



Crash Characteristic Analysis and Blackspot Identification using QGIS

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Abstract: Road accidents are becoming a major threat to the infrastructure development of a nation. Along with the development of a nation, road safety is an important parameter that needs a special concern. Road accidents were reported more in State highway and National highway, leads to tremendous economic loss approximately up to cores. The identification of accidents prone zones are necessary to provide appropriate safety improvement measures. GIS have a significant application in the transportation field. Blackspot identification helps to find out the reasons for accidents based on the spatial features of that area and preventive measures can be taken in order to reduce the accidents. As per National Transportation planning and research centre (NATPAC) State Highway 69 have reported lot of accidents. This project aims to find out the blackspot regions within Westfort junction -Kunnamkulam road (SH-69) using weighted severity index method (WSI) and locating the blackspots using QGIS.

Keywords: Blackspot, QGIS, Weighted Severity Index

I. INTRODUCTION

In Indian cities, the traffic is highly heterogeneous in nature, promotes a large accident rates. Analysis of traffic data indicated that drivers fault is responsible for majority of the accidents. 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. Therefore there is need to study and analysis the accident pattern and reasons along with the identification of black-spots. Accidents causing reasons can be classified as road related factors, vehicle related factors, road user factors and environmental related factors. As per National Transportation planning and research centre (NATPAC) state highway 69 have reported lot of accidents. It is necessary to find out the blackspots within the specified area and to suggest appropriate remedial measures. The selected stretch of road for the project is from Westfort - Kunnamkulam road (part of SH-69) should be evaluated on the basis of accident data and identification of blackspots using QGIS.

II. OVERVIEW OF THE LITERATURE

Mohammed [1] focuses the study of various types of accidents including causative factors and blackspot 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 blackspot map with same data. Based on the data collected, the data analysis, blackspot identification has done. An attribute table is created to give information about various fields involved in blackspots. Maps are made also with GPS (Global Positioning System). G.Apparao [2] reviews the traffic accident information on NH-58 from Meerut to Muzaffarnagar in Uttarakhand State and also discussed the identification of high rate accident locations by using GIS Software and safety deficient areas on the highway. Hence implementation of remedial measures to those accidental locations (Blackspots) and provisions for traffic safety were suggested. To determine the accident prone locations in Muzzaffanagar district, accident data from police stations were collected, analysed and blackspot location done using GIS. The ground control points (GCP) are collected with the help of the GPS. K.S Sojib [3] studied on Bhangra-Mawa-Dhaka road named N8 connected the south western part of Bangladesh. Arc GIS is found to be suitable for the accident analysis The data were collected from corresponding police station and GCP is normally collected with the help of the Google Map, Hand held GPS at the road segment where the accident occur. Characteristics analysis is done on selected hazardous road locations in national highway. This will help to understand the crash scenario of those roads which will assist in implementation of safety measures of those locations. R Mizanur [4] focused on hazardous road locations on Dhaka-Aricha-Banglabandh national highway. They concluded that the implementation of GIS in crashes analysis to make an effective



way of analysis and represent the accident with the exact location and verification of the method for a major highway of Bangladesh. B Snehal [5] aims to identify accidental blackspots on a section (820 km-830 km) of National Highway - 4 by studying the accidental data. Identification of blackspots is done by Weighted Severity Index (WSI) and Accidental Density Method (ADM) is used. Basic causes of accidents were found out and suitable remedial measures were also provided for a particular spot. M.S. Saran [6] analyzed in Kozhikode district to obtain the ten most accident prone locations (five each in urban and rural areas) using WSI method by assigning scores based on the number and severity of accidents. Road network map along with attribute data pertaining to the study area were created in ArcGIS environment. Top ten accident spots derived from weighted severity (WSI) method were prioritized in GIS, to obtain the most vulnerable accident spots in the study area.

III. METHODOLOGY

A. Determination of Study Section

Thrissur is one of the districts in Kerala which vulnerable to accidents. As per the study of NATPAC lot of accidents were reported in the state highway 69 (Thrissur- Kuttipuram). This study was carried out on state highway 69, starting from Westfort junction (10°31'20.5"N, 76°12'7.7"E) to Kunnamkulam bus stand (10°39'1.13"N, 76°4'11.84"E). The study stretch is 21.9km. Major places in this stretch are Westfort, Pukkunam, Puzhakkal, Amala, Peramangalam, Mundur, Kaiparambu,kechery, Choondal, Kunnamkulam.The selected road stretch Westfort-Kunnamkulam are shown in Fig.1.

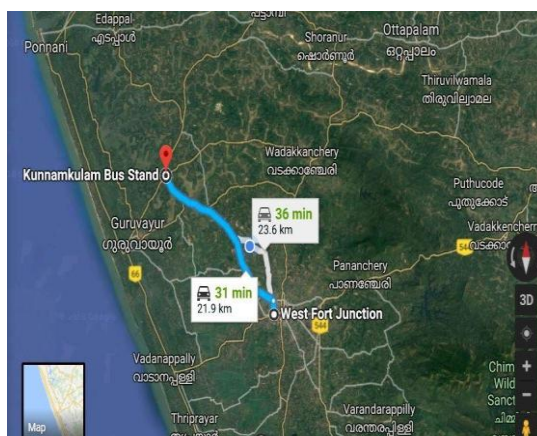


Fig. 1 Study section

B. Data collection and Processing

The road accident data which comes under IPC no.279/337/338/304 (A) of past five years (2013-2017) were collected from reports (F.I.R) maintained by the police stations of Thrissur traffic, Peramangalam and Kunnamkulam. These data analysed characteristically and by using WSI method. The analysed information processed into QGIS for the identification of blackspot. It includes the steps map scanning georeferencing, digitization, assigning attributes.

IV. DATA ANALYSIS

A. Road Accident Characteristic Analysis

Accident data from each police station is assessed separately so that analysis can be done easily. From this analysis how much accident severity is occurred in each places can be evaluated and the nature of accidents can be identified. The places within the SH 69, which comes under the control of Thrissur traffic station is from Westfort junction to Puzhakkal. It is one of the busiest route in Thrissur district. From the evaluation of past five year data this route promotes a higher amount of accidents. The major accident occurring locations are; Westfort junction, SKV college bus stop, Pukkunnam junction,in front of Nandilath Gmart, Westfort Hitech hospital, in front of Kalyan mobikes and Puzhakkal padam.

Total accidents reported in Westfort junction to Puzhakkal was 160.Accidents which occurred in past five years and accident severity is shown in the Fig.2 and Fig. 3

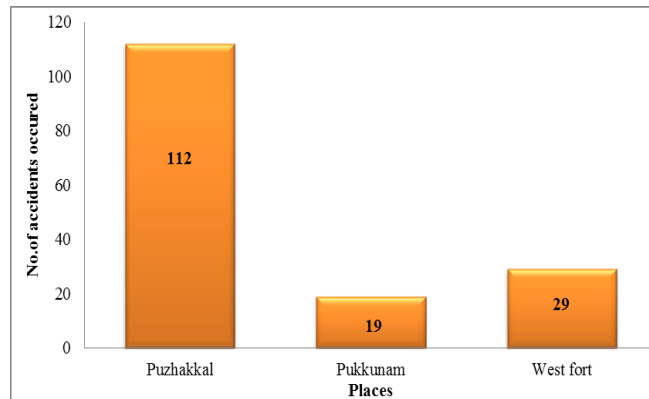


Fig.2 Total Accidents Occurred in the Route Westfort to Puzhakkal

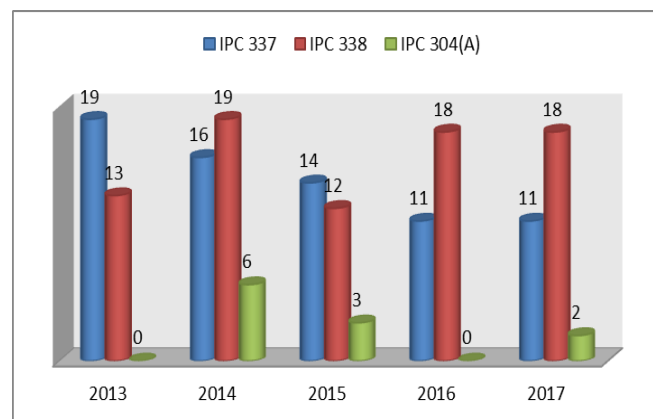


Fig.3 Road Accident Severity per Year

Peramangalam police station covers most of the accident spots in the west fort kunnamkulam road stretch. The most accident hazardous regions are; Sobha city, Puzhakkal temple, Muthuvara junction, Amala junction, in front of Amala hospital, Kurishupally road, Peramangalm junction, Manappadi pumb, Mundur junction, in front of Mundur church, Mundur temple, Ezhamkellu, Puttekara, in front of Kovilakam hotel, Kaiparambu junction, Kaiparambu beverage outlet. Total accidents reported in Westfort junction to Puzhakkal was 592. Road accidents which occurred in past five years and accident severity is shown in the Fig: 4 and Fig: 5.

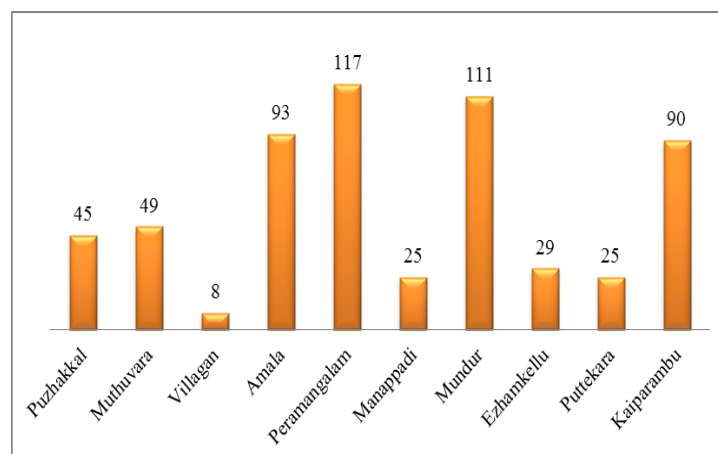


Fig.4 Total Accidents Occurred in the Route Puzhakkal (Sobha City) to Kaiparambu

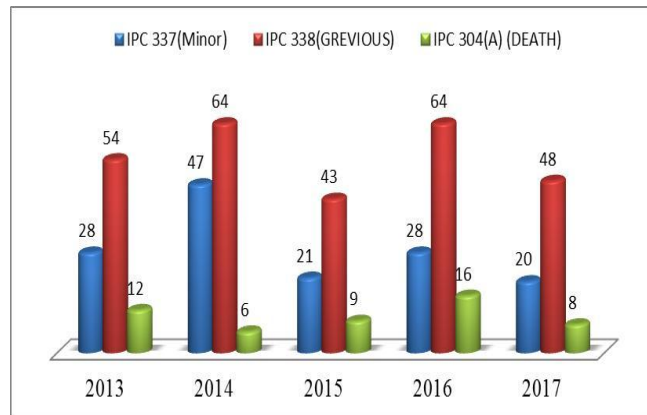


Fig.5 Accident Severity per Year

Kunnamkulam is one of the major accident zones. A huge amount of accidents were reported per year. But as we focussing into the selected road stretch the accident rates are lesser than while comparing with the whole kunnamkulam junction. The major accident locations coming under this station are ;Mazhuvanchery, Eranellur, Kecheri, Thoovanur bridge, Parannur, Choondal, in front of Unity hospital, in front of Bethany school, Jawhar junction, Onerio junction, Kunnamkulam bus stand. Total accidents reported in Westfort junction to Puzhakkal was 159. Road accidents which occurred in past five years and accident severity is shown in the Fig.6 and Fig.7

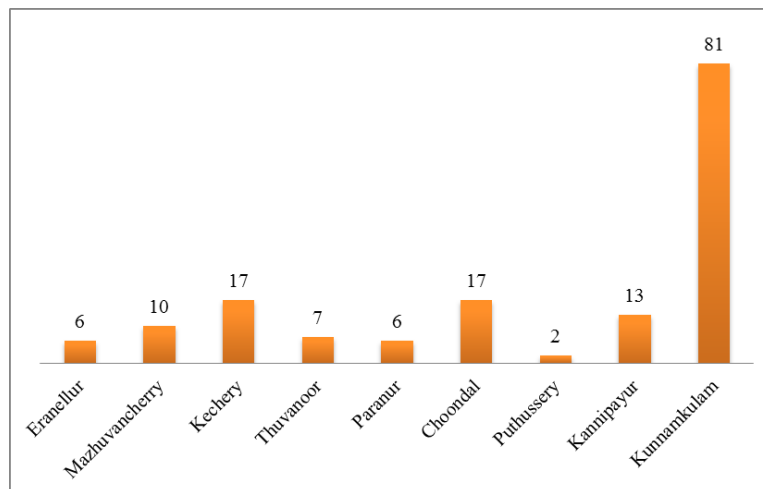


Fig.6 Total Accidents Occurred in the Route Mazhuvancherry to Kunnamkulam Bus Stand

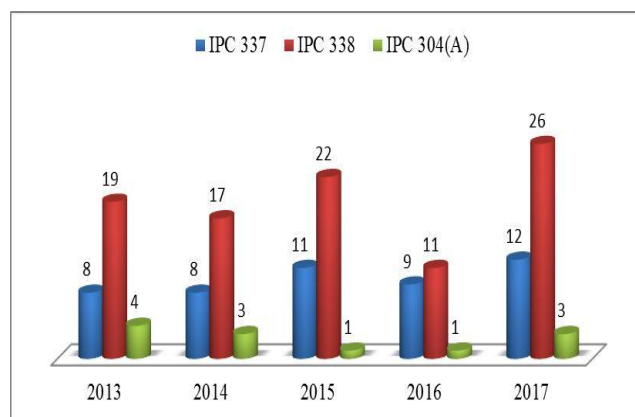


Fig.7 Accident Severity per Year



The sudden decrease of road capacity from four lane to two lane road and the diversion tendency of drivers into the minor roads makes more accident vulnerable. The invading nature of two wheelers and three wheelers in the congested road promotes a lot of accidents. As well as rushing speed and competition among the private buses and also KSRTC in these routes makes high accident rates. The presence of frequent summit and valley curve makes the scene more dangerous. Moreover the rash and negligent driving of human are the main reasons behind the accidents.

Vehicle - pedestrian involvement in accident analysis is an important factor to assess the vulnerability of mode of vehicles involved in accident and to improve the safety measures. This involvement is shown in Fig.8.

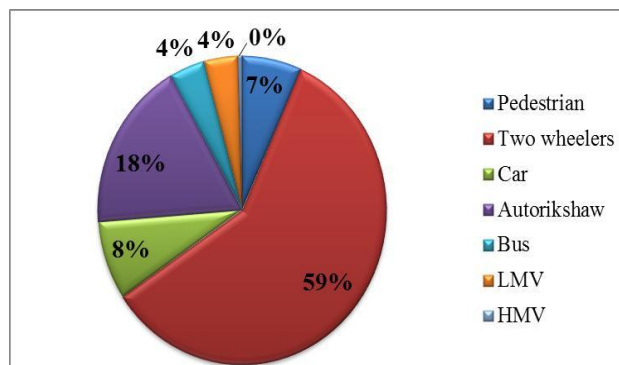


Fig.8 Percentage Involvement of Modes of Vehicles to Accidents

Pedestrians and two wheelers are most vulnerable to road accidents. Due to the fast and careless driving , use of mobile phones, driving without wearing helmet are the major factors promoting the two wheelers most vulnerable. Among the accidents 59% are of two wheelers.

Accident time period analysis is essential to understand the time which the most of the accidents. Fig.9 shows the analysis.

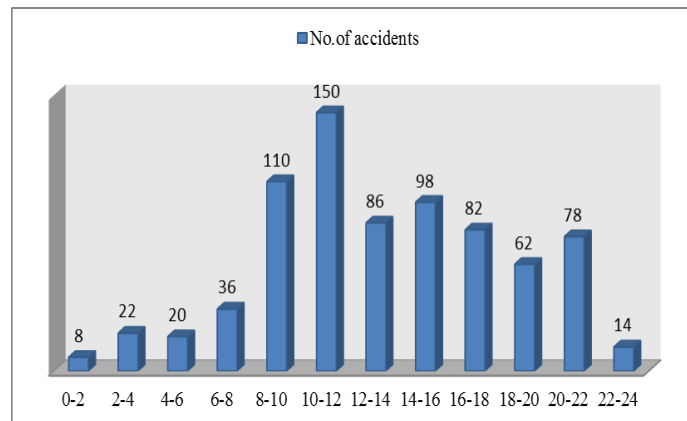


Fig .9 Accident Occurring Time Graph

Most of the accidents are happening the time period of about 10.00 am to 12.00 pm. Morning peak hours have high traffic intensity and most of them encountered accidents during 8.00 am to 12.00 pm. Likewise in the evening peak hours starting from 2.00 pm to 6.00 pm the accident intensity is more.

B. Blackspot identification analysis using Weighted Severity Index method.

Weighted severity index were calculated for each spot by using the 5 years accident data collected from the respective police stations.

Weighted Severity Index (WSI),

$$WSI = (41 \times K) + (4 \times GI) + (1 \times MI) \quad (1)$$



Where, K is the number of persons killed; GI is the number of grievous injuries; and MI is the number of minor injuries.

WSI value more than 40 is termed as blackspot. From analysis 34 blackspots were identified and WSI value above 100 and 200 were more severe.

Table.1: WSI value for locations having high accident severity

Location	WSI Value
Peramangalam junction	455
Mundur junction	449
Kaiparambu junction	255
Beverage outlet , kaiparambu	234
In front of Amala hospital	213
Amala junction	209
Puzhkkal padam	186
Onerio junction	156
Kunnamkulam stand	154
Puzhakkal temple	143
Muthuvara junction	142
Kalyan Mobikes ,Puzhakkal	141
Westfort Hitech hospital	137
Sobha city	114
HP petrol pumb, Amala	102
Kovilakkam hotel , Kaiparambu	102

C. Locating accident spots using QGIS

The major accident spots were identified using the WSI method and locating process is done using QGIS by incorporating the following steps;

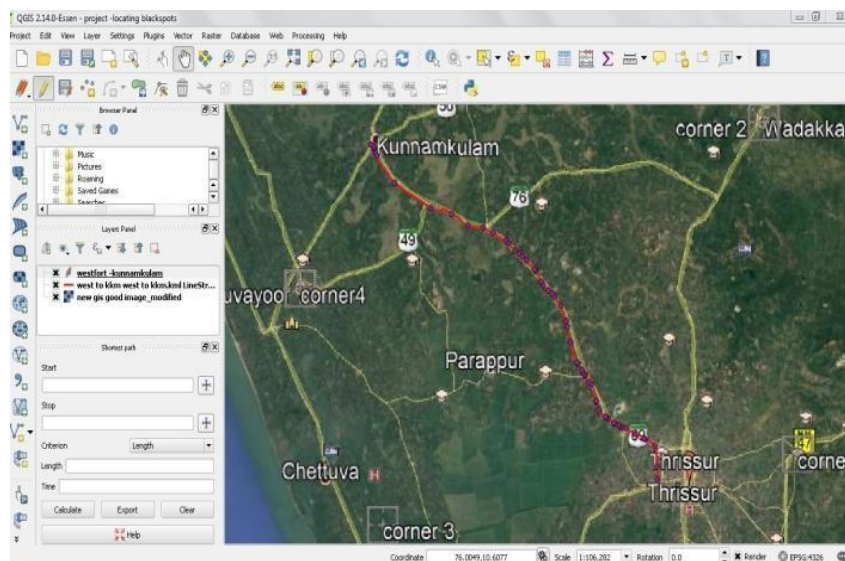


Fig.10 Location of all 34 Blackspots



- Scanning the map of study area
- Geo-referencing
- Digitization
- Creation of shape file
- Join the attribute table
- Accident prone location identification

All accident locations were located by using QGIS and attribute table were prepared and it is shown in Fig.10, Fig.11 and Fig.12.

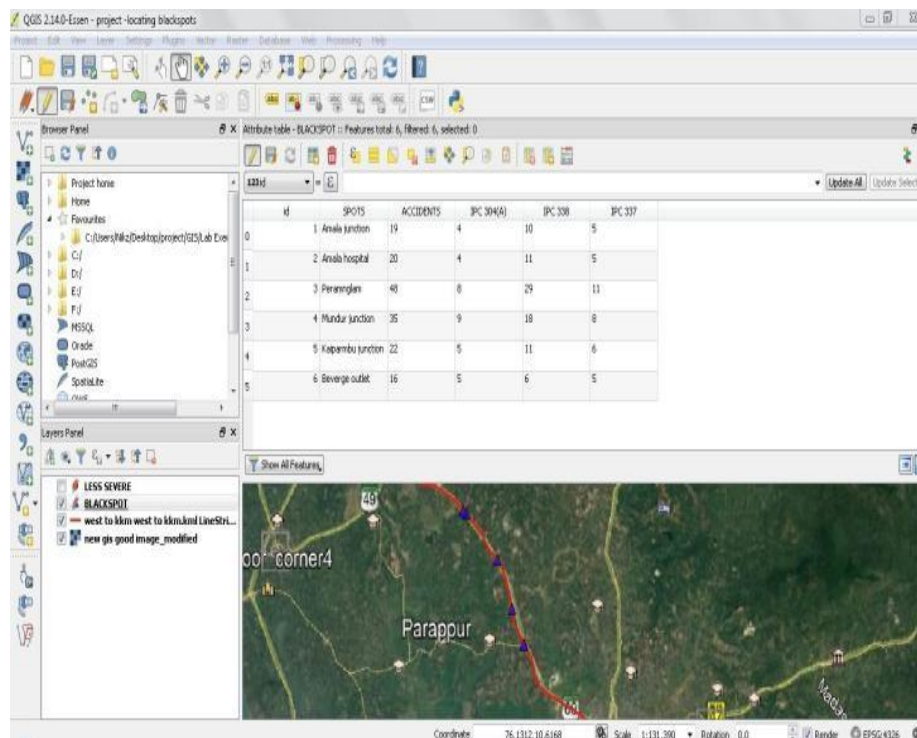


Fig.11 Location of Blackspots having WSI Value Greater than 200

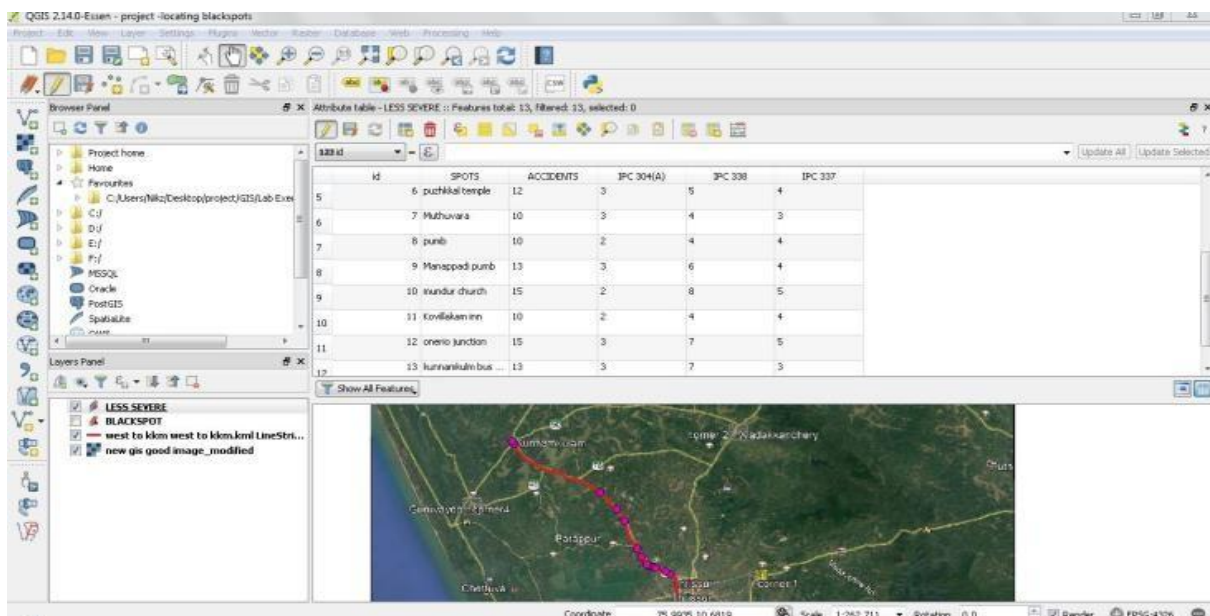


Fig.12 Location of Blackspots having WSI Value Greater than 100



D. Improvement Suggestions

Some suggestions for the improvement of these locations are given below

- Speed limit of vehicles should be decrease in accident prone zones.
- Frequent maintenance of shoulder should be done.
- Road capacity shall be increased by making the road into four lane.
- Sight distances should be obstruction free.
- Closure of minor roads which provide access to the accident zones.
- Traffic calming measures should be adopted on the main road and vehicle traffic on minor roads should be controlled.
- Enforcement measures should be strengthen in order to reduce the speed of vehicles.
- Invisible sign boards to road users should be made visible.
- Reckless overtaking and inappropriate operation of heavy vehicle should be reduced.
- Near schools, intersections and in curves speed should be reduced in order to improve safety.

CONCLUSION

The project was aimed to identify, evaluate and improve the accident blackspots in the Westfort-Kunnamkulam road. Analysis was done by Weighted Severity Index method and identification of blackspot was done by Quantum Geographic Information System (QGIS). The characteristic analysis of accident data results the causes for accidents .Major blackspots are Amala junction, in front of Amala hospital, Peramangalam, Mundur, Kaiparumbu junction and in front of the beverage outlet in Kaiparumbu. Appropriate remedial measures were suggested in order to reduce the intensity of accidents. The overall methodology was found to be effective by locating the high severe blackspots using QGIS.

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