

Identification of Accident Black Spot Locations Using GIS & GPS Technology: A Case Study of Hyderabad

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ABSTRACT: Accidents have been a major social problem in the developed countries of world for over fifty years. It is only in the past decade that developing countries like India have began to experience large increase in the number of road accidents taking place and have found it necessary to institute road safety programs.

It is strongly felt that most of the accidents, being a multi factor event, are not merely due to drivers fault on account of driver's negligence or ignorance of traffic rules and regulations, but also due to many other related factors such as abrupt changes in road conditions, flow characteristics, road user's behavior, climatic conditions, visibility and absence of traffic guidance, control and management devices.

In the above context an attempt is made to study various types of accidents including causative factors and black spot identification in Cyberabad area. The study involves collection of accident data from various police stations for the period of four years.

On the other hand a GIS (Geographic Information System) technique used for development of accident black spot map with same data. Based on the data collected, the data analysis, Black spot identification has done. Based on the spatial relationship between traffic accidents and road network elements, two-way association relationship is defined by spatial relationship computation. An attribute table is created to give information about various fields involved in black spots. Maps are made also with GPS (Global Positioning System) data and compared accuracy with traditional way of accident records. This attempt will show how GPS & GIS combines to give accurate black spot identification, rather than relying on assumed data for the location.

KEYWORDS: Accidents, Black spot, GIS, Fatal and non Fatal, GPS.

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I. INTRODUCTION

General The economic growth of any country depends on its transportation network, comprising of roads, rail, and water and air connectivity. Of these roads is the critical one. A good network of road is important as it provides connectivity between rural and urban areas. Along with this, road safety is an equally important aspect. It plays a key role towards a sustainable transportation development strategy. The adverse impact of modern road transportation system is injury and loss of life due to road accidents. While the road accident situation is improving in high income industrialized countries, most developing countries are facing a worsening situation. The continuous socio-economic growth over the years is causing an increase in demand for transport services including road transport. With the number of vehicles on the road growing rapidly, more road conflicts develop traffic accidents (MORT&H 2012). It is observed that most of these accidents result from human error and carelessness on the part of drivers or pedestrians. However, the probability of occurrence, and its severity, can often reduced by the application of proper traffic control devices and sound roadway design practice. The success or failure of such control devices and design specifications however, depends extensively upon the analysis of traffic accident records at specific location. It has long been recognized that one of effective means towards accident reduction lies in a systematic and scientific approach based on the use of accurate and reliable traffic accident data. However, the data required for such an analysis is not always available. Most of the accident information available in police records is incomplete and there fore may not be utilized to the fullest extent. In addition, records are also needed to provide facts to guide programs including enforcement, education, maintenance, vehicle inspection, emergency medical services and engineering improvements that can be provided to the streets and highways.

The reasons for accidents can be attributed to the lack of signage, raised cover with trees and bushes, making pedestrians not visible to drivers, improper design of pedestrian crossings, frequent median openings, and lack of enforcement to control wrong side entry and movement of vehicles. There are however, four factors which contribute to road accidents directly or indirectly like road, vehicle, road user and environmental factors (Schelling, 1997). In Indian cities, the traffic is highly heterogeneous in nature, ranging from pedestrians and animal drawn carts to motorized vehicles like cars, buses, and multi axle vehicles, as well as over sized vehicles. Analysis of traffic data indicated that drivers fault is responsible for majority of the accidents. As per recorded data in past years about 49254 accidents have occurred and 17325 persons were killed in Andhra Pradesh and Telangana. In Hyderabad, approximately 6561 accidents have occurred and more than 1570 people were killed and about 4991 were injured in traffic accidents in year 2011. In Hyderabad fatality rate is consistently in high range for the past decade (Fifth rank, as per MORT&H 2011). The economic and social costs of traffic accidents are tremendous. Property damage, lost productivity, medical expenses, and inflated motor insurance rates imposed an estimated loss to the Indian economy. Due to fatality and property damage an estimated amount of about 3% of GDP is lost by the nation in 1999-2000. Therefore there is need to study and analysis the accident pattern and reasons in Hyderabad along with the identification of black-spots location in the city.

Accidents causing reasons can be classified as

- Road related Factors
- Vehicle related Factors
- Road user related Factors
- Environmental related Factors

Objectives of the Study

The following are the specific objectives of the present study:

- To identify major contribution factor to the severity of road accidents in Hyderabad.
- To identify accident black spots locations in Hyderabad city based on secondary data collected.
- To develop maps showing accident spots data.

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II. LITERATURE REVIEW

Liyamoletal. (2013). Have precisely used GIS for identification of accident black spots. An Accident is a multifactor event preceded by a situation or event wherein one or more road users failed to cope with road environment results vehicle collision. The location in a road where highest number of traffic accidents occurs is called a Black Spot. The recent study conducted by the Kerala Road Safety Authority (KRSA) found that, the maximum numbers of accident-prone stretches or the black spots are in Alappuzha and Ernakulam districts.

Kumar and Rao. (2014). Have made a case study on Vishakhapatnam city, according to them road accidents in the present era are contributing to major deaths due to increase in vehicular density. It has been predictable that over 3 lakhs persons die and 1.5 lakhs persons are injured every single year in road accidents all over the world.

Lim Yu et al. (2005). According to Lim Many highway agencies have been using Geographic Information System (GIS) for analyzing accident data. Identification of problematic locations is one of the most important aspects in accident studies. The GIS based application combines the information collection capabilities with the visualization.

Pankaja and Rama (2012). According to Pankaj, India is one of the most accident-prone countries in world with a record rate of more than three lakhs of road crashes every year. In Bangalore 82% of road accidents are causing because of human factors, 12% of accidents are causing due to bad road conditions, while the vehicle factors contribute to about 5% and the remaining is due to environmental factors. In the present context overall Bangalore's accident statistics is presented in the present study.

Rodzi et al.(2011)According to Ahmad, it has been a big concern for many people and government to reduce the amount of road accident specially in Malaysia since it could be a big threat to this country The lack of a comprehensive accident recording and analysis system in Malaysia can be effective in these kinds of problems. By making use of IRAS (Intelligent Road Accident System), the police would be control and manage whole accident events as a real-time monitoring system.

Deepthi (2010). According to Deepthi, Accident analysis studies aim at the identification of high rate accident locations and safety deficient areas. In this study, an effort ahs been made to identify the accident prone zones within Kannur district, Kerala using GIS. For this purpose, the road accident data for the years 2006, 2007 and 2008 pertaining to Kannur district have been used. Accident particulars like date, location, type of vehicle involved, number of persons injured or died are included in the GIS database. Accident analysis studies aim at the identification of high rate accident locations and safety deficient areas.

Reshma et al. (2012). According to Reshma, Accidents in the present era are contributing to major deaths worldwide due to increase in vehicular density. It has been estimated that over 3, 00,000 persons die and 1-1.5 lakh persons are injured every single year in road accidents throughout the world. Bangalore today is obviously one of the most sought after cities in the country with the rapid growth in the IT industry and the rise in the number of job opportunities in the city.

III. STUDY METHODOLOGY

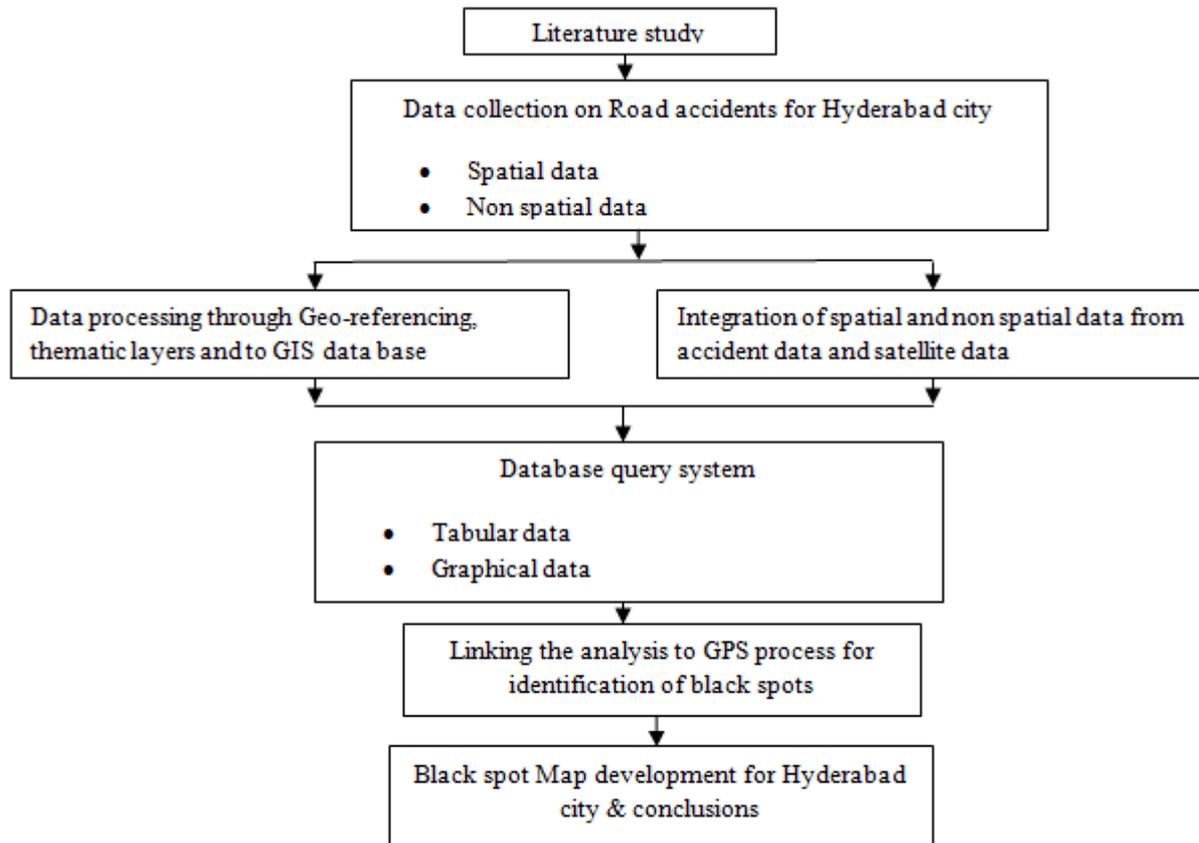
GeneralStudy methodology can be shown in flow chart, which is represented in fig 3.1. We proceed with previous studies, then with data collection and image collections, and then we proceed with combining both spatial and non spatial data. Then finally we represent it in maps.

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Study methodology flow chart

Study Area Description and Data Collection.

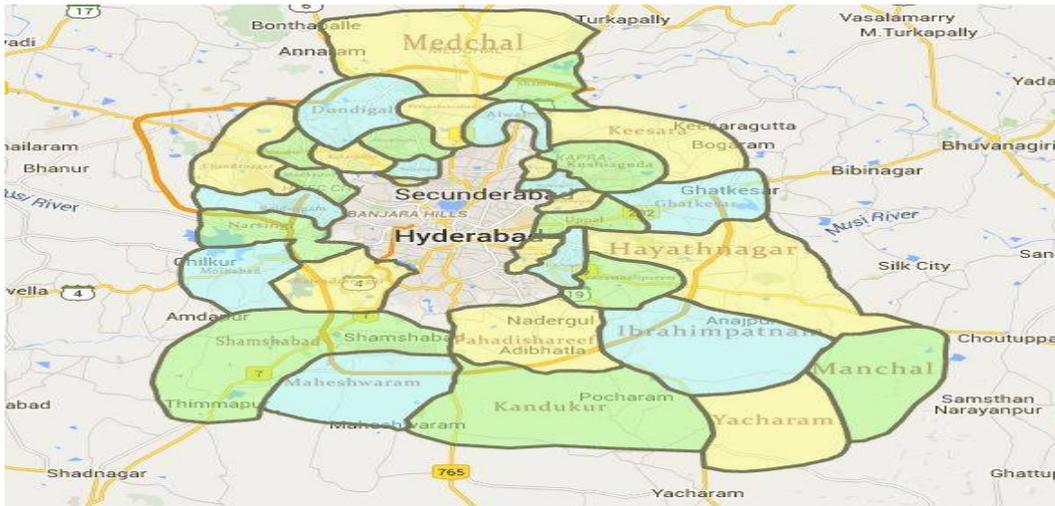
Cyberabad consists of all the outskirts and semi urban areas of the Hyderabad. Areas such as Madhapur, Kondapur, Gachibowli, Uppal, Medchal and Shamshabad etc. come under Cyberabad. Cyberabad surrounds Hyderabad on all sides. In other words, the area around the Hyderabad that has been developing lately is called as Cyberabad. With the aggressive promotion of some areas of Cyberabad, there have been extensive investments in luxurious residential townships, technological infrastructure such as Hitech city and many other IT and ITES companies. Area and Population of Cyberabad is approximately 3600 sq.km and 80 lakh, study area of Hyderabad can be seen in.

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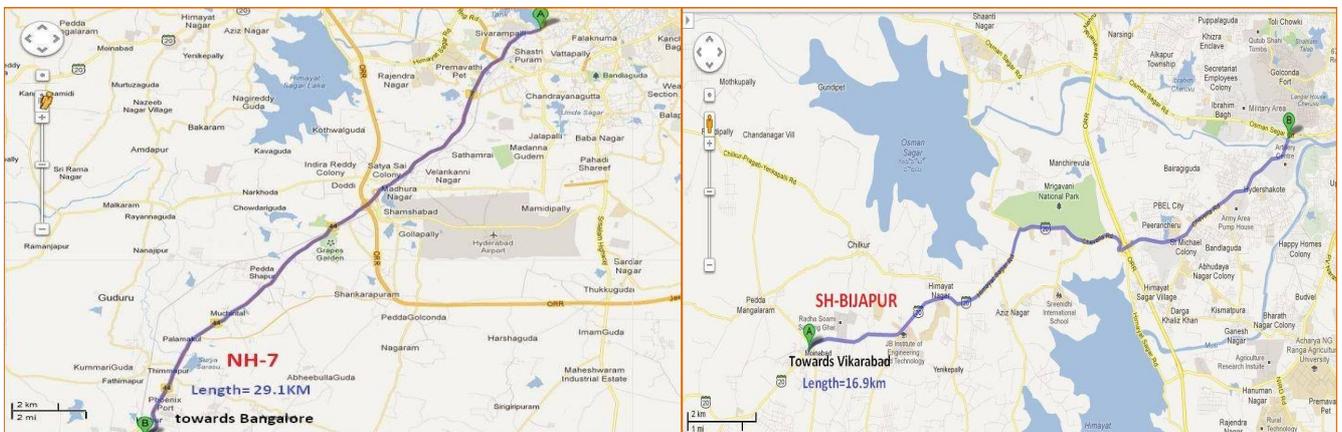
Map of Cyberabad Area

As per AP Crime Statistics records, Cyberabad registered highest number of road accident cases followed by Hyderabad city as per district wise from past 7 years and details.

Accident Data of Cyberabad comparing with Hyderabad

Year/City	2008	2009	2010	2011	2012	2013	2014
Cyberabad	3239	3716	3659	3506	3254	3333	3746
Hyderabad	3239	3400	3322	3333	2967	2868	2745

(Source: AP_CrimeStatistics_Road Accidents 2008-2014)



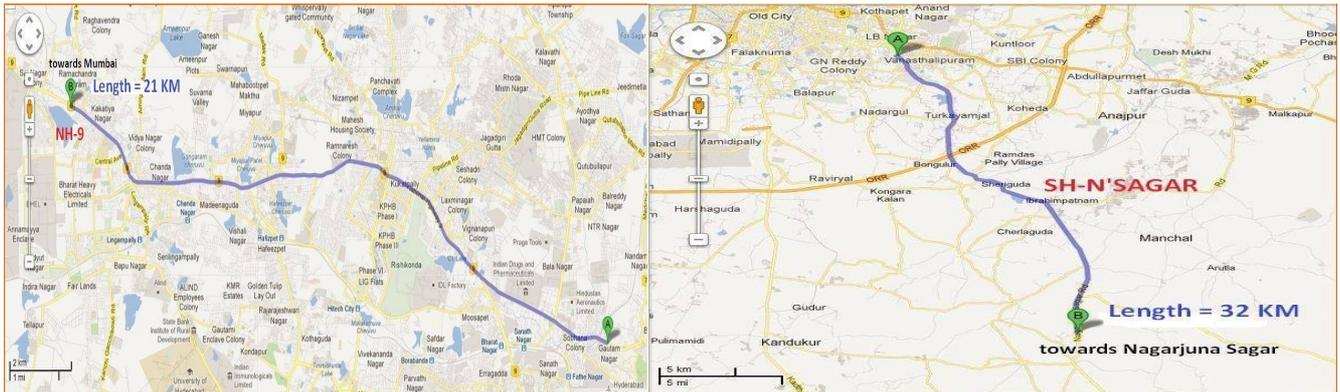
Main Stretch of NH-7(towards Bangalore) Main Stretch of SH-Bijapur

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Main Stretch of NH-9(towards of MUMBAI)

Main Stretch of SH-NagarjunaSagar Road

IV. RESULTS AND STUDY OF NATURE OF ACCIDENT

Nature of accident	No's of incident
Drag & Hit	27
Head on collision	22
Hit	2
Hit & Run	10
Overturning	2
Rear end collision	14
Right angle collision	13
Skidding	3

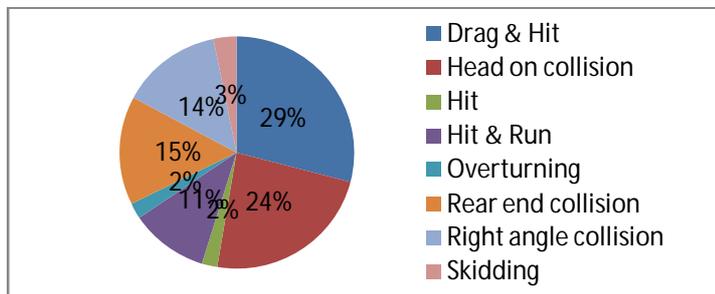
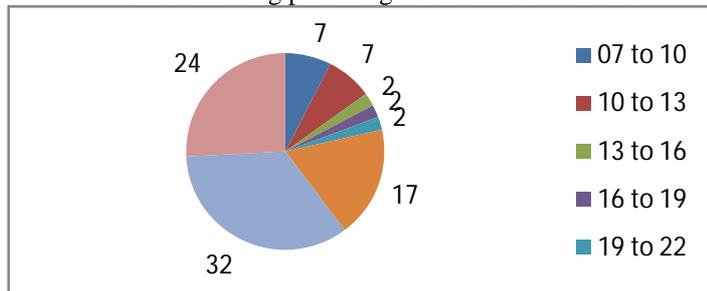


Chart showing percentage of nature of accidents

Hr. Of incident	No's of incident
07 to 10	7
10 to 13	7
13 to 16	2
16 to 19	2
19 to 22	2
22 to 01	17
01 to 04	32
04 to 07	24



Pie chart of Time of accident and number of accident

Near by place of incident	No's of incident
Bus stop	4
Collage	4
Fire station	1
Hospital	1
Marketing area	66
Near temple	2
Office complex	8
Open area	3

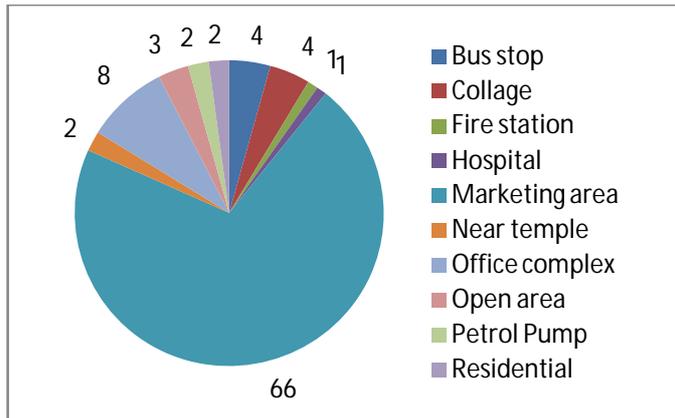
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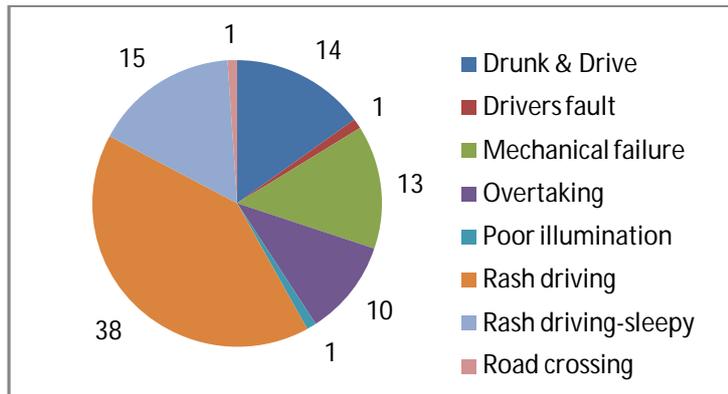
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Petrol Pump	2
Residential	2



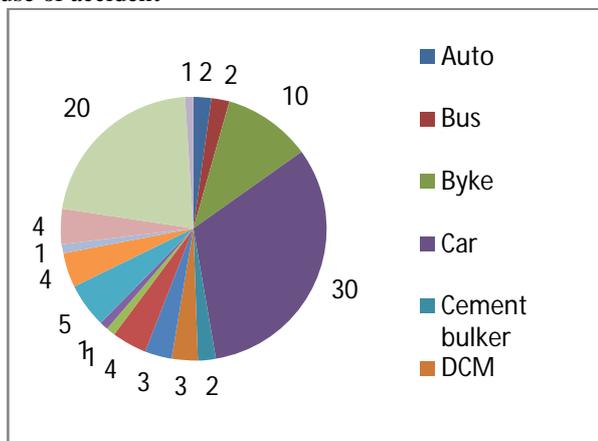
Pie chart of Place of accident

Causes of accident	No's of incident
Drunk & Drive	14
Drivers fault	1
Mechanical failure	13
Overtaking	10
Poor illumination	1
Rash driving	38
Rash driving-sleepy	15
Road crossing	1



Pie chart of Cause of accident

Type of vehicle	No's of incident
Auto	2
Bus	2
Bike	10
Car	30
Cement bulker	2
DCM	3
Eicher	3
Good carrier truck	4
Hydra	1
JCB	1
Pick up	5
Tipper	4
TM	1
Trailer	4
Truck	20
Water tanker	1



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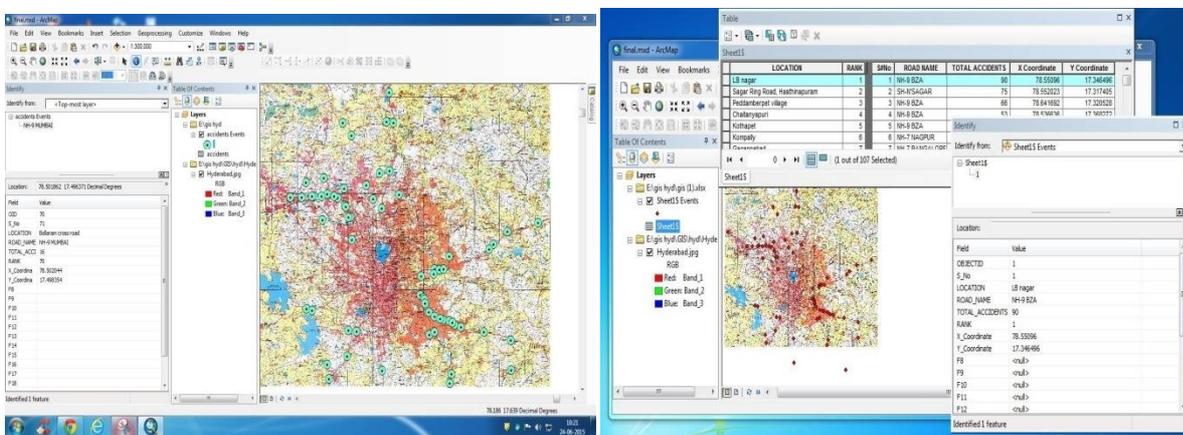
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Chart showing Type of vehicle Involved in Accident

GIS map of Accident Black Spot Locations of Hyderabad

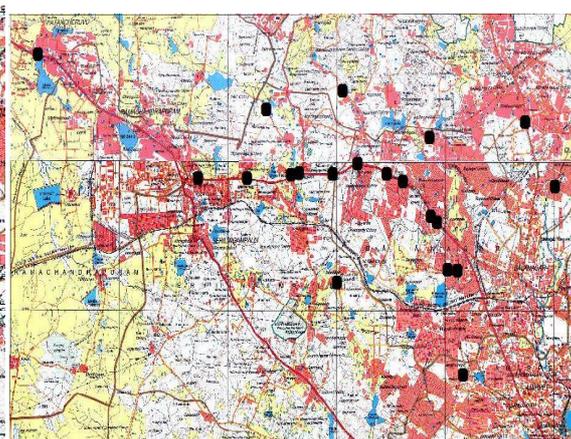
From all the above studies we come to know that accidents are happening at all places and times, by considering the data collected and the X Y coordinates of that locations which have been shown in table 5.1, one can create a map using spatial data like image file of Hyderabad map which can be generated by scanning maps from Survey of India, or getting directly image file of satellite data from Government Remote sensing agencies etc., Such maps have been generated in ARCGIS 10.0 and are studied for further purpose.



Map showing Hyderabad city with Black Spots GIS map of Hyderabad



Map showing NH 7 along with identified black spots.



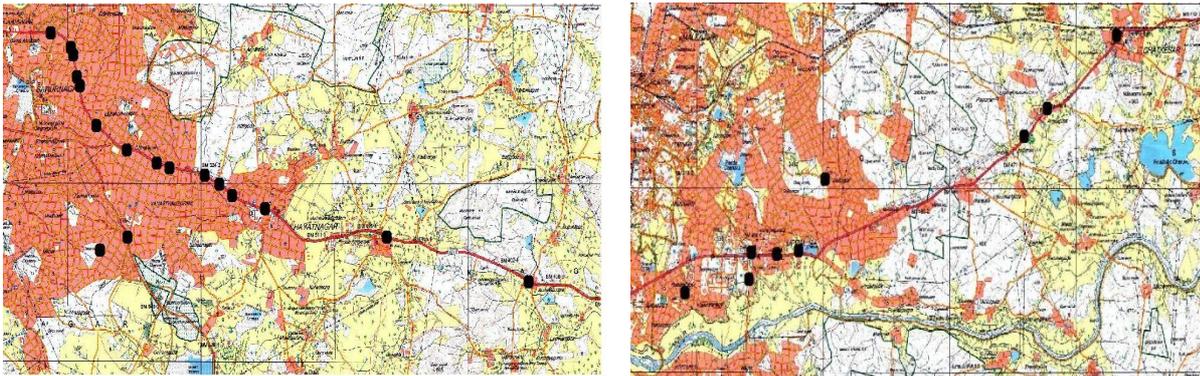
Map showing NH 9 towards Mumbai with black spots.

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Map showing NH 9 towards Vijayawada along with black spots. Map showing NH 202 along with identified black spots.

V. CONCLUSIONS

- Finally, regarding the future aspects of the proposed methodology, there are several improvements that can be implemented in order to have a more user-friendly and automated system and to make data accessibly for all the road users and to implement various procedures to provide more safety on roads.
- By using GIS tools, and specifically the proposed methodology, many of the problems, mentioned above, can be managed.
- The implementation of the methodology can contribute in many levels. First of all, the Road Accident Data Collection and Elaboration Procedure can be standardized. Secondly, the spatial dimension of the Road Accidents can arise into a major factor, for analyzing the facts and setting priorities. In such a way, Spatial Analysis can be implemented and Black Spots can be pointed out, supporting more reliable and focused surveys.
- Moreover, all of the resources can be managed in a more efficient way, reducing the time needed to process the data. First of all, for the import of data, configured forms can be used, while for the process of the data, specific tools, based on the local needs, can be developed.
- Moreover, a web-based platform can be created, in order to give the users the ability to fill in the forms via Internet, and also provide accessibility to all the interested parties, enhancing the cooperation between them and making the data and the results visible to the public. In that way, the new technologies can be used in order to improve the analysis of Road Accident Data, a phenomenon with profound effects on the Society.
- Attribute table is created and can be modified number of times.
- We can specifically target any location for its accident data.
- User friendly can take data in any format and provide us platform to work. Very easy to check the progress of rectifying black spots.

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