

## Road Crossing Behaviour Of Pedestrian At Midblock Section, Bangalore

Seelam Srikanth,

*Assistant professor, School of Civil Engineering, REVA University, Rukimini Knowledge Park, Kattigenahalli, Yelahanka, Bangalore, Karnataka-560064  
Email: srikanths.reddy@reva.edu.in*

Syed Omar Ballari,  
Professor, Department of civil engineering, Anurag University, Hyderabad, Telangana.

Deepika P S,  
*PG Student, School of Civil Engineering, REVA University, Rukimini Knowledge Park, Kattigenahalli, Yelahanka, Bangalore, Karnataka-560064*

Chunchu Bala Rama Krishna  
*Assistant professor, School of Civil Engineering, REVA University, Bengaluru, Karnataka -560 064.*

### **Abstract:**

*Pedestrians are one of the most vulnerable elements of the transportation framework. The vast majority of developments that have taken place are coordinated towards the improvement of the vehicular system and facilities, but little has been done for the pedestrians. With an expansion in the motor vehicular traffic and the corresponding increase in the congestion of traffic leads to increase in the road accidents, the importance for improvement of the pedestrian facilities has assumed great significance. The provision for such walk can be skywalk, zebra crossing, stairs or escalators. This study aims to determine total pedestrian volumes of the area during the peak and non-peak hours of a day, to collect the data factors which affect the pedestrian behaviour which cause risk of pedestrian accidents and to determine the safety of the pedestrian. The case study was performed at ITI Gate and Benniganahalli, Bangalore, India. The method was applied for the area to obtain data of pedestrians is videography method and Questionnaire survey and models are developed to understand the pedestrian behaviour. From the study conclude that female pedestrian were found to cross the road at slower rate compared to males due to safety concern and the factors like gender, age, usage of phone, baggage, presence of children and stages of crossing have major influence on pedestrian behavior.*

**Keywords:** *Pedestrian, Vehicular traffic, Safety and Comfort.*

### **Introduction:**

Walking is an everyday essential activity for humans and most of the walk journeys involve road crossing that is potentially hazardous activity at mid-block places. Pedestrians want to look for good enough vehicular gaps to go the street effectively. It is uncommon to get ok gaps below mixed traffic conditions at unprotected mid-block places. So, pedestrians make use of special behavior characteristics to cross the street quick via the use of non-safe gaps. If the automobile drivers are not able to yield to pedestrians due to higher automobile velocity, then it outcomes in hazardous crossing. The person on foot vehicle clashes will increment with increment in change-off among walker misconception of vehicular gaps and vehicular driver yield conduct. Generally, pedestrian's increases their crossing speed or change their crossing path when the available time gap of an approaching vehicle is less than safe gap. The pedestrian fatalities increase because of attempts of non-secure gaps below mixed traffic conditions. Traffic accidents related to pedestrians have emerge as a prime

protection trouble in most of the developing nations like India. The main aim of this study is to analyse and investigate the changes in pedestrian road crossing behavior at midblock sections under mixed traffic conditions. For this purpose, traffic and pedestrian data were collected from a midblock section located in Bangalore city. Various parameters like gender, age, waiting time, crossing patterns, crossing times, crossing speeds, speed and types of vehicles are extracted and separated from the recorded videos. The IRC Code for pedestrian facilities is IRC -103:2012 “Guidelines for Pedestrian Facilities”.

## Literature Review

B Raghuram Kadali, et.al. (2014) pedestrians normally cross the road at mid-block locations in India because of the benefit and luxury to achieve their required spot compared to intersection locations. It's difficult to analyse the pedestrian Gap acceptance behavior at mid-block sections because of lack of vehicular gaps under mixed traffic condition, which ends into the pedestrian road crossing conduct. During this study analyzed the pedestrian Gap acceptance behavior using artificial neural network (ANN) to understand the choice making technique of pedestrian. The obtained outcome of ANN helps in decreasing the pedestrian and vehicular conflicts by using correct measurements at mid-block locations.

Pengfei LI, et.al. (2015) during this study examine the four characteristics behaviour like crossing speed, waiting time, running across the road, not looking before crossing. Here the information is calculated by mean, Chi-Square test and analysis of variance (ANOVA). They conclude that the crossing of adult and adult pair is different from that of the children alone and kids are more likely to cause accidents.

Mohamed Shawky, et.al. (2016) a logistic regression model was created to appear at the factors which will influence the variables that may affect the severity of pedestrian crashes. The key of those crashes are due when the pedestrians trying to cross road. They analyzed the factors affecting the severity of pedestrian-vehicle collisions in Emirate of United Arab Emirates capital severe crashes in AD are pedestrian-related crashes.

Dig Vijay S, et.al. (2016) in this study they explored pedestrian temporal and spatial gap acceptance at uncontrolled mid-block road crossing, where vehicles do not allow to pedestrians to cross and pedestrians have to choose for safe gap on their own, which results in complex interaction between pedestrian and vehicles. To analyze the interactions of both and to estimate the gaps deterministic method and probabilistic method are used. Data collected by using camera at midblock crossing sections. Based on the study results temporal and spatial gaps at study area follows lognormal distribution. The chances of accepting the spatial gap decreases with increase in the conflicting vehicle speed.

Vedagiri, et.al. (2018) in this examination the midblock areas are paid attention to investigations the person on foot crossing conduct. The fundamental point of this examination is to learn about the passerby hole acknowledgment conduct by utilizing MLR Model. From the investigation it reasoned that hole acknowledged by people on foot relies upon person on foot characters like moving hole and vehicle speed additionally shows noteworthy impact on gap acknowledgment conduct.

Huseyin Onur Tezcan, et.al. (2019) in this study the data were collected from the field studies at four selected sections of one way streets by recording the videos. By using the two hour recordings at each sections required parameters like age, gender, distraction status, traffic characteristics were extracted for analysis. Multinomial logit models for grouping and individual crossing were estimated for each stratum. From this study they concluded that platooning increases as the traffic volume and group size increases. The pedestrians should be prevented by installing traffic signals with push-to-walk buttons etc.

## Study area and Data Collection

To examine pedestrian crossing speed change behavior, in this study has considered two unprotected mid-block sections and three lanes per direction two-way road in Bangalore, India. The selected midblock locations are Mid-block-1 at Benniganahalli Gate shown in fig 1 (a) and Mid-block-2 at ITI Gate shown in fig 1(b) in Bangalore city. These locations have distinct land use patterns, such as residential, shopping and commercial area and bus stops are located away from the selected locations. These crosswalk locations do not have sign boards to control the vehicular traffic, no zebra crossing, no median opening and the width of median is 11.30m and 11.60m respectively. It has an acceptable volume of pedestrians and also vehicular traffic for the collection of the required data for study.

At each selected location Vedio graphic survey was conducted during a normal weather and working day condition. The survey was conducted for four hours during peak hour condition. The video camera was placed on the top building for recording the video to collect the required data. The camera viewed a total of 30m length along longitudinal direction of the road in this; the viewed 30m road section is used for data collection where the pedestrians are usually crossing the road at selected section. The entry and exit lines are marked at the selected section to calculate the speed of the vehicle and also vehicular flow values.



Fig 1(a) Photography of Benniganahalli Bangalore



Fig 1(b) Photography of ITI Gate, Bangalore

## Data Extraction

The recorded video data was extracted frame by frame with help of MPC –HC video editor software.

At each selected location data such as vehicular characteristics like vehicle type, speed of vehicle and pedestrian behavioral characteristics like gender, age, pedestrian crossing time, stages of crossing, baggage effect, usage of phone are extracted from the recorded video. These factors are extracted for every 1m by clicking step forward option of the software. The pedestrian speed and vehicle speed are calculated by dividing the lane width of the selected section with pedestrian crossing duration. These factors are considered with in the 30m road length of the selected midblock and entry and exit point are marked. {Shown in the fig 1(a) and fig 1(b)}

The average observed vehicular traffic during the survey at midblock 1 is 2906 and mean vehicular speed of vehicular traffic is 14.150m/s and at midblock 2 the vehicular traffic is 6208 and mean vehicular speed is 8.825m/s. The vehicle composition at midblock 1 and midblock 2 are shown in the fig 2(a) and fig 2(b) respectively and pedestrian composition at midblock 1 and at midblock 2 are shown in fig3(a) and fig3(b) respectively. Here the presence of 2w and 4w are more compared with the other category of vehicles and the pedestrian are categorized as Male, Female, Group 2 and Group 3, here male pedestrians are more compared to female at both the midblock locations.

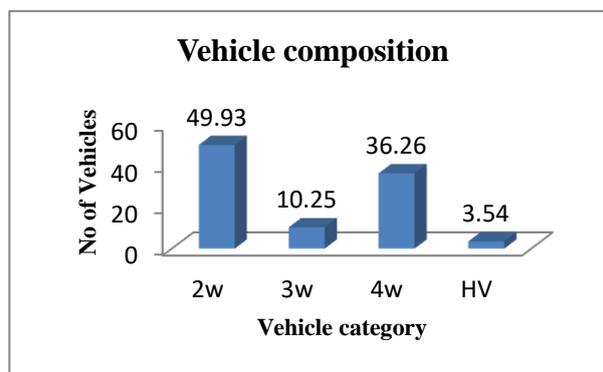


Fig 2(a) Vehicle composition at midblock 1

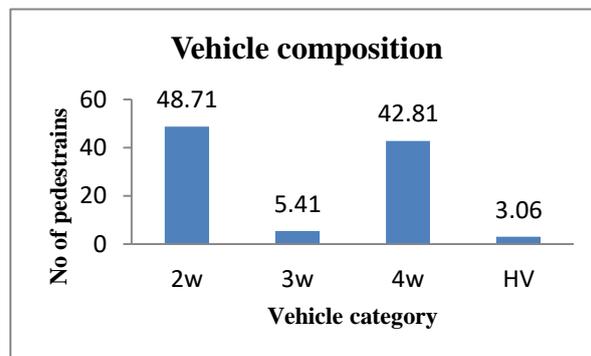


Fig 2(b) Vehicle composition at midblock 2

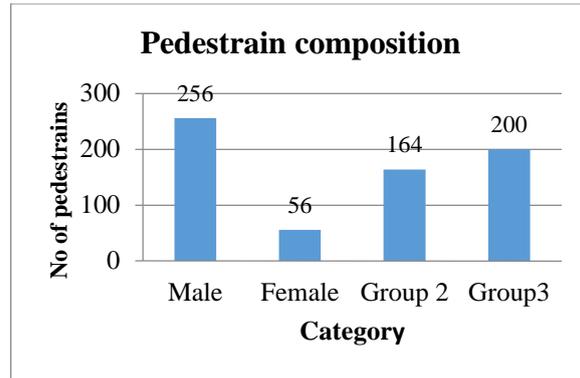


Fig 3(a) Pedestrian composition at midblock 1

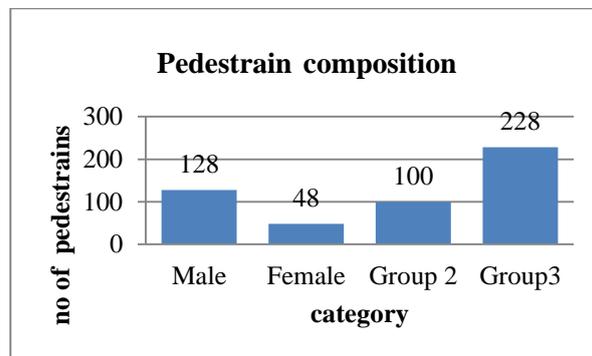


Fig 3(b) Pedestrian composition at midblock 2

The extracted pedestrian data is extracted based on the baggage effect, usage of phone, presence of children, age difference type of crossing, type of movement and classified as with or without these factors these factors And also compared between male and female and male is to have more number with respect to females. The results are shown below.

	Midblock 1	Midblock 2
Observed data	No of pedestrians observed	No of pedestrians observed
Classification	Male Female	
<b>Gender</b>		
Male	256	128
Female	56	48
Group 2	164	100
Group 3	200	228
<b>Age group</b>		
Youth	28	8

Middle	220	124
Old	64	44
<b>Type of crossing</b>		
Walk	248	128
Run	64	48
<b>Type of movement</b>		
Straight	176	120
Diagonal	124	48
Rolling	12	8
<b>Usage of Baggage</b>		
With	22	12
Without	290	164
<b>Presence of Children</b>		
With	28	8
Without	284	168
<b>Using Phone</b>		
With	18	4
Without	292	168
<b>Vehicle Type</b>		
2w	1451	3024
3w	298	336
4w	1054	2658
HV	103	190

### Analysis of Mean Walking Speed

Walking speed of pedestrians is analyzed by considering the factors like category of pedestrian, baggage, usage of phone, presence of children, type of crossing and movement. Here the Mean speed, Standard deviation, maximum and minimum values are calculated using excel and compared with the Male and Female mean speed values of different parameters. The walking mean speed is compared between male and female at both the midblock sections and it is found that, the mean walking speed for male is 1.064m/s for male and 1.049m/s for female at midblock 1 and meanspeed of male is 1.077m/s and female is 1.064m/s at midblock 2 shown in fig 3. In both the cases the Mean walking speed of male is more as compared to female and female pedestrains cross the road at slower rate due to the safety concern. The mean speed is calculated for all the above parameters at it is found that the mean speed is more with out baggage, children, phone compared to with these factors and the mean speed is more while rolling and running compared to other mode of crossing and movement but this leads to pedestrain accidents.

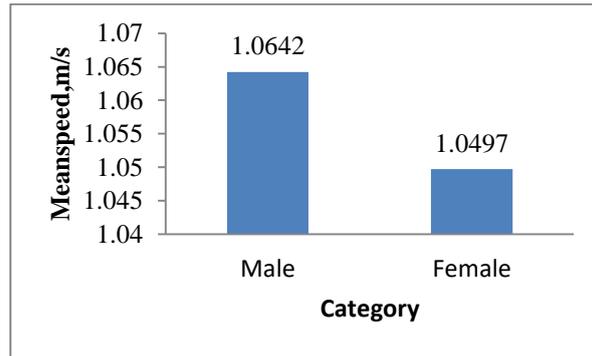


Fig 3(a) Walking Mean speed of Pedestrian at midblock 1

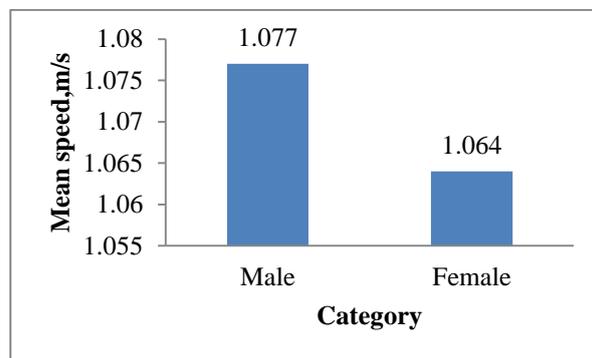


Fig 3(b) Walking Mean speed of Pedestrian at midblock 2

## Conclusion

From video-graphic survey, at both mid-blocks, number of male pedestrians is higher compared to female. Most of the pedestrian choose to cross the road in a straight manner which gives easy way of crossing and takes less time duration compared to rolling and diagonal. The mean walking speed of male is higher compared to female at both the locations, females wish to cross the road at slower rate compared to male due to safety concern. The mean walking speed varies with the presence of baggage, children, phone, compared with the presence of these factors. These factors impact on the pedestrian road crossing behavior and slowdowns the pedestrian walking speed and divert the pedestrian concentration while using phone. From the study concluded that these all the above factors are reason for the risk of accidents. The pedestrian consumed with alcoholic, drug are also main reason of accidents and also poor lightening, dashing, darting, over speed limit of driver these physiological character also reason for pedestrian accidents. The planners and designers have to focus on the correct planning facilities for pedestrians and it is the major task for them.

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