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Evaluation of Pedestrian Road Crossing Behavior at Signalized Intersection

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Abstract: —Pedestrian crossing behaviour is more difficult at any rotary intersection because of less response time of pedestrian as well as vehicle. It is the most concerned problem in developing urban areas to provide proper safety and instructions to the pedestrians for the same. The aim of the paper is to provide overview of pervious papers published on pedestrian behaviour aiming at factors affecting pedestrian behaviour like crossing speeds, gender, total number of pedestrians, rules, waiting time and directions. Overall aim of the paper is to provide better safety to the pedestrians, to reduce accidents and reducing waiting time at any intersection**.**

Keywords: Pedestrian, Intersection, Mixed Traffic, Crossing Pattern.

I. INTRODUCTION

Traffic safety have become a major concern all over the world with increasing number of accidents. As the population density is increasing and due to high urbanization of countries there has been an increase in pedestrian volume at pedestrian crossing and with the unexpected delay or less waiting time the risk factor increases leading to accidents. Due to high number of deaths daily it has become a high priority to analyses pedestrian behaviour.

Pedestrian crossing speed is one of the main parameters for designing any signalized intersection. In India standard speed of pedestrian crossing is 1.2 m/s. It is given by Indian road congress (IRC). Walking is one of the most important travel modes in all countries but pedestrians are always ignored during transportation planning and design. Survey shows that children under 15 years have the highest rate of injury. Elders also have a higher rate of injury due to low visibility. Other factors like drug abuse, alcohol consumption also contribute to road accidents.

II. LITERATURE REVIEW

Study on pedestrian crossing behaviour at signalized intersection

Marisamynathan ET AL(2014) conduct that paper studied on pedestrian behaviour at signalized intersection and have taken 775 pedestrian samples from three different signalized intersections in highly populated cities. The data was collected by videography method after that they find some important data about pedestrian behaviour like pedestrian crossing volume, crossing time, pedestrian gender, age group and also behaviour like walking running alone or in a group, whether pedestrian crosses the road during the green signal or red signal. After getting all the results they did some test like pedestrian crossing speed by crossing speed deviation factor (CSDF) and ANOVA test. It was observed that the proportion of males were greater than female in peak hour and young pedestrian higher than children or older people and 77% of people utilize the crosswalk and the rest 22% do not. The average crossing speed of the pedestrian is 1.2m/s to 1.4m/s. this paper provides different behaviour at signalized intersection at mixed traffic condition.

Study on pedestrian crossing behaviour at un-signalized intersection in Chittagong city

Towhidul Islam ET AL(2020) analyzed pedestrian crossing behaviour at Chittagong city under mixed traffic condition by video observation and questionnaire survey at field total 5472 pedestrians have been observed by video graphic method and 550 pedestrians were observed by the questionnaire survey method after getting all the parameters like age, gender, crossing patterns, educational status and pedestrian income it was observed that 330 pedestrians did not use crossing facilities. 24-34 years age group and above 60 age group have violated the rules aggressively. It was observed that the people violating the rules were more educated (HSC) than the ones following the rules (SSC). Income shows that 40000 – 60000 BDT per month group obey traffic rules while ones from 30000-40000 violated the traffic rules to a larger extent. Another study describes that males only 83 % of people followed the crossing rule while rest did not from which 12% were males and 24% were female.

Pedestrian behavior analysis at intersection:

Akash Jain ET AL(2014) 3 intersections are taken for BSM, civil lines and Chunginaka. The analysis was done using the videography, time elapse and opinion survey. It is observed males take more risk compared to female and the children and elder age pedestrians are more prone to accidents due to immaturity in children and week vision in elders. The luggage does not seem to cause delay in waiting time or crossing speeds. The paper describes that children were the ones with less safety gaps, high crossing speeds and high-risk factors. The males had fewer crossing speeds than female but at the same time males had less waiting time. The average crossing time for oblique and perpendicular crossing were 6s and 1s. The waiting for two step crossing was more than that of one step crossing. Average pedestrian crossing speed of perpendicular crossing was around 1.36m/s while for oblique crossing it was 1.98m/s. it was also observed that females and elders took more time gaps and less crossing speed thus signifying high safety factors.

Pedestrian Behavioral Pattern and Preferences in Different Road Crossing Systems of Dhaka City:

Manik Kumar Saha ET AL(2013) The author has been taking 10 pedestrians for observational purpose and 300 questionnaires for every crossing. It was observed that the young people tend to violate crossing rules more than that of elders. It was also observed that the people who were educated and with decent profession were keen on following rules other than students and small businessmen and hawkers. The study also shows that the under ways for crossing were safe but were avoided due to lack of safety, unwanted people and lack of sanity in the under ways. There was a high risk at both ends the over ways and under way for one it was traffic and for other it was lack of security. The study also indicate that males were more irresponsible while crossing roads while compared to females with a percentage of ration of 48.90 to 58.80 who follow rules. Elder and younger follow rules with a 100% while 26-35 years age group tends to violate the most with a 58.29%. the teachers followed the rules with top priority with a 100% result at the same time hawkers violated the rules with a 100%. Unemployed people also tend to follow rules with a 75.09% accuracy and at the same time small businessmen tend to violate the rules with an alarming 69.29% suggesting time is the essence for following rules and determines the waiting time.

Evaluation of human behavior at pedestrian crossings

Emese Mako a ET AL(2016) agenda is to priories the implementation of infrastructural engineering, safe environment, safety equipment and training for reducing the no of accidents at different crossing. It also highlights that pedestrians and vehicles both are equally responsible for the accidents caused and the major factor acting is waiting time or the urge to pass first. About 44% of pedestrians violated the rules and other 65% with driving mistakes. The major mistake from 44% is due to careless behavior contributing a 67% from the 44%. There were different irregularities in the infrastructure and after development of proper infrastructure it was observed the accident rates fell by 85%. About waiting and delay time when 50 vehicles and 50 pedestrians were compared in Gyor city it was observed that pedestrians had the facility of Refugee Island but still tried to cross the road in one go. The vehicle delay time at the roundabout also plays an important role as due to increased delay time there seems to impatience at the crossing despite of proper infrastructure. Author concludes that the ones with improper infrastructure should be improvised and pedestrians should be given less refugee islands also training to pedestrians should be given as pedestrian volume is increasing day by day.

III. 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.

Methodology for Data Analysis

Video observstion method is for data collection. The value of pedestrian gender, crosswalk use or not, single or group, age group, run, walk, crossing speed observed from recorded video and analyzed in MS – Excel work sheet for future processing of the data.

IV. DATA COLLECTION AND ANALYSIS

This following table data was collected on Vrundavan char rasta at morning peak hour 8:00 a.m. to 10:00 a.m.

Time	**Moring**			
Direction	**Sardar estate side**	**Uma**	**Parivaar char rasta**	**waghodia chokdi**
Gender				
Male	351	130	218	561
Female	163	21	85	122
Crosswalk				
Used	158	55	72	174
Not used	356	135	231	503
Single or group				
Single	299	123	216	355
Group	215	67	87	328
Crossing type				
Run	34	7	22	48
Walk	480	183	281	635
Age group				
Child	20	11	10	21
Adult	458	139	356	621
Old	36	40	37	41

Speed				
Child	>1.2=4	>1.2=2	>1.2=3	>1.2=4
	<1.2=6	<1.2=9	<1.2=8	<1.2=17
Adult	>1.2=105	>1.2=45	>1.2=78	>1.2=202
	<1.2=358	<1.2=94	<1.2=178	<1.2=419
Old	>1.2=31	>1.2=22	>1.2=22	>1.2=23
	<1.2=5	<1.2=18	<1.2=15	<1.2=18

This following table data was collected on Vrundavan char rasta at evening peak hour 06:00 p.m. to 08:00 p.m.

Time	**Evening**			
Direction	**Airport circle**	**Mahavir Char rasta**	**Vrundavan**	**Ajwa**
Gender				
Male	**136**	**158**	**169**	**176**
Female	**89**	**88**	**95**	**110**
Crosswalk				
Used	**88**	**89**	**98**	**105**
Not used	**137**	**157**	**166**	**181**
Single or group				
Single	**130**	**168**	**145**	**156**
Group	**95**	**78**	**119**	**130**
Crossing type				
Run	**8**	**9**	**11**	**6**
Walk	**217**	**237**	**253**	**280**
Age group				
Child	**6**	**8**	**12**	**180**
Adult	**101**	**212**	**232**	**246**

Old	**18**	**86**	**20**	**22**
Speed				
Child	**>1.2=2**	**>1.2=2**	**>1.2=2**	**>1.2=6**
	<1.2=4	**<1.2=6**	**<1.2=10**	**<1.2=12**
Adult	**>1.2=34**	**>1.2=66**	**>1.2=61**	**>1.2=102**
	<1.2=67	**<1.2=212**	**<1.2=171**	**<1.2=144**
Old	**>1.2=14**	**>1.2=18**	**>1.2=17**	**>1.2=17**
	<1.2=4	**<1.2=8**	**<1.2=3**	**<1.2=5**

\Data analysis

- Morning analysis

Total 1651 pedestrian observed in this analysis 1260 male and 391 female in percentage wise it is 76.31% and 23.69 %.

Crosswalk use pedestrian percentage is 27.80% and not use crosswalk counting percentage is 72.20%.

Single pedestrian crossing percentage is 57.78% and group pedestrian crossing percentage is 42.22%.

In crossing pattern run pedestrian percentage is 6.72% and walk percentage is 93.28%

Age group is found in this analysis 3.75% child, 86.91% adult, and 9.32% old.

- evening analysis

Total 1021 pedestrian observed in this analysis 639 male and 382 female in percentage wise it is 62.58% and 237.42 %.

Crosswalk use pedestrian percentage is 37.21% and not use crosswalk counting percentage is 62.78%.

Single pedestrian crossing percentage is 58.66% and group pedestrian crossing percentage is 41.34%.

In crossing pattern run pedestrian percentage is 3.33% and walk percentage is 96.67%

Age group is found in this analysis 8.22% child, 77.47% adult, and 14.29% old.

V. CONCLUTION

According to obtained results we can clearly see that more males are there than females in the research also age group wise percentage shows that the research is inclined towards the adult group. The percentage of using and not using crossways suggests that there is less awareness or more of negligence in using crossways. Also, the data about the crossing style suggest most of the people are in a hurry to cross the roads. The difference in the evening and morning data suggest as the percentage of old people increases, we can see that the use of crossways is preferred and suggest adults are more reckless. The percentage of group and individual crossing is almost similar in evening and morning and is unaffected by other changes. The children group also affects different factors and they are more into following rules. At last, we can conclude that the most of the people do not use crossways and due to less surveillance of traffic police people tend to break rules making road crossing risky. The ratio of males is more than female that also suggest that males are more reckless than females and apart from the adult group the old and children group tend to use crossway frequently.

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