

Pedestrians' exposure to road traffic crashes in urban environment: A case study of Peshawar, Pakistan

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Abstract

This study was aimed at exploring accident statistics and suggesting counter measures to mitigate road traffic crashes in Peshawar, Pakistan, and was conducted in 2015-16. Data was extracted from all 30 police stations in cantonment, city and rural circles for the 2003-12 period. A total of 3,280 crashes were reported, including 856(26%) fatal and 2,424(74%) non-fatal ones. Moreover, 602(69%) fatalities and 1,782(59%) injuries of overall road traffic fatalities and injuries during the period studied were borne by pedestrians. No regular annual pattern was noticed for overall and pedestrians' fatalities and injuries. Detailed RTCs' analysis, police officials' interviews and engineering judgement during field visits indicate that there is a dire deficiency of physical infrastructure for pedestrians, signage and markings. There is a need to improve post-crash evaluation and implement counter measures for speed control.

Keywords: Road traffic crashes (RTCs), Pedestrians, Peshawar, Pakistan.

Introduction

Road traffic crash (RTC) is defined as a crash which occurs on a way or street open to public traffic, killing or injuring one or more persons, or which results in property damage involving at least one moving vehicle.¹ A fatal crash is defined as any crash in which a person is killed whereas, a non-fatal crash is defined as any injury crash other than a fatal one.² RTCs have become a serious life threat as around 1.24 million people are killed while 30-50 million face injuries in RTCs each year across the globe, making road traffic injuries the eighth primary cause of death.³ "Killed persons" are RTCs' victims who die immediately or within thirty days following the road crash.^{2,4} Generally, RTCs put an economic burden of 1-3% of gross domestic product (GDP) of the countries, though

in some instances it was reported as high as 6%.³ RTCs depend upon typical factors such as road traffic density, socio-economic characteristics of the region, literacy rate of the drivers, etc.⁵ According to a report,⁶ more children lose their lives in RTCs in low-income and middle-income countries than in high-income countries. Despite rapid motorisation in China and other low and middle-income countries, most families in these countries are unlikely to own a car or other motorised four-wheeler within the next 25 years⁷ which reveals that in these countries pedestrians will remain active road users thus vulnerable to RTCs. Therefore, it is essential to understand factors behind pedestrians-induced road crashes at national level and suggest corrective measures to improve road safety.

Pedestrians are the most vulnerable group of RTCs due to least protection. On average, one pedestrian dies every 2 hours while one pedestrian injury is reported every 8 minutes as a result of RTCs in the United States.⁸ Old-age pedestrians are considered the most vulnerable to road crashes. Aging can affect perception and cognition, which in turn might have an impact on street-crossing behaviour.⁹ A study carried out on the pedestrian-crossing trends showed that younger road users act more safely than senior citizens.¹⁰ Pedestrians under the age of 30 years are relatively more involved in crossing at red light than older ones, resulting in more conflict situations.¹¹ Predicting pedestrian behaviours is an essential factor in analysing pedestrian crashes. According to a study carried out in Dhaka,¹² people between the ages of 26-35 years (58.2%) mostly violate traffic rules, whereas people under 15 years and above 65 years absolutely obey the rules. In many developing countries, pedestrians prefer accepting small traffic gaps rather than waiting at the curb for a longer time and are non-compliant and primarily risk-taking.¹³ According to a study,¹⁴ up to 49% pedestrians lose their lives in RTCs around the world. The proportion of total vehicle-related deaths accounting for pedestrians, bicyclists and operators of powered two- and three-wheelers in lower-income regions is much higher than Organisation for Economic Co-operation and Development (OECD) countries.¹⁵

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In Pakistan, national-level studies on RTCs reveal that relatively high percentage of males, in their twenties and thirties, lose their lives in RTCs than females.¹⁶⁻²⁰ This is worrying for a male-dependent society like Pakistan because such losses push many families into poverty and economic crisis. A study conducted in Islamabad reveals that among 250 reported fatal RTCs, pedestrians were involved in 141(56%) fatal crashes causing 144(53.3%) pedestrian fatalities out of a total of 270 life losses.¹⁹ Likewise, a study conducted in Karachi (2007-2014) showed that the highest number of fatalities were borne by riders of two-wheelers (cyclists and motorcyclists) which is 3,393(37.2%) out 9,126, followed by 3,300(35.80%) pedestrians, showing extreme pedestrians' vulnerability to RTCs in urban environment.²⁰ In 2013, Raza et al. concluded that a majority of the RTCs' victims were 16-30 years old (51%) and males (94%).²¹ Also, the same study reveals that pedestrians were the major affected group in these crashes (31.11%).²¹ There are certain causes which result in high percentage of pedestrians' fatalities, including speeding by drivers on urban corridors, pedestrians not using designated infrastructure like footpaths and zebra crossings and unavailability of right of way to pedestrians due to drivers' violations.¹⁹

In Pakistan, transport contributes about 10% to the GDP and accounts for over 6% of employment.²² The reliance on road transportation in the country has increased from mere 8% (1947) to well over 90%.²² Thus the road transportation can be regarded as the backbone of Pakistan's economy with 96% of total inland freight and 92% of passenger traffic.²³ Over the past 68 years, road network in the country has expanded from about

50,000km in 1947 to about 260,000km.²² The current road density is 0.32km per square km which is proposed to be increased to 0.45km per square km in the recent national perspective plan.²⁴ Total stretch of the national highways including motorways is about 12,000km (4% of total road network) that is constructed and maintained by the National Highway Authority (NHA) and it carries about 80% of the intercity traffic load of the country.²⁴ Peshawar is the major educational, political and business centre of Khyber Pakhtunkhwa. With an overall area of 1,257km², it is one of the 10 largest cities of the country with a peculiar geo-strategic location bordering with the tribal areas in close proximity with Afghanistan. Peshawar district's current projected population is 3.57 million with an average annual growth rate of 3.56%.²⁵ Total vehicular volume on of the city is 521,150 with an average annual growth rate of 12.83%.²⁶ Although having significantly fewer traffic vehicles per 1,000 persons, most of the world's road crash victims are reported from the low and middle-income countries like Pakistan.²⁷ For instance, death toll in developing countries per 10,000 vehicles in selected South Asian countries is much higher than the world's most motorised country, the United States.²⁷ Due to rapid motorisation in Pakistan, this bleak safety scenario is bound to increase in future if due system intervention is not done in time. Besides other major cities, Peshawar is also one of the major victims of RTCs. The current study was carried out to understand road accident statistics in Peshawar and to identify essential infrastructural characteristics and human behaviour issues causing RTCs.

Methods and Results

This study was conducted in 2015-16 using data of RTCs

Table-1: Temporal Distribution of RTCs in all Police Stations, Peshawar (2003-2012).

Year	Fatal Road Crashes						Non-Fatal Road Crashes					
	Total RTCs	Fatalities	Pedestrians		Type of Vehicles		Total RTCs	Injuries	Pedestrians		Type of Vehicles	
			Nos.	%	Cars	Others			Nos.	%	Cars	Others
2003	93	99	64	64.6	41	53	56	62	48	77.4	21	35
2004	111	117	81	69.2	40	71	306	373	220	58.9	155	191
2005	133	133	80	60.2	54	79	235	397	238	59.9	150	175
2006	63	66	45	68.1	11	52	328	433	216	49.8	144	214
2007	65	60	19	31.6	14	45	179	138	76	55.1	87	99
2008	95	95	89	93.6	32	63	370	481	283	58.8	164	228
2009	76	76	62	81.6	42	34	181	272	185	68.0	104	97
2010	45	45	30	33.3	17	28	178	214	147	68.7	84	104
2011	66	69	37	53.6	34	32	203	240	144	60.0	108	95
2012	109	112	95	84.8	29	81	283	397	225	56.7	137	195
Total	856	872	602		314	539	2424	3007	1782		1154	1433
Average Per Year	85.6	87.2	60.2		31.4	53.9	242.4	300.7	178.2		115.4	143.3

RTC: Road traffic crash.

Table-2: Spatial Distribution of RTCs in City Circle, Peshawar (2003-2012).

Police Station	No. of RTCs		Total Killed	Total Injured	Pedestrian			
	Fatal	Non-Fatal			Freq	Percent	Freq	Percent
Banamari	44	106	45	131	33	73.3	70	53.4
Faqirabad	15	136	15	158	14	93.3	72	45.6
Gulbahar	31	12	34	152	19	55.9	91	59.9
GulfatHussain	22	103	22	115	19	86.4	76	66.1
Khan Razzaq	13	62	14	66	3	21.4	42	63.6
GorGatheri	0	4	0	4	0	0.00	3	75.0
Pahripura	25	153	28	175	13	46.4	112	64.0
Phandu	0	15	0	15	0	0.00	8	53.3
Dabgari	0	4	0	4	0	0.00	4	100
Yakatoot	35	85	35	107	33	94.3	62	57.9
Total	185	790	193	927	134	69.4	540	58.3

RTC: Road traffic crash.

Table-3: Temporal Distribution of RTCs in City Circle Police Stations, Peshawar (2003-2012).

Year	Fatal Road Crashes						Non-Fatal Road Crashes					
	Total RTCs	Fatalities	Pedestrians		Type of Vehicles.		Total RTCs	Injuries	Pedestrians		Type of Vehicles.	
			Nos.	%	Cars	Others			Nos.	%	Cars	Others
2003	26	26	16	61.5	14	12	13	14	12	85.7	06	07
2004	17	26	22	84.6	08	16	119	126	78	61.9	47	72
2005	18	18	15	83.3	07	11	116	142	81	57.0	54	62
2006	22	22	13	59.1	02	18	136	161	87	54.0	49	87
2007	22	11	03	27.3	03	08	111	41	27	65.9	54	14
2008	15	15	13	86.7	06	09	99	139	90	64.7	47	72
2009	17	17	12	70.6	06	11	34	61	38	62.3	18	36
2010	18	18	15	83.3	05	13	32	58	25	43.1	16	26
2011	19	21	15	71.4	10	09	44	55	29	52.7	17	27
2012	17	19	10	52.6	07	10	86	130	73	56.2	37	72
Total	191	193	134		68	117	790	927	540		345	475
Average Per Year	19.1	19.3	13.4		6.8	11.7	79.0	92.7	54.0		31.5	47.5

RTC: Road traffic crash.

reported in the jurisdictions of 30 police stations during 2003-2012 in Peshawar, Pakistan. Initially, data were extracted from First Information Reports (FIRs) from individual police stations in the three administrative zones: cantonment, city and rural. The RTCs were divided into two categories: fatal and non-fatal. Field visits of the corridors were conducted to evaluate the existing physical infrastructure for pedestrians, markings and signage and pedestrians and drivers' behaviour in the city. In addition, police reporting officials were informally interviewed to establish a link between human violations and road crashes. Each of the police station is headed by a senior official, i.e. Station House Officer (SHO). During interviews, SHOs of all 30 police stations were inquired about drivers and pedestrians'

behaviour leading them to RTCs and traffic signage and markings. This study focused on making assessment and association of RTCs with infrastructure characteristics, drivers' and pedestrians' behaviour in the jurisdictions of each police station.

Out of the 3,280 RTCs reported, 856(26%) were fatal in which 872 persons lost their lives, including 602(69%) pedestrians. Of the 2,424(74%) non-fatal crashes, 3,007 people were injured, including 1,782(59%) pedestrians. No regular yearly pattern was noticed for pedestrians' fatalities and injuries in RTCs. During the analysis period, 60 pedestrians lost their lives each year while 178 faced various injuries in the RTCs. Also, other vehicles (bikes, Suzuki pickups, vans, trucks, buses, etc) were involved in 54 fatal crashes, whereas cars were reported in only 32

Table-4: Spatial Distribution of RTCs in Rural Circle, Peshawar (2003-2012).

Police Station	No. of RTCs		Total Killed	Total Injured	Pedestrian			
	Fatal	Non-fatal			Freq	Killed Percent	Freq	Injured Percent
Badaber	93	138	93	163	81	87.1	95	58.3
Chamkani	112	249	113	294	46	40.7	160	54.4
Daudzai	72	168	77	203	52	67.5	115	56.7
Kahzana	35	53	35	88	31	88.6	66	75.0
Mathani	24	31	27	35	18	66.7	14	48.6
Mathra	37	89	38	115	22	57.9	63	54.8
Urmar	11	19	12	18	11	91.7	11	61.1
Total	384	747	395	916	261	66.1	524	57.5

RTC: Road traffic crash.

Table-5: Temporal Distribution of RTCs in Rural Circle Police Station, Peshawar (2003-2012).

Year	Fatal Road Crashes						Non-Fatal Road Crashes					
	Total RTCs	Fatalities	Pedestrians		Type of Vehicles.		Total RTCs	Injuries	Pedestrians		Type of Vehicles.	
			Nos.	%	Cars	Others			Nos.	%	Cars	Others
2003	39	44	28	63.6	13	27	20	21	19	90.4	05	15
2004	45	49	22	44.8	11	34	97	106	59	55.6	36	61
2005	46	46	16	34.7	15	31	99	118	73	61.8	39	60
2006	29	30	21	70	06	23	103	133	64	48.1	31	72
2007	23	24	08	33.3	06	17	39	60	31	51.6	16	73
2008	52	52	52	100	11	41	114	145	84	57.9	38	76
2009	36	36	36	100	23	13	73	91	57	62.6	50	23
2010	17	17	06	35.2	06	11	50	53	49	92.4	18	32
2011	30	30	12	40	16	14	54	67	34	50.7	28	26
2012	67	67	60	89.5	15	53	98	122	54	44.2	41	57
Total	384	395	261		122	264	747	916	524		302	495
Average Per Year	38.4	39.5	26.1		12.2	26.4	74.7	91.6	52.4		30.2	49.5

RTC: Road traffic crash.

fatal crashes per year in the city. However, cars and other vehicles-related average annual injury rates were found almost equal having values of 118 and 124, respectively (Table-1).

The RTCs which occurred in each of the three circles were studied separately as well. The city circle comprises densely populated core urban areas. The Grand Trunk (GT) Road passes through the jurisdictions of police stations Paharipura, Gulbahar and Gulfat Hussain. In this circle, a total of 975(26%) RTCs were reported, including 185(19%) fatal and 790(81%) non-fatal crashes. In the fatal crashes, 193(22.1%) persons were killed, of whom 134(69%) were pedestrians. Similarly, of the 927(31%) people injured in the city circle, 540(58%) were pedestrians. Considering the total number of fatal RTCs as a determining factor, the jurisdiction of Banamari Police Station was the most notorious. The jurisdiction of Paharipura Police Station

was the most dangerous with maximum 153(19.4%) non-fatal RTCs reported in the circle. In contrast, minimum numbers of RTCs were reported from the core city areas. GorGatheri and Dabgri police stations reported only 4(0.5%) non-fatal crashes each in their jurisdictions. Yakatoot, Faqirabad and Gulfat Hussain police stations reported maximum number of RTCs to the pedestrian in the circle (Table-2).

The annual distribution RTCs in the city circle followed an irregular pattern throughout the analysis period. However, on average 19 ± 3.11 fatal RTCs and 79 ± 41.84 non-fatal crashes were reported per year causing 14 pedestrians to lose their lives and other 54 suffering various injuries on an annual basis. The lower annual rate of fatal crashes in city circle as compared to that in rural circle is due to higher traffic density and low vehicular speed which enhances the likelihood of non-fatal crashes. Maximum pedestrians' fatalities were

Table-6: Spatial Distribution of RTCs in Cantonment. Circle, Peshawar (2003-2012).

Police Station	No. of RTCs		Total		Pedestrian			
	Fatal	Non-fatal	Killed	Injured	Freq	Killed Percent	Injured Freq	Injured Percent
Gharbi	15	79	18	99	10	55.6	66	58.9
Gulburg	4	17	4	20	4	100	12	60.0
Hayatabad	40	173	38	199	39	97.5	157	71.4
Michini	0	22	0	24	0	0.00	14	58.3
N.Bagh	0	9	0	10	0	0.00	8	80.0
P.Khara	52	110	51	138	35	66.0	86	56.2
Regi	2	1	2	1	1	50.0	1	100
Sarband	6	16	9	18	6	66.7	16	88.9
Sharqi	39	145	38	178	28	70.0	95	50.3
Tatara	6	13	7	12	2	28.6	8	53.3
Tehkal	42	100	42	133	27	64.3	102	76.7
University Campus	6	50	6	60	2	33.3	28	44.4
University Town	69	234	69	269	53	76.8	150	55.8
Total	281	969	284	1164	207	71.4	743	60.6

RTC: Road traffic crash.

Table-7: Temporal Distribution of RTCs in Cantt. Circle Police Stations, Peshawar (2003-2012).

Year	Fatal Road Crashes						Non-Fatal Road Crashes					
	Total RTCs	Fatalities	Pedestrians		Type of Vehicles.		Total RTCs	Injuries	Pedestrians		Type of Vehicles.	
			Nos.	%	Cars	Others			Nos.	%	Cars	Other
2003	28	29	20	69.0	14	14	23	27	17	63.0	10	13
2004	42	42	37	88.1	21	21	130	141	83	58.9	72	58
2005	69	69	49	71.0	32	37	110	137	81	59.1	57	53
2006	14	14	11	78.6	03	11	119	139	65	46.8	64	55
2007	25	25	08	32.0	05	20	29	37	18	48.6	17	12
2008	28	28	24	85.7	15	13	157	197	109	55.3	79	80
2009	23	23	14	60.9	13	10	74	120	90	75.0	36	38
2010	10	10	09	90.0	06	04	96	103	73	70.9	50	46
2011	17	18	10	55.6	08	09	105	118	81	68.6	63	42
2012	25	26	25	96.2	07	18	126	145	98	67.6	59	66
Total	281	284	207		124	157	969	1164	715		507	463
Average Per Year	28.1	28.4	20.7		12.4	15.7	96.9	116.4	71.5		50.7	46.3

RTC: Road traffic crash.

reported during 2004 whereas maximum pedestrians' injuries took place in 2008 (Table-3).

The rural circle of Peshawar comprises vast chunks of lands, mainly in northern and southern parts of the district. Major radial roads of the city like Charsadda Road, Warsak Road and Nasir Bagh Road pass through these areas in the north while Phandu Road, Bara Road and Kohat Road pass through rural areas in the south. Again, high-speed GT Road passing through the jurisdiction of Chamkani Police Station reported maximum fatal and non-fatal crashes. A total of 261(66%) fatalities and 524(58%) injuries were borne by pedestrians. The majority of crashes involving

pedestrians were reported in the jurisdiction of Badber Police Station followed by Khazana and Urmar police stations (Table-4).

The temporal distribution RTCs in the rural circle followed an irregular pattern. However, on average 39±14.01 fatal RTCs and 75±30.46 non-fatal crashes were reported per year causing 26 pedestrians deaths and other 53 suffering various injuries on an annual basis. The annual distribution of both fatal and non-fatal crashes in the rural circle shows considerable variation. The average annual rate of fatal RTCs and pedestrians deaths was quite higher in the city circle than the rural circle due to higher probability of



Location 1: University Road near Jehangir Abad



Location 2: Tanvir Khalil Chowk, University Town



Location 3: University Road in front of Custom House



Location 4: University Road in front of Islamia College

Figure: Various Locations Showing Pedestrians' Exposure to RTCs in Peshawar.

RTC: Road traffic crash

vehicular-pedestrian conflict as more pedestrians are involved in city circle due to existence of shopping malls, educational institutions and health centre. Maximum pedestrian fatalities, i.e. 60(23%), were reported during 2012 followed by 52(20%) in 2008 (Table-5).

A total of 1,250(38.1%) RTCs were reported in the cantonment circle, including 281(22%) fatal and 969(78%) non-fatal crashes. As a result, 290(33.3%) people lost their lives including 207(73%) pedestrians, whereas 1,164(38.7%) individuals, including 743(64%) pedestrians, received various injuries. In the cantonment circle, University Town Police Station reported 303(24.24%) RTCs, followed by Hayatabad Police Station 213(17%) and Tehkal Police Station 142(11.4%). Most fatalities were reported in University Town 53(18.3%) and most injuries in Hayatabad 157(13.5%) (Table-6). Each year, 28 fatal RTCs were reported each year in Cantt. Circle causing 21 (72.71%) pedestrians' fatalities (Table-7). Statistics showed that highest number of overall fatalities i.e. 69

life losses were reported during 2005, including 49 pedestrians' deaths (71%).

On average, 238 pedestrians were either killed or injured in RTCs in the city annually. The cantonment circle had the highest number of pedestrians' involvement in fatal and non-fatal crashes which was 950(39%), followed by the rural circle and city circle with 785(33%) and 674(28%), respectively. The descriptive statistics also showed that a high percentage of RTCs, i.e. 1,250(38%), were reported in the cantonment circle, followed by rural and city circles, respectively. It was observed that in the cantonment circle, the highest number of RTCs was recorded in the jurisdiction of University Town Police Station 303(23%), followed by Hayatabad Police Station 213(17%). Also, relatively more pedestrians' fatalities and injuries were reported in the same two police stations.

Pedestrians are the highest vulnerable group to both road traffic fatalities and injuries in Peshawar. However, statistics of RTCs in the city showed that like

rest of the country, road crashes in Peshawar have been following an irregular pattern, averaging out at around 328 RTCs per year.²⁸ The jurisdictions of some police stations were notorious for fatal RCTs while that of others showed medium likelihood of pedestrians' fatalities. For instance, the police stations of GorGatheri and Dabgri in the city circle reported only four non-fatal crashes each in their jurisdictions. These areas are highly congested with the roads serving local population of routine shoppers and urbanites living in the core city. The roads usually serve local traffic like rickshaws, cars, motorcycles and taxis which have an average speed of less than 20kph during the daytime. Yakatoot, Faqirabad and Gulfat Hussain police stations reported maximum number of pedestrians' RTCs in the circle. The pedestrians in all three areas are exposed to intercity traffic of greater speed and intense urban use. Above findings are consistent with previous studies.²⁹⁻³¹

In the rural circle, the majority of RTCs involving pedestrians were reported in jurisdictions of police station of Badber, followed by Khazana and Urmar. In all the cases, intercity traffic passes through dense settlements in the peripheral urban areas. Though these areas are predominantly rural, linear developments along the intercity roads during the past few decades have led to an increase in uncontrolled and unmanaged pedestrians' movement that appear to be the main cause of these crashes and high pedestrians' fatality rate. The finding is consistent with the past research as the probability of pedestrians' fatality or injury is dependent on the impact speed of the hitting vehicle.^{29,32}

The University Town Police Station, in the cantonment circle, reported more than 300 RTCs, followed by Hayatabad Police Station and Tehkal Police Station. Jamrud Road, which is a part of the main arterial road of the city and passes through the jurisdiction of the University Town Police Station, showed more crashes. This section is densely populated with major commercial establishments on both sides that result in more frequent use of road space by pedestrians due to unavailability of appropriate pedestrians' infrastructure. Another part of this high-speed corridor passes through Tehkal Police Stations' jurisdiction and it also reported 27(64%) fatalities and 102(77%) injuries sustained by the pedestrians. The excessive pedestrians' road crossing due to existing shopping areas on either side, relatively higher driving speed²⁹⁻³¹ and carelessness of both drivers and pedestrians result in higher rate of pedestrians'

fatalities and injuries. Also, there is a special need for implementing modern technology and intelligent transport system (ITS) applications to safeguard the pedestrian movement at intersections and other designated locations.³³

Various factors govern severity of pedestrian crashes. No well-defined crossing points for pedestrians and the shifting of public transport to service road specifically along the university road has drastically shrunk the safe mobility space for pedestrians. The removal of footpaths to widen the road and low priority given to pedestrians are increasing the risks to the non-motorised users as they start using the streets for walking because the capacity of the existing sidewalk is exceeded or the footpath is totally removed.³⁴ The situation has worsened with continuous increase in the commercial, educational and health centres. The government has built some overhead bridges and underpasses for pedestrians, but due to inadequate planning these facilities are underutilised and the pedestrians continue to put themselves in danger by crossing the road at various unregulated points. The provision of overpasses and underpasses at places where required and educating pedestrians to use the existing ones can significantly decrease pedestrian crashes.³⁵

During field visits it was observed that roads are congested and unsafe because of the inflated population under the influence of the Afghan war and military operations in the abutting tribal areas. Moreover, there is a lack of appropriate physical infrastructure for pedestrians. Though there are underpasses at Hashtnagri, Peshawar Board, Arbab Road and Peshawar University and overpasses near Islamia College University, other localities with massive pedestrian traffic do not have such facilities for pedestrians' crossing. The majority of pedestrians are unaware of the safety education and benefits, and therefore they avoid the use of existing facilities and put themselves at risk by directly crossing the road. The footpaths are not amply provided, even the available ones are deteriorated or not properly designed thereby a majority of the pedestrians avoid using them and prefer using service roads (Location 1, Figure). No proper markings or signs like zebra crossings and stop lines were observed (Location 2, Figure). Encroachments of public space due to poor enforcement and unavailability of sidewalks for pedestrians are also one of the serious issues in the city that create lateral friction (Location 3, Figure). It was reported that mostly pedestrians, other than local

residents and daily commuters, are unfamiliar with the city traffic and their wrong gap anticipation cause accidents. Mixed traffic also aids to the issue which can be observed at various locations, such as in front of Islamia College Peshawar's Gate-1 (Location 4, Figure).

Conclusion

The study will help transportation agencies and enforcement officials in planning countermeasures to improve the current hazardous situation on the city roads. However, there is a dire need of improvement in the post-crash evaluation protocol as the data was extracted from the FIR records of the Peshawar Police Department, which is a monotonous job, and also do not contain detailed information as required for research to investigate some more interesting trends. Also, the study was carried out only on the reported FIRs where one cannot ignore the issue of underreporting of some crashes involving only minor injury or property damage. The Peshawar Police Department needs to develop a standard crash report form (a four-page crash report form is already used by National Highway and Motorway Police [NHMP], Pakistan) rather than using traditional FIRs for crash reporting. The NHMP form covers sufficient data regarding driver, vehicle, roadway geometrics and environment which enables the researchers to dig some new insights in the field of safety. Pedestrians were involved in the majority of both fatal and non-fatal crashes in all three circles of the city. The 95% confidence interval was found to be resting between 316 and 443 RTCs annually, showing almost one crash per day. Pedestrians' induced RTCs can be reduced considerably if their use of road space can be regulated. It is imperative to provide essential physical infrastructure like at level pedestrian crossing, signalised zebra crossing, etc. Removals of the encroachments from the walkways, installation of warning signs and other information in areas with more frequent pedestrians' use of road space are also important to reduce RTCs in cities like Peshawar. There is a dire need of safety education, media campaigns and use of modern applications of ITS for pedestrians to use the existing pedestrians' infrastructure. Drivers should be discouraged of exceeding the designated speed limit in the city.

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