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Spatial Analysis of Urban Traffic Accidents Case Study – Tiruppur City

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Abstract: Road traffic accidents is one of the adverse elements which contributes difficulty in economic growth, because of this many losses occurs in and around country so it is necessary to concern about it .In transportation development traffic safety is main consideration. In today's transportation system there are many loses of life and property due to accidents. The success of traffic safety and highway improvement is based on number of decreased accidents and for this improvement we need accurate accidental data. This study shows the present state of traffic accident information in Tiruppur city. It also used for the Identification of high accident rate locations suggested using a QGIS Software and safety deficient areas on the highways. For this purpose the road accident data for year 2016, 2017 and 2018 of the Tiruppur city have been used. Accident particulars like date, location, time, type of vehicle involved, and number of person injured or died are included. Frequent occurrence of accidents in the hotspot can be attributed to varying factors. As a major share of accidents occur in such hotspot measures should be taken to reduce number of accidents in these spots to improve the overall road safety. The present study aims to find the major accident hotspots in the study stretch and to identify various traffic factors and road factors causing accidents. The capability of GIS to link attributes data with spatial data facilities prioritization of accident occurrence on roads. Based on the results suggestion are provided to reduce the accidents in the future.

Introduction

Road accidents are increasing nowadays, mainly because of the development of transportation infrastructure fails to keep pace with other sectors like industry and real estate. These road traffic accidents serves as the leading cause of human deaths and/or illness worldwide. These accidents often result in fatalities, injuries or damages to people around the world.

The majority of these accidents is due to human errors (inattention of drivers), therefore systematically analyzing the accidents, using appropriate solutions such as traffic control equipment, better design of roads and also effective activities of traffic police department could lead to a decrease in the number or the intensity of accidents. Hence, the probability of accident occurrence, and its effect, can be reduced by the systematic analysis of the incident scenarios and by resorting to appropriate solutions involving the application of proper traffic control devices, design of roadway practices and suitable traffic police activities. However, the task of taking necessary effective solutions warrants analysis of spatial and temporal patterns in the zone of traffic accidents, can be achieved through the application of geospatial technology. The nonrandom distribution of accidents, both in time and space, often raises questions about the location and the reasons for that location. Unlike the conventional methods, spatial analysis helps to identify the patterns and suggest reasons for the pattern characteristics. Many traffic agencies use GIS technology to analyses the hotspot region. Understanding of spatial and temporal crash patterns helps the safety specialists to detect the sections having a higher number of crashes, to compare with other similar locations. These sections are defined as hotspots.

Area of Study

Tiruppur is a city located in Tamil Nadu. It is situated at the centre of the South Indian Peninsula, about 450 kilometres southwest of the state capital Chennai about 50 kilometres east of Coimbatore and 50 kilometres south of Erode.

Tiruppur is administered and maintained by municipal corporation which was established in 2008 and the total area of the corporation is 159.6 $km^2$and it is divided into 60 wards. The total population of the city as per the 2011 census is 4,44,352.

Tiruppur is a major textile and knit wear hub contributing to 90% of total cotton knit wear exports from India.[7] The textile industry provides employment to over six lakh people and contributed to exports worth 200 billion(US$2.8 billion) in 2014-15

Methodology

The main purpose of this study is to examine the distribution of accidents through identification of hotspots using GIS and spatial statistics. Although the accidents have been thoroughly examined based on various attributes, a spatial framework will provide useful insight into road safety patterns. If present, it indicates that there are locations in study area where accidents are more likely to occur. As a result, more funding and research must be dedicated for these locations.

Hotspots analysis will be used to identify and supply required information to help decision makers in making suitable decisions to prevent and reduce traffic accidents. In general, traffic accidents statistics has been considered as assessment index to evaluate possible future traffic accidents in roads. Nowadays, using real data and GIS are of tools to predict spatial pattern of traffic accidents which have correlation with real conditions. Technical details of methodology used in the analysis are presented below.

Kernal density method is adopted for the analysis of hotspot in the QGIS.

In this methoad density is calculated based on the numbers points in a location with larger numbers of clustered points resulting in larger values

Data Collection

The accident prone zones and traffic congestion, data are collected initially. Data is generally classified into two i.e. spatial and non-spatial data.

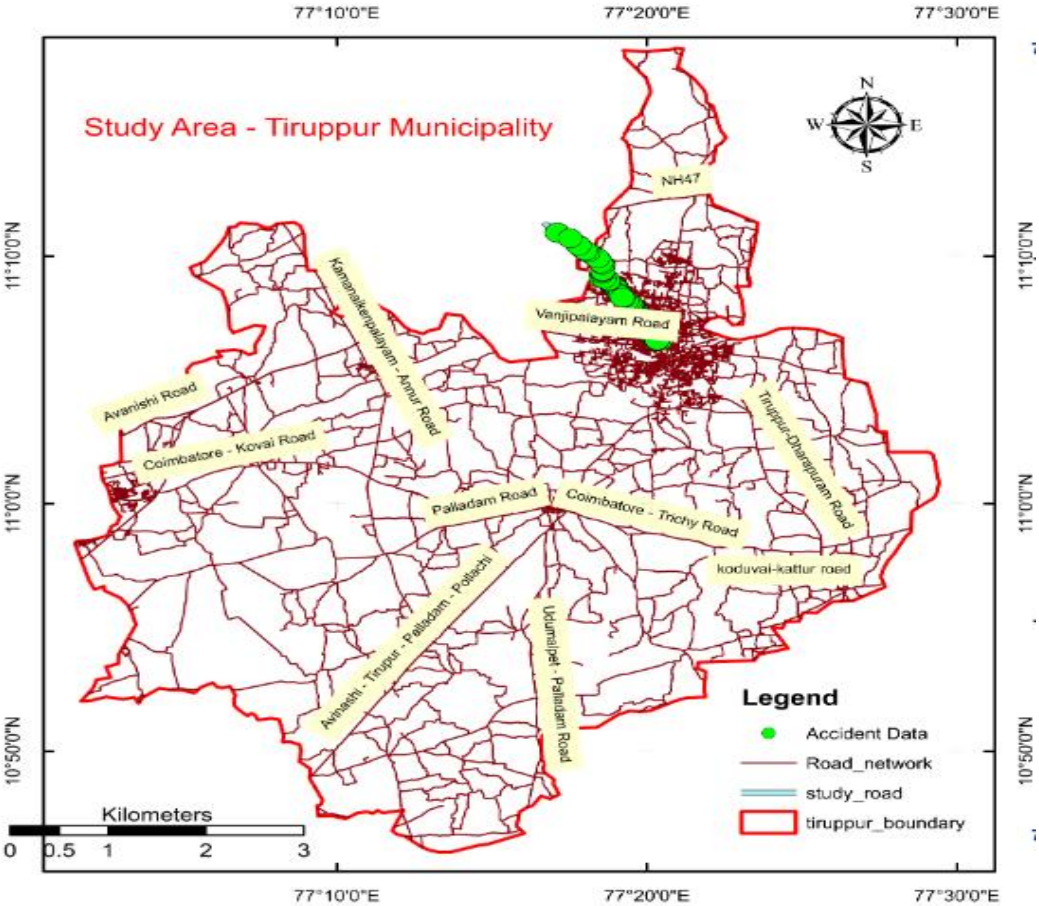
Spatial data

- Spatial data generally provides exact geometric information such as boundary extend, road network and location.
- The Open Series Map (OSM) was obtained from Survey of India, Updated taluk map was obtained from Survey and settlement department and road network map was obtained from Highways Department.

Non-spatial data

- The available information on spatial data is called non- Spatial data.
- The accident details include type of accident, Time, date of the Accidents, Vehicles involved, Gender, Licensed or Non Licensed, Drunk and drive etc.
- These details were collected from Commission rate of Police, Tiruppur City.
- The bus stop details such as bus route and number, the hospital Information was gathered from the Google earth and direct visit.
- The data's are tabulated below.

No of Accidents in Tiruppur to Avinashi road		
Year	**Fatal**	**Non-fatal**
2016	**20**	**54**
2017	**12**	**46**
2018	**12**	**73**

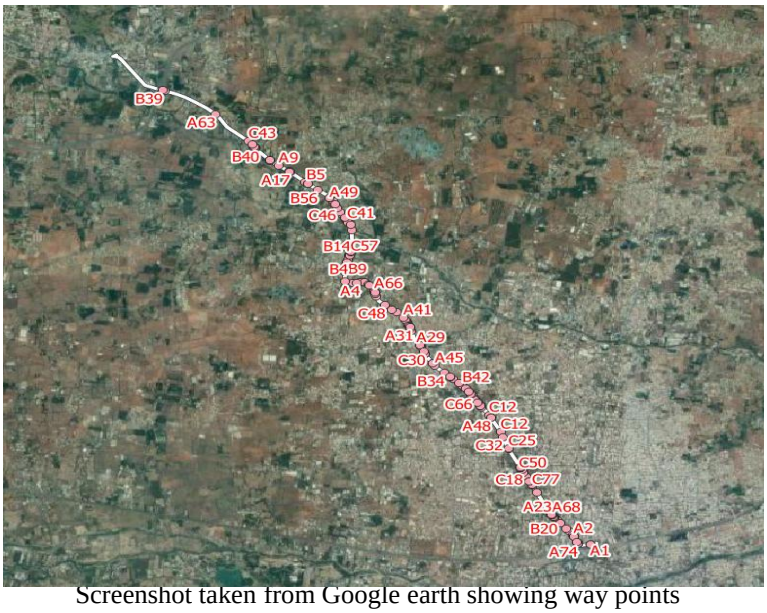


Tiruppur map comprising spatial data

Analysis from GIS

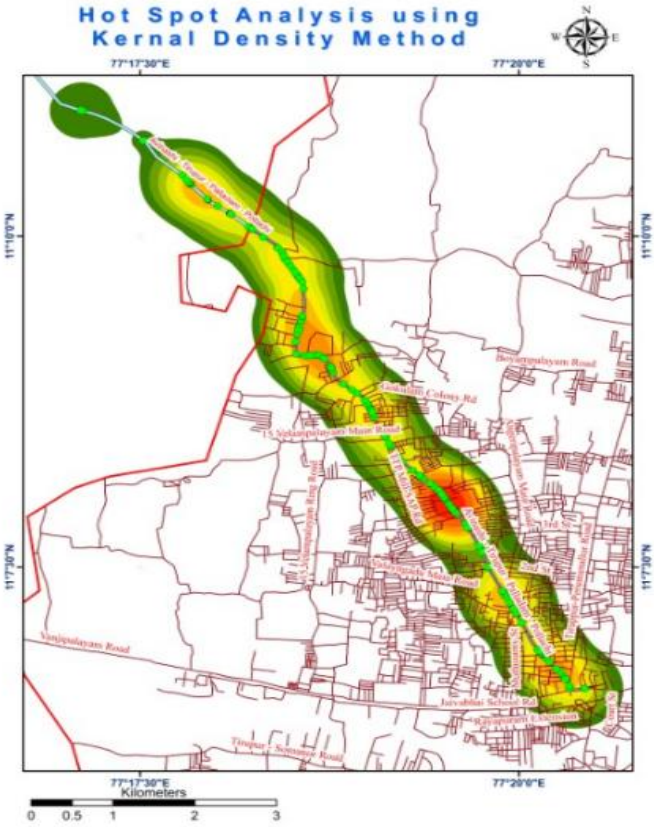
- Using Google earth the road maps of Tiruppur city have been drawn. The way points collected from the Google essential are imported in GIS.
- Using kernel density analysis method the hotspot regions have been found for every 1000 accidents.
- In the Google earth the Tiruppur city is addressed for which we have to create map and aerial view is turned on and the setting of boundary line is made.
- To export the field boundaries drawn in Google earth to QGIS it has to save as Keyhole markup language film (kml) file format.
- The Avinashi to Tiruppur road has been drawn in QGIS with the help of Google earth using vector data.
- To know the geographical information of the accident location the app namely GPS essential is used.
- At the accidental location direct visit is done and points are marked in GPS essential.
- The marked way points collected through the Google essential app has been imported in the Google earth.
- Kernal density method is adopted for the analysis of hotspot in the QGIS.
- In this methoad density is calculated based on the numbers ppoints in a location with larger numbers of clustered points resulting in larger values

Screenshot taken from QGIS showing Tiruppur to Avinashi road



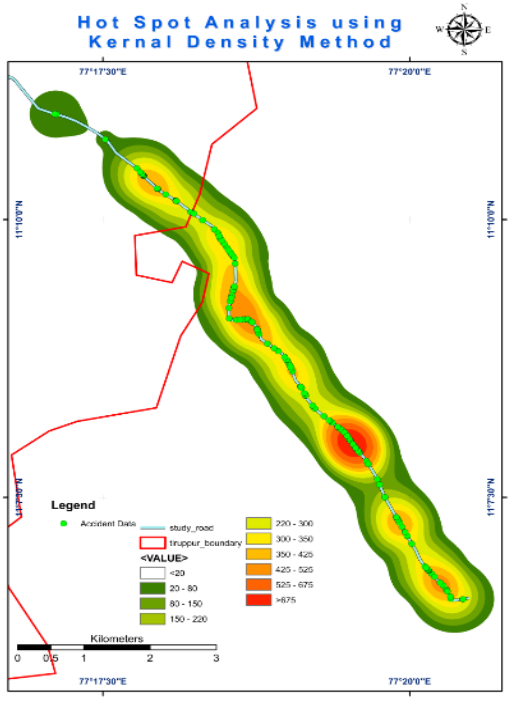
Screenshot taken from Google earth showing way points

Accidental analysis

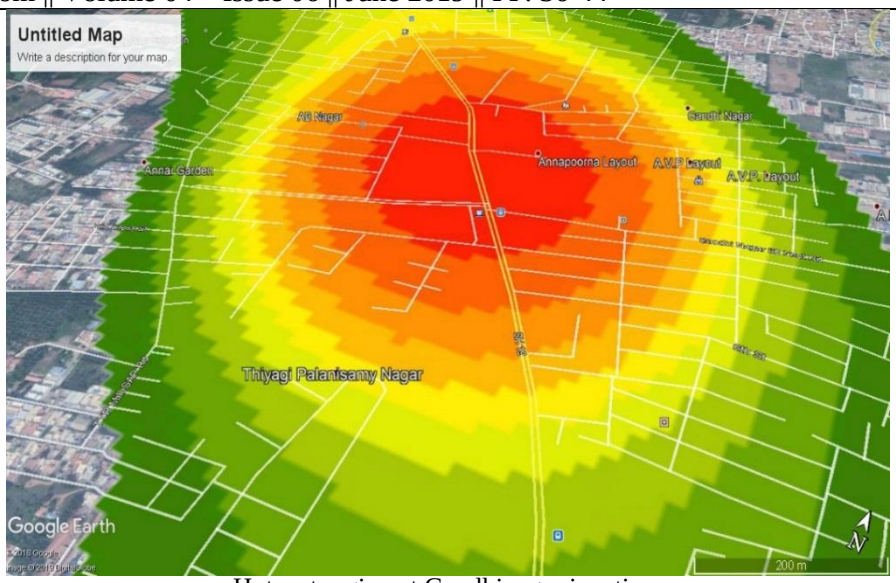


Result analysis from QGIS with Road Map

The above figure is the analysed result from the QGIS along with map of the tiruppur city drawn through Google earth . The red colour shows the higher density of accident occurence based on the analysis done in QGIS.



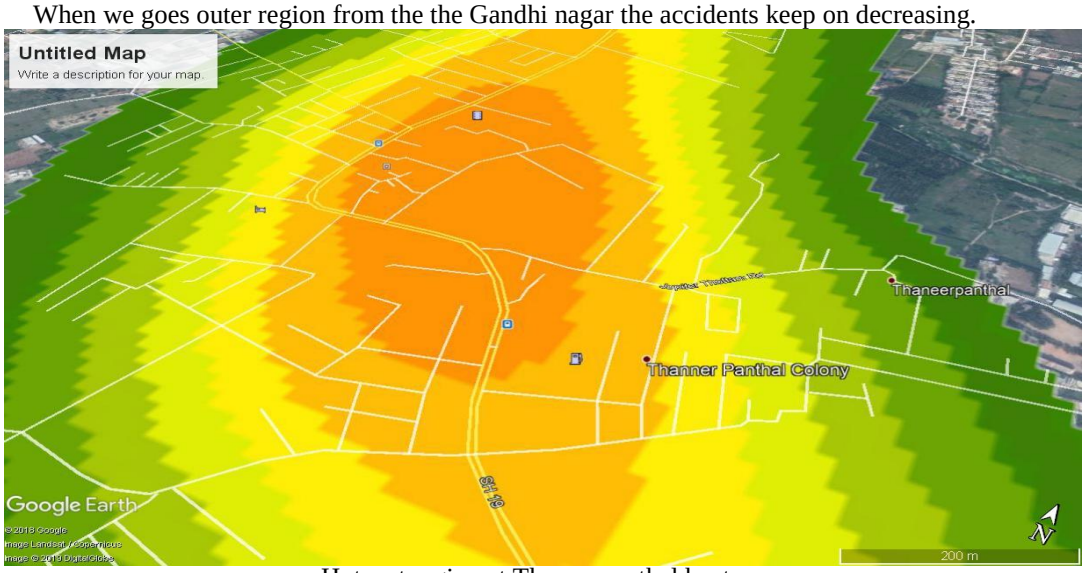
Accidental Analysis for every 1000 accidents from QGIS



Hotspot region at Gandhinagar junction

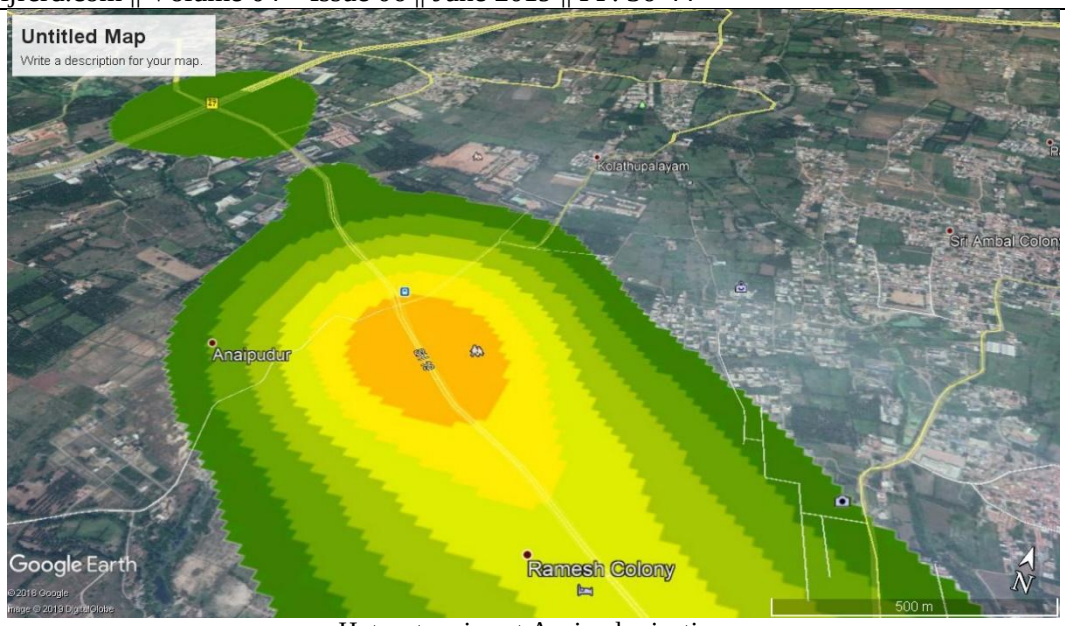
It shows main hotspot region of the Tiruppur to Avinashi road where higher amount of accidents occur in every year .The accident rate was more than 675 for every 1000 of accidents occurs in the Avinashi to Tiruppur road.

When we goes outer region from the the Gandhi nagar the accidents keep on decreasing.



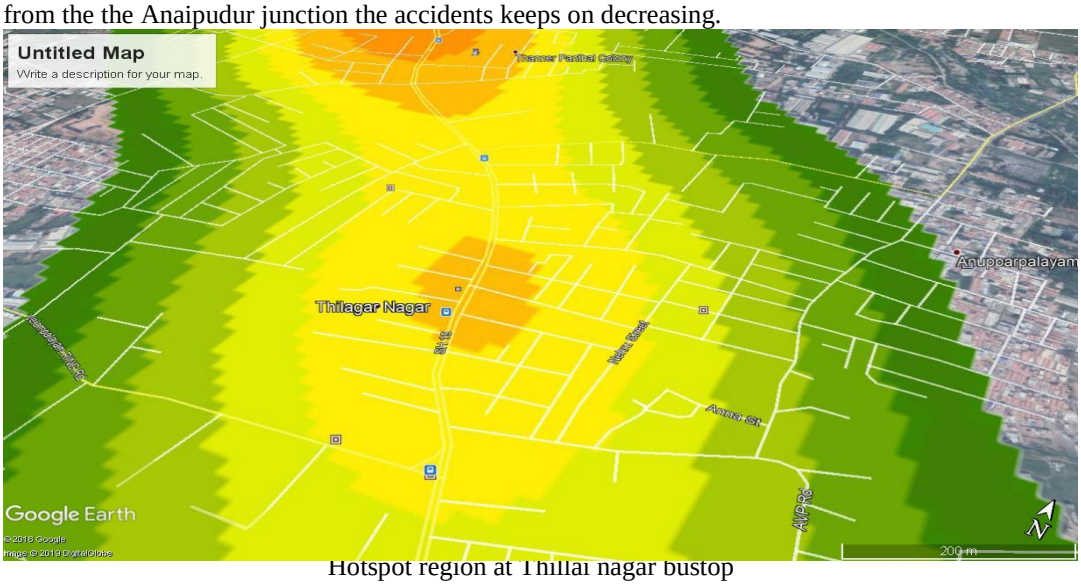
Hotspot region at Thaneerpanthal bustop

It is a second hotspot region of the Tiruppur to Avinashi road accidents occur in every year .The accident rate was 425 to 525 for every 1000 of accidents occurs in the Avinashi to Tiruppur road.When we goes outer region from the the Thaneerpanthal the accidents keeps on decreasing.



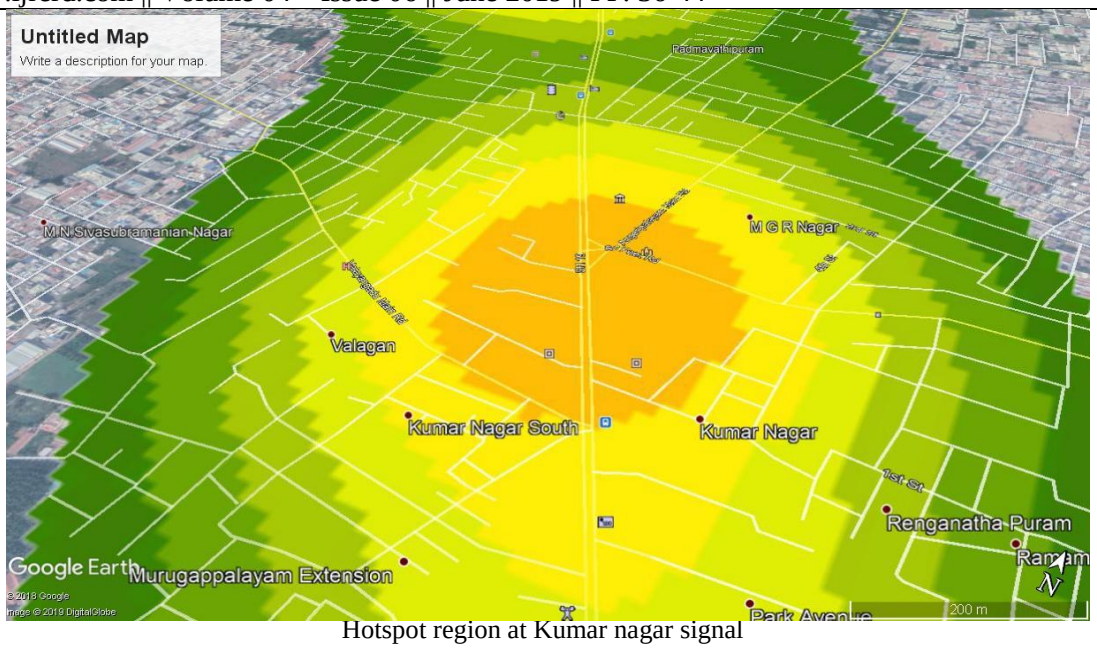
Hotspot region at Anaipudur juction

It is a third hotspot region of the Tiruppur to Avinashi road accidents occur in every year .The accident rate was 350 to 425 for every 1000 of accidents occurs in the Avinashi to Tiruppur road.When we goes outer region from the the Anaipudur junction the accidents keeps on decreasing.



Hotspot region at Thillai nagar bustop

It is a fourth hotspot region of the Tiruppur to Avinashi road accidents occur in every year .The accident rate was 350 to 425 for every 1000 of accidents occurs in the Avinashi to Tiruppur road.When we goes outer region from the the Thillai nagar junction the accidents keeps on decreasing.



Hotspot region at Kumar nagar signal

It is a fifth hotspot region of the Tiruppur to Avinashi road accidents occur in every year .The accident rate was 350 to 425 for every 1000 of accidents occurs in the Avinashi to Tiruppur road.When we goes outer region from the the Kumar nagar signal the accidents keeps on decreasing.

Suggestions at Gandhinagar junction

1. There are so many junctions to the Avinashi road in that surrounding and open medians it has to be reduced
2. Reduce the number of U – turns and provide adequate length and width for median openings.
3. Provide footpath on both the sides of the road for the safety of pedestrians. Installation of barricade on either side of the road to pavements to restrict the illegal crossing of animals and local pedestrian particularly near junction.
4. Take suitable enforcement measures to reduce the speed of vehicles.

Suggestion at Thaneeerpanthal

1. It has a bend so check for visibility and sight distance has to be done
2. Some sign boards are hidden due to trees, make it visible to the drivers.
3. Provide separate bus bays for avoiding delay of other vehicles at the bus stops.
4. Provide footpath on both the sides of the road for the safety of pedestrians.
5. To reduce the speed of the vehicles to 40km/hr.

Suggestion at Anaipudur junction

1. Allotting of traffic police at the bustand junction during peak hours especially during night time to control the vehicular movements from the bustand to the feeder roads
2. To reduce the speed of the vehicles to 40km/hr.
3. Provide adequate drainages
4. Provide separate bus bays
5. Some sign boards are hidden due to trees, make it visible to the drivers.

Suggestion at Thillainagar bus stop

1. Provide necessary sign boards at T – junctions.
2. To reduce the speed of the vehicles to 40km/hr.
3. Provide separate bus bays
4. Provide adequate drainages
5. Installation of automatic traffic signals at the junction or curves.

Suggestion at Kumarnagar bus stop

1. To improve the standard of the existing signal
2. Installation of barricade on either side of the road to pavements to restrict the illegal crossing of animals and local pedestrian particularly near junction.
3. Provide separate bus bays
4. Installation of automatic traffic signals at the junction or curves
5. Provide necessary sign boards at T – junctions.

Conclusion

Although the number and speed of vehicles has been increased in recent years, the quality of roads have not been improved enough and safety standardof vehicles has not reached a desired level. In addition, people have not received required instructions and training to improve their attention in terms of safe driving. The present study aims to investigate and compare different types of traffic accidents in terms of spatial aspect, which is the first attempt in the Tiruppur city corporation. Furthermore, the paper tends to develop the operational approach of spatial patterns in GIS framework in order to analyse thetypes of urban accidents.We here by conclude that hotspot regions found in Avinashi to Tiruppur road are Gandhi nagar junction, Thaneerpanthalbus stop, Kumar nagar signal, Anaipudur junction, Thillainagarbustop .By analysing those areas we have given suggestions above to avoid future accident occurrence.

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