Research Article ISSN 0976 – 4380

Identification of Accident Hot Spots: A GIS Based Implementation for Kannur District, Kerala

Deepthi Jayan.K , B.Ganeshkumar

PSNA College of Engineering & Technology, Dindigul, Tamilnadu, India

bgeekay@gmail.com

ABSTRACT

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. The "Density" function available in the spatial analyst extension of the Arc GIS software was applied to identify the accident prone areas in Kannur district during the years 2006, 2007 and 2008. Both simple and Kernal densities were applied in identifying the accident patterns. The road geometry was measured in the accident prone locations to find out the causes for the accident. Based on the result, suggestions are provided to reduce the accidents in the future.

1. Introduction

Worldwide, the transportation problems faced by various nations have increased manifold, necessitating search for methods or alternatives that ensure efficient, safe, feasible and faster means of transport. It has been estimated that India currently accounts for nearly 10% of road accident fatalities worldwide. In addition, over 1300000 persons are seriously injured on the Indian roads every year. Hence, traffic safety has become a major area of concern for the authorities. The development of urban transport system has not kept pace with the traffic demand both in terms of quality and quantity. As a result the use of personalized transport mainly two wheelers and intermediate public transport is growing at a rapid speed. The disproportionate growth in the traffic vis-à-vis growth in road length along with unauthorized encrochments on

Research Article ISSN 0976 – 4380

road space, lack of traffic and lane discipline and deficiencies in traffic control have contributed to the increasing problem of congestion in urban areas.

The advancements in GIS and GPS an be put to effective use in accident analysis. Although GIS has been used for over thirty years however it has only been recently used in the field of transportation. In addition to promoting linkage between various types of data and maps GIS is able to manipulate and visually display numerous types of data for easy comprehension. GIS is a technology for managing and processing locational and related information. It visually displays the results of analyses thus enabling sophisticated anlysis and quick decision making. Development of a system that uses GIS to analyse traffic accidents has been pursued towards improving the efficiency and effectiveness of traffic accident countermeasures. Also GIS would make analysis less time consuming and less tedious which otherwise would become very labour sensitive. Thus GIS will offer a platform to maintain and update accident record database and use it for further analysis.

2. Study Area

Kannur District is one of the 14 districts in the state of Kerala, India. The town of Kannur is the district headquarters, and gives the district its name. Kannur District is bounded by Kasaragod District to the north and Kozhikode District to the south. To the east the district is bounded by the Western Ghats, which forms the border with Karnataka state. The Arabian Sea lies to the west. Kannur is the most urbanised district in Kerala, with more than 50% of its residents living in urban areas. Kannur has an urban population of 1,212,898, which is the second largest in Kerala.The district lies between latitudes 11° 40' to 12° 48' North and longitudes 74° 52' to 76° 07' East and covers an area of 2,996 km². The West Coast road from Mahe to Talapady is the backbone of the road system in Kannur district. This is part of the National Highway (NH-17). Thalassery –Kodagu road and the Thalassery – Mysore road are the other important roads. The length of Public Works Department roads in Kannur district is 1421 kms. The black topped roads have a length of 1061 kms. There are 6848 panchayat roads. The length of the national highway in the district is 80.5 kms.

Research Article ISSN 0976 – 4380

3. Methodology and Materials Used

3.1 Data Collection

In order to determine the accident prone locations in Kannur district, following data were collected and used.

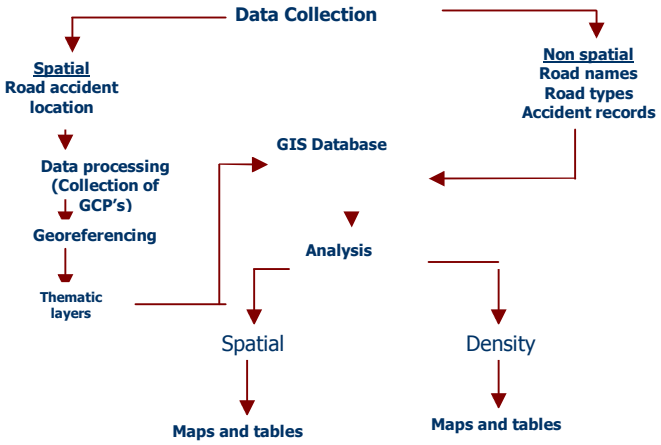
1. Police stations limit map obtained from the office of superindentend of police, kannur.
2. Accident reports for the years 2006, 2007 and 2008.
3. Survey of India topological map at a scale 1:50000

3.2 Collection of Ground Control Points

The GCP is nomally collected with the help of the GPS. Here there are eight GCPs collected from the survey of india toposheet at various road intersections

3.3 Data processing

The data processing involves the following three steps. The flow chart of the data processing is shown below figure



Research Article ISSN 0976 – 4380

3.4 Map scanning

The Survey of India topographical map at a sale of 1:50000 were scanned as the raster input.

3.5 Georeferencing

Scanned maps usually do not contain information as to where the area represented on the map fits on the surface of the earth. To establish the relationship between an image co ordinate system and a map(x, y) coordinate system e need to align or georeference the raster data.

3.6 Digitizing

Digitizing is the process of encoding the geographic features in digital form as x, y co ordinates. It was carried out to create spatial data from existing hard copy maps and documents. In the present work the georeferenced raster image of Kannur district is digitized using Arc GIS9. This type of digitization is called on- screen digitization. Road network of the study area was digitized as line features. Accident locations are digitized as point features. The above spatial data were organized in a personal geodatabse and feature class. The exact location of accidents were identified by using “measure” tool in ArcGIS9. By using the measure tool the spatial location of a particular accident can be marked by knowing its distance from a particular station. The map showing the accident locations for the years 2006, 2007 and 2008 are shown in the fig.

3.7 Assigning attributes

All vector data (i.e line, polygon, point features) will contain separate attribute tables. Here each road is labeled with its corresponding name with the help of the city map obtained from the police station. Similarly the accident location attribute table contains the following data.

1. User identification Number (UID)
2. police station limit
3. Month and date of occurrence
4. Time of occurrence
5. Exact area of occurrence

Research Article ISSN 0976 – 4380

6. Type of accident
7. Type of injury
8. type of vehicle involved

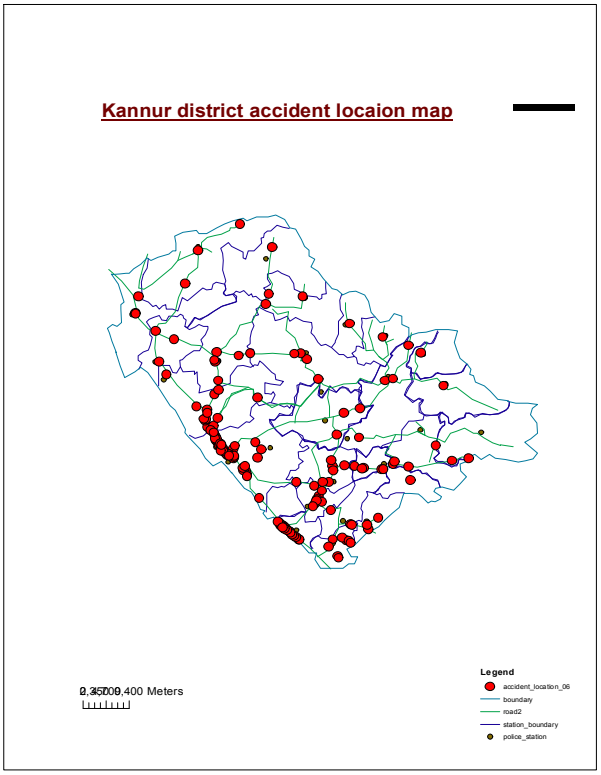


Fig: Map showing the accident locations in Kannur district during the year 2006

Research Article ISSN 0976 – 4380

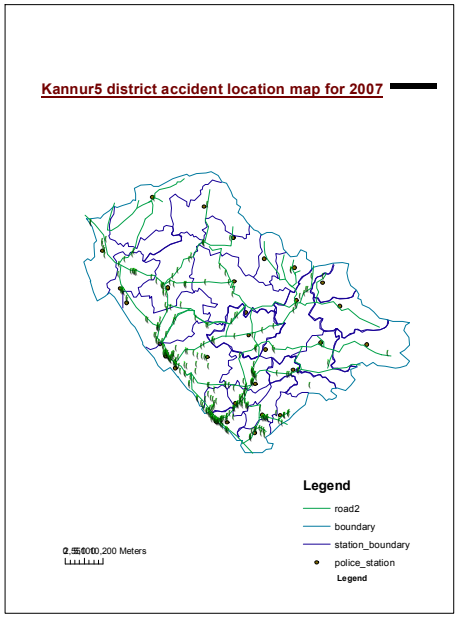


Fig: Map showing the accident locations in Kannur district during the year 2007

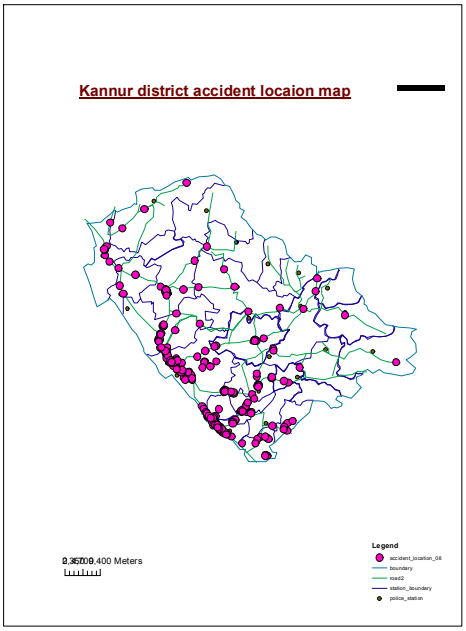


Fig: Map showing the accident locations in Kannur district during the year 2008

Research Article ISSN 0976 – 4380

3.8 Preparation of density map

In this study the analysis has not been confined to any particular class or type of accidents but rather towards utilizing the open nature of GIS in data manipulation. Hence it is decided to consider all the crashes irrespective of type of vehicle involved and to determine accident locations by developing density maps. By calculating density we spread point values out over a surface. They are predominantly created from point data and a circular search area is applied to each cell in the output raster being created. The search area determines the distance to search for points in order to calculate a density value for each cell in the output raster. The results show the highest concentration of a particular type of accidents and are useful for looking at patterns rather than at locations of individual features. Density maps are created for the years 2006, 2007 and 2008 with the input data as individual accident points.

Simple and Kernel density methods are applied in identifying accident prone locations. In a simple density calculation points or lines that fall within the search size are summed and then divided by the search area size to get each cell's density value. The kernel density calculation works similar to the simple density calculation except that points or lines lying near the centre of a raster cell's search size are weighted more heavily than those lying near the edge. The result is the smoother distribution of values.

Research Article ISSN 0976 – 4380

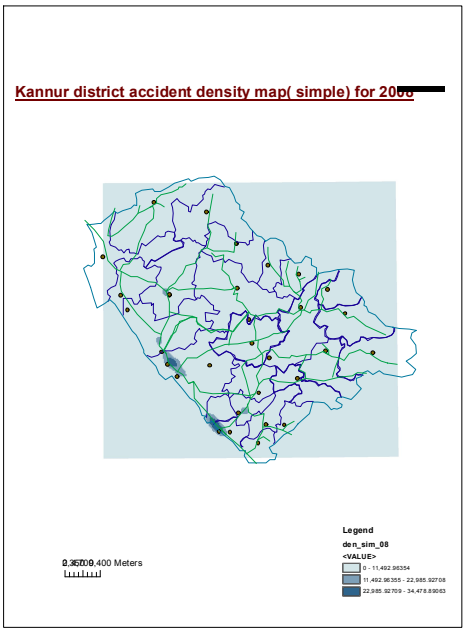


Fig: Accident density map for Kannur district for the year 2008

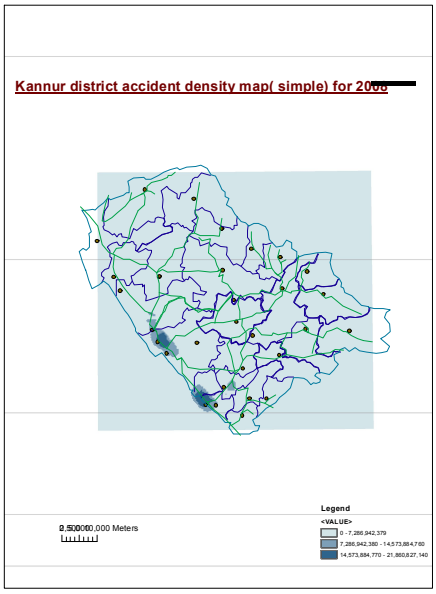


Fig: Accident density map for kannur district for the year 2008 (using kernal)

Research Article ISSN 0976 – 4380

4. Conclusion

The crux of the problem of urban transport is congestion of traffic. This result in increased number of trips, increased journey time, travel cost, mental agony and reduced accessibility. Widening of roads is not possible due to the intense developments on either side of the road. Heterogeneity of traffic is another problem which causes severe congestion. This work gives an insight into the present scenario of the traffic condition of the area and shows out the most accident prone roads in the district. It can also facilitate spatial data sharing within transportation agencies and between transportation department and other government agencies. This geodatabase in turn can be fed into "expert" systems and so provide accurate recommendations to vehicle drivers the police, motoring organization and of course local authorities. The effect such systems will have on the traffic scene is too early to say but clearly they will give planners and traffic authorities some breathing space when considering long term objectives and likely solutions.

5 References

1. Kamalasudhan, National University of Singapore, An anlysis of expressway accidents in Singapore using GIS, www.gisdevelopment.net.
2. Alind Saxena, Environmental & Road Traffic Safety, CRRI, GIS as an aid to identify accidents patterns, www.gisdevelopment.net.

1. Vanjeeswaran, Identifiation and ranking of High Pedestrian Crash zones using GIS, 2005 Annual ERI International User Conferene, ASCE.
2. Environmental Systems Research Institute (2006) 'Getting Started with MapObjects 2.4
3. Gheorghe. AV (1999), 'Integrated Decision Support Systems for Emergency Preparedness and Management', Annual Con of the Int Emergency Management Society, pp 151 – 162
4. Harewood, S.I (2002) 'Emergency Ambulance deployment in Barbados: a multi objective approach', Journal of the Operations Research Society, Vol 53, pp 185-192.