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Pedestrian Crossing Behaviour Analysis at Intersections of Mysuru City

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ABSTRACT
Pedestrian crossing behaviour is examined for the provision of apposite pedestrian facilities at preferred locations as well as to improved their safety while crossing the roads. The analysis of pedestrian crossing behaviour conduct from an examination at Mysuru city (Karnataka state in India). The effects of pedestrian characteristics like gender, age and they carrying baggages and luggages as well as their crossing patterns were analyzed on pedestrian stream qualities like waiting speed and crossing time. Pedestrian safeties was also analyzed with respect to gaps accepted by pedestrian in traffic flow. Crossing patterns were watched for different gender and age group. The present study discuss about effect of pedestrian walking at intersection Gap acceptance was determined by use of Multi linear regression model.

Keywords: Road accidents, Black spots, Vehicular traffic, Alleviation measures.

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I. INTRODUCTION

1.1 General

Traffic accidents including pedestrians obtain turn into a major safety issue everywhere throughout the world, especially in emergent nations, because of high population density, quick urbanization, and absence of adherence to traffic regulations by both pedestrians and drivers. Absence of adherence to traffic regulations at pedestrian crossings especially by drivers make a worldview in which pedestrians may possibly befit bold and force moving toward vehicles in the traffic flow to brake in order to gain priority at the pedestrian crossing. On the other hand, pedestrian crossings with heavy pedestrian flow are likely to cause unsatisfactory vehicular delay. Pedestrians are observed to be a main element of the total urban traffic accidents. Participating in India, pedestrians represent for 65% of the accident deaths and out of these, 35% are pedestrian children.

Hence, there is a special need to examination conduct of the crossing behaviour of pedestrians to guarantee their safety on roads.

1.2 Road accident scenario in Mysuru

Most of the developing countries including India face a serious problem of increasing number of road accidents.Fatality and injury rates in developing countries are quite high in comparison with those in the developed countries.

The rapid increase in the number of registered vehicles is one of the many factors that increase the road accidents, but the relationship between vehicle growth and rate of accidents is highly unpredictable. Some of the factors leading to road accidents could be rash and negligent driving, poor geometric and engineering condition of the roads, inadequate width of foot path, absence of meaningful sign boards, improper and ill designed unscientific poorly maintained road humps, absence of traffic awareness and education, impatience of drivers and pedestrians. Table 1.1 shows the number of people killed and injured in road accidents of Mysuru.

Table 1.1 Accidents in Mysuru

Sl no	**Year**	**Accidents**	
		killed	Injured
1	2014	71	566
2	2015	56	417
3	2016	55	435
4	2017	65	371
5	2018 (28/02/2018)	9	66

(Source: Mysuru traffic police)

1.2.1 *Problems due to growth of road traffic*

The following problems are encountered due to the growth in road traffic:-

1. Increase in road congestion.
2. Increase in travel time and thereby increase in fuel loss and man-house lost.
3. Increase in road accidents.
4. Air pollution and environment degradation.
5. Inadequate width of footpaths for pedestrian due to widening of roads.

The increase in traffic congestion itself has been mainly attributed to:

1. Uneven service conditions of the roads
2. Increase in mass transport facilities and private vehicles
3. Movement of slow- moving vehicles like bullock cart, cycles etc along with fast moving vehicles.
4. Pedestrians and their haphazard crossing at intersections and middle of roads
5. Rotary intersections (weaving and merging of vehicles and their impacts)
6. Location of Bus stops on carriage ways, instead of separate bus bays.
7. Vehicle parking's along the road at CBD areas and other busy roads.

1.2.2 *Pedestrian accidents in Mysuru*

Pedestrian accidents have been recognized as a major cause of death and injury and considerable resources have been spent on trying to reduce this problem through education and development of countermeasures. Table 1.2 shows Pedestrian accidents in Mysuru

Table 1.2 Pedestrian accidents in Mysuru

Slnor	Year	Pedestrians killed	Pedestrians injured	Percentage of pedestrian killed	Percentage of pedestrian injured
1	2014	26	128	36.61	22.61
2	2015	25	89	44.64	21.34
3	2016	15	79	27.27	18.16
4	2017	22	67	33.84	18.06
5	2018(28/02/18)	2	11	22.22	16.67

(Source: Mysuru traffic police)

1.3 Pedestrian Crossings

1.3.1 *Types of Pedestrian Crossings*

Pedestrian crossing can be broadly classified (IRC: 103-1988) as:

1. At-grade crossings,
2. Grade separated crossings.

1. At-grade crossings: At grade crossings the pedestrians cross the carriageway at the same level as that of vehicular movement. It is extremely regular in urban areas and towns. It might be controlled and uncontrolled. Uncontrolled crossings are those where the pedestrian cross walk is set apart by studs or paint line however not controlled by any arrangement of signs or a zebra type of crossings. With respect to locational perspectives, such crossings be able to be there classified as:

a) Pedestrian crossings at intersections:apedestriancrossingorcrosswalk isa place designatedfor pedestrianstocross a road. Crosswalks aredesignedto keeppedestrianstogetherwheretheycanbeseenbymotorists,andwherethey cancrossmostsafelyacross theflowofvehiculartraffic.

b) Mid-block crossings: These pedestrian crossings, which commonly occur at schools, parks,

c) museums, waterfronts, and other destinations, have historically been overlooked or difficult to access, creating unsafe or unpredictable situations for both pedestrians and vehicles.

2. Grade separated crossings: These are where the crossings where the pedestrians are required to cross the carriageway at a level different from that of vehicular movement. It might be in the form of a pedestrian subway or else a base done suspension bridge from corner to corner the road.

1.4 Pedestrian Crossing Behaviour

Past researches have influenced hypothetical and methodological commitment to a reasonable understanding of pedestrian's behaviour as well as the interaction involving the driver next the pedestrian by the side of pedestrian crossings. Pedestrians arriving at the pedestrian crossing look for adequate gaps between vehicles in the traffic stream. They both allow otherwise deny such gaps. Rejection of current gaps leads en route for longer waiting time at the control side.

Pedestrian crossing behaviour is divided here into four classes to be specific

1. One stage:pedestrians crossthe roadwithoutwaitingnearthemedian.

2. Two-stage: they cross up to the median in one go and subsequently cross the far side.

3. Perpendicular direction: pedestrian crosses the road in a straight path,

4. Oblique direction: pedestrians cross the road in a zig-zag manner.

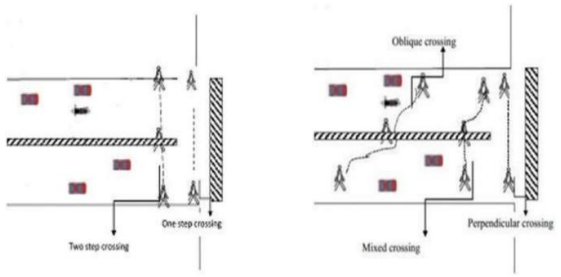

Figure 1.1 Pedestrian crossing pattern

1.4.1 *Factors Affecting of Pedestrians Crossing Behaviour*

Pedestrian crossing behaviour is conduct is typically get affected by different components identified with pedestrian characteristics, pedestrian movements, traffic conditions, road conditions moreover environmental surroundings. Practical unsafe crossing behaviour of children, comparable not stopping at the curb, not looking in advance crossing, attempting to cross when a vehicle is nearing and running over the road. Female pedestrians are practical compliant extra gaps and less hazard contrasted with male pedestrians. Experimental investigations on the impact of age of a pedestrian in gap selection. They reported that, for all age group, gap determination is fundamentally based on vehicle speed and distance.

Moving toward traffic volume and vehicle speeds are instrumental in deciding the pedestrian's waiting time (delay) and the quantity of crossing attempts. Pedestrians, who acknowledge higher hazard, need to stop their waiting time, while pedestrians, who are probably going to bring down the hazard, need to expand their waiting time at pedestrian crossings. Pedestrian's conviction, thought processes and situational elements can influence their crossing behaviour at signal controlled crossings. Situational elements like nearness of different pedestrians and their behaviour towards 'Walk' and 'Don't Walk' signs influence the behaviour of female pedestrians and traffic volume influence the behaviour of male pedestrians at signalized crossings

1.5 Objectives of the Study

The main objectives of this study are:

1. To study the crossing behaviour pedestrians at uncontrolled andcontrolled (signalizedand unsignalized) intersections.
2. To analyze and study the effect of various factors related to pedestrian characteristics, pedestrian movements, traffic conditions, road conditions, walking environmental surroundings and intersection conditions.
3. To study the width and length of zebra crossings and analyse whether it is suitable for crossing of road
4. To create awareness about traffic fines, rules and regulations for pedestrians as well as transporter.
5. Toanalysevolumeofpedestriansandvolumeof vehiclesandprovideabetterand safetycrossingforpedestrian.

II. LITERATURE REVIEW

1. Akash Jain, Ankit Gupta, Rajat Rastogi (2014); Pedestrian crossing behavior is analyzed for the provision of proper pedestrian facilities at desired locations, as well as to improve their safety while crossing the road. This paper presents the analysis of pedestrian crossing behavior from a study conducted at Roorkee city (Uttarakhand state in India). The effect of pedestrian characteristics like age, gender and that of carrying baggage and luggage as well as their crossing patterns were examined on pedestrian flow characteristics like crossing speed and waiting time. Pedestrian safety was also analyzed with respect to safety margins and gaps accepted by pedestrian in traffic stream. Crossing patterns were observed for different age group and gender.

2. B. Raghuram Kadali and Vedagiri Perumal (2012); Walking is one of the main transport mode and more sustainable to human society. Pedestrian interaction with motor vehicles is found to be one of the major constraints to pedestrians' during road crossing. Traffic accidents involving pedestrians are a major safety problem throughout the world. The objective of this study is to investigate pedestrians' gap acceptance behaviour at mid block street crossings in urban arterial roads. In this study the size of vehicular gaps accepted by pedestrians and the decision making processes are mainly examined. For this purpose a suitable mid block section was selected in Hyderabad. Video graphic survey was conducted to collect pedestrians' characteristics, vehicular characteristics and flow characteristics. Pedestrian gap acceptance behavioural model was developed using regression technique. The study result shows that pedestrians' gap acceptance is better explained by the following variable attempts - pedestrian speed condition during crossing, crossing direction, rolling gap, vehicle speed and pedestrian age. The rolling gap plays a main role in pedestrians' decision making process.

3. Sun, J.; Yang, Y.; Wang, H. (2011) ; The issue of disorder, high risks and low efficiency at signalized intersections is mainly attributed to illegal pedestrian crossing. Faced with the challenge of complicated psycho-physical factors, virtual experimental method using microscopic traffic simulation tools shows its advantage over theoretical analysis and questionnaires in studying pedestrian crossing behaviors.

4. Cherry, C.; Donlon, B.; Yan, X.; Moore, S.E.; Xiong, J. (2012). China has experienced

unprecedented economic growth and changes in urban form in the past decades. Increased urbanisation and motorisation puts pedestrians and automobiles at greater conflict. Because of China's long urban blocks (superblocks), many conflicts occur mid-block at informal or illegal crossings. This study focuses on factors influencing mid-block crossing and gap acceptance. We fit a probit discrete outcome model to the data to estimate environmental determinants of gap acceptance (and rejection) behaviour, including gap size, vehicle speed, time waiting and gap lane position. We also estimate a conflict model, focusing on parameters that influence the probability of vehicle speed changes or lane deviations.

5. Dhananjay K. Patil Dr. Bhalchandra V. Khode (2017) Pedestrian is one of the most important components in transportation system which behaves vulnerable at un-protected midblock locations under mixed traffic conditions. At mid-block crossing some vehicles yield to pedestrian who are already at crosswalk but some pedestrian use forced gap to cross the road. This action of pedestrian affects the vehicular flow characteristics. As compared to crossing road and sidewalk, sidewalk do not show direct effect on vehicular flow characteristics. The present study discuss about effect of pedestrian walking at mid-block un-signalized road section on traffic LOS (Level of Service). Gap acceptance was determined by use of Multi linear regression model. Regression was done using Microsoft excel.

6. Kadali, B.R.; Vedagiri, P. (2013) Pedestrian road crossings have become a major issue in road traffic flow, especially in urban areas where there is no controll for pedestrian road crossings. Pedestrian road crossing behaviour is a serious threat to pedestrians at uncontrolled midblock crossing locations in the mixed traffic conditions. Due to increase in motor vehicle growth there is an increase in the regulation of motor vehicles only and the regulation of pedestrian is completely neglected. This increases the uncontrolled road crossing behaviour of pedestrian. The main motivation of this study is to investigate the pedestrian road crossing behaviour at the uncontrolled midblock location in India under mixed traffic condition. Pedestrian road crossing behaviour at uncontrolled midblock has been modeled by the size of vehicular gaps accepted by pedestrian using multiple linear regression (MLR) technique. Also choice model has been developed to capture the decision making process of pedestrian i.e., accepted or rejected vehicular gaps based on the discrete choice theory. Suitable study stretch, which a four lane divided urban arterial in Hyderabad, India, was selected for data collection. The collected data consists of 4198 gap data points which include both accepted and rejected vehicular gaps. Pedestrians' road crossing behaviour has been explained in terms of minimum gap acceptance value by using a rolling gap (pedestrian roll over the small vehicular gaps). It has also been explained by the binary logit model with the help of vehicular gap size, frequency of attempt and rolling gap. The study concludes that the pedestrian behavioural characteristics like the rolling gap, driver yielding behaviour and frequency of attempt plays an important role in pedestrian uncontrolled road crossing. These inferences are helpful for pedestrian facility design and controlling pedestrian safety issues at uncontrolled crossings.

III. DATA COLLECTION

3.1 Identification of Study Locations

The locations for carrying out the pedestrian study are decided based on the combination of land utilizes, road width and the type of intersection. Data were collected from the following locations in Mysuru city:

1. Agrahara Circle
2. AV Circle
3. Big Clock Tower
4. KR Circle
5. Nehru Circle
6. Ramaswamy Circle

The study locations chosen for the present investigation, fulfils the following criteria:

1. The pedestrian traffic is sufficient.
2. The traffic flow is continuous.
3. The effective width of the road is uniform all through the length considered.
4. For video recording of pedestrian flow, the width of the road considered should be effectively accessed from vantage point.

The photograph showing location of intersection and actual pedestrian crossing scenario are given in

1. Agrahara Circle

Figure 3.1 Agrahara Circle
(Source: Google Earth)

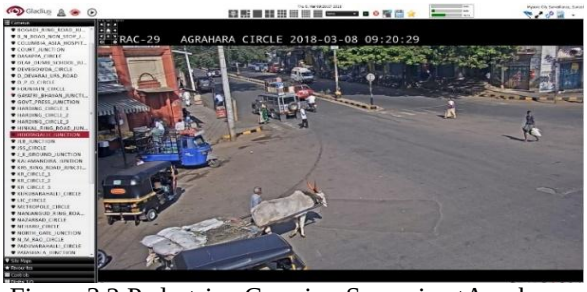

Figure 3.2 Pedestrian Crossing Scenario atAgrahara Circle
(Source: Mysuru traffic police)

3.2 Data Collection Technique
There are different methods for data collection. These are given below:
1. Direct observation methods,
2. Video observation methods,
3. Time Lapse Photography,
4. Pedestrian opinion surveys.

1. Direct observation methods: It is a method under which data from the field is collected with the help of observation by the observer or by personally going to the field.
2. Video observation methods: video graphic method is utilized in the present study. The camera was fixed in an upper position in order to acquire a general perspective of the chose test locations. Footage Recording was done for around an hour at a time, during morning (8.00 am to 10.00 am) and evening peak periods (4.00 pm to 6.00 pm) on a typical working day. The road width (i.e. perpendicular and oblique) are measured utilizing an instrument called measuring wheel as shown in figure 3.13
3. Time Lapse Photography: Time-lapse photography is a technique whereby the frequency at which film frames are captured (the frame rate) is much lower than that used to view the sequence. When played at normal speed, time appears to be moving faster and thus lapsing.
4. Pedestrian opinion surveys: Design conduct a public opinion survey where pedestrians and bicyclists, or the general public would be interviewed to collect an understanding and awareness of pedestrian traffic laws as well as their interactions with drivers and vehicles.

IV. METHODOLOGY FOR DATA ANALYSIS

Introduction

Recorded capture is utilized to separate information. The estimations of pedestrian crossing time and waiting time are seen from the recordings and recorded in MS-Excel work sheets for additionally handling of the data. In view of the above recorded data and utilizing the estimation of width of road sections, pedestrian speeds are evaluated. Behavioural viewpoints like gap acceptance, safety margins etc. are also computed and inspected utilizing the information. Variety in speed concerning to pedestrian individual qualities like gender and age and impact of conveying baggage while proceeding on the speeds of the individuals are also studied.

Data Analysis

This section shows the connections plotted between pedestrian waiting time, crossing time, total travel time and cumulative percentage of pedestrians. In view of these connections, the estimations of pedestrian attributes like crossing speed are computed designed for mixed traffic flow conditions. Variety in pedestrian speeds indicated by age and gender, and for conditions like moving with and without baggage; and different conditions like geometry of intersections, traffic density etc. are additionally examined. Alongside with that the accepted and rejected gaps curves are developed and safety margins are examined.

4.2 Pedestrian Crossing Behaviour

4.2.1 *Crossing Patterns at intersection*

At some stage in the analysis of recorded information from various investigation, two major crossing patterns are observed which can be named as
(a) One step/two step,
(b) Perpendicular/ oblique crossings.
The proportion of pedestrians evaluated within these different crossing patterns are shown in Table 4.1 for all study locations.

Table 4.1 Pedestrians Crossing Patterns at Intersection

Crossing Patterns	Percentage Of Pedestrians (%)	
	One Step Crossing	Two Step Crossing
Perpendicular Crossing	75.54	24.46
Oblique Crossing	0	0
Overall	75.54	24.46

4.2.2 *Crossing Time and Waiting Time*

Subsequent gathering the information from study area utilizing video graphic technique, the analysis of pedestrian crossing speeds with concerning certain pedestrian attributes is normally desired. For that reason, initially the pedestrian waiting time and crossing time is observed from the video of study areas. The crossing and waiting time is observed for perpendicular and oblique crossing condition independently. The analysis of crossing time and waiting time is done for one step crossing

and two step crossing independently. The analysis introduced here utilizations information of all study areas. The Average crossing time and waiting time are given in Table 4.2

Table 4.2 Observed Average Waiting and Crossing Time

Location	Crossing Patterns	Perpendicular Crossing		Oblique Crossing	
		Waiting Time In Sec	Crossing Time In Sec	Waiting Time In Sec	Crossing Time In Sec
Overall	One Step	2.46	11.28	-	-
	Two Step	2.41	14.70	-	-

4.2.3 *Variations in Pedestrian Waiting and Crossing Time*

Variation in average pedestrian crossing and waiting time is generally affected by various factors like

(a) Way of pedestrian crossing (one step or two step crossing)
(b) Age of Pedestrian
(c) Pedestrian gender
(d) Handling baggage.

The variation in estimated crossing and waiting time are given in Tables 4.3-4.6.

Table 4.3 Variation with Respect to Pedestrian Crossing Patterns

Location	Crossing Patterns	Perpendicular Crossing		Oblique Crossing	
		Waiting Time In Sec	Crossing Time In Sec	Waiting Time In Sec	Crossing Time In Sec
Agrahara Circle	One Step	3.25	13.48	-	-
	Two Step	3.71	16.58	-	-
AV Circle	One Step	3.41	10.14	-	-
	Two Step	6.35	13.04	-	-
Big Clock Tower	One Step	1.79	9.36	-	-
	Two Step	0.57	11.81	-	-
KR Circle	One Step	3.41	12.64	-	-
	Two Step	1.29	17.48	-	-
Nehru Circle	One Step	1.79	8.73	-	-
	Two Step	1.22	11.72	-	-
Ramaswamy Circle	One Step	1.11	13.31	-	-
	Two Step	1.38	17.58	-	-

Table 4.4 Variation of Time with Respect to Age of Pedestrian

Location	Adults		Older People		Children	
	Avg. Waiting Time (Sec)	Avg. Crossing Time (Sec)	Avg. Waiting Time (Sec)	Avg. Crossing Time (Sec)	Avg. Waiting Time (Sec)	Avg. Crossing Time (Sec)
Agrahara Circle	3.40	14.71	4.41	15.70	0.00	11.07
AV Circle	4.35	11.1	5.98	13.01	1.34	8.12
Big Clock Tower	1.66	9.79	1.24	10.87	0.00	7.95
KR Circle	3.26	13.62	1.56	16.28	1.01	10.01
Nehru Circle	1.95	8.96	1.09	10.52	0.43	6.60
Ramaswamy Circle	1.19	14.02	1.17	15.35	0.00	9.92

Table 4.5 Variation with Respect to Pedestrian Gender

Location	Male		Female	
	Avg. Waiting Time (Sec)	Avg. Crossing Time (Sec)	Avg. Waiting Time (Sec)	Avg. Crossing Time (Sec)
Agrahara Circle	3.45	14.45	3.42	15.14
AV Circle	4.22	10.97	5.17	11.84
Big Clock Tower	1.34	9.54	1.95	10.47
KR Circle	3.06	13.48	2.63	14.41
Nehru Circle	2.07	8.85	0.81	9.65
Ramaswamy Circle	1.01	14.07	1.30	14.16

Table 4.6 Variation with Handling or without Handling Baggage

Location	With Baggage		Without Baggage	
	Avg. Waiting Time (Sec)	Avg. Crossing Time (Sec)	Avg. Waiting Time (Sec)	Avg. Crossing Time (Sec)
Agrahara Circle	3.57	15.67	3.38	14.29
AV Circle	4.41	11.93	4.68	11.04
Big Clock Tower	1.59	10.71	1.50	9.30
KR Circle	3.38	15.12	2.67	13.24
Nehru Circle	1.47	9.76	1.80	8.83
Ramaswamy Circle	0.98	14.65	1.30	13.71

4.3 Pedestrian Crossing Speeds

4.3.1 *Average Crossing Speeds at Study Locations*

Average crossing speeds estimated based on the crossing times are given in Table 4.7 for different study locations. Overall average crossing speeds are given in Table 4.8

Table 4.7Pedestrian Average Crossing Speeds at Study Locations

Location	Crossing Patterns	Average Pedestrian Crossing Speeds (m/sec)	
		Perpendicular Crossing	Oblique Crossing
Agrahara Circle	One step	1.45	-
	Two step	1.17	-
AV Circle	One step	1.33	-
	Two step	1.03	-
Big Clock Tower	One step	1.28	-
	Two step	1.02	-
KR Circle	One step	1.34	-
	Two step	0.97	-
Nehru Circle	One step	1.29	-
	Two step	0.96	-
Ramaswamy Circle	One step	1.50	-
	Two step	1.14	-

Table4.8Pedestrian Overall Average Crossing Speeds

Crossing Patterns	Perpendicular Crossing Speed (m/sec)	Oblique Crossing Speed (m/sec)
	Average speed	Average speed
One step	1.36	-
Two step	1.05	-

4.3.2 *Analysis of Variation in Speeds*

Variation in speed with respect to pedestrian personal characteristics like age category and gender; and crossing patterns like one step or two step crossing is analyzed. The effect of carrying baggage on the speeds of the individuals is also studied. While calculating speed of the pedestrian with baggage, the pedestrian carrying heavy baggage is considered. The variations in crossing speeds are given by the bar chart in Fig. 4.1

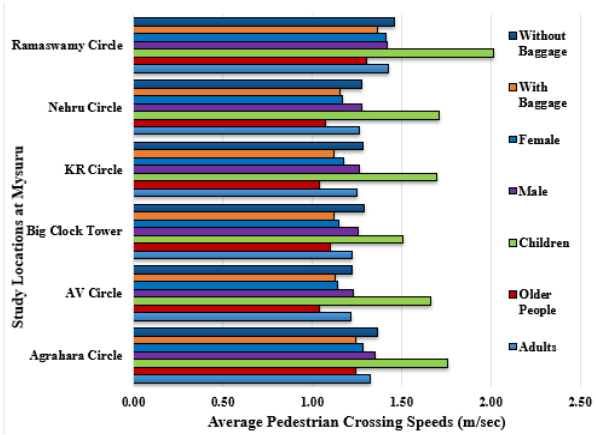

Figure 4.1 Variations of Pedestrian Crossing Speeds at Different Study Locations

4.4 Gaps Accepted

Data extracted from video-graphic survey was processed under various using Microsoft excel. Data required calculating the vehicle speed. Extracted data from video is analyzed and processed under various equations and processes to evaluate gap acceptance.

Gap acceptance depends upon dependent and independent variables of pedestrians To analyse gap accepted by pedestrian while crossing the road MLR model was used.

Table 4.16 MLR Test Results

	Coefficient
Constant	6.3166
Vehicle speed	-0.0217
Pedestrian crossing time	-0.3869
Pedestrian waiting time	0.4172

Gap Accepted = 6.3166 – 0.0217 * AVS – 0.3869 * APCT + 0.4172 * PWT

Regression model was generated using Microsoft Excel 2007 software to find out minimum gap accepted by pedestrian while crossing road. Table 4.16 Shown Average Values of Gap Accepted.

Table 4.17 Average Values of Gap Accepted

Category	Average Gap Accepted (sec)
Males	3.75
Females	4.25
Adults	3.85
Olders	3.40
Children	4.00

V. CONCLUSIONS

- Among the crossing patterns more pedestrians crosses the roads in perpendicular direction and very few of them crosses the roads in two stages.
- The average crossing speeds at different study locations are varied with respect to various pedestrians' characteristics like gender, age category, baggage handling condition, volume and composition of traffic moving on road.
- Among them males and children have the higher crossing speeds.
- There is no significant variation in pedestrian's speeds due to handling of baggage.
- The pedestrian crossing behavior analysis is the important factor for deciding the assurance of pedestrian safety on roads and the pedestrians waiting time can be used to decide the need of pedestrian facility in the area.
- Femalepedestrianswerefoundtocrosstheroada taslowerratethanmalesin boththescenarios duetotheirsafetyconcern.
- Insomeofthecircles pedestrians werewalkingoutsideofzebracrossings

- InNehrucircleandagraharacirclezebracrossin gis erasedsoproperdimension fromIRC-103:2012is widthofzebracrossingis3-5m
- Someofthebuses arestoponthezebracrossings soitis difficulttocross theroad forpedestrians.Henceproperbus stops areconstructandbuses arestopinthat regions only
- Raisedpedestrian crossings shouldbecompulsoryas refferedfrom IRC103:2012 codebooksoitwillprovidebetter crossingofpedestrians andas wellas tostop vehiclesbehindthezebracrossings.

REFERENCES

[1]. Akash Jain, Ankit Gupta, Rajat Rastogi (2014); Pedestrian crossing behaviour analysis at intersections, Journal of Traffic and Transportation Engineering · March 2014
[2]. B. Raghuram Kadali and Vedagiri Perumal (2012); Pedestrians' Gap Acceptance Behavior at Mid Block Location, IACSIT International Journal of Engineering and Technology, Vol. 4, No. 2, April 2012
[3]. Gupta, U.; Tiwari, G.; Chatterjee, N.; Fazio, J. 2010. Case Study of Pedestrian Risk Behavior and Survival Analysis, Journal of the Eastern Asia Society for Transportation Studies, Vol. 8: 1-17.
[4]. IRC: 103, 1988. Guidelines for Pedestrian Facilities, Indian Roads Congress, New Delhi, India.
[5]. Sun, J.; Yang, Y.; Wang, H. (2011); Development and Application of a Simulation-Enhanced Platform for Pedestrian Crossing Behaviors Experiment. Available from Internet:
[6]. Cherry, C.; Donlon, B.; Yan, X.; Moore, S.E.; Xiong, J. 2012. Illegal Mid-Block Pedestrian Crossings in China: Gap Acceptance, Conflict and Crossing Path Analysis, Journal of Injury Control and Safety Promotion.
[7]. Dhananjay K. Patil Dr. Bhalchandra V. Khode (2017). Effect of Pedestrian Movement on Traffic Los, IJSTE - International Journal of Science Technology & Engineering | Volume 3 | Issue 09 | March 2017
[8] .P Vedagiri, B RaghuramKadali (2013) "Modelling pedestrian road crossing behavior under mixed traffic condition" European Transport\TransportiEuropei (2013) Issue 55, paper no 3.
[9]. High Capacity Manual 2000, Transportation Research Board