

Black Spot Analysis Using Weighted Severity Index Method at Bhongir Zone - Rachakonda Police Commissionerate – Hyderabad

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Abstract The identification of accidental Blackspots gives information about a particular stretch/location of a Road, which provides information to the road users at the time of travelling. To know about traffic information in the study area, Peak and Non-Peak hours traffic volumes and also spot speed data (Primary data) have been recorded. Past 3 years 2016-2018 accident data (Secondary data) were collected from Rachakonda Police Commissionerate. Further, this Primary and Secondary data has been analyzed by using MS Excel 2019; from the primary data total traffic volume, highest and lowest speeds of the particular locations of the study zone identified; from the secondary data, different types of analysis are carried out to identify the severities about accidents and also accident locations are marked in google maps. With help these maps, kilometer wise number of accident locations are calculated. Using these severity values Blackspots of the study area calculated using Weighted Severity Index formula, top severity value locations were selected as blackspots as per the WSI values. The information helps road users at the time of travelling in the study area to know about blackspots.

Keywords Weighted Severity Index, Blackspots, Accident, Traffic Volume, Spot Speed, Peak Hour, Non-peak Hour Volume

1. Introduction

In today's world road and transport have become a necessary aspect of each individual. In India every year about 1,81,113 traffic accidents are occurring, due to accidents 1,54,732 people killed and about 4,39,262 people injured [8]. As per statistics over 1214 road accidents happen every day in India and one death for every four minutes due to road accidents. Road safety is one of the most important problems in our society. India positions second in the rundown of nations, with the most noteworthy populace keep on developing, the requirement for transportation likewise builds, "leading to an increase of vehicles on the road, the probability of road accidents also increases", an accident is the unanticipated occurrence of physical damage to the animate inanimate structure. Experimental investigation was done to collect information about physical parameters of accidents, collected secondary data correlated with physical parameters to identify the accidents Black Spots By using the Weighted severity index method and Accident Density method based on the combined accident severity values remedial measures also suggested for Blackspot locations [1]. Implied that clumsy areas can be distinguished by

positioning the boundaries in light of their seriousness and ascertaining the seriousness record, physical an overview was completed at the genuine area for chose extends, a boundary which caused the greatest number of accidents were allocated most extreme weightage, The summation of the weights was calculated to find out the total severity [2]. To identify the black spots the data was analyzed by Kernel density estimation Method, severity indices were computed and raking of the black spots was estimated [3]. Seeing that for distinguishing proof of Accident Black spots on National Highway, the main five spots were chosen according to WSI esteem from the gathered information and recommended some conceivable elective measures [4]. To collect road accidents information in the study area a physical study was conducted, based on the information collected critical examination was done to identify accident blackspots on National Highway (study area) using Weighted Severity index method and also assigned ranks based on Density of accidents [5]. Major accident locations have been identified based on the frequency of accidents, the severity of an accident; further blackspots were identified using Accident Density method, Weighted Severity Index method [6]. Equivalent accident number economy scale used to identify different accident rating levels, these ratings are helpful to determine the accident severity weightages, with help of severity values using upper limit control statistics block spot locations are determined [7]. In the present study, Weighted Severity Index method was used to identify the black spots in Bhongir Zone. It is located at 17.5108°N 78.8889°E with an average elevation of 329 meters (1,079 ft). The zone area covers 9.63 km² as on 2011 India census. Bhongir zone had a population of 53,339. Males constitute 51% of the population and females 49%. It is 49 Km away from Hyderabad (Capital city of Telangana State) mixed with urban and rural locations and it is also rapidly developing area due to this reason population growth and vehicle increased year by year it leads to a greater number of accidents.

Table 1. Accidents record from 2015 to 2019 in Telangana state

Year	No of Vehicles	No of accidents
2015	74,62,846	21,253
2016	82,54,653	22,812
2017	96,06,185	22,484
2018	1,06,31,322	22,230
2019	1,25,59,616	22,060

The above table 1 gives information about number vehicles and number accidents occurred in Telangana state from 2015 to 2019, major amount of accidents took place in Cyberabad, Rachakonda, Warangal, Medak and Sanga Reddy areas. Bhongir zone comes under Rachakonda area only, total number of vehicles registered in this area approximately 10 to 15% (18,83,942) of

overall vehicles in Telangana state, nearly 40 to 50% (9,41,971) of vehicles are entering in to the city daily, it is also one of the reason to occur more number of accidents.

2. Methodology

To know about accidents information and identify dangerous spots at Bhongir zone Methodology chosen as Black spots study, Black Spot or black zone is an overall term used to depict a stretch of street noted to have the high danger in accidents.

Weighted Severity Index Method used to calculate the severity of accidents, a system of scores assigned based on the type of injury at the particular location, injuries are classified as Fatal (K), Major Injured (GI) and Minor Injuries (MI).

WSI is calculated by formula $(41 * K) + (4 * GI) + (1 * MI)$

In WSI formula, a fatal accident has been given 10.02 times more weightage than major injury ($4 \ll 41$). Also, minor injury has been given unit coefficient ($1 \ll 41$). The locations with WSI value greater than or equal to 41 is usually termed as a black spot. WSI value is independent of traffic volume, traffic speed, number of vehicles or length of road. The weightage points 41, 4.1 and 1 were assigned based on updated Road User Cost Study (RUCS) carried out by Ministry of Road Transport and Highways (MoRTH). The major limitation of this method is that the number and type of accidents are only considered.

2.1. Data Collection and Analysis

Primary data Collection

Traffic Volume

Traffic volume studies are conducted to determine the volume of vehicles moving on the particular lane/road, according to the traffic volume study, the time can be classified as peak hour and non-peak hour. The Volume count done by video graphic method in which the video recording is taken for required time at site and manual count is done based on that video. Passenger car unit (PCU) is a measure of impact that a mode of transport has on traffic variables (such as headway, speed, density) compared to a single standard passenger car.

Spot Speed

Photography method is used for spot speed study in which there is a recording video for a stretch decided based on mean speed for one hour each lane for both peak and non-peak conditions, each and every vehicle speed is calculated by its passing time through the basic length, data is divided into speed groups based on its maximum and minimum speeds found by the vehicles at that particular length.

Secondary data Collection

Past 3 years (2016-2018) accidents information data has been collected from the police stations (Rachakonda Commissionerate). The secondary data contains information like number, type, location, time, type of vehicle and victim of accidents etc... in bhongir zone. In this study area total 17 police stations are there (Alair, Athmakur, Addaguduru, Bhongir Town, Bhongir Rural, Bibinagar, Bommalaramaram, Choutuppal, Motakondur, Mothkur, Narayanpur, Pochampally, Ramannapet, Rajapet, Thurkapally, Valigonda, Yadagirigutta).

2.2. Analysis of Primary Data

Practically collected data tabulated using MS-Excel 2019 software and analysis has been done, based on the

analysis peak and non-peak hour traffic volume and spot speeds identified graphs generated.

From Fig 1 we can observe that peak hour traffic volume in one direction at selected locations, from Choutuppal toward LB Nagar a greater number of vehicles moving and also least number of vehicles moving Addaguduru toward Mothkur, remaining some locations also recorded more and a smaller number of vehicles moving.

From Fig 2 we can observe that peak hour traffic volume in opposite direction at selected locations, a greater number of vehicles moving at Bhongir towards Jangoan, a lower number of vehicles moving at Narayanpur towards Jangoan and also some remaining stretches a greater number of vehicles moving, few locations a smaller number of vehicles moving.

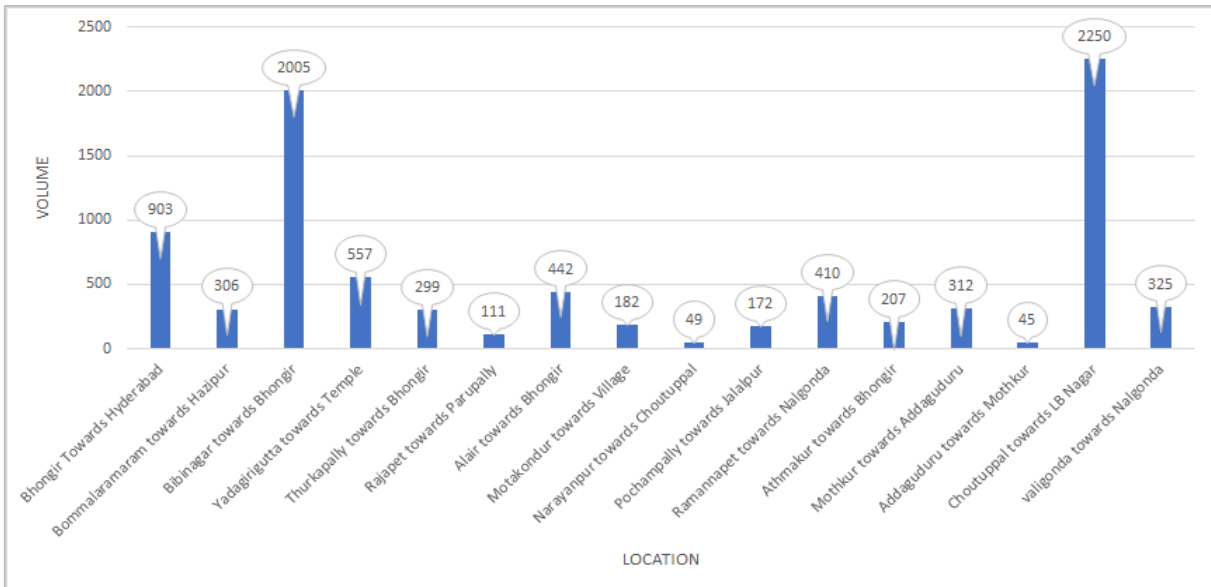


Figure 1. Peak hour traffic volume in one direction of all locations

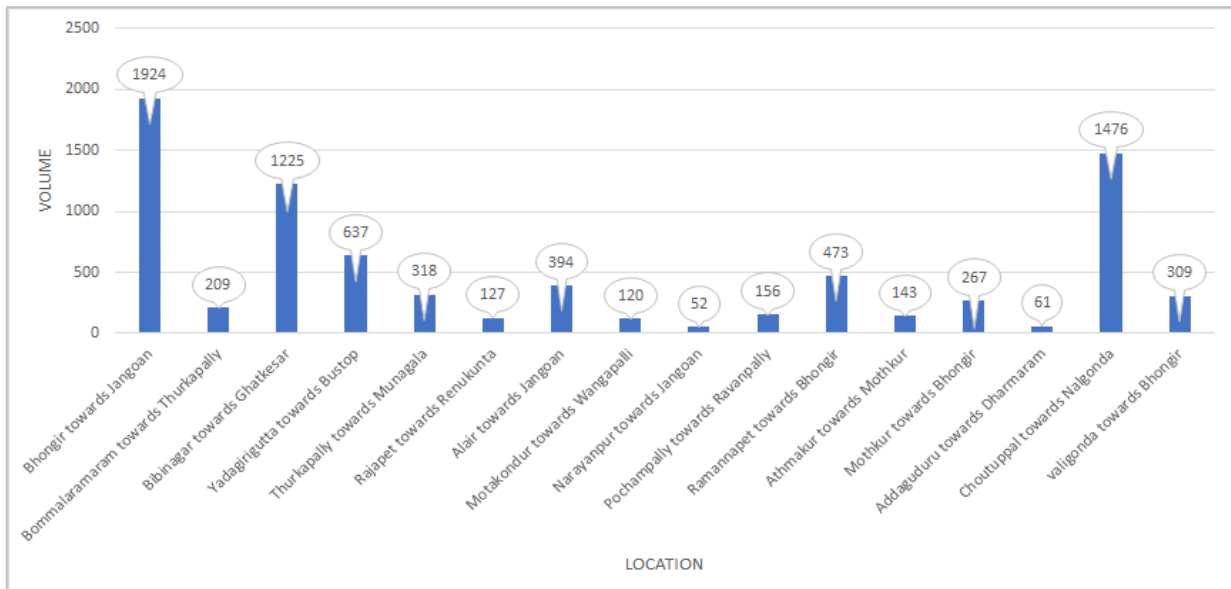


Figure 2. Peak hour traffic volume in opposite direction of all locations

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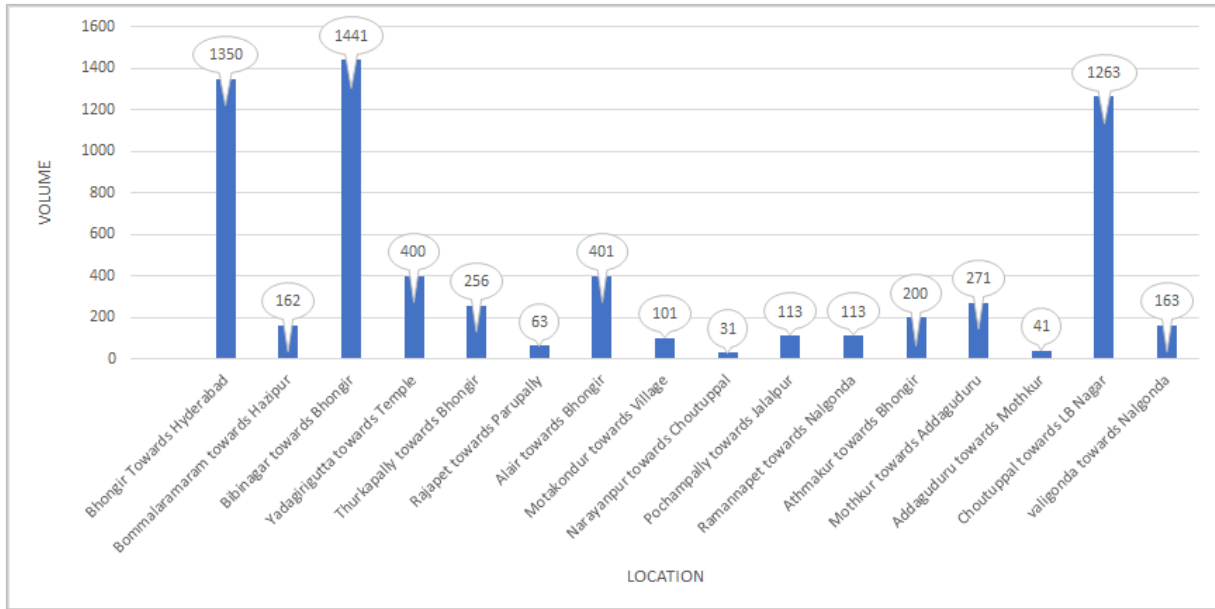


Figure 3. Non-Peak hour traffic volume in one direction of all locations

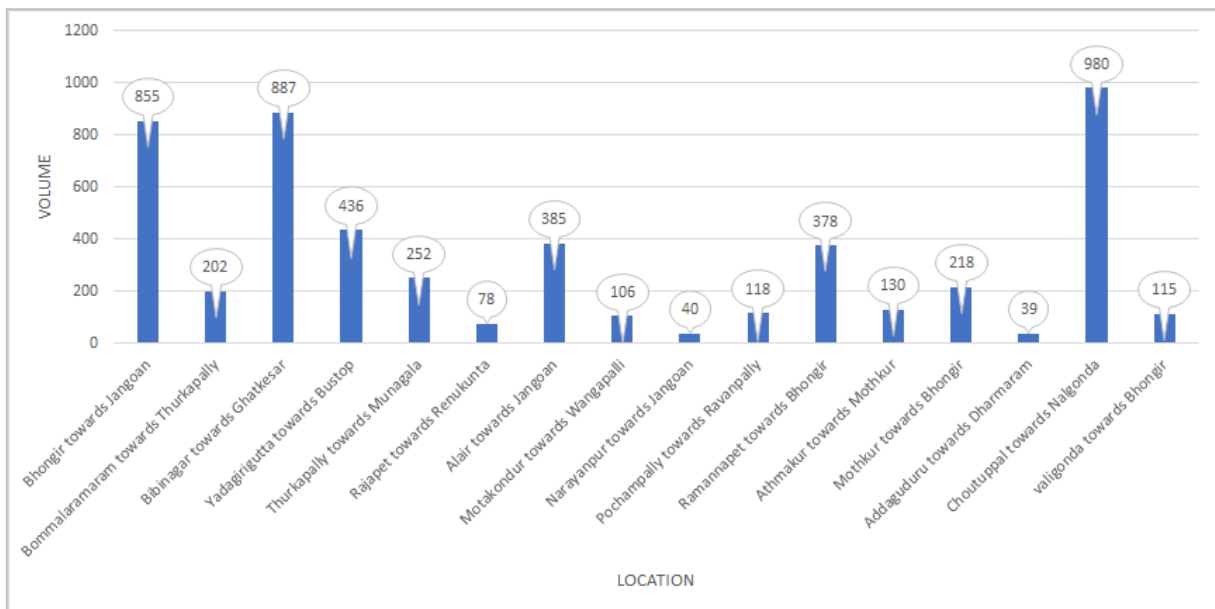


Figure 4. Non-Peak hour traffic volume in opposite direction of all locations

From Fig 3 we can note that non peak hour volume in one direction at selected locations in the study area, from Bibinagar towards Bhongir a greater number of vehicles moving and less number of vehicles moving from Narayanpur towards Choutuppal, remaining some locations also a greater number of vehicle’s moving, some locations less numbers of vehicles moving.

From Fig 4 we can note that non peak hour traffic volume in opposite direction of selected locations in study area, a greater number of vehicles moving at Choutuppal towards Nalgonda, a less number of vehicles moving at Addaguduru towards Dharmaram and also few stretches a greater number of vehicles moving, more locations smaller number of vehicles moving.

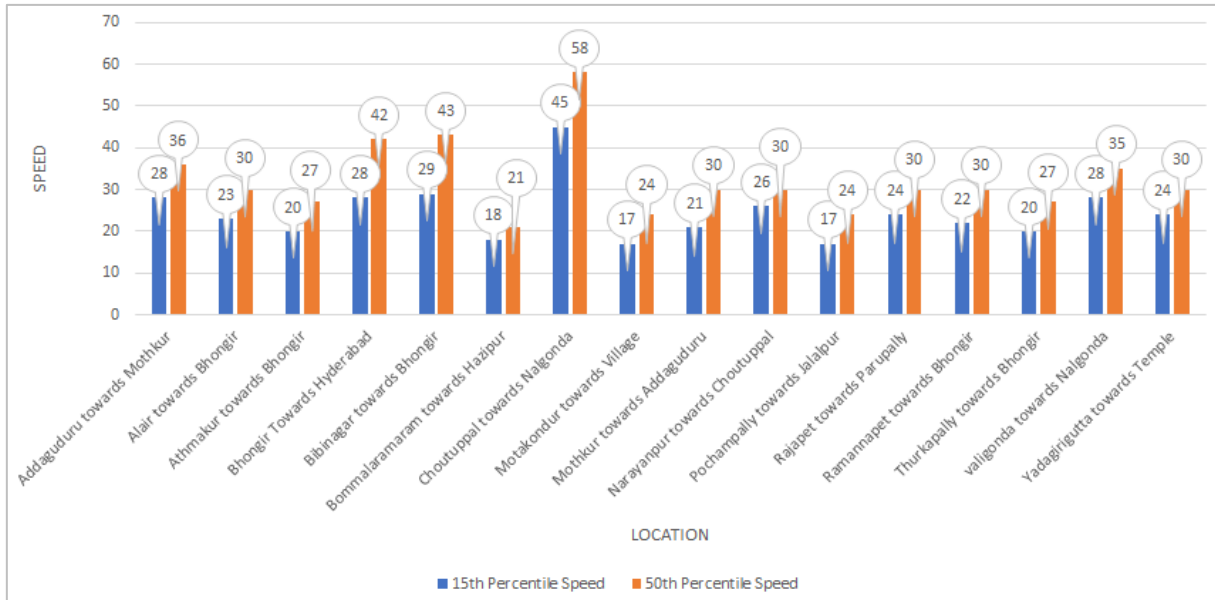


Figure 5. Peak Spot speeds of 15th and 50th percentile in one direction all locations

The above Fig 5 we can observe that 15th and 50th percentile peak hour spot speed values in one direction, Choutuppal towards Nalgonda highest speeds are recorded and Motakondur towards village, Pochampally towards Jalapur lowest speeds identified.

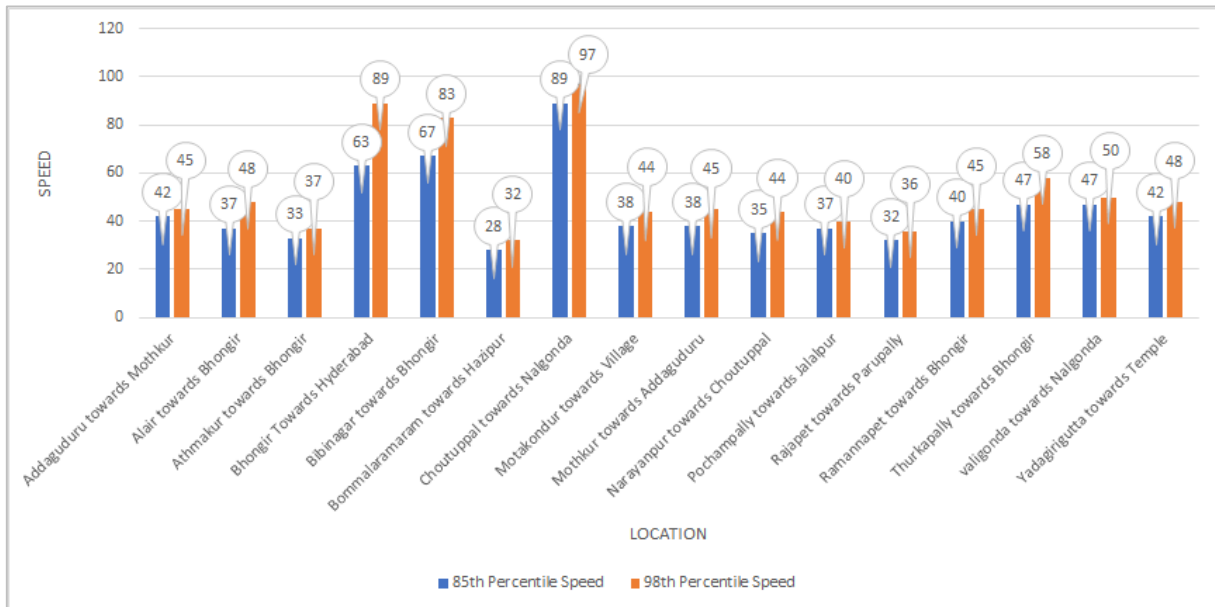


Figure 6. Peak Spot speeds of 85th and 98th percentile in one direction all locations

The above Fig 6 we can observe that 85th and 98th percentile peak hour spot speed values in one direction, Choutuppal towards Nalgonda higher speeds recorded and Bommalaramaram towards Hazipur low speeds are recorded.

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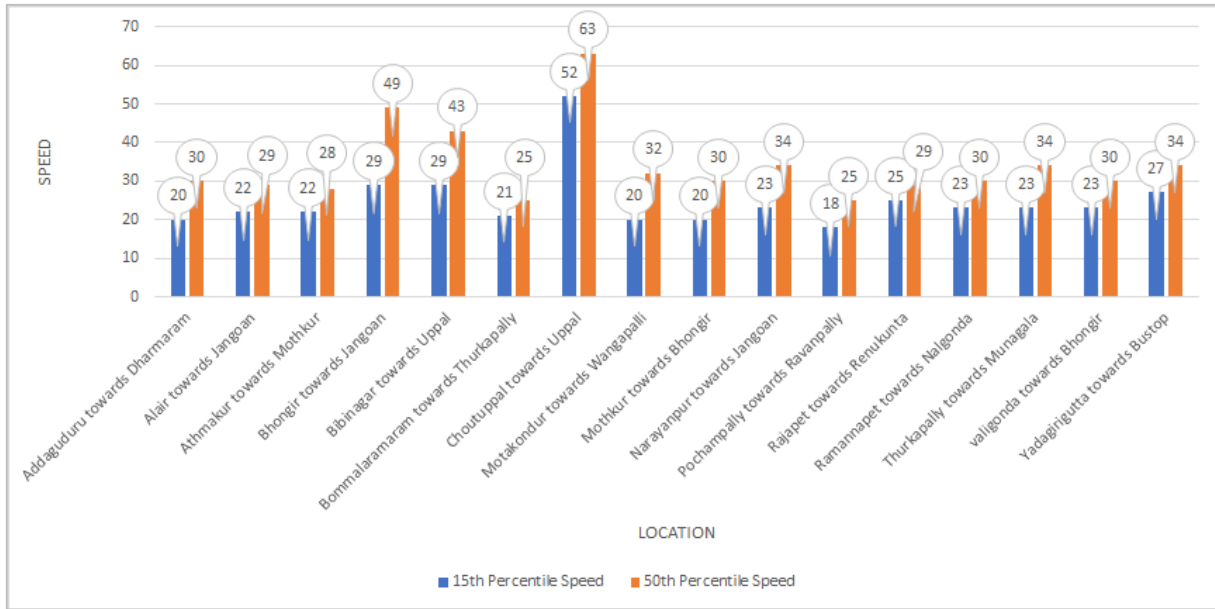


Figure 7. Peak Spot speeds of 15th and 50th percentile in opposite direction all locations

The above Fig 7 we can observe that 15th and 50th percentile peak hour spot speed values in opposite direction, Choutuppal towards Uppal greater speeds are identified and Pochampally towards Ravanpally lower speeds are recorded.

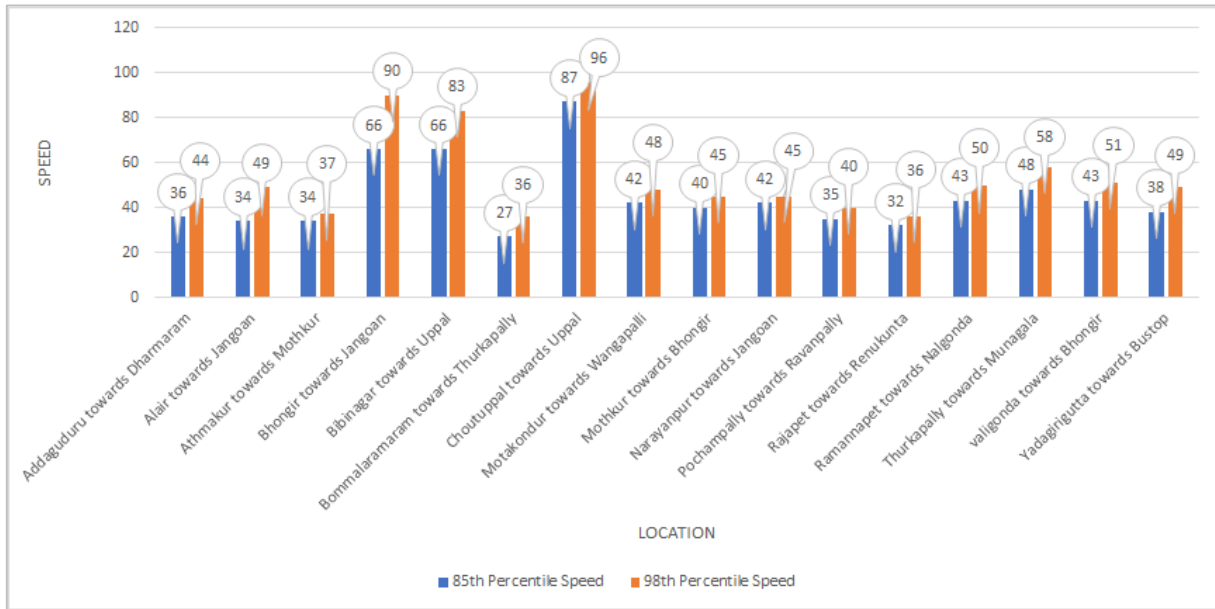


Figure 8. Peak Spot speeds of 85th and 98th percentile in opposite direction all locations

The above Fig 8 we can observe that 85th and 98th percentile peak hour spot speed values in opposite direction, Choutuppal towards Uppal greater speeds are recorded and Bommalaramam towards Thurkapally lesser speeds are recorded.

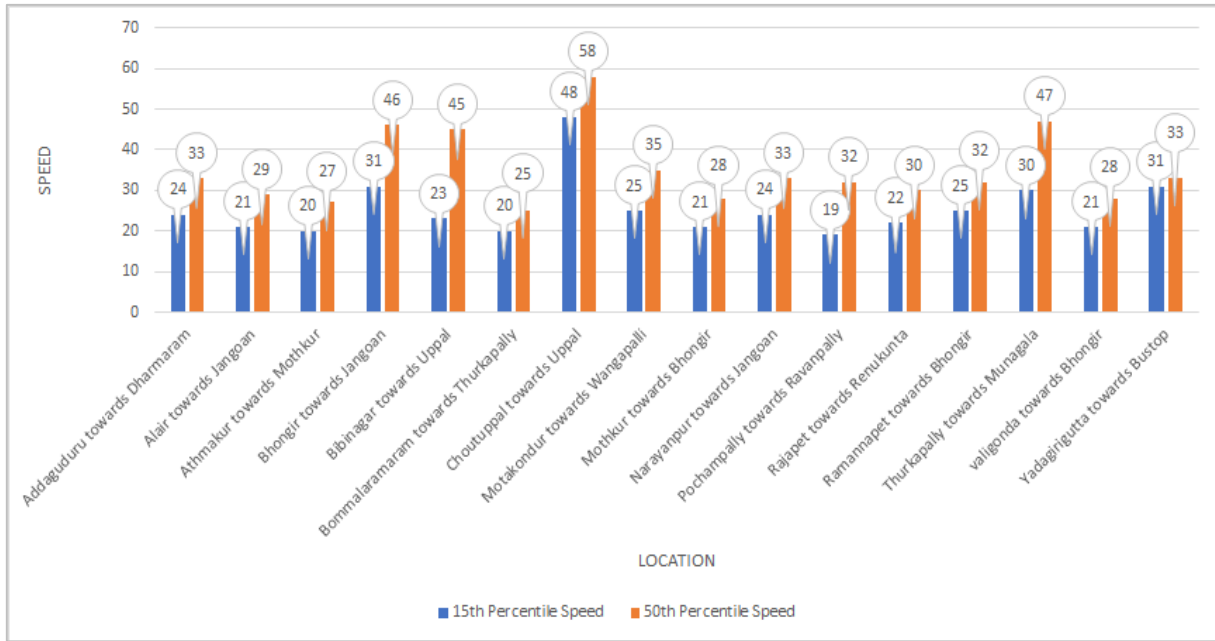


Figure 9. Non-Peak Spot speeds of 15th and 50th percentile in one direction all locations

The above Fig 9 we can observe that 15th and 50th percentile Non peak hour spot speed values in one direction, Choutuppal towards Uppal major number of speeds identified and Pochampally towards Ravanpally a smaller number of speeds identified.

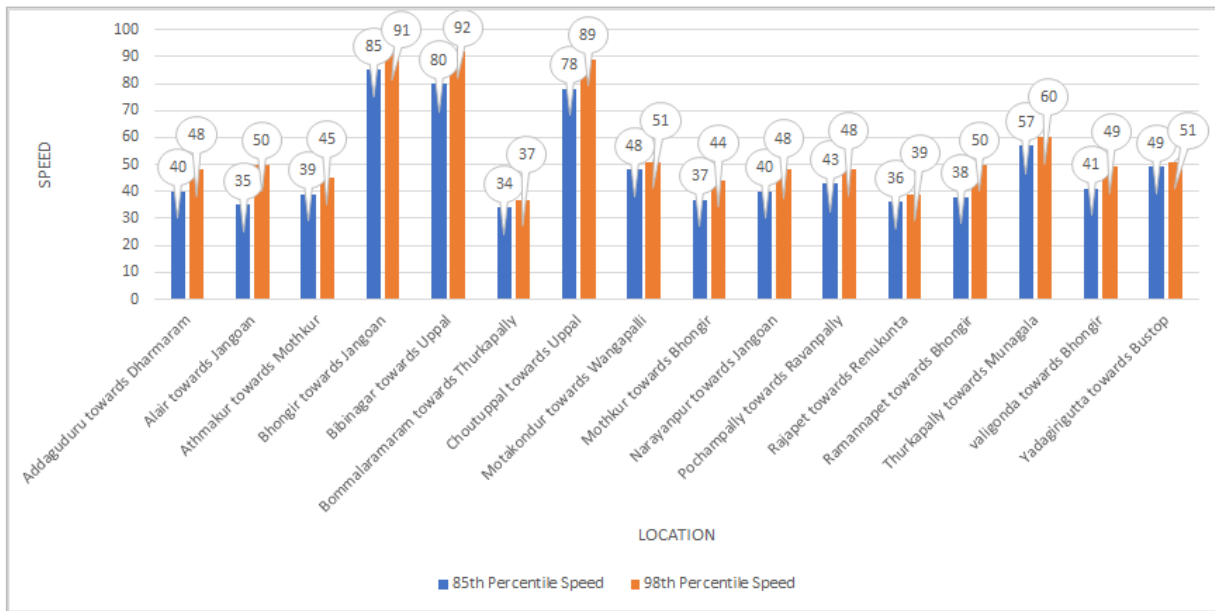


Figure 10. Non-Peak Spot speeds of 85th and 98th percentile in one direction all locations

The above Fig 10 we can observe that 85th and 98th percentile Non peak hour spot speed values in one direction, Bhongir towards Jangoan, Bhongir towards Uppal and Choutuppal towards Uppal higher speeds are recorded and Bommalaramam towards Thurkapally lower speeds are recorded.

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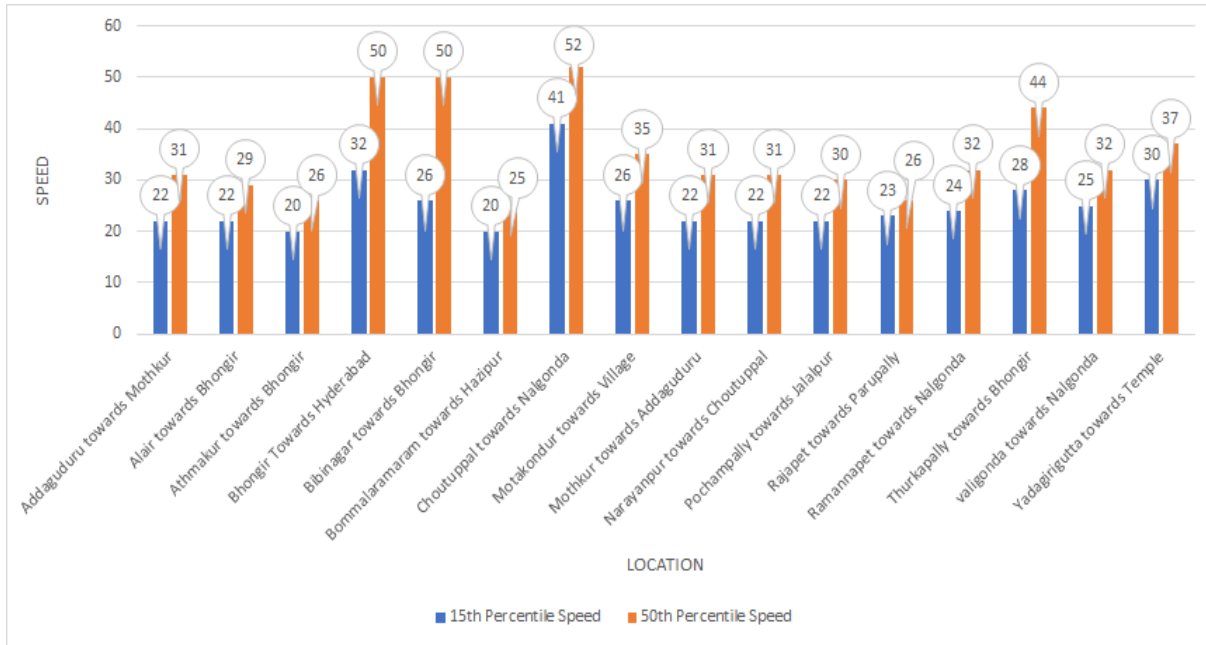


Figure 11. Non-Peak Spot speeds of 15th and 50th percentile in opposite direction all locations

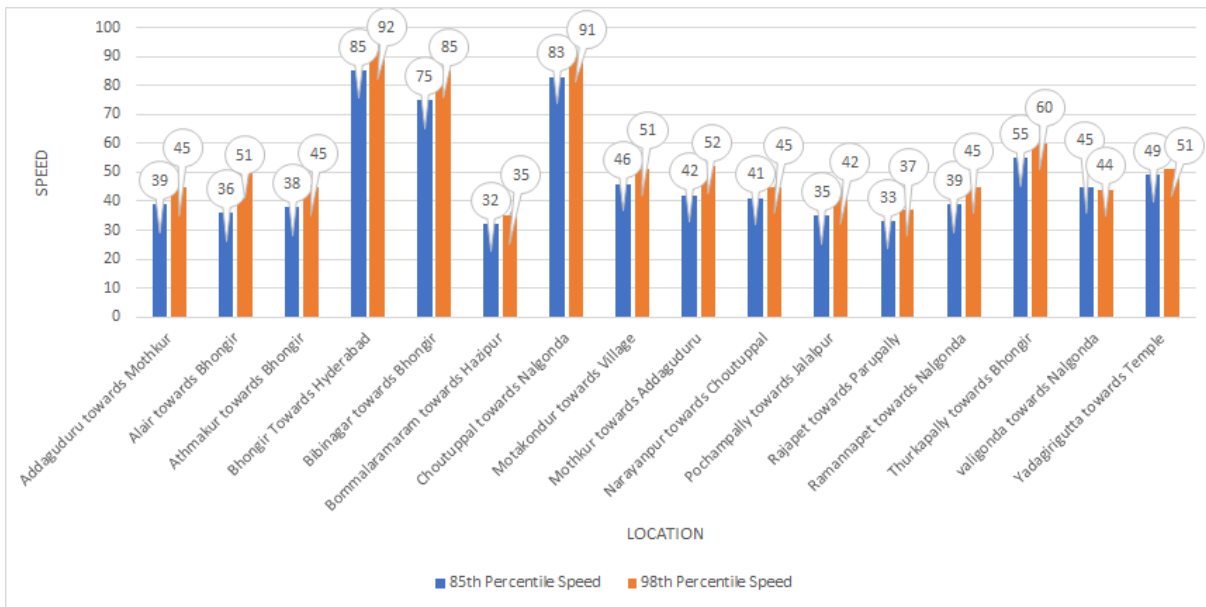


Figure 12. Non-Peak Spot speeds of 85th and 98th percentile in opposite direction all locations

The above Fig 11 we can observe that 15th and 50th percentile Non peak hour spot speed values in opposite direction, Choutuppal towards Nalgonda higher number of speeds recorded and Athmakur towards Bhongir, Bommalaramaram towards Hazipur lower speeds recorded.

The above Fig 12 we can observe that 85th and 98th percentile Non peak hour spot speed values in opposite direction, Bhongir towards Hyderabad, Choutuppal towards Nalgonda and Bibinagar towards Bhongir

recorded greater speeds and Bommalaramaram towards Hazipur, Rajapet towards Parupally recorded lesser speeds.

Analysis of Secondary Data

Accident data collected from Secondary source is analyzed as year wise, month wise, day wise, time wise...etc. and also accident locations marked in Google earth map, Kilometre wise accidents calculated.

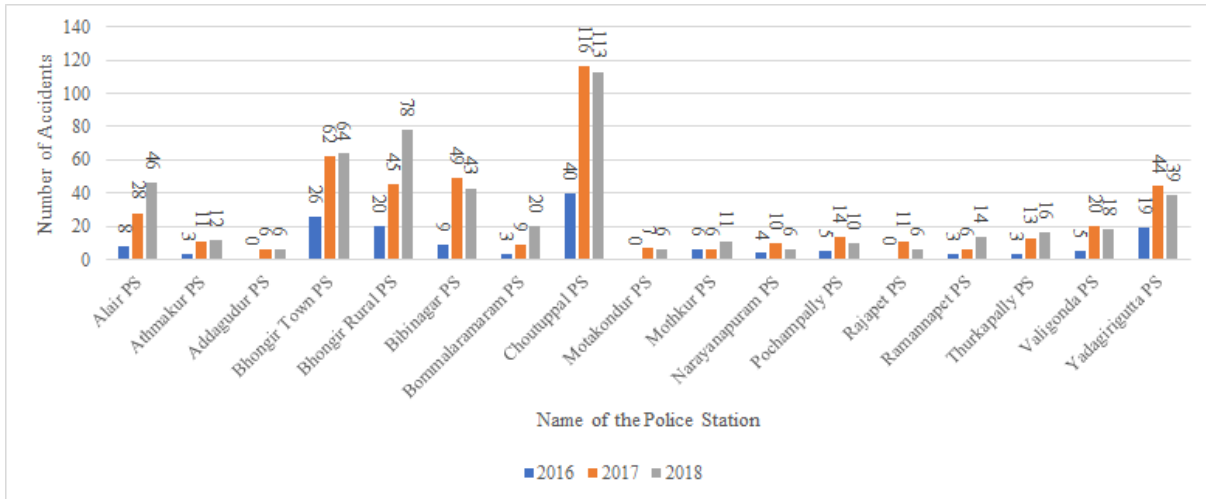


Figure 13. Variation of Accidents in each Police Station year wise

The Fig 13 shows that yearly variation of accidents in every police station in the study area, over all from the year 2016 to 2018 number of accidents increased, in the year 2016 accidents occurred 156, in 2017 accident occurred 457 and in 2018 accidents occurred 508. Choutuppal PS limits very high number of accidents recorded and Addagudur PS, Mothukur PS limits very low number of accidents recorded, remaining PS limits also some high and some low accident recorded.

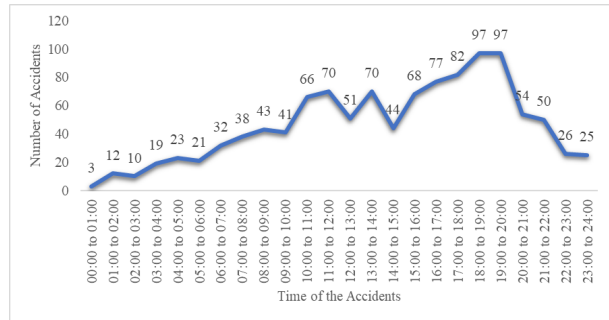


Figure 15. Time wise variation of accidents in all Police Stations

The above Fig 15 gives information about timely variation of accidents reported in the study area, most of the accidents happened in night time, morning and afternoon times, highest number of accidents occurred in between 18:00 to 20:00 hours, very low number of accidents happened in between 00:00 to 01:00 hours.

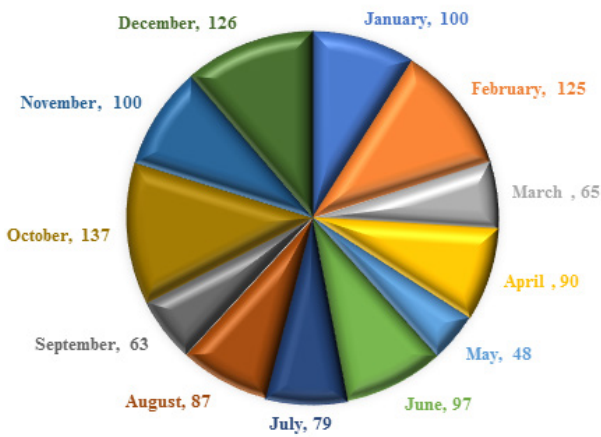


Figure 14. Month wise variation of accidents in all Police Stations

The above Fig 14 shows that monthly variation of accidents in study area, highest number of accidents occurred in the month of October, lowest number of accidents occurred in the month of May and also remaining some another months also high and low number of accidents recorded.

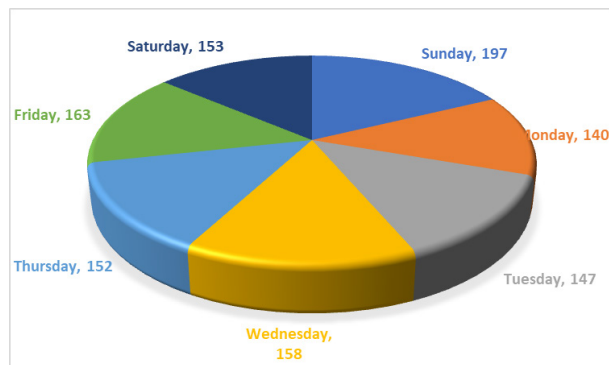


Figure 16. Time wise variation of accidents in all Police Stations

The above Fig 16 gives information about day wise accidents information in the study area, most of the accidents are happened in weekend days Saturday and Sunday, remaining working days from Monday to Friday also major number occurred, the highest number recorded on Sunday and lowest number recorded Monday.

3. Results and Discussion

Based on the analysis data results obtained, from the results all accident location information map generated, with help of this map kilometer wise number of accidents calculated and identified more severity value places.

Fig 17 all accidents locations in the study area marked in Google earth pro, it gives the information about total number of accidents in the study area and also each 1 Km wise number of accident locations, these vales useful to calculate WSI in the study area.

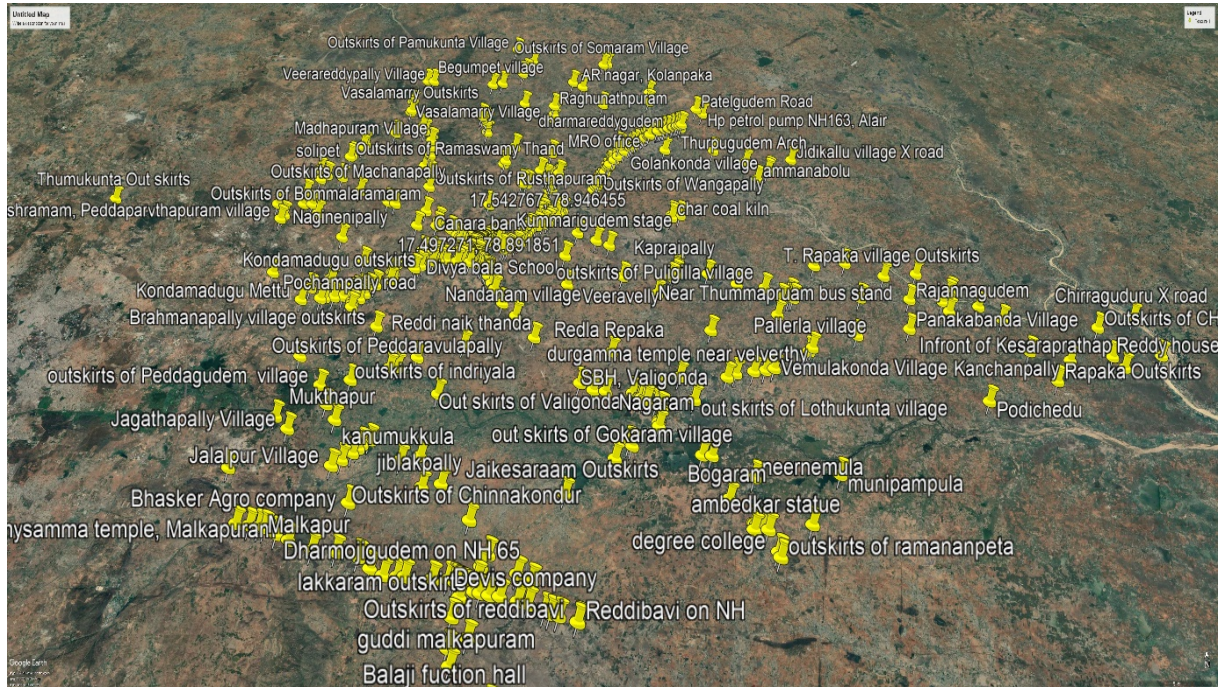


Figure 17. All accident locations in study area

Table 2. Kilometer wise accidents

No. of accidents	Places	No. of deaths	No. of major injuries	No. of minor injuries	WSI Value
22	TVS Showroom	6	7	8	282
	Shilpa hotel				
	MRF Showroom				
	Jagadevapur Chowrasta				
	Padmaja hospital				
	Prince corner				
	SBH				
	Court Bhongir				
	ICICI Bank				
	Bhongir bus stand				
	Junior college ground				
	Vinayak Chowrasta				
Tharakaram Nagar					

Table 2 gives information about each 1 Km wise number of accidents, location of accidents, number of deaths, major and minor injuries, a total length of 137 km identified, with help of these data weighted severity index values of each kilometer length identified, based on the obtained values minimum WSI 1 and maximum WSI 519, the range of WSI values 1 to 10 24 locations, 11 to 20 5 locations, 21 to 50 27 locations, 51 to 100 36 locations, 101 to 200 21 locations, 201 to 300 14 locations, 301 to 400 6 locations, 401 to 500 3 locations, more than 500 1 location identified.

Table 3. Kilometer wise accidents

Rank	Blackspots
1	Singannagudem Chowrasta-Vasundra theatre
2	Thallagudem outskirts-Bahupet outskirts
3	Teachers' colony- Hyderabad Chowrasta
4	Lingojigudem- petrol bunk
5	Lakkaram - Thangedpally X road
6	Malkapur outskirts
7	Sankalp hotel- Raigiri village
8	Toopranpet-outskirts
9	Alair Vivekananda statue-Bus stand
10	Vennela college-Spinning Mill

The above table 3 shows top ten ranks of black spots locations in the study area, identified as Singannagudem Chowrasta, Vasundra theatre with the highest number of accident severity rate, vehicle speeds also very high in this location in peak and non-peak hours. Whereas Outskirts of addagudur - Kesarapraphreddy house, Sangaya Thanda, Manthapuri-Galanukonda village recognized as places with lowest accident severity rate, vehicle speeds in this location peak and non-peak hours very low.

4. Conclusions

In the present analysis, identification of accident Blackspot locations in Bhongir zone area was carried out using Weighted Severity Index method.

- I. Severity index method as suggested by "Sorate RR et al. (2015)", "Dhruvit Shah and M Pranay Shah (2016)", "Mohan Athira and Dr. V.S. Landge (2017)" and "Chetna et al. (2018)" gives good results in the analysis.
- II. Based on the results highest accident prone location Singannagudem Chowrasta-Vasundra theatre in Bhongir town area, lowest accident prone location Outskirts of addagudur-Kesarapraphreddy house in Addagudur area.
- III. From the analysis Sunday most of the accidents happened, in between 06 to 08 Pm hours high

accident rate recorded, in October month most of the accidents occurred, in the year 2018 many accidents happened.

- IV. This information helpful to the road users where the accident prone locations are identified in the map, when the time of travelling with help road map road users can know the accidental prone locations.
- V. The information also helpful, for road safety authorities need to provide proper accident zones related information in the form of signs and symbols to alert road users.
- VI. Also the information helps how to take safety measures to prevent accidents and also to provide signals at blackspot locations.

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