facilities to encourage walking.

According to modal split study conducted in Mumbai in India told that out of nearly 2.85 million trips, 52.4% trips are walking trips (MMRDA 2008). African cities have more walking trips comparatively Asian and Latin-American cities. The average walking trips percentage of Africa, Asia and Latin-America cities are 57, 37and 22% respectively (Montgomery 2006).

Pedestrian movements are classified into two types they are pedestrian sidewalk and pedestrian crosswalk. In this report pedestrian sidewalk has been considered by me. The sidewalk facilities provided and improved was more important in urban areas.

PEDESTRIANS

Population explosion in the cities of India is one of the major environmental challenges of our time. Major reason of the population explosion is not biologic but indiscriminate migration of rural population. India is experiencing the menace of swollen cities with least amenities. Larger cities have larger transportation demands in terms of traffic volumes and the travel distances. A mix of private vehicles as well as the public transport vehicles has to cater to the need of the transportation demand. One of the best options for travel is to walk to your destination. This means that increase the pedestrian facilities to reduce the motorization. A **pedestrian** is a person traveling on foot, whether [walking](#) or [running](#). In modern times, the term usually refers to someone walking on a [road](#) or footpath [pavement](#). In most of the cities in India due to increased use of motorized vehicles, the

pedestrians always find difficulties in going from one place to another place. Our transportation facilities are not pedestrian oriented. Due to this aspect the pedestrians face lot of difficulties. They are mainly drivers' perceptions of risk, Speed of vehicle, Volume of traffic, absence of midblock crosswalks, Width of roads, Poor timing of crossing signals, and type of vehicles and physical Environment. These problems create an aversion in the minds of the parsons who have to travel on roads and they opt for a motorized transport. The owners or boarders of the motorized vehicles have to walk. For example the public or private vehicle has a limitation due to its size, parking facilities etc.



Fig. 1.

BRTS INDORE

In general a modern concept is to increase the public transportation facilities. Bus Rapid Transit is one of the concepts in public transportation system wherein a dedicated lane is provided for buses. In Indore a BRTS system(closed type) has been executed for a length of 11.5 km on east while National Highway No. 3 connecting Mumbai and Agra. The BRT system is laid between Niranjapur in north to Rajeev Gandhi Chouraha is south of Indore city in the year 2013. The BRT has a central dedicated lane and on both the sides there are mixed vehicle (MV) traffic lanes. On the curbs there are other facilities such as foot path and bicycle lane etc. The boarders of BRT system face lots of difficulties in crossing the MV Lane and many intersections where one has to cross diagonally for boarding or alighting. The BRT has divided an important corridor of Indore wherein lots of educational and commercial activities are taking place. The pedestrians have to travel a distance of almost 200 to 500 m to cross the road to reach their destinations.



Fig. 2.

1.1 The Problem

1. As part of the Study a comprehensive assessment has been carried out to identify individual problems and problem areas. These include the following
2. Overcrowding along narrow footpaths.
3. Difficulties in crossing the road at ground level.
4. Poor signage, and barriers to pedestrian movement.
5. An unwelcoming environment for the elderly and physically disabled.
6. Safety problems in relation to traffic and in areas that are poorly lit or badly maintained.
7. Noise and air pollution from traffic.
8. Unattractive streets and pedestrian links which lack character, identity and comfort (shade, seating, plants) etc.

2. LITERATURE REVIEW

Hocherman, J. Bar-Ziv, A.S.Hakkert 1985 This study dealt with the methodological aspects of conducting counts of pedestrians crossing urban streets. These counts were carried out in order to plan pedestrian facilities for research purposes. The study concentrated on describing the delay distributions of pedestrians crossing residential and CBD streets in Israel. It also dealt with the problem of adequacy of short counts for estimating hourly pedestrian volumes. The results showed that the daily distribution of crossing pedestrians was featured by three peak periods: 7:00-8:00, 12:00-13:00, and 17:00-18:00. In the residential neighborhoods, the morning peak was higher than in the CBD, while the noon and afternoon peak periods were shorter. In addition, it was found that the recommended periods for counting pedestrians for the purpose of estimating the daily volume were 8:00-10:00 and 14:00-15:00. Short counts of the magnitude of 15 minutes were not recommended for estimating hourly or daily pedestrian volumes on residential streets.

Zaidel et. al. (1988) examined the effect of holding flags during road crossing events. 500 pedestrians were interviewed and 20,000 were observed crossing streets during morning and afternoon hours at four non-signalized marked crosswalks in two residential neighborhoods. The participants were asked to hold yellow flags or raise their hands before they cross the street. The observations showed that only 15% of the pedestrians used the flags. However, there was not found any significant difference between the three conditions of crossing: use of flag, use of hand, and no communication.

Katz 1989 The paper reviewed literature on the topic of pedestrian safety. The findings from the literature were categorized into three groups: (1) information and safety support systems; (2) roads and traffic; (3) pedestrian and driver behavior. The author concluded that much research would be needed on the topics of: (1) safety practices, especially in the engineering fields; (2) safety of pedestrians on arterial and heavily trafficked streets; (3) public information and community action countermeasures; (4) the methodology and decision priorities of land use allocation and town planning, with the express purpose of maximizing pedestrian safety.

Katz, A. Elgrishi 1992 This study aimed to (1) evaluate the national planning for the pedestrian safety campaign conducted by the Road Safety Authority of the Israel Ministry of Transport, (2) evaluate the local planning in six cities, and (3) evaluate the crossing guard operation on a daily basis in the six cities. 500 pedestrians were interviewed two months after the campaign. The results showed that the national planning was deficient in providing sufficient publicity material to the cities—both in quantity and when needed. In addition, the large cities fulfilled 23% of their planned volunteer activity and small cities 48%. Even though the volunteers received instruction in their task in advance, supervision was poor.

Moukwas 1994 Young pedestrians are hurt and injured more in severe accidents than in other kinds of accidents. Dealing with this problem requires not only finding geometric solutions, but also rendering protective measures based on recognizing the pedestrian's weak points. This study addresses the cognitive development of children and its ramifications on the children's ability to use the road safely. In addition, the paper presents data on the basic instructions regarding safe road crossing.

Elgrichi, A. Katz 1982 The study aimed to assess a Pre-school Safety Program whose purpose had been to inform parents of pre-school children how to deal with the problem of traffic safety. The program was evaluated with regards to: (1) parents' understanding of the material presented in the program, and (2) parents' and kindergarten teachers' satisfaction with the program. The participating parents had three evening meetings with specially trained instructors, and they were also required to help their children complete a workbook at home. The overall evaluation was positive in respect to understanding of the material and satisfaction with the program.

Katz, A. Elgrichi, L. Guttman 1984 The aim of this report was twofold: (1) to survey the regulations and conditions related to traffic control and school zones, and (2) to survey the children's activities and travel behaviors after school hours. In the first survey, it was found that many countries had specific regulations pertaining to school zones, and covering such issues as parking, speed control, signing, crossings, etc. The traffic regulations in Israel did not treat the school zone as a separate topic. A survey of 870 children who were asked to keep an activity and travel log for one week showed a large range of away-from-home and outdoor activity during the afternoon and early evening hours. Most (65%) of their trips consisted of walking, 25% traveled by car, and 10% traveled by bus.

Katz and Elgrichi (1983) described the results of Part 2 of a multi-stage research project, the purpose of which was to find ways to reduce the traffic accident involvement of elderly pedestrians. 487 elderly people were interviewed individually and asked about their travel habits, accident involvement, safety knowledge, knowledge of traffic signs, and knowledge of safe walking habits. The findings showed that, as a group, elderly people do not correctly identify traffic signs and do not have a good understanding of safe walking habits. In addition, they were found to be dependent on the walking mode and public transport for their mobility

Katz, A. Elgrichi 1995 There were three aims of this study: first, to investigate and update literature which deals with elderly pedestrians in order to learn how other countries deal with safety problems among these pedestrians. Second, to report and give examples of educational and explanatory materials with regard to the elderly pedestrian safety. The last was to survey the involvement of elderly people in traffic accidents in Israel.

A. Katz, L. Guttman 1982 This study analyzed national traffic accident data pertaining to pedestrians over the age of 65 and who had been injured in Israel during the period 1970-1980. In addition, the researchers studied 200 police files which described injury accidents to elderly pedestrians in the city of Haifa during the years 1977, 1978, and 1979. The results showed that (1) 45% of the elderly pedestrians injured were within walking distance of home; (2) 75% of the elderly pedestrians were injured on streets with heavy traffic volumes; (3) elderly people are overrepresented as residents in areas of the city of Haifa characterized by heavy flow; (4) the age specific injury rate of pedestrians over 65 was 2.1/1000 persons, compared to 0.6/1000 persons for adults aged 25-44; (5) 9% of elderly pedestrians suffered fatal injuries; (6) rain and/or extended darkness increase the number of heavy accidents involving elderly pedestrians; (7) 85% of elderly pedestrians were injured while crossing the road and 15% while walking or standing on the road, and (8) the majority of injured elderly pedestrians were men.

Katz, A. Eligrishi, O. Eisenman 1984 The aim of this report was to provide statistical information with respect to pedestrian injuries and accidents for the years 1979-81. The data presented in the study represented 35% of all traffic accidents in Israel, 25% of all personal injuries, and 46% of all traffic deaths for these years. The statistics were organized into three sections: (1) pedestrian injuries analyzed by the age of the injured pedestrian; (2) pedestrian accident location on road network urban/interurban, intersection/non-intersection, and urban road type-center city, residential, arterial, industrial, and (3) pedestrian fatalities analyzed by the age of pedestrian, type of road, hour of day, vehicle striking, etc.

Zaidel et. al. (1986) described three related research activities: (1) an analysis of factors involved in pedestrian accidents on arterial streets; (2) the continued development of a method for assessing crossing difficulty, and (3) an attempt to characterize streets in term of pedestrian crossing activity and crossing difficulty. With respect to the first research activity, a three-year accident analysis based on a Haifa street inventory combined with an accident file showed that the higher the density of junctions on arterial streets, the greater the number of accidents. Regarding the second research activity, the observation method for recording pedestrian crossing events and rating their level of friction was improved and adapted for mid-block situations.

A.S. Hakkert, V. Gitelman, E. Ben-Shabat 2000 The study presents a model that includes systems for detecting pedestrians near the crosswalk zone and for warning drivers on pedestrian presence; this is achieved by means of flashing lights towards the approaching vehicles embedded in the pavement adjacent to a marked crossing. The study evaluates the safety impact of the model, through consideration of changes in road user behavior in the crosswalk zone; in addition, it examines the operation under field conditions. Four sites were observed, two in Haifa and two in Bat-Yam. The findings show that under certain conditions the system can bring (1) about a 2-5 kph reduction in vehicle speeds near the crosswalk zone, (2) an increase in the rate of giving way to pedestrians, (3) a significant reduction in the conflict rate, and (4) a reduction in the share of crossings outside the crosswalk.

Kotkar et al.(2010) analysed pedestrian flow characteristics under mixed traffic conditions. Data were presented in mathematical and graphical relationships between speed volume, speed and density, flow.

The data were collected using video graphic technique. The data for movements in both the directions were collected during morning and evening periods. The recorded film was replayed in laboratory to extract the desired information.

The pedestrian data were analyzed using a statistical software NCSS (National computer system and services 2007). Curves were plotted between speed and density, speed and flow, flow and density and flow and area module.

This study shows the characteristics of the location and pedestrians have their effect on the pedestrian flow characteristics. The findings of this paper have implications for transportation and urban planning policies and design practices.

Nishi Mittal (2010) studied to find out the provision of pedestrian crossing facilities in Delhi from the safety and environmental point of view. For this study the survey were conducted at four arm intersection, T intersection and on approach road in different location of Delhi.

Availability of pedestrian facilities such as Zebra crossing, footpath, and availability of pedestrian signal, the footbridges or subways were surveyed. Proper side walk width, side walk height, encroachment on side walk and behaviour of pedestrians to use all this facilities were observed.

Provision, visibility as per environmental point of view and for safety the studied location was observed. Availability of road marking, guard railing, pedestrian traffic signals, location of bus stops were observed to know the pedestrian facilities.

Opinion survey of pedestrians was also conducted with sample size of 250 pedestrians were also conducted to know there feedback on different questions such as (1) safe to cross (2) understanding of the pedestrian signals, (3) visibility aspects of signals, (4) waiting for green signals to cross, (5) time allotted to cross (6) drivers behaviour towards pedestrians (7) risk while crossing.

This study can be used to improve the pedestrian facilities with providing safety.

Marisamyathan and P. Vedagiri (2013) taken this research with the aim of developing a pedestrian delay model for signalized intersection crosswalk.

Required model parameters were extracted based on the video graphic survey conducted at four arm signalized intersection in Mumbai, India. Crossing speed, crossing time, arrival pattern and some of the behavioural factor were observed to develop delay model.

These models are only applicable for selected type signalized intersection crosswalks and are not in general in nature. Wherever existing model have failed to predict accurately and this model is helpful to be found the all of the possible pedestrian crossing behaviours.

Marisamynathan and Vedagiri (2014) analyzed the crossing behaviour of pedestrians like crossing speed, compliance with signal, and pedestrian-vehicular interaction under mixed traffic conditions and identified the influencing factors based on statistical tests.

To analyze pedestrian behaviour 775 pedestrians were observed at three signalized intersections in Mumbai. For the analysis of crossing behaviour and significant factors affecting pedestrians were identified by conducting Pearson's correlation co-efficient test, ANOVA test and student t test. logistic regression models also had been developed in which the odds of pedestrian violation and interaction were modelled and verified.

This paper provides an analysis of various pedestrians crossing behaviour at signalized intersections under mixed traffic conditions and it is helpful to develop pedestrian delay models and pedestrian level of service models at signalized intersection. Also can be used for improving pedestrian safety at signalized intersections. Further extended by taking a much larger sample thereby giving better statistics results.

B Raghuram et al. (2014) examined the pedestrian gap acceptance behaviour by employing an artificial neural network(ANN) model to understand the decision making process of pedestrians, i.e. acceptance or rejection of vehicular gaps at a mid-block location.

For evaluation of pedestrian behaviour at mid block, six lane divided urban mid-block section with median opening which is partially controlled by zebra cross marking at Worli in Mumbai was chosen as the experimental site for Data collection. Three cameras were used one to capture the pedestrian behaviour and remaining two were used for recording the vehicular characteristics along the vehicular movement.

The developed ANN based pedestrian gap acceptance model results may useful in design or evaluation of pedestrian facilities under mixed traffic conditions. This paper may also be helpful in reducing pedestrian and vehicular conflicts.

Akash Jain et Al. (2014) analyzed the crossing behaviour of pedestrians at Roorkee city (uttarakhand state in India). pedestrian behaviour was examined on pedestrian flow characteristics like crossing speed and waiting time. Pedestrian safety, gap acceptance, crossing behaviour was observed for different age group and gender.

Data were collected by video graphic at three locations BSM intersection, Chungi Naka intersection, Civil Lines IIT Roorkee intersection for 60 minutes at a time during peak hours of morning and evening.

Data were presented by the relationships plotted between pedestrian crossing time, waiting time, total travel time and cumulative percentage of pedestrians. The accepted and rejected gaps curves are developed and safety margins are studied.

Crossing types namely perpendicular and oblique movements are observed. According to result one out of seven pedestrians crosses the road in two stages. Crossing time varies between 4 sec to 10 sec and waiting time from 1 sec to 6 sec. Average crossing speed is estimated to be 1.36 m/sec for perpendicular movement and 1.98 m/sec for oblique movements. This study can be used to decide the need of pedestrian facilities in the area.

Gang Ren et. Al. (2011) This study examines the behavioural characteristics of pedestrians and the factors affecting pedestrian behaviour. Data on pedestrian behaviour were obtained from video images of pedestrian movements recorded at 26 signalized intersections in three Chinese cities.

The questionnaire used for the survey comprised 10 questions about what pedestrians may do and how they feel when they cross at crosswalks of signalized intersections. The questions covered the following areas: (a) demographic information, (b) the main reason why the pedestrians violated the crossing laws, and (c) pedestrian perceptions of safety.

To analyze whether demographic factors (age and gender) or social factors (such as crossing in a group) have a significant influence on pedestrian crossing behaviour, a one-way analysis of variance (ANOVA) was first applied. For further analysis, each factor was then analyzed by use of a single-factor model with the odds ratio (OR) statistics. The OR is the ratio of the odds that an event will occur in one group to the odds that an event will occur in another group.

The observation data provided the following information: pedestrian gender, estimated age group, crossing time, whether the pedestrian is walking or running, whether the pedestrian is alone or in a group, whether the pedestrian is in the crosswalk, and whether the pedestrian complies with the signal.

Zaidel et. al. (1984) investigated the safety of pedestrians crossing signalized intersections. Three intersections were investigated: an uncontrolled (but marked) crossing at the right turning filtering lane; a pedestrian crossing phase concurrent with the vehicle phase; and an exclusive pedestrian phase, separating pedestrians from turning vehicles. The researchers collected data regarding the geometry, traffic, and operational characteristics of 320 signalized intersections in Tel-Aviv, Jerusalem, and Haifa, and details of 5132 vehicle accidents and 1310 pedestrian accidents which took place at those intersections during 1977-1982. The results showed that the various crossing types had little influence on the number of pedestrian accidents, and no effect on the number of vehicle accidents.

3. CONCLUSION

In this study experiments pedestrians using sidewalk of BRTS Indore at three different places (Vijaynagar, Palasia and Bhawarkua) shows that pedestrians are facing problems related to their safety, comfort and convenience at BRTS sidewalks due to time delay, obstructions and less maintained sidewalks.

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