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Road Crossing Behaviour Of Pedestrians At Uncontrolled Intersections

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Abstract

Uncontrolled intersections are the most common intersection type. Although they do play an important role in the control of traffic network. In most of the sequence, pedestrians are considered as mode of transportation. As the pedestrians need to walk along the road and they must cross the road. Crossing the road should be safe, easy, comfort and convenient to road users. This paper presents study and analysis of road crossing behavior of pedestrians, a study conducted at Bangalore city. They cause more effects on the behavior of pedestrian characteristics like age, gender, stages, presence of children, using mobile phones, carrying with or without baggage and their crossing patterns were examined based on pedestrian flow characteristics like crossing time and waiting time and all these parameters were extracted from video-graphic survey. The analysis for extracted data is performed by considering various combinations of pedestrian characteristics and vehicle characteristics. The result shows that most of them uses mobile phones, they cross the road by one stage, and the movement of pedestrian is straight. The crossing speed of male is more than the female pedestrians and also male take more risk compare to female while crossing the road. If the number of pedestrian increases while crossing the road then the vehicle speed gets decreases.

Keywords:*Pedestrian, road crossing behaviour, uncontrolled intersection.*

Introduction

Transportation is defined as port to port transfer of person or goods by a medium which may be a vehicle or an individual. Pedestrian behavior plays an important role in analyzing the operations of unsignalized intersections and isolated crossings, because a pedestrian creates a complex of interactions with vehicles at such locations. Pedestrians are being most neglected and are given less priority at uncontrolled intersections by mode of transportation in terms of safety and facility, face difficult situations while crossing. But if the behavior of pedestrians while crossing is analyzed in such conditions, it would be possible to make suitable solution to reduce the danger and ensure safety [1]. In India, pedestrians account for 65% of the accident deaths and out of these, 35% are pedestrian children. If the inadequate facilities available for their movement, there exists a continuing conflict between the pedestrians and therefore the vehicles share the limited space available on a road.

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Therefore, it's necessary to analyses the risks involved in pedestrians crossing at these uncontrolled locations [2]. Hence, there is a special need to analyze the crossing behavior of pedestrians to ensure their safety on roads. Data base on factors which influence pedestrian's behavior are formed on the basis of traffic video recordings, and often the experiments are conducted at laboratory conditions. The effect of pedestrian characteristics like age, gender, carrying baggage, crossing patterns, crossing speed and waiting time are examined. Pedestrian safety also analyzed with respect to safety margins and gaps accepted by pedestrian in traffic stream [3]. They noted various sorts of road crossings; those were single stage crossing, two stage crossing and rolling crossing. It had been observed that pedestrians prefer to adopt rolling crossing in comparison to single stage and two stage crossing [4]. use mobile phones while crossing and comparison of pedestrian who are using phones are less safe than the other pedestrians and also that texting/viewing on phone is unsafe but to lesser extent than mobile phone talk and youths use more mobile phones increases in unsafe behavior than the older pedestrians behaves more safely while crossing the road [5]. The pedestrians did not want to wait more than 20–30 s to cross the road and also it varies with intersection control type, gender, age, minimum gap, waiting location, and vehicle flow [6].the effect of waiting time as well as distribution of pedestrian walking speed. As the results was pedestrian waiting time was 3s to 30s conflicts get decreases, as beyond 30s pedestrian crosses in risky situation [7].The pedestrian characteristics like age, gender, baggage and vehicle speed are also considered as these directly effect on the decision of probability of pedestrian's utilization. The results are to reduce the risks from vehicular-pedestrian interactions and to improve pedestrian crossing behaviors and also reduce the exposure of accident risks [8].

The mainobjective of the study is to study and analyze the crossing behavior of pedestrians which includes pedestrian characteristics, vehicular characteristics, traffic conditions, and intersection conditions at uncontrolled intersections.

Methodology:

Methodology involves the selection of study locations, Data collection using video graphic survey, data extraction, data analysis and suggesting some measures for observed problems in the locations.

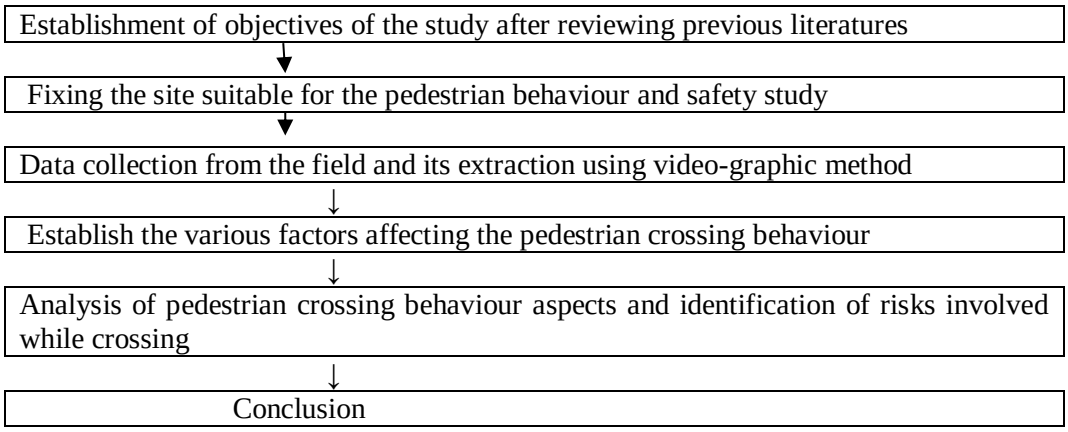

Fig a) Methodology Flow Chart

Study area:

The locations for carrying out the study are decided based on the pedestrian and vehicle interactions at particular uncontrolled intersection. The study locations chosen for the present study is in Bangalore city.

1. SubedarChatram Road and Nagappa street.
2. Uttarahalli circle.

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Fig.1 SubedarChatram road, Nagappa street (Y-intersection) Bangalore.

Fig.2 Uttarahalli Circle (T-intersection), Bangalore

Data Collection:

The data collection methods used for the study is video-graphic survey. The video-graphic survey was conducted on each location from an elevated point during peak time periods. The camera was fixed in an elevated position so as to obtain overall view and recording was done for 4 hours during morning and evening (i.e., 6:00-10:00 AM and 4:00-8:00PM) on normal working day at normal weather condition and also the width of road section is 3.5m and the length of area covered by camera is 30m. Recorded video is used to extract data. Based on the recorded information pedestrian waiting and crossing timeand vehicle speeds are recorded in MS-Excel work sheets and estimated.
The extracted data from video includes pedestrians characteristics like age, gender, the way of crossing, speed, crossing time and waiting time etc. The age of pedestrians is categorized in general into, youth, middle aged and elders according to the visual appearance. Then platoon size, in this they are considered into number of pedestrian's while crossing i.e., single or group. Similarly, pattern of movement, type of crossing, number of attempts, presence of children, stages of crossing, using mobile phones, carrying baggage, etc. are collected from the extracted video using excel sheets further study is continued.

Analysis and Results:

The data from the video was extracted using Media Player Classic at an accuracy of 1 in 1000 sec (0.001s). As the pedestrians and vehicles are observed on both sections, there is more in first section compared to second section. The observed results are 69% of pedestrians and 53% of vehicles are at first section which is more than the second section. The pedestrians were categorized into 4 groups (i.e, male, female, group two
members, group more than two members).

1) **At first location, SubedarChatram Road and Nagappastreet;** There are 45% of male pedestrian were observed (fig.3). The mean speed of male pedestrian is more than other categories (fig.4).

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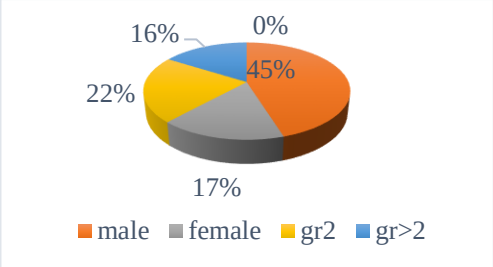

Fig.3 Percentage of pedestrians observed

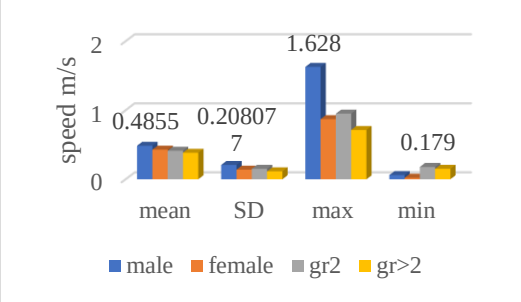

Fig.4 Mean crossing speed of pedestrians

Comparing between male pedestrians and female pedestrians

a) Considering Age group

The elder pedestrian crossing speed is less and they take more time to cross the road (fig.5).

	male			female		
age	elder	middle	youth	elder	middle	youth
mean	0.401529	0.462449	0.558	0.43867	0.430025	0.429958
SD	0.144341	0.208848	0.208134	0.135985	0.136158	0.135756
max	0.904	1.279	1.628	0.871	0.871	0.871
min	0.168	0.132	0.061	0.092	0.022	0.022

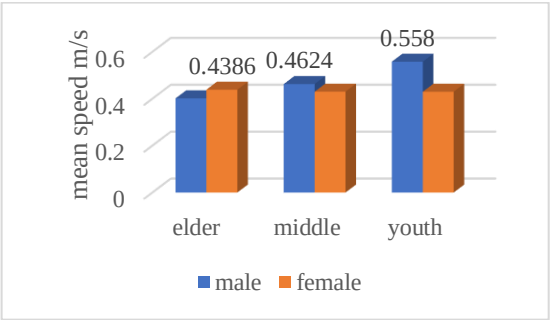

Fig.5 Effect of crossing speed on different age categories of pedestrians

b) Considering pattern of movement

There are two type of movements, either they cross by rolling movement or zig-zag way and straight movement. Most of the male pedestrians choose straight movement than rolling movement as this helps in safe crossing than causing any accident by vehicle interactions (fig 6).

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	male		female	
movement	straight	rolling	straight	rolling
mean	0.511982	0.45836	0.444417	0.414367
SD	0.208077	0.208914	0.141035	0.140157
max	1.628	1.256	0.871	0.777
min	0.193	0.061	0.022	0.092

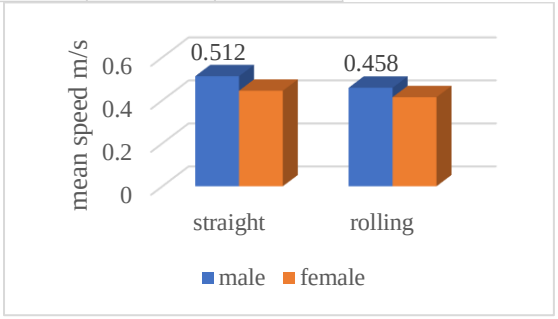

Fig.6 Effect of crossing speed on pattern of movement

c) Considering type of Crossing

The road crossing behaviour impacts on the type of crossing of pedestrians whether they choose to run or walk along the road. Here they prefer walking instead of run type because of safety while crossing the road (fig 7).

	male		female	
crossing	walk	run	walk	run
mean	0.433547	0.77228	0.429392	0.434545
SD	0.208077	0.210216	0.140157	0.139203
max	1.279	1.628	0.871	0.871
min	0.061	0.281	0.022	0.092

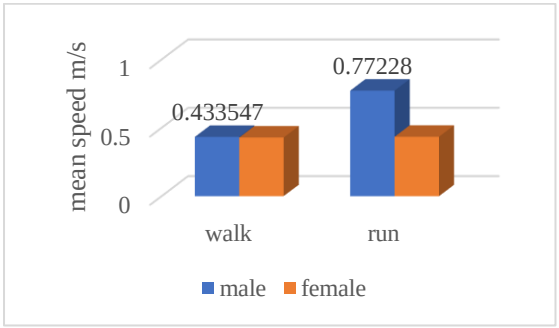

Fig.7 Effect of crossing speed on type of crossing

d) Considering using of mobile phones

In this study some members use mobile phones that to male pedestrians are more (fig8).

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	male		female	
mobile	yes	no	yes	no
mean	0.487938	0.485374	0.439604	0.426509
SD	0.193644	0.208077	0.134582	0.140611
max	0.956	1.628	0.871	0.871
min	0.191	0.061	0.092	0.022

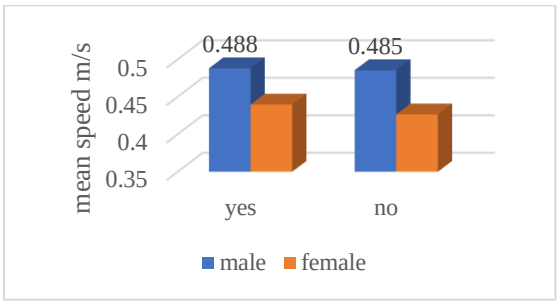

Fig.8 Effect of crossing speed on using mobile phones

e) Considering Baggage

while carrying baggage they consume more time to cross and it is risky where it depends on the weightage of baggage carrying. While without carrying baggage can easily cross the road and does not involve any risk (fig9).

	male		female	
baggage	with	without	with	without
mean	0.482769	0.487112	0.417411	0.465333
SD	0.208326	0.208663	0.140157	0.141024
max	1.256	1.628	0.738	0.871
min	0.061	0.132	0.022	0.177

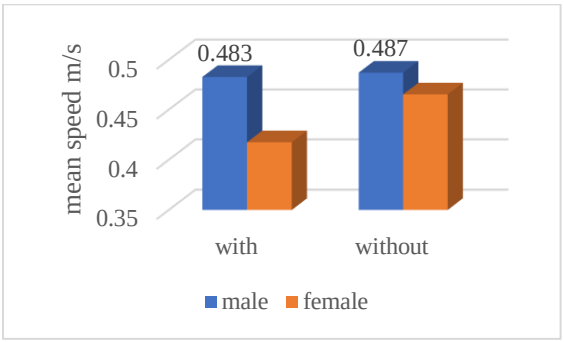

Fig.9 Effect of crossing speed by using with/without baggage

Considering overall categories, (fig.10) using mobile phones which is very dangerous and having more speed compared to others. The type of crossing is running type where they involve in traffic crashes. The pattern of movement is straight which is good type without getting disturbance by moving in rolling

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movement. Then the pedestrians carrying without baggage has more speed compared to carrying with baggage it is risky and also depends on weightage of luggage.

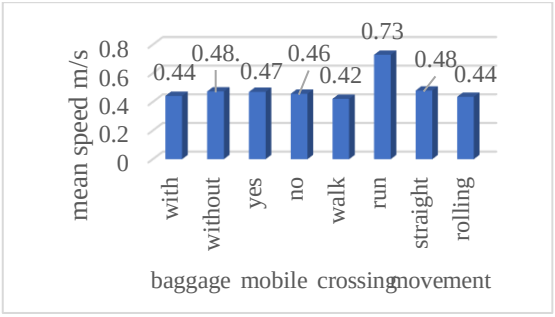

Fig.10some parameters cause effect on mean crossing speed of pedestrians

In this study, 2822 vehicles are followed in video graphic survey (fig11), and then they classified into 2-wheelers, 3-wheelers, Car, Bus/Heavy vehicles for the analysis purpose. We can observe that 53% of 2-wheelers are present. Then the entry and exit time were observed by taking 30m length on the road section.

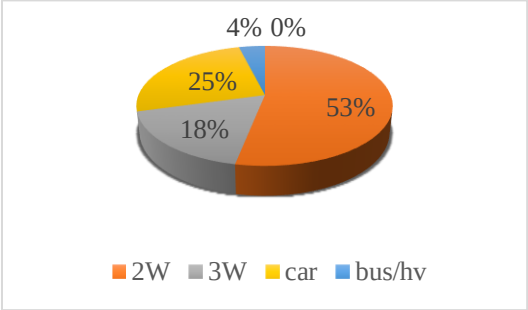

Fig.11 Vehicle composition in percentage

2) At second location, Uttarahalli Circle;

There are 47% of male pedestrian were observed (fig.12). The mean speed of male pedestrian is more than other categories (fig.13).

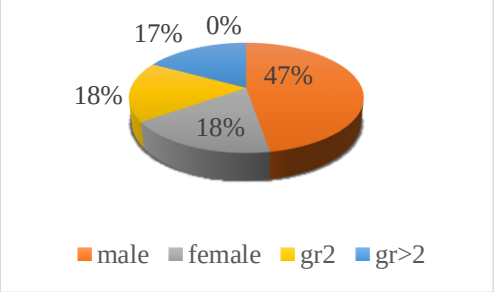

Fig.12 Percentage of pedestrians observed

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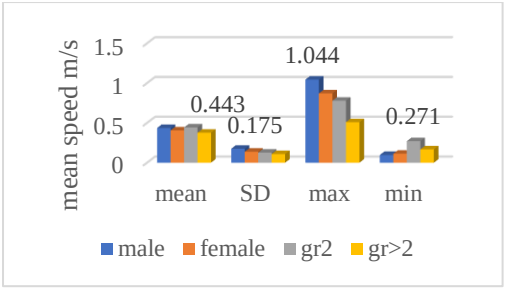

Fig.13 Mean crossing speed of pedestrians

Comparing between male pedestrians and female pedestrians

a) Considering Age group

The mean speed of male youth is more than the other two categories where they cross the road very quickly without considering vehicle interactions and also, they take risks while crossing. But the mean speed of female middle aged is more than another category (fig 14).

	male			female		
age	elder	middle	youth	elder	middle	youth
mean	0.3732	0.405966	0.490439	0.354375	0.424714	0.400261
SD	0.149115	0.184987	0.163884	0.144334	0.159086	0.103975
max	0.739	0.985	1.044	0.6	0.871	0.621
min	0.104	0.097	0.126	0.113	0.176	0.202

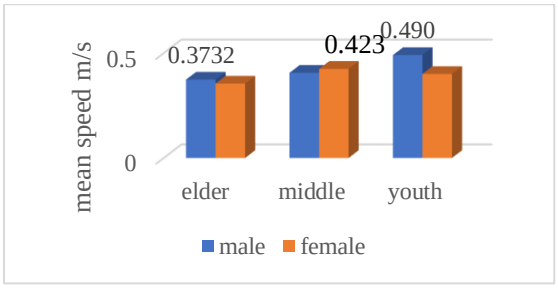

Fig.14 Effect of crossing speed on different age categories of pedestrians

b) Considering pattern of movement

The mean speed of male chooses straight movement than rolling movement as it requires more time as they intersect with many vehicles while crossing the road. The mean speed of female pedestrian chooses rolling pattern than straight movement (fig15).

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	male		female	
movement	straight	rolling	straight	rolling
mean	0.457131	0.410113	0.399774	0.412143
SD	0.19364	0.148573	0.158467	0.112754
max	1.044	0.809	0.871	0.729
min	0.097	0.126	0.113	0.236

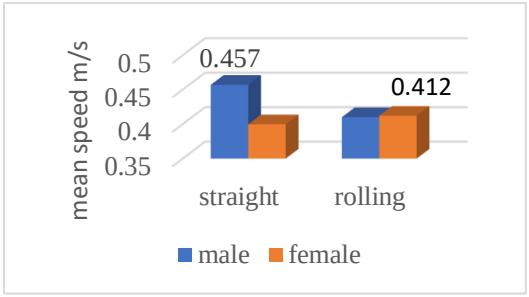

Fig.15 Effect of crossing speed on pattern of movement

c) Considering type of Crossing

The mean speed of running is more than the walking speed, because while walking they take more time compared for running. But taking heavy risk while crossing by run type leads to accidents (fig16).

	male		female	
crossing	walk	run	walk	run
mean	0.405036	0.701063	0.390018	0.6205
SD	0.147188	0.181738	0.116834	0.233576
max	0.822	1.044	0.729	0.871
min	0.097	0.394	0.113	0.338

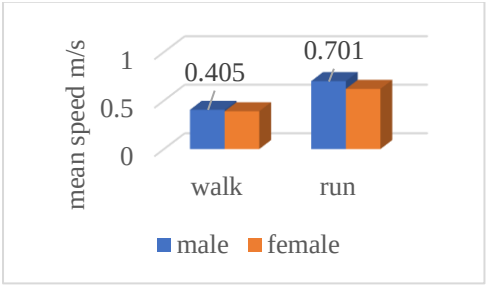

Fig.16 Effect of crossing speed on type of crossing

d) Considering using of mobile phones

In this study some members use mobile phones that to male pedestrians are more (fig17).

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	male		female	
mobile	yes	no	yes	no
mean	0.3415	0.440714	0.38	0.406544
SD	0.23637	0.17115	0.062225	0.139747
max	0.721	1.044	0.424	0.871
min	0.097	0.104	0.336	0.113

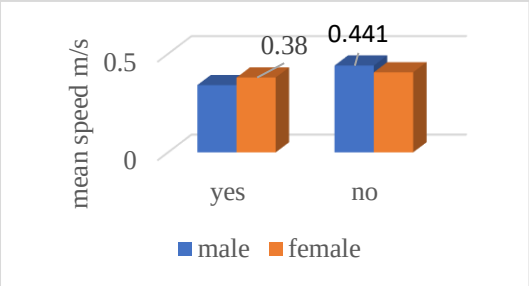

Fig.17 Effect of crossing speed on using mobile phones

e) Considering Baggage

The male pedestrians are more carrying the baggage and the mean speed is more while they take more time and walking speed will be less as compared to pedestrians without carrying baggage (fig 18).

	male		female	
baggage	with	without	with	without
mean	0.412107	0.448879	0.389395	0.435048
SD	0.146292	0.189441	0.117778	0.166947
max	0.822	1.044	0.738	0.871
min	0.119	0.097	0.113	0.182

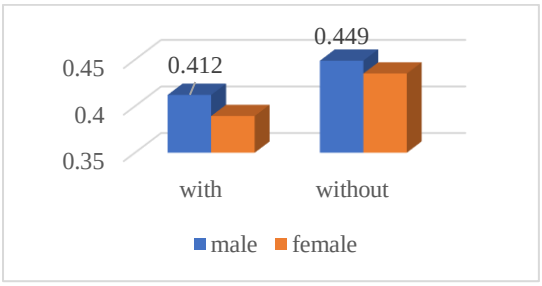

Fig.18 Effect of crossing speed by using with/without baggage

Considering overall categories,(fig.19) the pattern of movement here the pedestrians chosen rolling movement and speed is more compared to straight movement which may results in accidents. Without using cell phones, they can be in safe and concentration will be on the road surface it avoids traffic crashes.

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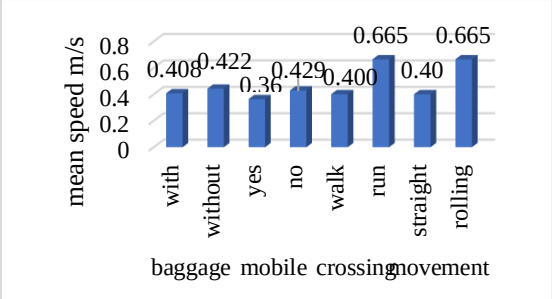

Fig.19 Effect of crossing speed on different age categories ofpedestrians

In this study, 2530 vehicles are followed in video graphic survey, and then they classified into 2-wheelers, 3-wheelers, Car, Bus/Heavy vehicles for the analysis purpose. We can observe that 60% of 2-wheelers are present.

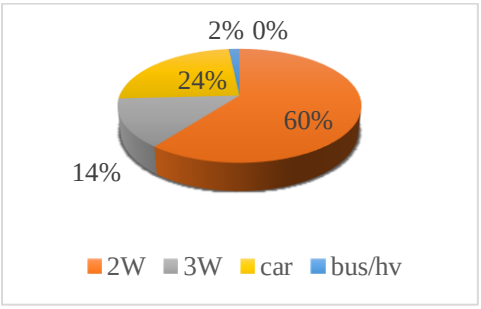

Fig.20 Vehicle composition in percentage

Conclusion

The study examines the behaviour of pedestrians at selected locations. To understand the risk of pedestrians while crossing the road comparison was made with some parameters like age, gender, speed etc.Pedestrian crossing decisions (to cross the road or not) may be associated with traffic conditions and with vehicle and pedestrian characteristics.

The crossing speed of male pedestrian is more than the female pedestrian while they take risk while crossing.Most of the male pedestrians uses mobile phones while crossing and their mean speed is more which results in accidents.If the number of pedestrian increases while crossing the road then vehicle speed decreases. Almost in both cases most of them chosen one stage of crossing and also straight pattern of movement. The pedestrians carry baggage take more time than the pedestrians carrying without baggage.The average waiting time for pedestrians to cross generally decreases with decreasing vehicle flow volume and also decreases with an increase in the number of pedestrian crossings.

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