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Traffic Analysis and Road Accidents: A Case Study of Hyderabad using GIS

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Abstract. Globalization has impacted many developing countries across the world. India is one such country, which benefited the most. Increased, economic activity raised the consumption levels of the people across the country. This created scope for increase in travel and transportation. The increase in the vehicles since last 10 years has put lot of pressure on the existing roads and ultimately resulting in road accidents. It is estimated that since 2001 there is an increase of 202 percent of two wheeler and 286 percent of four wheeler vehicles with no road expansion. Motor vehicle crashes are a common cause of death, disability and demand for emergency medical care. Globally, more than 1 million people die each year from traffic crashes and about 20–50 million are injured or permanently disabled. There has been increasing trend in road accidents in Hyderabad over a few years. GIS helps in locating the accident hotspots and also in analyzing the trend of road accidents in Hyderabad.

1. Introduction

The process of rapid and unplanned urbanization has resulted in an unprecedented revolution in the growth of motor vehicles world-wide. The alarming increase in morbidity and mortality owing to road traffic incidents (RTI) over the past few decades is a matter of great concern globally [1, 2, 4, 5]. Currently motor vehicle accidents rank ninth in order of disease burden and are projected to be ranked third in the year 2020[7-9, 11-13, 15-16]. In India, more than 70,000 people get killed due to RTI every year, and this needs to be recognized as an important public health issue[3,14,17]. Very few studies have attempted to understand the epidemiology of risk factors associated with RTI in Indian cities [10, 18]. The present study aims to examine the magnitude of this multifaceted problem in a rapidly developing Hyderabad metropolis and analyse the causative factors.

Hyderabad, a 400 year old city is the state capital of Andhra Pradesh. It lies on the Deccan Plateau, 541 meters (1776ft) above sea level, over an area of 625 sq.km. of municipal corporation and 7200sq.km.of Hyderabad Metropolitan area, is the fifth largest city in India, with a population of above 8 million. Unlike other Indian metros it continues to attract considerable migrant population due to its strategic geographical location, multilingual and cosmopolitan culture, tremendous growth potential and investment

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friendly economic policy has propelled the overall population growth of the city and the surrounding areas. The increasing pressure of the burgeoning population is putting Hyderabad's Transport system under constant pressure. Due to its prominence as a major high-tech center, it is one of the fastest growing with a population density of more than17,000 persons per sq.km. The rapid rate of urbanization with increased economic activity has encouraged migration to the twin cities, which led to an increase of personal, public, and para (3 and 6 seat autos) transit vehicles, industrial output, and increasing burden on the city's infrastructure.

Hyderabad along with the surrounding ten Municipalities constitutes the Hyderabad Urban Development Area (HUDA) and has been growing at an average rate of 9%.The need of the hour is a robust system that is dependable, comfortable, affordable and sustainable. Population with an estimation to touch 13.64 million by 2021, and the increase in vehicular number has definitely created crisis in Hyderabad. The increase in the vehicles since last 10 years has put lot of pressure on the existing roads and ultimately resulting in road accidents. It is estimated that since 2001 there is an increase of 202 percent of two wheeler and 286 percent of four wheeler vehicles with no road expansion. Motor vehicle crashes are a common cause of death, disability and demand for emergency medical care [6].

The main reason for road accidents in the city of Hyderabad is attributed to physical characteristics. The study tries to assess the increase in vehicular number and its effect on road accidents, also tries to locate the hotspots of road accidents and its causes.

The main objectives of the study are

1. To study the cause of road traffic accidents in Hyderabad city.
2. To identify and analyze the risk factors and accident prone sites (Hot spots), which form the crucial determinants of the RTI.
3. To understand the nature, type and mode of occurrence of accidents.
4. To study the nature and type of injuries.

2. Methodology

The methodology adopted in the study is based on secondary data from various govt. sources namely; Census of India, Ministry of Transport, Hyderabad Traffic Police, Road Transport Authority etc. The study is also based on primary survey where data was collected through observation and survey methods. The use of GIS was also done as it helps in locating the accident hotspots and also in analyzing the trend of road accidents in Hyderabad.

The classified traffic counts data collected at the various busy points and inner ring road points were Analyzed to arrive at hourly flows and daily flows as per direction and class of vehicles. Traffic volume analysis is essential to appreciate traffic characteristics along these lines, mid-block sections and at Inner corridor. Traffic analysis was done for all the above locations to get the information of hourly variations, compositions and peak hour flows. The Origin-Destination data was analyzed to get the information of occupancy, trip purpose, and trip length for passenger traffic.

The analysis regarding traffic at various locations in the city suggest that the traffic flow on NH-65 near Malakpet is highest with 2, 21,922 vehicles/day; while a minimum traffic is observed at Bollaram with only 8,293 vehicles/day. On the other side the maximum traffic

flow is observed at Begumpet ROB with 2, 16,235 vehicles/day; along the inner corridor the maximum traffic flow is observed at Chaderghat bridge with 1,19,009 vehicles/day; It can be seen that the share of Private vehicles are in the range of 42% and 84%. Public Transport is observed to be around 10% Non-Motorised Transport was observed to be around 14% at Moula-Ali station which was highest among all the locations. Volume was also observed to be lowest among all the locations (3,569 vehicles).

Table 1. Average daily traffic at various locations

S.No	Location	Passenger Vehicles				Total vehicles
		Private	IPT	PT	NMTs	
1	Faluknuma ROB	39,061	14,834	3,643	1,020	58,558
2	Kandikal Gate Colony	8,708	5,168	113	1,317	15,306
3	UppuGuda	8,218	6,343	95	882	15,538
4	TalabKatta	23,438	11,015	139	2,779	37,371
5	Yakutpura	9,324	5,403	117	1,476	16,320
6	On NH-65 near Malakpet	1,68,573	33,139	9,073	1,645	43857
7	Nimboliadda	28,496	7,414	1,359	1,812	39,081
8	Tilak Nagar	61,154	12,116	974	1,533	75,777
9	APHB Colony	34,354	7,815	47	3,107	45,323
10	Vidyanagar	45,067	7,598	1,843	819	55,327
11	Adikmet Road	35,186	5,738	1,521	329	42,774
12	Arts College	9,993	2,182	11	578	12,764
13	Sitaphalmandi	26,891	4,978	307	646	32,822
14	AlugaddaBhavi	1,04,297	18,851	5,880	884	25615
15	Lallaguda Gate	12,147	2,802	63	667	15,679
16	Safilguda	33,666	5,277	330	608	39,881
17	Bolaram	7,231	692	79	291	8,293
18	Hi-tech City MMTS Station RUB	76,593	16,629	1,271	227	94,720
19	Sanath Nagar ROB	92,904	15,206	7,148	741	115,999
20	Fateh Nagar ROB	64,222	13,199	1,103	902	79,426
21	Begumpet ROB	2,16,325	34,691	6,788	903	42,382
22	Ministers Rd - Necklace Rd, James	41,152	5,140	37	508	46,837
23	Ranigunj	72,312	10,551	3,242	979	87,084
24	Rashtrapathi Road	70,132	15,683	2,864	1,765	90,444
25	Oliphant Bridge-Rathifile	60,091	27,878	8,168	1,336	97,473
26	Rail Nilayam RUB	1,04,329	13,496	1,953	641	16,090
27	Lalaguda ROB	38,107	7,520	2,170	917	48,714
28	Tippukhan Bridge	32,941	4,414	2,063	666	40,084
29	Attapur Bridge	85,472	18,719	1,943	1,437	107,571
30	PuranaPul Bridge	45,654	9,671	159	4,353	59,837
31	Muslim Jung	54,157	11,405	183	4,010	69,755
32	Nayapul Old Bridge	49,742	12,411	3,098	2,441	67,692
33	Nayapul New Bridge	73,987	15,953	2,379	2,648	94,967

34	Shivaji Bridge - Salar Jung	40,008	5,691	2,261	2,179	50,139
35	Chaderghat Causeway	58,817	14,526	2,796	962	77,101
36	Moosarambagh	68,068	13,064	1,153	1,597	83,882
37	Nagole Bridge	77,904	11,668	3,516	427	93,515

Source: Transport Department

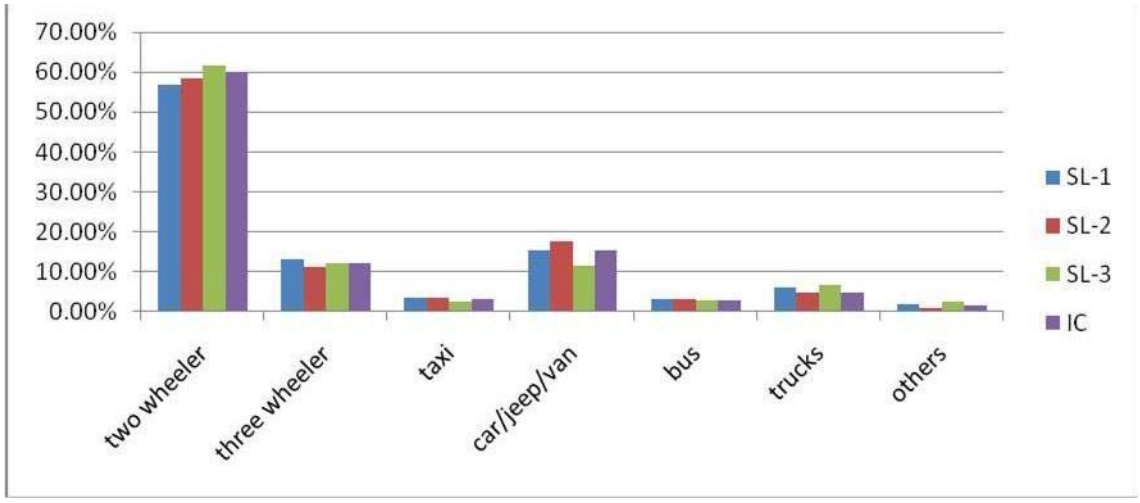


Figure 1. Vehicle movement in Hyderabad.
Source: Hyderabad Traffic Police.

3. Analysis

Nearly 3,400 people die on the world's roads every day. Tens of millions of people are injured or disabled every year. Children, pedestrians, cyclists and the elderly are among the most vulnerable of road users. In 2013, deaths due to road traffic crashes were the tenth leading cause of death in all age groups in India. According to the WHO,1,97,135 people were killed in 300 000 road traffic crashes in India in 2013 Although the leading causes of death in India in numerical terms are cardiovascular diseases, respiratory infections and diarrhoeal diseases, the ranking of causes of death changes when age-at-death is considered. Road traffic crashes are the third leading cause of death for people between 5 and 44 years of age. It is estimated that the morality rate in road traffic crashes has risen from less than 30 per 100 000 in the early 1970s to more than 50 per 100 000. Despite this, road safety has not received enough attention in India as well as in many other developing countries.

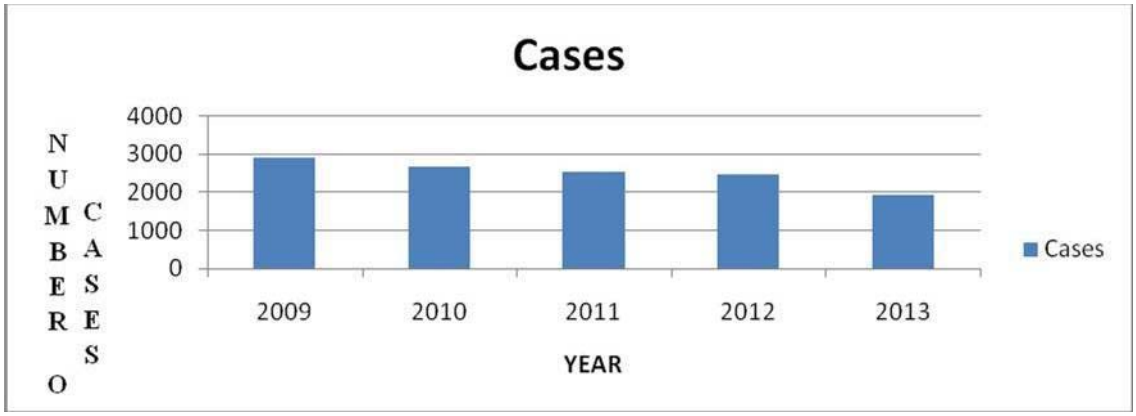


Figure 2. Injured cases for last five years.

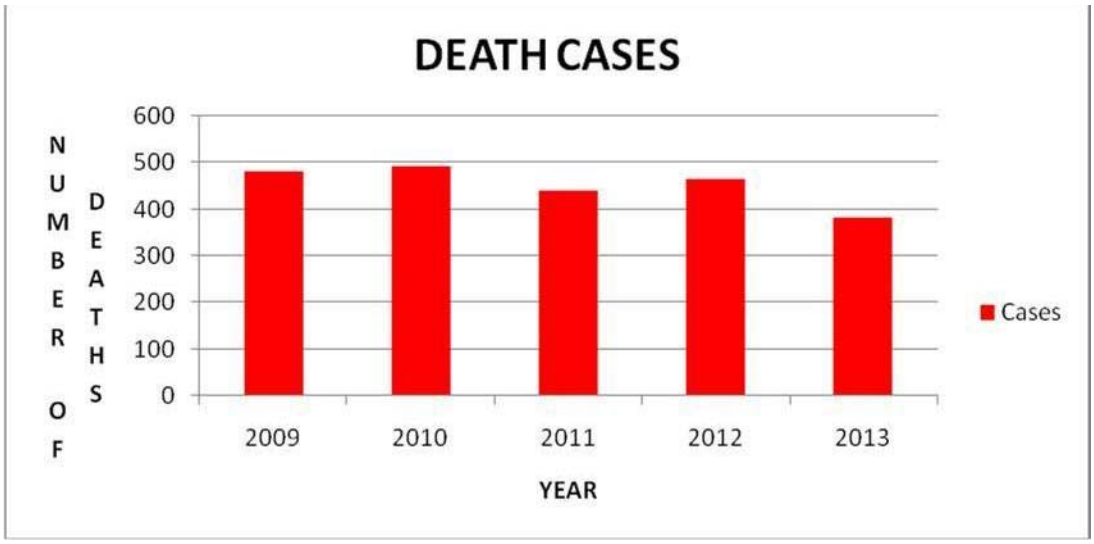


Figure 3. Death cases in Hyderabad.

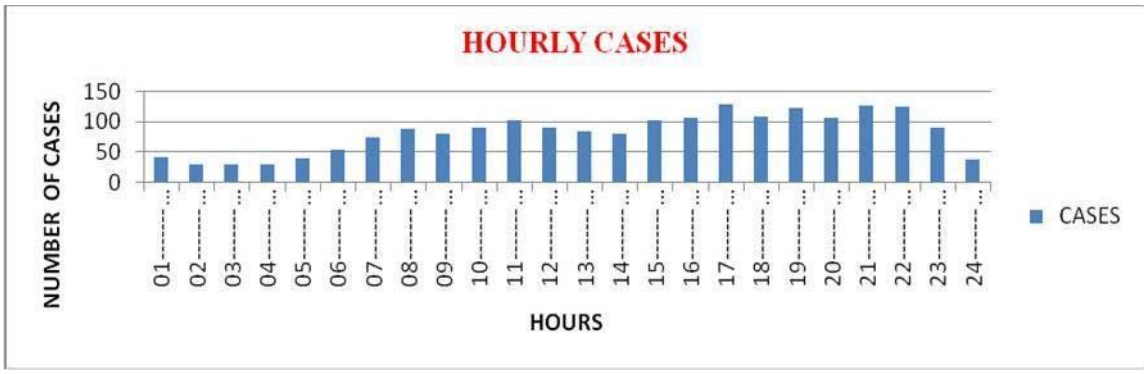


Figure 4. Hourly accident cases in Hyderabad.

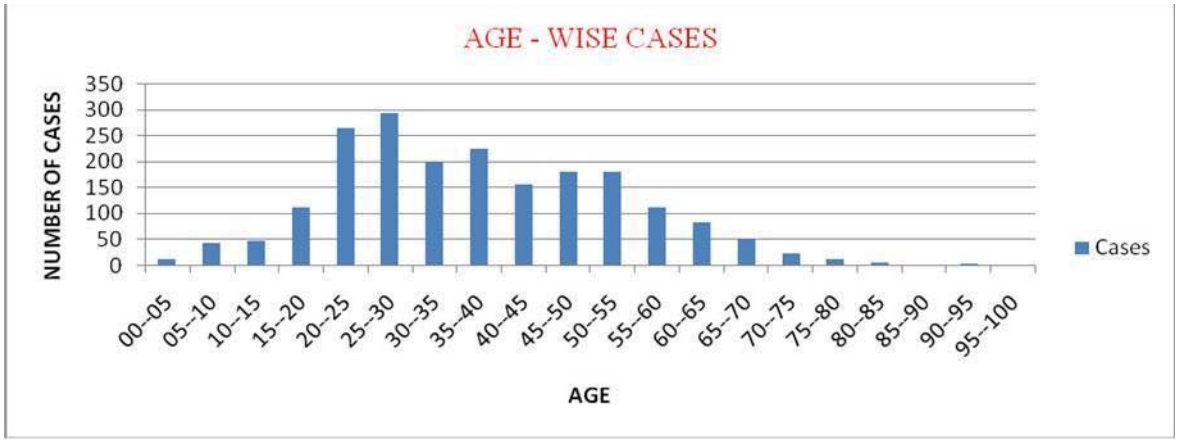


Figure 5. Accident victims age.

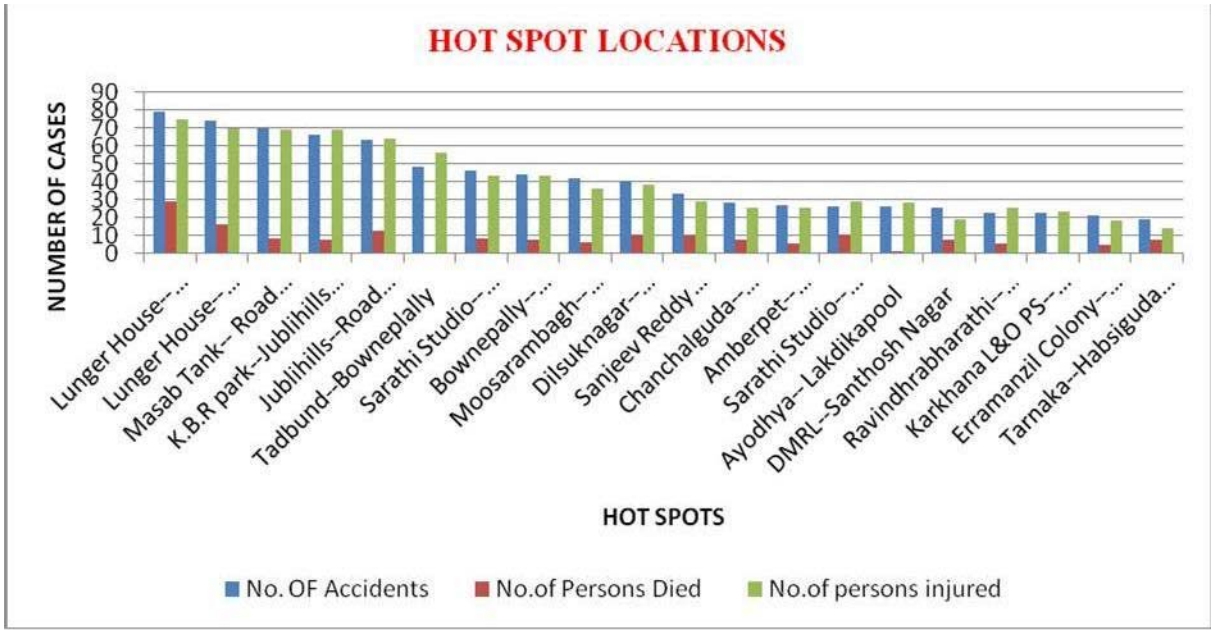


Figure 6. Accident hotspot locations.

4. Results & Discussions

A total of 2,990 cases of road traffic incidents were recorded in the police database for 2013, in which 411 (16.08%) people were killed. In the same year, 316 cases of road traffic crashes resulting in 353 deaths were reported in the newspaper. The majority of those who died due to these crashes were males. Seventy per cent of those killed were between 16 and 49 years of age. Pedestrians and riders of two- wheelers were the most vulnerable. Collision with a vehicle caused 86.4% of all crashes and 60% of the victims died before reaching a hospital. The maps reveal the nature of incidents and also the vulnerable spots in the city. The maps give us the various types of injuries and type of vehicle involved.

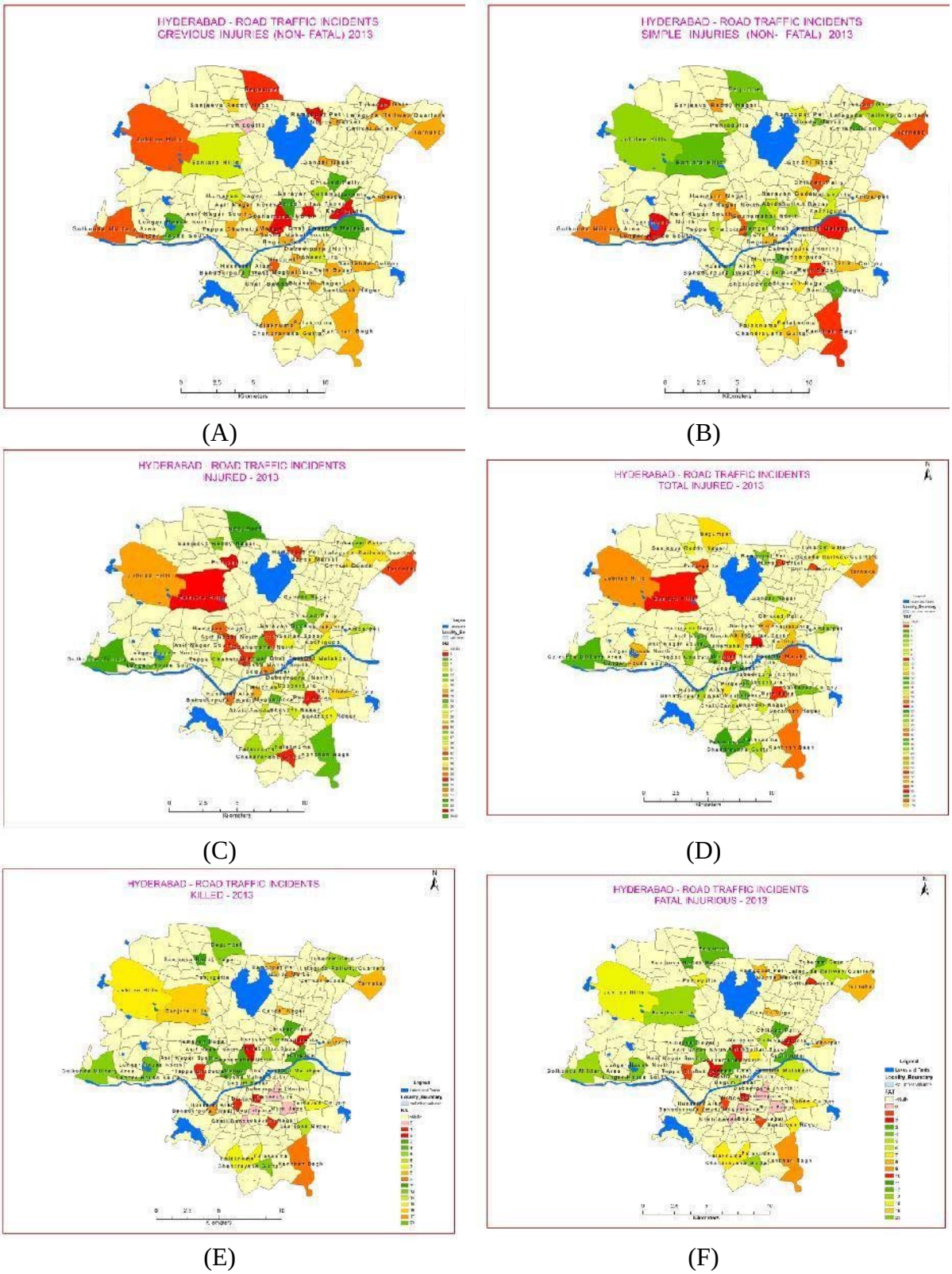


Figure7. Road traffic incident hotspot locations.
Source: Hyderabad Traffic Police, 2013.

The available data were not comprehensive enough to provide a thorough basis for planning intervention strategies to reduce fatalities due to road crashes. These data also highlight that there is a need to strengthen surveillance. The data currently available do not give the true magnitude of the burden due to road traffic crashes as there could be

underreporting; reliability of these data needs strengthening as discrepancies were noticed between the two data sources; and these data are not comprehensive enough to plan proper intervention strategies to reduce fatalities and injuries due to road crashes. As it cannot be expected that the newspapers would cover all the above because it is not their prime responsibility, we focus on the police database for recommendations as it is the legal source of information on fatalities and injuries due to road crashes. It is important to know the correct number of people killed in road traffic crashes to understand the real burden of road crashes. It is possible that some cases of road traffic crash deaths are not reported to the police.

The possible reasons for this could be suboptimal coordination between the police and hospitals in the event of death occurring in hospitals due to a road crash; not all deaths are reported to police by the public; and because not all deaths related to road traffic crashes occur in hospitals. It is also possible that someone who was recorded as 'injured in road traffic crash' in the police database died at a later date but this is not reflected in the police database, which can result in underreporting of deaths due to road traffic crashes. A proper data collection mechanism with involvement of all the major stakeholders on whom this data collection depends needs to be put in place, including regular updating of the police database to understand the real burden of road crashes. There is also a need to extend the coverage of data on road traffic crashes collected by the police to include all the factors needed to assess the true nature of road crashes.

The reporting of road crashes is not adequate as the physical environment at the time of the crash, status of the people involved (alcohol or drug use and behavior), use of protective gear for two-wheeler riders (helmet), condition of the vehicles involved in the crash are not covered in the police database. All this information is important to have a comprehensive understanding of the nature of road crashes, and plan and evaluate proper intervention strategies. The reliability and accuracy of the data collected are also important. For example, in the police database the nature of crash was recorded as 'head-on collision', and the cause of crash as 'negligence of driver' for the entire road crashes that resulted in death. We explored the reasons for this documentation. Many of the forms received did not have 'nature of crash' filled, and it was assumed to be 'head-on collision'. Second, recording of the cause of crash as 'negligence of driver' in the police report did not require any proceedings in a court of law, and thereby served to reduce the administrative burden, as the resources available with the police are limited.

5. Conclusion

In conclusion, the police database and newspaper reports provide insights into the magnitude and nature of fatalities due to road traffic crashes. The limitations of the police database, which is the legal source of information on fatalities resulting from road traffic crashes, indicate a need for strengthening the road traffic crash surveillance system so that reliable, accurate and adequate data on road traffic crashes and the resulting fatalities and injuries can be collected. This could then form the basis for planning effective intervention strategies to improve road safety in the city. More effort is needed to have a comprehensive understanding of the various aspects of road traffic crashes, and the recommendations made for strengthening surveillance could serve as an initial step towards reducing fatalities and injuries due to road crashes in the long term.

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