

RESEARCH PAPER ON STUDY OF PEDESTRIAN CROSSING BEHAVIOUR, ANALYSIS AT INTERSECTION

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Abstract – Walking is not usually considered a transportation mode. This is because it does not employ vehicles or because it is a fundamental means of movement. But walking is the most efficient and effective mode of transportation for the short trips. People walk for many purpose i.e. work, shopping and recreation etc. Moreover every journey necessarily starts and ends as a walk trip. All trips in urban areas, be it by bus, car or train begin and ends as a pedestrian movement. In India, the proportion of pedestrian movement is very large. Pedestrians are the most vulnerable among road users and the most affected in urban traffic accident. Complete segregation from vehicle through space may solve the problem of pedestrian's casualties in road traffic accidents especially at cross walks. These can be achieved by using stairways or pedestrian bridges and subways i.e. foot over bridges and foot under bridges which is defined as pedestrian movement in vertical direction or at gradients.

Keywords: Pedestrian, pedestrian flows, grade-separated intersections, reduce vehicular delays, foot over-bridges

1. INTRODUCTION

Walking is one of the most important travel modes in every country. However, pedestrians are always neglected in transportation planning and management. With the development of environment friendly and resource saving society, pedestrians are getting more and more attention. A pedestrian can be termed as a person who travels on foot. Any person walking, running, standing or sitting on a road, a pram or in a mobility device or persons in a toy vehicle not capable of exceeding 10 Km/h is known as pedestrian. It also includes dismounted cyclists. Walking is recommended for a healthy lifestyle. It is also considered to be clear example of sustainable mode of transport especially suitable for urban use and/or relatively shorter distances. Pedestrian spaces are becoming increasingly rare nowadays. With the importance imparted to vehicular modes of travel, in the planning and design of transportation systems, pedestrians are not taken into account. What is frequently overlooked is the fact that at some point or the other, every person is a pedestrian. So, serious thought should be given to the various issues relevant to pedestrians such as pedestrian safety, convenience and amenities. Pedestrian spaces have a long history. Most of the older towns in India as well as abroad, display a degree of respect towards the pedestrian which is higher than modern day cities. One of the obvious reasons is that the pedestrian was a significant mode of traffic in those days. The Industrial era and the advent of the automobile signaled the decline of walking and its associated spaces. Indian cities have not yet reached the level of western cities in terms of vehicular volume, but they are growing very rapidly. With a major percentage of trips performed by walking, logic dictates that pedestrians deserve more respect in the overall urban scheme. Various studies have demonstrated the benefits that could accrue to a city by the creation of proper pedestrian spaces - improvement in circulation of people, better areas for shopping, attraction for tourists, higher rental values,

increased opportunities for leisure, better environment for residential areas, helps in environmental protection, increased scope for conservation, helps in promoting intellectual social relations and in projecting a better image of the town and its administration. The movement of pedestrians in the urban environment is vital for sustaining the social and economic relationships essential to city life. Walking enable individual to have direct contact with the environment and other people, enable the passage of people from place to place, and makes possible due to safety or ecological reasons. To enable and encourage walking for different purposes, the physical facilities must be designed to satisfy the physiological, and social needs of pedestrians and accidents. Planning and implementing such facilities require an understanding of the characteristics of pedestrian traffic.

2. Factors affecting pedestrian demand

The demand for pedestrian facilities is influenced by a number of factors of which some of the most important are:-

- The nature of the local community: - Walking is more likely to occur in a community that has a high proportion of young people.
- Car ownership: - The amount of walking is day by day reduced by private cars, even for short journey.
- Local land use activities: - Walking primarily used for short distance trips. Consequently the distance between local origins and destinations (e.g. homes and school, homes and shops) is an important factor influencing the level of demand, particularly for the young and elderly.
- Quality of provision: - Then demand will tend to increase if good quality pedestrian are provided.
- Safety and security: - facilities should be provided to pedestrian so that they can feel safe and secure. This means freedom from conflict

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with motor vehicle, as well as uneven surfaces and from personal attacks also.

3. Pedestrian Problems:-

Accidents Circumstances - Pedestrian accidents occurs in a variety of ways the most Common type involves pedestrian crossing or entering the street at or between intersections.

- Darting is used to indicate sudden appearance of a pedestrian from behind a vehicle
- Dashing refers to the running pedestrians.

3.1 Special Problems:-

- Age: - The largest group of victims in pedestrians are children under 15 years of age group, they have more chances of injury also.
- Intoxication and Drug effects: Alcohol and drugs impair the behavior of pedestrians to large extent which may be cause of accident.
- Dusk and Darkness:- During dusk and darkness motorists cannot see pedestrians clearly.

4. Literature Review

Di'az, 2002; Male pedestrians are more willing to violate regulations and make unsafe crossing decisions. They are also less likely to perceive risk when crossing a roadway in the presence of motor vehicles.

Holland and Hill (2010) collected adult pedestrian accident data which demonstrated that the risk of being killed or seriously injured varies with age and gender. A range of factors affecting road crossing choices of 218 adults aged 17-90 were examined in a simulation study using filmed real traffic. With increasing age, women were shown to make more unsafe crossing decisions, to leave small safety margins and to become poorer at estimating their walking speed. However, the age effects on all of these were ameliorated by driving experience. Men differed from women in that age was not a major factor in predicting unsafe crossing decisions.

Zhuang and Wu (2011) studied that pedestrian's crossing out of crosswalks (unmarked roadway) contributed many traffic accidents, but existing pedestrian studies mainly focus on crosswalk crossing in developed countries specifically. Field observation of 254 pedestrians at unmarked roadway in China showed that 65.7% of them did not look for vehicles after arriving at the curb. Those who did look and pay attention to the traffic did so for duration of time that followed an exponential distribution. Pedestrians preferred crossing actively in tentative ways rather than waiting passively. The waiting time at the curb, at the median, and at the roadway all followed exponential distributions. During crossing, all pedestrians looked at the oncoming vehicles. When interacting with these vehicles, 31.9% of them ran and 11.4% stepped backwards. Running pedestrians usually began running at the borderline rather than within the lanes. Pedestrians preferred safe to short paths and they crossed second half of the road with significantly higher speed.

Guo et al., 2012 Dependent behavioral variables chosen for this study include pedestrian delay time, utilization of available crossing treatments, and conflicts between

pedestrians and motor vehicles. Pedestrian delay is an important variable to study because pedestrians frequently become impatient while waiting to cross the street.

Khatoon, Tiwari and Chatterjee (2013) observed that pedestrians on Delhi roads are often exposed to high risks. This is because the basic needs of pedestrians are not recognized as a part of the urban transport infrastructure improvement projects in Delhi. Rather, an ever increasing number of cars and motorized two-wheelers encourage the construction of large numbers of flyovers/grade separators to facilitate signal free movement for motorized vehicles, exposing pedestrians to greater risk. This paper describes the statistical analysis of pedestrian risk taking behavior while crossing the road, before and after the construction of a grade separator at an intersection of Delhi. A significant number of pedestrians are willing to take risks in both before and after situations. The results indicate that absence of signals make pedestrians behave independently, leading to increased variability in their risk taking behavior. Variability in the speeds of all categories of vehicles has increased after the construction of grade separators. After the construction of the grade separator, the waiting time of pedestrians at the starting point of crossing has increased and the correlation between waiting times and gaps accepted by pedestrians show that after certain time of waiting, pedestrians become impatient and accepts smaller gap size to cross the road. A Logistic regression model is fitted by assuming that the probability of road crossing by pedestrians depends on the gap size (in s) between pedestrian and conflicting vehicles, sex, age, type of pedestrians (single or in a group) and type of conflicting vehicles. The results of Logistic regression explained that before the construction of the grade separator the probability of road crossing by the pedestrian depends on only the gap size parameter; however after the construction of the grade separator, other parameters become significant in determining pedestrian risk taking behavior.

Dulaski and Liu (2013) the interaction between the pedestrian and vehicular driver at un-signalized mid-block locations when pedestrian is waiting at curb and stepping off the curb. From the results, it was concluded that, the driver yield behavior is more when the pedestrian steps off from the curb and it is more during morning peak hours. Safety at mid-block crosswalks depends on the ability of drivers and pedestrians to recognize potential conflicts. Some of the researchers explored pedestrian safety at mid-block crosswalk location and they concluded that pedestrian safety is governed by driver yield behavior.

Granic, M A., Brenac, T, et al., 2014 pedestrian behavior being strongly dependent on biological gender, as shown in past researches, it has also been found to depend on the psychological masculinity of an individual. Pedestrian speeds are also significantly related to pedestrian age, and the speeds of pedestrians are slower as they get older.

Satish Chandra, Rajat Rastogi et al (2014) Three types of crossings were observed in field; single stage, two stages and rolling gap. Single stage gap acceptance was found to have less deviation from critical gap. Two stage crossings were less in number and people preferred rolling gap crossing as compared to the other two types of crossing. The average gap accepted was found to be the lowest for Young and the

highest for Old pedestrians. It was found that the older pedestrians exhibit a higher level of deviation in their accepted gap from critical gap than the other two categories. Based on age, it was found that young pedestrians take higher risk while crossing the roads. The critical gap at four locations was between 5.90 and 7.60 s and it decreases with increasing road width. It suggests that crossing speed of pedestrian increases with road width. Considering the safety aspect, a general value of 8 s is recommended for design of crossing facilities (like signal) and a higher value of 12 s are recommended at locations where female or old pedestrians are substantial.

5.Methodology and Data Collection

A methodology has been drawn starting from the identification of study locations for data collection to the final result that can be achieved. The data collection has been done by survey.

5.1Descriptions of study Areas

Cities with varying city size and population were selected for carrying out the pedestrian studies with the scope of observing pedestrian speed and behavior in different environments with varying city size and population. The study locations were in Ambala and Chandigarh city. In these cities, one site was located at Ambala Cantt Railway Station and another site at Chandigarh Bus Stand sector 43 near entrance of ISBT.

5.2 Identification of Test Locations

The location chosen for the present study were such that they satisfied the following criteria

1. The pedestrian traffic was quite high
2. The flow was continuous i.e. there was no scope for pedestrian to halt for a longer time.
3. The pedestrian flow was of mixed type including the very young and old persons of either sex and of all possible types of pedestrians.
4. To provide higher safety to pedestrians without obstructing/hampering the inflow and outflow of traffic.
5. To provide better transportation facilities ,either fail to provide pedestrian facilities on the roadside or compromise the safety of pedestrians.

5.3Data Collection Methods

The possible methods of obtaining such estimates are manual count and questionnaire survey described as follows.

5.4Manual Count

Through a junction, the flow of pedestrians is called manual counting across a road, or along a road section manually using manual clicker and tally marking sheet. Manual counts need to satisfy the following conditions.

1. The time in the day over which the counts are undertaken must coincide with the peak times of the activity of study.
2. Avoid School holidays, early closing, and special events should be avoided since they can result in non-typical conditions.

3. The survey locations need to be carefully selected in order to ensure that the total existing demand is observed.

Advantages of this manual counting are that these are simple to set up and carry out, and flexible to response observed changes in demand on site and disadvantages are that these are labour intensive also simple information can be achieved and not detailed information.

5.5Questionnaire Survey

Questionnaire Survey requires enabling complete information about pedestrian's origins and destination points and gather information on what new facilities, improvements to existing facilities, need to be provided to divert trips to walking, or increase the current pedestrian activities.

6.Results

In this project a gather the information of pedestrian facilities. We could establish a methodology to deal with pedestrian optimization problems. The various pedestrians' behavior at both intersections (Ambala Railway Station and Chandigarh Bus stand sector 43) on different time has been carried out in present study.

6.1Choice of Under bridge/ Over bridge at Ambala Railway Station

In this question, choice of passengers was asked for over bridge and under bridge. Most of them commented for under bridge. An underpass or a tunnel is an underground passageway, completely enclosed except for openings for ingress and egress, commonly at each end. These are constructed when it is necessary for pedestrians to cross a highway. If an underpass is constructed for pedestrians and/or cyclists beneath a road or railway, allowing them to reach the other side in safety, then such a construction is termed as a Subway. 302 out of 450 voted for under bridge i.e. 67% voted for foot under bridge.

148 out of 450 voted for over bridge i.e. approx. 33% voted for foot over bridge. An overpass also known as a flyover is a bridge, road, railway or similar structure that crosses over another road or railway. A pedestrian overpass allows pedestrians safe crossing over busy roads without impacting traffic.

Table 6.1 Choice of over bridge or under bridge

No. of Sample	Over bridge	Under bridge
450	148	302

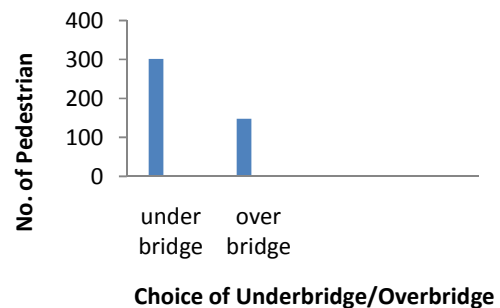


Fig. 6.1 Choice of under bridge or over bridge

6.2 Choice of Lightening at night

Choice of passengers was asked for lightening at night. Most of them commented yes for it. This question has more significance in case of Ambala railway station to National Highway Area. Females feel more secure and safe in light. It was observed by some people that old age people will get help by lightening as they have less visibility. During fog, lightening provides great help. Slippery steps, damaged steps etc. are visible due to light.

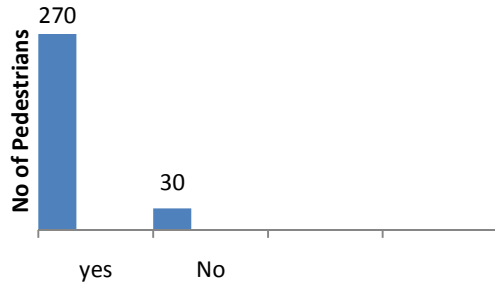


Fig. 6.2 Choice of Lightening at night

6.3 Frequency Of Visits Of Pedestrian's

Data is collected to have an idea about how many times a person crossing in that particular Area. Around 73% of persons cross 1-2 times in a day, 15% persons cross 3-4 times in a day and 12% persons cross 5-6 times in a day. They go in the morning to their office/place and come back in the evening.

Percentage of Samples	Frequency of Visits of pedestrians
73%	1-2 times
15%	3-4 times
12%	5-6 times

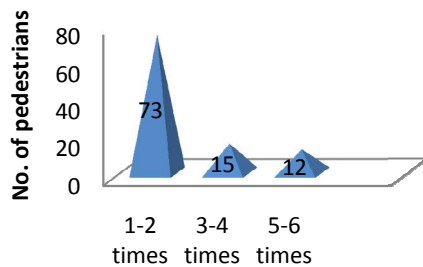


Fig. 6.3 Frequency of visits of pedestrians

6.4 Choice of under bridge/Over bridge at Chandigarh Bus Station sector 43

In this question, choice of passengers was asked for over bridge and under bridge. Most of them commented for foot over bridge. An overpass also known as a flyover is a bridge, on road structure that crosses over another road. A pedestrian overpass allows pedestrians safe crossing over busy roads without impacting traffic. And overpasses are used to replace at-grade crossing as a safer alternative. Overpasses allows

for unobstructed traffic flow from mixing with vehicular and pedestrian traffic. Around 65% pedestrians voted for foot over bridge.

Table 6.4 Choice of over bridge or under bridge

No. of Sample	Over bridge	under bridge
267	186	81

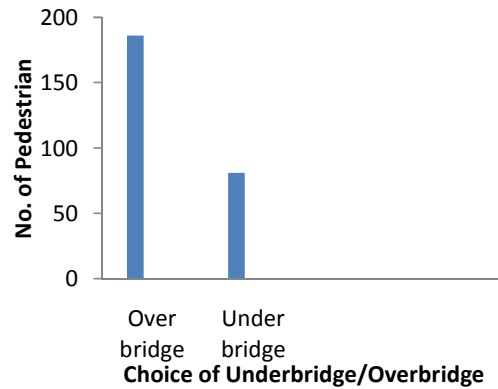


Fig. 6.4 Choice of under bridge/Over bridge at Chandigarh bus stand sector

6.5 Choice of Lightening at night

In this question, choice of passengers was asked for choice of lightening at night. Most of them commented yes for it. Lightening helps the minimizing the accident during night time. Fear of dark is one of the factors for pedestrian safety. Females feel more secure in light. It was observed by some people that old age people will get help by lightening as they have less visibility

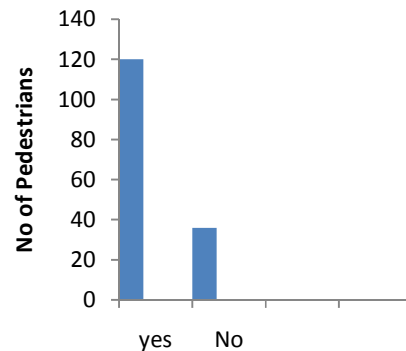


Fig. 6.5 Choice of Lightening at night

6.6 Frequency Of Visits Of Pedestrian's

Data is collected to have an idea about how many times a person crossing in that particular Area. Around 69% of persons cross 1-2 times in a day, 25% persons cross 3-4 times in a day and 6% persons cross 5-6 times in a day. They go in the morning to their office/place and come back in the evening.

No of samples	Frequency of Visits of Pedestrians
69%	1-2 times
25%	3-4 times
6%	5-6 times

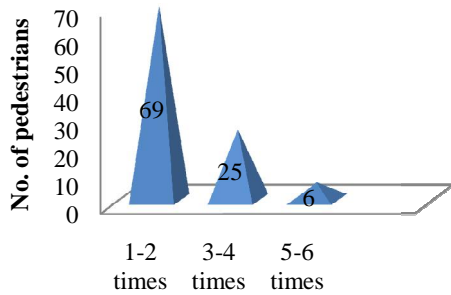


Fig. 6.6 Frequency of visits of pedestrian's

6.7 Recommendations for future study

- The Survey can be validated at other intersections of city and thus can help transport planners and officials for assuring safety of pedestrians.
- The National Highway and Public work Department shall review signal, intersection, FOB and underpass projects in the transportation Improvement to evaluate and recommend pedestrian enhancements that could be incorporated into the project to improve pedestrian travel.
- In order for people to reclaim the urban environment overrun by motor vehicles strategies must be incorporated.
- Policies and investments provide a momentum to transform Indian cities, encourage pedestrianization and allow people to enjoy better mobility and quality of life.

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