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Driver and Pedestrians Interactions Characterization

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Abstract-Traffic accidents comprising pedestrian have been a huge problem in third world countries. These accidents occur due to robust and greater number of urban infrastructural developments, increase in the number of vehicles and lack of traffic rules followed by the drivers and pedestrians. The basic road design in the developing countries does not provide pedestrian safety. A case study has been conducted at Inter Junction Principal (IJP) Road in Rawalpindi to find out the effect of pedestrians on traffic flow. Similarly, a linear relation has been found between the flow and density while an inverse relation of the travel time with flow and density.

Keywords- Pedestrians, Speed, Density, Travel Time, Flow, Vehicles

1 INTRODUCTION

Developing countries around the world have problems of transportation in context of traffic jams and accidents. These problems are mainly attributed to the increase number of road user. The basic design of the road does not provide frequent safety provision for the pedestrian in Pakistan [1, 2]. It provides limited space for pedestrians for road crossing which causes accidents. Drivers has a small reaction time to avoid accidents. Most of the fatalities in developing countries are due to lack of pedestrians crossing facilities [1]. As per the World Bank Estimation in 1996, total deaths on road were 500,000. 350,000% of these accidents were occurred in the developing countries [1]. In 1994 at Karachi, Pakistan 462 of road accidents occurred due to pedestrians. In the US only 14.5% of pedestrians were involved in road accidents [3]. Globally, more than 270,000 pedestrians lose their lives in the road accidents [4]. Approximately 1.35 million of peoples loss their lives on the roads. Most of these accidents occur in urban areas [3]. 80% pedestrian accidents occur by striking of cars, Lories, and buses while only 20% of accidents occur by striking each other at designated crossing. In 2013, 12,385 deaths of pedestrians were occurred in India [1]. There are various factors which governs a pedestrian decision to cross a road. Children misjudge safer gap than adults during road crossing [5]. Two studies of pedestrians crossing in Israel showed that men are more likely to move along the crossing than women when the walker passage light was red. The pedestrian involved in eating or hearing through headphone were less aware [6]. Environmental factor also plays an important part in the pedestrian decision to cross the road. In rain and windy weather, a pedestrian hesitates while crossing a road [7]. Pedestrian wait when a large number of vehicles are moving towards an intersection or when a vehicle has high speed [8]. The conduct of the pedestrian crossing is classified into different classes i.e. two gaps, risk taking, two phases and walking & look. Single level and rolling at different facilities. Studies of pedestrian gap acceptance and vital gap have shown that walking speed and road width can determine that a pedestrian embrace or refuses gaps and there is a 2s difference between lag and gap [9]. Standards were established to observe the length of the traffic spaces accepted by walkers. Certain endeavors have been done to investigate the road traversing attitude of walkers in blended movement condition. Road traversing attitude of walker with regard to the demographic features have been found in different studies. Various research has too dug into the significance of pedestrians velocities at various location and they delineated that men walk remarkably quicker than women while crossing the roads [10]. Researches on crossing mood were also done by different researchers and they concluded by categorizing the pedestrians crossing behavior into three classes i.e. single stage, two stage, and rolling. It was found that with one way traversing number of pedestrians were larger for two stage gaps, on the other hand single stage crossing was frequent on two way roads [11]. It is clear that interactions exist between pedestrians and vehicles on roads. The basic design of a road in the third world countries does not provides frequent safety provision for the

pedestrian. It provides limited space for pedestrian in a lane, and crossing which causes complication between pedestrian and vehicle at crossings.

Objectives of the Study

The study is focused on de pedestrians and vehicles interactions to analyze the basic flow parameters like speed and density in the presence and absence of the pedestrians.

2 SCOPE/SIGNIFICANCE OF THE STUDY

Huge traffic jam in modern time is mitigated by traffic modelling. It is actually a virtual tool to solve the traffic congestion issues. Congestion causes greater traveling cost and social stresses. To cope with these problems, a traffic data analysis is required to solve congestion problems due to pedestrians such as

- Congestion minimization
- Enhancing speed
- Save the cost on huge infrastructure.

3 RESEARCH METHODOLOGY

For data collection Inter Junction Principal (IJP) Road Faizabad, Rawalpindi is chosen as large number of pedestrians crosses the road width. Secondly, the metro station Faizabad overpass over IJP road is suitable for a top view video recording. Videos were recorded at 8 AM, 2 PM, and 4 PM. Camlytics software was used to detect vehicles and pedestrians crossing at the selected section. Travel time was calculated in this section.

3.1 Traffic Conditions on Monday, Tuesday and Wednesday:

Table 1: Effect of Pedestrians on Travel Time, Speed, Density and Flow

S. No	No of Pedestrians			Travel Time (s)			Speed (km/hr.)			Density (veh / km)			Flow (veh / hr)		
	Mon	Tues	Wed	Mon	Tues	Wed	Mon	Tues	Wed	Mon	Tues	Wed	Mon	Tues	Wed
1	0	0	0	1.64	1.76	1.37	71.53	61.37	78.64	80	80	80	8583	7364	6291
2	1	1	1	1.81	2.09	1.87	60.57	57.23	60.12	80	80	80	4845	6867	4809
3	2	2	2	3.27	2.63	2.13	52.5	48.51	58.96	60	60	60	4200	3880	3537
4	3	3	3	3.69	3.02	4.56	29.21	35.73	38.41	60	60	60	1168	1429	2304
5	4	4	4	8.14	3.55	2.92	13.26	32.19	37.34	40	40	40	530	1287	1493
6	5	5	5	7.01	4.07	3.55	15.40	23.44	36.60	40	40	40	616	937	1464

Table 1 depicts that on Monday in the absence of pedestrian a maximum average speed of 71.53 Km / h is recoded but as a pedestrian appears in the road section, the speed decreases to 60.57 Km / h. With the increase in number of pedestrians, the speed reduces more drastically. Presence of five pedestrians in the section reduce the speed to 15.4 Km / h which is 21.5% decrease in the speed when there were no pedestrians in the section. While the presence of pedestrians

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also effects the density and reduces it to 33% when there were no pedestrians in the section. Similarly flow value also decrease with the increase in number of pedestrians in the section and reduce to 10%.

As it is cleared from Table 1 also that a maximum speed of 61.37 Km / h is recorded on Tuesday, when there was no pedestrian on the road for which the density value is 120 so it gives us a maximum flow of 7364. But as the pedestrians appear in the section, the speed start decreasing according to the numbers of pedestrians and the density and flow values also goes on decreasing. Presence of five pedestrians in the section reduce the speed to 23.44 Km / h which is 38% decrease in the speed as compared to the speed in the absence of pedestrians. While the presence of pedestrians also effects the density and reduce it to 33%. Furthermore, flow value also decreases with the increase in number of pedestrians in the section and reduces to 12.7%.

As shown in Table 1 for day Wednesday, maximum speed 78.64 Km / h is observed in the absences of pedestrians for which the density value is 80 and the maximum flow value is 6291, while the minimum speed is 36.6 Km/h for which the density is 40 and minimum flow recoded is 1464 veh /h. Presence of five pedestrians in the section reduce the speed to 36.66 Km / h which is 46% decrease in the speed as compared to speed, when there was no pedestrians in the section. While the presence of pedestrians also effects the density and reduce it to 50%. Moreover, flow value also decreases with the increase in number of pedestrians in the section and reduces it to 23%.

4   RESULTS

For data extraction and analysis, a 0.025 km section was considered. For Travel time extraction form the traffic flow Camlytics software was used. Camlytics software actually detects the entrance and exit of vehicles in a section. All data were run through Camlytics for data extraction. After getting the Travel time and other variables like speed, density and flow were easily determined using proper formulas in the excel sheet.
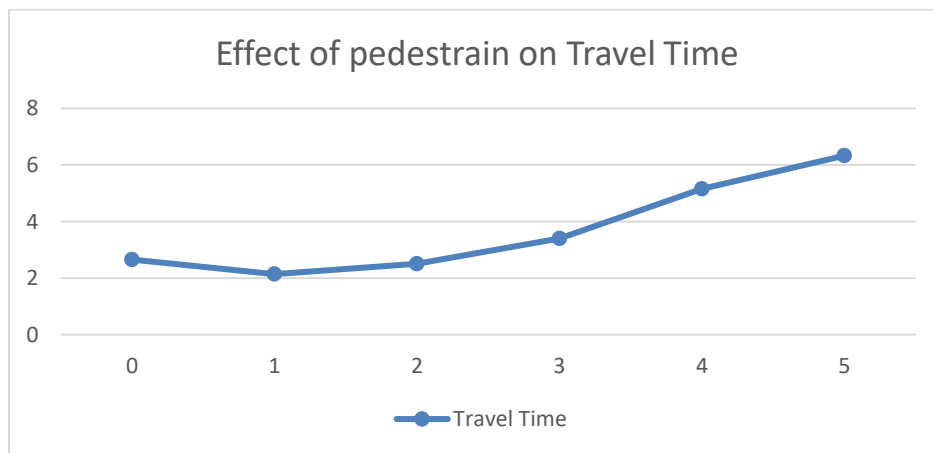

Figure 1: Effect of Pedestrians on Travel Time

Figure 1 shows the effect of pedestrians on the travel time of the vehicles. At the very start when there is no pedestrian in the section the travel time is 2.65 s but as the numbers of pedestrians increases in the section in the section, the travel time also increases and reach to a value of 6.33 s that is 41 % increase in the travel time.
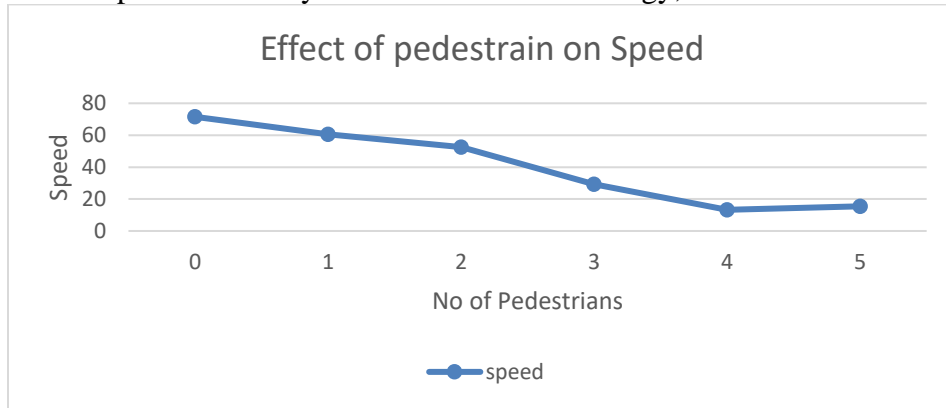
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Figure 2: Effect of Pedestrians on Speed

The effect of pedestrians on the traffic speed is shown in Figure 2. At the very start in the absence of pedestrian the speed is maximum 71.53 Km / hr. but as the number of pedestrian crossing from one side to other side of the road, they reduce the speed accordingly. The presence of five pedestrians in the section decrease the speed up to 15.4 Km / hr. which is 21.5% decrease in the speed in comparison to the speed in the absence of any pedestrian.
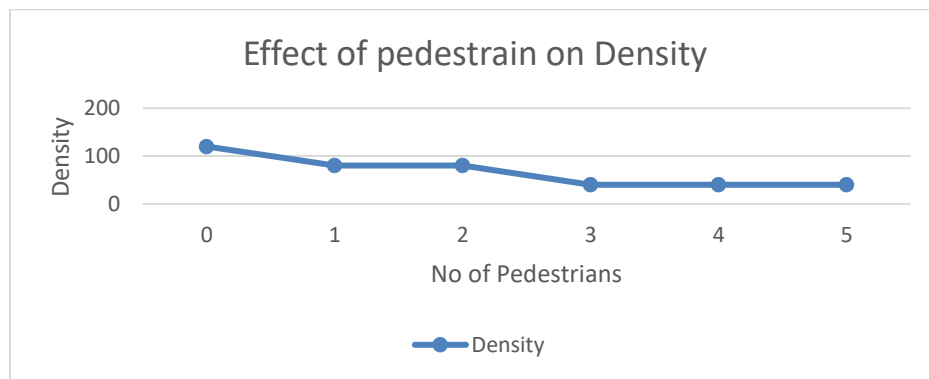

Figure 3: Effect of Pedestrians on Density

The effect of pedestrians on the traffic density is shown in Figure 3. In the very start when there was no pedestrian in the section the density is 120 veh / 0.025 Km but as the number of pedestrians increases in the section, the density value decreases and goes down to a value of 40 veh / 0.025 Km when there are five pedestrians in the section. These fives pedestrians have decreased the density value by 33%.

5   PRACTICAL APPLICATIONS THE WORK

- Effect of pedestrians on the density flow and speed can be determined.
- Strict law abidance in those area where pedestrians crosses road without using zebra crossing.
- An overpass also minimizes the pedestrians directly crossing over the road.

6   CONCLUSIONs

Sequel to compiled results and discussions, following conclusions are made:-

1. Presence of pedestrians in a section effect the traffic flow directly.
2. Presence of pedestrians in a section enhance the Travel time as in our case the travel time was increase up to 41 %.
3. Presence of the pedestrians also effect the speed. As from figure 2 it is evident that the speed was reduced by 21.5 % when five pedestrians were present in the section.

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4. Presence of the pedestrians also effect the density of the traffic flow. As from the figure 3 it is clear that the density has been decreased by 33 %.

7   RECOMMENDATIONS AND FUTURE WORK

1. A model can be prepared by using driver's pedestrian's interaction analysis.
2. An alternate way for pedestrians can be determined so that less interaction is observed between drivers and pedestrians.
3. A new model can be postulated based on geometric design.
4. The proposed data can be practically validated.
5. The proposed data analysis can be adopted by traffic representation for ITS

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