TEST Engineering & Management

May-June 2020
ISSN: 0193-4120 Page No. 8892 - 8901

Road Accident Scenario in Vijayawada – A Case Study

Dr. K. Shyam Prakash[1], S. Satish[2], T. Srikanth

[1]Asst. Professor, Department of Civil Engineering, PVP Siddhartha Institute of Technology, Kanuru, Vijayawada– 520007 India

[2]Asst. Professor, Department of Civil Engineering, V. R. Siddhartha Engineering College, Kanuru, Vijayawada– 520007 India

[3]Assoc. Professor, Department of Civil Engineering, Gokaraju Rangaraju Institute of Engineering and Technology, Kukatpally, Hyderabad– 500090 India

Article Info
Volume 83
Page Number: 8892 - 8901
Publication Issue:
May - June 2020

Article History
Article Received*: 19 November 2019*
Revised*: 27 January 2020*
Accepted*: 24 February 2020*
Publication*: 18 May 2020*

Abstract:
Road traffic continues to be a major developmental issue, a public health concern and is aleading cause of death and injury across the World killing more than 1.35 million globally in2016 as reported in the Global Status report on Road Safety 2018 with 90% of these casualtiestaking place in the developing countries. The study collect the previous accident data such as, state, area, location, type of accident, road condition, weather condition, injuries of the victim, gender of the victim, vehicle damage, type of vehicle. Those data are collected from the Autonagar, Penamaluru, kankipadu, police stations. This section highlights the methods that have been used to identify and rank the block spots. The accident data collected and analysed those locations having accident cases more than 14 (i.e. 2 or more accident cases per year on an average) have been considered for the identification of the black spots using statistical methods viz. Weighted Severity Index Method, Priority Score Method, Accident Severity Index and Fatality Rate and then ranked with the help of these methods.

Keywords*: Accident, Blackspot, Fatality, Method, Ranking, Injury*

INTRODUCTION

THE GLOBAL CONTEXT

India is a participant to the second Conference on Road Safety held in Brazil in 2015, which, inter-alia, resolved to fifty percent, by 2020 the deaths and injuries from accidents. The target in 2030 is also set for sustainable development by the participating countries.

Road traffic continues to be a major developmental issue, a public health concern and is a leading cause of death and injury across the World killing more than 1.35 million globally in2016 as reported in the Global Status report on Road Safety 2018 with 90% of these casualties taking place in the developing countries.

As per the World Health Organisation, accident related deaths, are known to be the eighth leading cause of death and the first largest cause of death among children aged 5-14 and adults in the age 15-29. Globally, 54% of accident related deaths are pedestrians, cyclists and motorcyclists. This results in considerable economic losses not only to individuals, their families, butal so to the nations as a whole. The losses are on account of cost of treatment as well as lost productivity for those killed or disabled by their injuries, loss of productivity of family members who need to take time off work or school to care for the injured etc.

TEST Engineering & Management

May-June 2020
ISSN: 0193-4120 Page No. 8892 - 8901

Road transport remains the most favoured mode of transport for both freight and passenger movement in India. The fast-growing population, exceptional rate of motorization coupled with the ever-growing urbanization has made people vulnerable to frequent road accidents resulting in fatalities, injuries/disabilities.

Road accidents in India kill almost 1.5 lakh people annually. Accordingly, India accounts for almost 11% of the accident related deaths in the World.

1.2Road accidents in India 2018 & 2017 – A brief outline

The position in respect of road accidents, numbers killed and injured in the last five years is given in the table 1 below.

Table 1: Road accidents, Number of persons Died and Injured in the last five years 2014-2018

Year	Total Number of Road Accidents (in numbers)	% change	Totol Number of Persons Killed (in numbers)	% change	Total Number of Persons Injured (in numbers)	% Change
2014	4,89,400		1,39,671		4,93,474	
2015	5,01,423	2.46	1,46,133	4.63	5,00,279	1.38
2016	4,80,652	-4.14	1,50,785	3.18	4,94,624	-1.13
2017	4,64,910	-3.28	1,47,913	-1.9	4,70,975	-4.78
2018	4,67,044	0.46	1,51,417	2.37	4,69,418	-0.33

It will be noted that in 2018 a total of 4,67,044 road accidents were reported by States and Union Territories (UTs) killing 1,51,417 people and causing injury to 4,69, 418 persons. Road accidents in 2018 compared to the previous year i.e. 2017, increased by 0.46 percent, the number of persons killed increased by 2.37 percent and the number injured decreased by 0.33 percent.

The number of 4,67,044 accidents and 1,51,417 deaths in 2018 translates into an average of 1,280 accidents and 415 deaths every day and nearly 53 accidents and 17 deaths every hour.

A road accident may cause a loss of life/lives or grievous injury, minor injury or non-injury to road-users. An accident, which results in death of one or more person, is a fatal accident. Grievous injury accident is one in which one or more victims suffer serious injury requiring hospitalization. Minor injury accident is one in which victim(s) does not require hospitalization. The breakup of Road accidents in the above categories in the last five years i.e. 2014 to 2018 is presented in Table 2 below:

What is evident from the above table is that of the total number of accidents in 2018, Minor injuries accounted for the largest share of about 36%, followed by fatal accidents of about 30%with Grievous injuries accounting for another 27%. The share of Non injury accidents accounted for 7% of the total. The position in terms of the number of accidents, number of persons killed and those injured by the category of Roads in 2018 is given in Table 3 below:

May-June 2020
ISSN: 0193-4120 Page No. 8892 - 8901

Table 2: Trends in the Type of road accidents (2014 to 2018)

Type of road accident	Parameter	2014	2015	2016	2017	2018
Fatal Accident	Number	1,25,828	1,31,726	1,36,071	1,34,796	1,37,726
	% age increase/decrease		4.7	3.3	-0.9	2.2
	Share in Total	25.7	26.3	28.3	29	29.5
Grevious Injury accidents	Number	1,15,454	1,19,668	1,20,848	1,20,971	1,25,311
	% age increase/decrease		3.6	1	0.1	3.6
	Share in Total	23.6	23.9	25.1	26	26.8
Minor Injury accidents	Number	1,92,310	1,92,634	1,87,642	1,74,400	1,69,920
	% age increase/decrease	0	0.005	0	0	0
	Share in Total	39.3	38.4	39	37.5	36.4
Non-Injury accidents	Number	55,808	57,395	36,091	34,743	34,087
	% age increase/decrease		2.8	-37.1	-3.7	-1.9
	Share in Total	11.4	11.4	7.51	7.47	7.3
Total	% age increase/decrease	4,89,400	5,01,423	4,80,652	4,64,910	4,67,044
	Share in Total		2.5	-4.1	-3.3	0.5

Table 3: Number of accidents, Number of persons Died and those injured by the category of Roads in 2018

Category of Roads	Length as on 31.3.17		Accidents		Persons Killed		Persons Injured	
	Kms	%age share in Total	Number	%age share in Total	Number	%age share in Total	Number	%age share in Total
National Highways	1,14,158	1.94	1,40,843	30.16	54,046	35.69	1,40,622	29.96
State Highways	1,75,036	2.97	1,17,570	25.17	40,580	26.8	1,21,579	25.9
Other Roads	56,08,477	95.1	2,08,631	44.67	56,791	37.51	2,07,217	44.14
Total	**58,97,671**	**100**	**4,67,044**	**100**	**1,51,417**	**100**	**4,69,418**	**100**

It will be seen from above that National Highways which comprises of 1.94 percent of total road network accounted for 30.2 per cent of total road accidents and 35.7 per cent of deaths in 2018. State Highways which account for 2.97% of the total road length accounted for 25.2 percent and 26.8 percent of accidents and deaths respectively. Other Roads which constitute about 95.1% of the total roads were responsible for the balance 45 % of accidents and 38% deaths respectively.

Highways (both national and State) which accounted for about 5% of total road network witnessed a disproportionately large share of accidents of 55 % and accident related killings of 63% during the year 2018 and naturally become the focus of our attention. More accidents on these have been attributed to higher vehicles speeds and increasingly higher volume of traffic on these roads.

The State of Tamilnadu recorded the highest number of road accidents (63, 920) in 2018 while the highest

May-June 2020
ISSN: 0193-4120 Page No. 8892 - 8901

numbers reported as killed in 2018 were in the State of Uttar Pradesh (22,256). Both these States have maintained their leads in terms of number of accidents and number of persons killed since 2017 despite the several road safety initiatives taken by both the Central and State Government.

The reporting 50 million plus cities accounted for 18.27 percent of total road accidents, 11.70 percent of total persons killed and 16.35 percent of total persons injured in road accidents. Chennai ranks first in road accidents (7,580) and number of persons injured (7,438). Delhi ranks first in number of fatalities (1,690).

Amongst the different vehicle categories, two-wheelers account for the highest share in total accidents (35.2%), in total number of persons killed (31.4%) and in persons injured (32.7%) followed by cars/Taxis/Vans and Trucks for all categories of accidents, accident related deaths and those injured respectively.

In terms of road-user categories, the share of two-wheeler riders in total road accident deaths has been the highest (36.5%) in 2018. Pedestrian road-users comprise15.0 percent of persons killed in road accidents during 2018 confirming the share provided by WHO.

1.3 Vijayawada accidents data

1.3.1 Study Area

The study area comprises the area under Vijayawada Municipal Corporation. It extends over61.88sq.km. Administratively it is identified into 3 circles and 59wards. For CTTS, wards have been identified as Traffic Analysis Zones (TAZ). In addition external areas are identified into 15 TAZs. The 59 internal zones are regrouped into 11 sectors for presentation of characteristics.

1.3.2 Vijayawada Zonal Development Plan

The Vijayawada Guntur Tenali Mangalagiri (VGTM) Urban Development Authority (UDA) has taken up preparation of Zonal Development Plans for the VGTM urban region. Vijayawada is one of the 23 zones in the region. The ZDP (Final Draft) for Vijayawada zone comprising the area under Vijayawada Municipal Corporation, extending over 61.88 sq. km has since been prepared under development of VGTMUDA. The ZDP has been prepared after extensive surveys and intensive public participation.

1.3.3 Traffic within City:

Traffic intensity on the road network of Vijayawada city is intense. It ranges between 2019 and 60571 vehicles. The composition is heterogeneous. 2-wheelers and Auto rickshaws predominate. Slow moving vehicles also have share. Peak hour share ranges between 5.7% and 8.7% (Inner Cordon). Share of busses is low at 5% (Inner Cordon).

1.3.4 Traffic Speeds

The traffic speeds on different links of the city road network are generally poor. Nearly 85% of the road network in city area and nearly 100% of the roads within Core Area have speeds less than 30 kmph. While this is the stream speed, those of buses will be much less, as they need to stop at bus stops.

METHODOLOGY

2.1 Data collection:

The study collect the previous accident data such as, state, area, location, type of accident, road condition, weather condition, injuries of the victim, gender of the victim, vehicle damage, type of vehicle. Those data are collected from the Autonagar, Penamaluru, kankipadu, police stations. And also collect the literature reviews for the accident data.

2.2 Methods used to analysis data:

This section highlights the methods that have been used to identify and rank the block spots. The accident data collected and analysed those locations having accident cases more than 14 (i.e. 2 or more accident cases per year on an average) have been considered for the identification of the black spots using statistical methods viz. Weighted Severity Index Method, Priority Score Method, Accident

May-June 2020
ISSN: 0193-4120 Page No. 8892 - 8901

Severity Index and Fatality Rate and then ranked with the help of these methods.
The different methods are as follows:

2.2.1 Weighted Severity Index: According to this method, the accidents for one year are considered for one location and WSI is calculated using the formula mention below:

$$WSI = 41\times F + 4\times GI + MI$$

Where F= No. of Fatalities for a particular location in a particular year
GI= No. of Grievous/ Major Injuries
MI= No. of Minor Injuries
If the WSI value exceeded 41 for any location for any of the 7 years (2011-2017), they were considered to be a BLACK SPOT.

2.2.2 Priority Score Method: In this method, the accidents of one year are considered for finding the priority score (P) using the following formula:

$$P = 5\times F + 3\times GI + MI$$

Where F= No. of Fatalities for a particular location in a particular year
GI= No. of Grievous/ Major Injuries
MI= No. of Minor Injuries

If the P value exceeded 15 for any location for any of the 7 years (2011-2017), they were considered to be a BLACK SPOT.

2.2.3 Fatality Rate Method: According to this method, the FR was calculated according to the formula mentioned below:

$$FR = (\text{No. of fatalities}) / (\text{Total No. of accident})$$

2.2.4 Accident Severity Index: According to this method, ASI was calculated according to the formula mentioned below:

$$ASI = 10\times F + 5\times GI + 3\times MI + 2\times PDO$$

Where F= No. of Fatalities for a particular location in a particular year
GI= No. of Grievous/ Major Injuries
MI= No. of Minor Injuries
PDO= Property Damage Only

2.3 Objectives of the project:

1. Accident data collection from police stations.
2. Analysis the data by using Weighted Severity Index.
3. Analysis the data by using Priority Score Method.
4. Analysis the data by using Accident Severity Index.

DATA ANALYSIS AND RESULT

The Study conduct analysis by using the accidents data collected from the Autonagar, Penamaluru and Kankipadu Police Stations. Analysis of the accidents data as follows

3.1 Gender Wise Analysis:

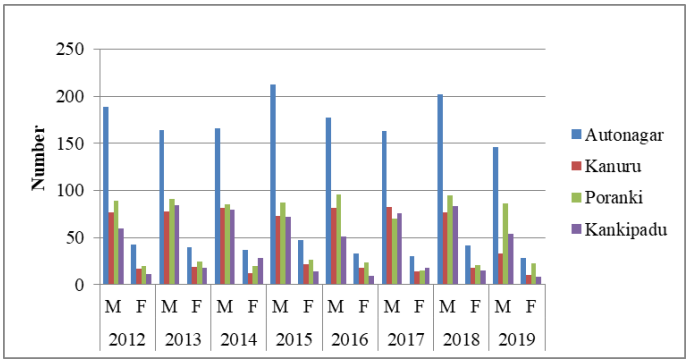

Fig – 1: Gender wise accidents

After conducting gender wise analysis for the accidents data collected from the Autonagar, Penamaluru and Kankipadu Police Stations, The study recognise that the major accidents occurred by the male drivers than the female drivers. In that greater number of accidents occurred at Autonagar region. Kanuru, Poranki and Kankipadu regions had lesser number of accidents occurred than Autonagar region.

3.2 Age Group Wise Analysis:

May-June 2020
ISSN: 0193-4120 Page No. 8892 - 8901

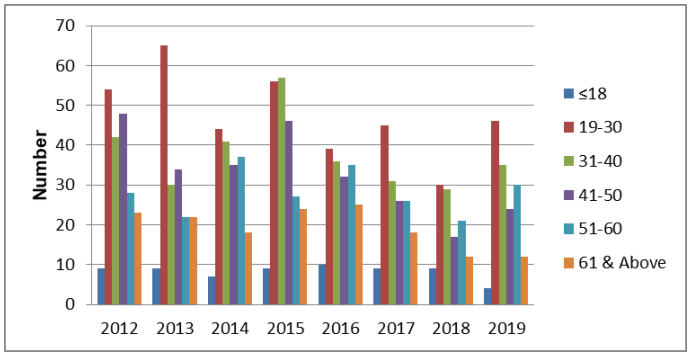

Fig- 2: Age group accidents for Autonagar

After conducting the age group wise analysis at Autonagar for the collected accidents data from the Autonagar police station, we recognise that greater number of accidents done by between 19 and 30 age groups. And next greater accidents done by between 31 and 40 age groups. The remaining age groups are almost similar.

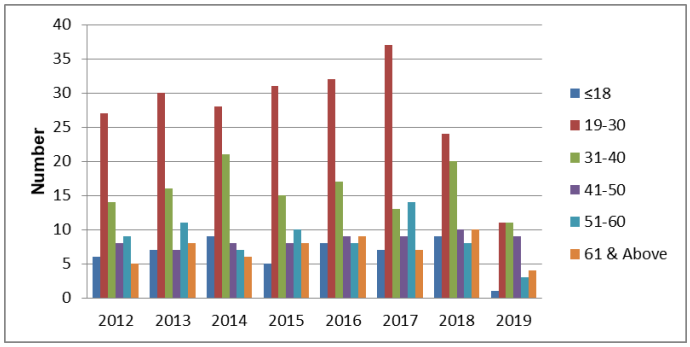

Fig – 3: Age group accidents for Kanuru

After conducting the age group wise analysis at Kanuru for the collected accidents data from the Penamaluru police station, The study recognise that greater number of accidents done by between 19 and 30 age groups. And next greater accidents done by between 31 and 40 age groups. The remaining age groups are almost similar.

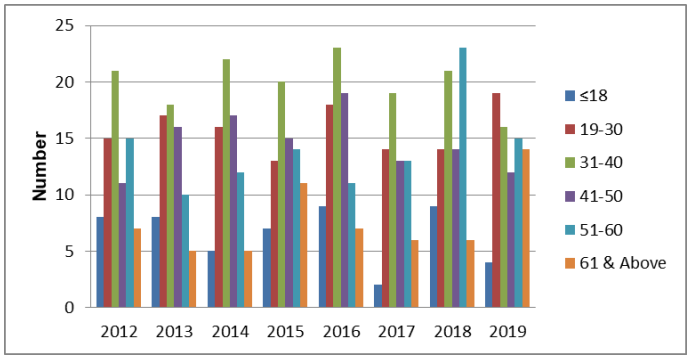

Fig – 4: Age group accidents for Poranki

After conducting the age group wise analysis at Poranki for the collected accidents data from the Penamaluru police station, The study recognise that greater number of accidents done by between 19 and 30 age groups. And next greater accidents done by between 31 and 40 age groups. The remaining age groups are almost similar.

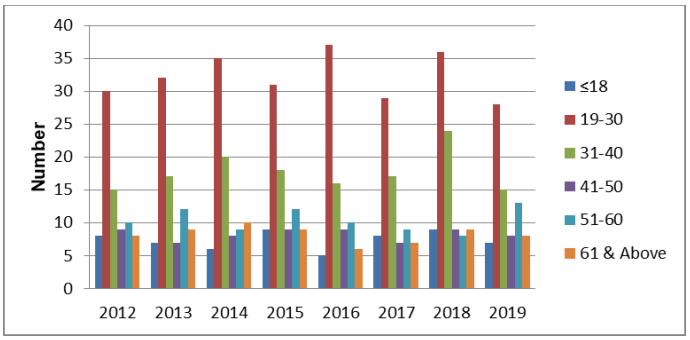

Fig – 5: Age group accidents for Kankipadu

After conducting the age group wise analysis at Kankipadu for the collected accidents data from the Kankipadu police station, The study recognise that greater number of accidents done by between 19 and 30 age groups. And next greater accidents done by between 31 and 40 age groups. The remaining age groups are almost similar.

3.3 Mode Wise Analysis:

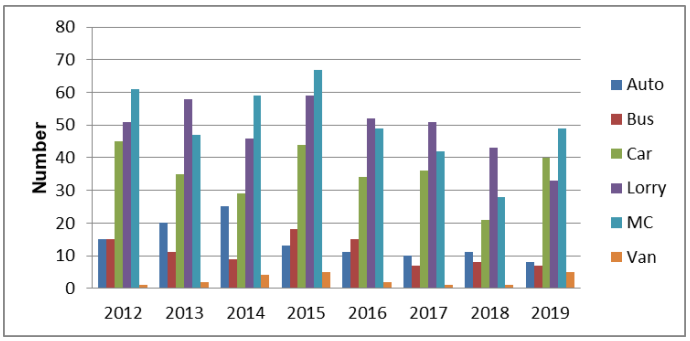

Fig – 6: Mode wise accidents for Autonagar

After conducting the mode wise analysis at Autonagar for the collected accidents data from the Autonagar police station, The study recognise that greater number of accidents done by motor cycles. And next greater accidents done by lorries and cars. The remaining modes are almost similar.

May-June 2020
ISSN: 0193-4120 Page No. 8892 - 8901

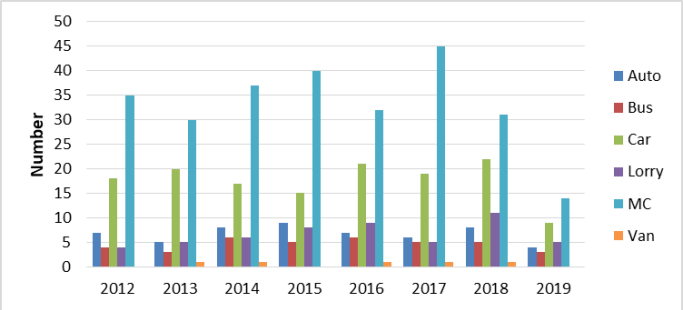

Fig – 7: Mode wise accidents for Kanuru

After conducting the mode wise analysis at Kanuru for the collected accidents data from the Penamaluru police station, The study recognise that greater number of accidents done by motor cycles. And next greater accidents done by lorries and cars. The remaining modes are almost similar.

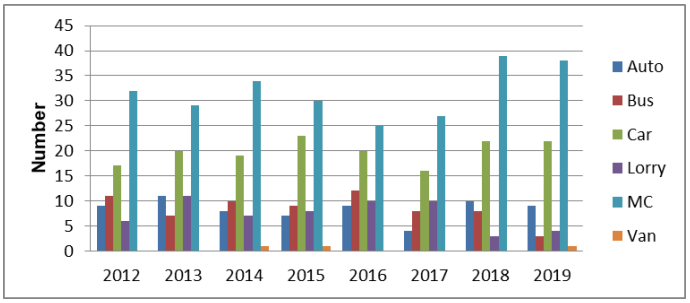

Fig – 8: Mode wise accidents for Poranki

After conducting the mode wise analysis at Poranki for the collected accidents data from the Penamaluru police station, The study recognise that greater number of accidents done by motor cycles. And next greater accidents done by lorries and cars. The remaining modes are almost similar.

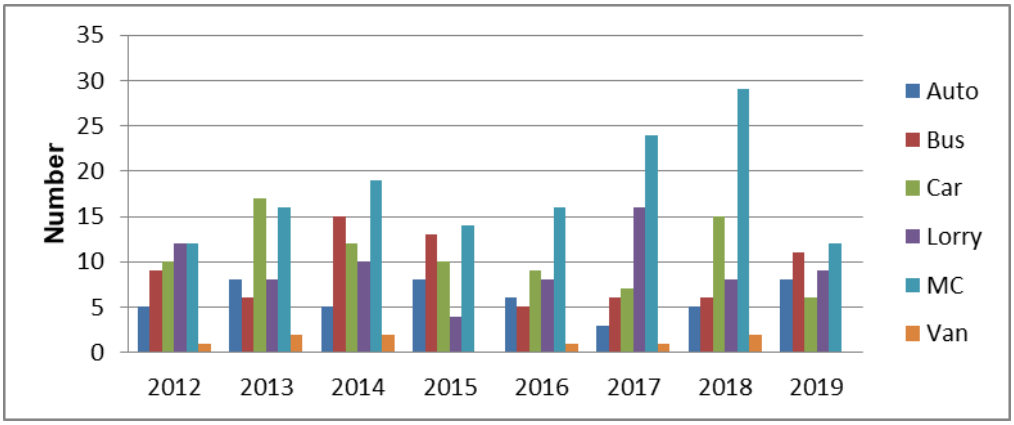

Fig – 9: Mode wise accidents for Kankipadu

After conducting the mode wise analysis at Kankipadu for the collected accidents data from the Kankipadu police station, The study recognise that greater number of accidents done by motor cycles. And next greater accidents done by lorries and cars. The remaining modes are almost similar.

Table 4: Maximum no of accidents at each region as per methods

Region	WSI	P	FR	ASI
Autonagar	72694	11088	1.80	24081
Kanuru	30240	4414	1.36	10440
Poranki	37164	5570	1.53	12641
Kankipadu	29055	4388	1.81	10115

May-June 2020
ISSN: 0193-4120 Page No. 8892 - 8901

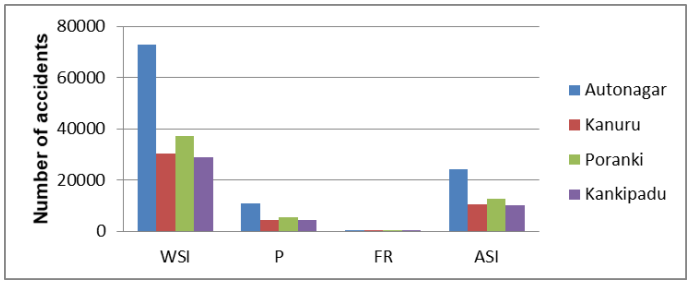

Fig – 10: Maximum number of accidents as per methods

After do the analysis for the fatalities by using accidents data collected from the above specified police stations. Then the study recognised that greater number of accidents occurred at Autonagar region compared to other regions in all four methods. And next greater number of accidents occurred at Poranki region. The remaining two regions Kanuru and Kankipadu are similar accidents number.

3.4 Ranking the Regions:

Table 5: Ranking the regions

Region	WSI	P	FR	ASI
Autonagar	1	1	2	1
Kanuru	3	3	4	3
Poranki	2	2	3	2
Kankipadu	4	4	1	4

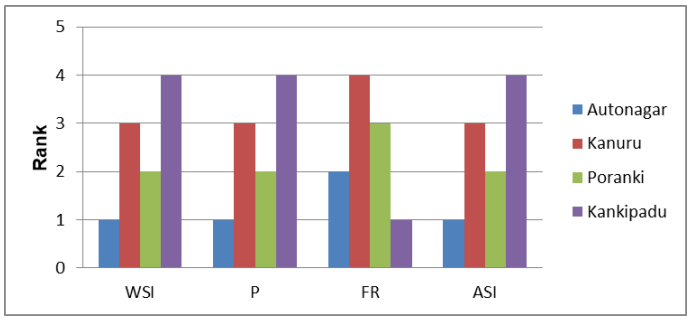

Fig – 11: Ranking the regions

From the tables, the black spots can be found out with their respective ranks. From the WSI, P, FR and ASI values of the black spots, ranking has been done and overall ranking is done taking the average of the WSI, PS, FR and ASI ranks taking into consideration that more the rank, lower severe the black spot. From table 5.6, it is evident that Autonagar region is the most severe black spot followed by Kanuru, Poranki, Kankipadu. Kankipadu has the highest value of fatality rate. Autonagar has the highest value of WSI, ASI and PR.

Findings and Conclusion

The black spots should be dealt with immediate effects in the order of their respective ranks and it should be taken care such that the most severe spots should draw the attention of Vijayawada Police Commissionerate and they should deploy traffic police to these spots to bring everything under control.

Also, speed limit sign boards should be installed and proper road markings should be done in these places so that the speed is under a certain limit (say 40kmph) because even if there are any crashes, the severity can be reduced, which would lead to drastic reduction in the fatality rate.

Proper road markings and sign boards should be installed and use of helmet should be strictly enforced. Severe penalty should be imposed on wrong way driving and on street parking should be reduced. Certain trees and on road activities that hinders the traffic movement and that compromises the visibility should be immediately cleared.

It is observed that the major causes behind the accidents in Vijayawada are as following:

i. Negligent and rash driving, over-speeding
ii. Busy intersections with no control
iii. Drinking and driving
iv. Uneducated drivers
v. No proper road markings
vi. Unavailability of sign boards
vii. No proper bus and auto stops
viii. Wrong way driving

4.1 The recommended countermeasures are:

i. Installation of signal system
ii. Deployment of traffic police
iii. Installation of Speed Limit sign boards at intersections
iv. Educating the drivers and enforcement of the traffic laws

May-June 2020
ISSN: 0193-4120 Page No. 8892 - 8901

v. Clear the obstructions that hinders visibility
vi. Proper road marking and lighting systems
vii. Wrong way driving should be strictly prohibited

4.2 Gender wise analysis:

- Greater number of accidents occurred by the male drivers than the female drivers.
- Autonagar region had recorded accidents on an average of 180 accidents per year.
- Kanuru and Poranki regions had recorded accidents on an average of 90 accidents per year, due to having similar number of accidents.
- Kankipadu region had recorded accidents on an average of 60 accidents per year.
- Autonagar region is the most severe black spot followed by Kanuru, Poranki and Kankipadu regions.

4.3 Age group wise analysis:

- Greater number of accidents done by between 19 and 30 age groups than others.
- Autonagar region had recorded accidents on an average of 50 accidents per year.
- Kanuru and Kankipadu regions had recorded accidents on an average of 30 accidents per year.
- Poranki region had recorded accidents on an average of 20 accidents per year.
- Autonagar region is the most severe black spot followed by Kanuru, Poranki and Kankipadu regions.

4.4 Mode wise analysis:

- Greater number of accidents done by Motor Cycles than others vehicles.
- Autonagar region had recorded accidents on an average of 55 accidents per year.
- Kanuru region had recorded accidents on an average of 35 accidents per year.
- Poranki region had recorded accidents on an average of 25 accidents per year.
- Kankipadu region had recorded accidents on an average of 15 accidents per year.
- Autonagar region is the most severe black spot followed by Kanuru, Poranki and Kankipadu regions.

4.5 Analysis of Fatalities with different methods:

- Autonagar region had an average value of 3000 in previous 8 years.
- Kanuru, Poranki and Kankipadu regions had an average value of 1000 in previous 8 years.
- Autonagar region is the most severe black spot followed by Kanuru, Poranki and Kankipadu regions.

4.6 Ranking the regions:

- Overall ranking is done taking the average of the WSI, P, FR and ASI ranks.
- Ranking is given as, if it has more the rank then it is lower severe the black spot.
- Autonagar region is the most severe black spot followed by Kanuru, Poranki and Kankipadu regions.
- Due to Autonagar is having the less rank.

References

1. Kali Priyo Ghosal, CSRK Prasad. (), "Black Spot Identification in Warangal"
2. Athira Mohan., Dr. V.S. Landge L., Yong Z. (2006), "Identification of Accident Black Spots on National Highway", International Journal of Civil Engineering and Technology (IJCIET) Volume 8, Issue 4, April 2017, pp. 588-596
3. Gourav Grewal, Rahul Bansal, V. K. Ahuja. (2015), "Study on Accident Severity Index, Time of Accident and Vehicle involved in Accident in Hisar City", International Journal of Enhanced Research in Science Technology & Engineering, ISSN: 2319-7463 Vol. 4 Issue 5, May-2015, pp: (128-135)
4. Riadh H, Fedy O, Rafaa M. (2016), "Detection and Classification of Road Accident Black Zones Using Exploratory Spatial Data Techniques", International Journal of Trend in Research and Development, Volume 3(1), ISSN: 2394-9333
5. Rajiv Gupta., Manpreet Singh (2014), "Accident Black-Spot Validation using GIS", 15th Esri India User Conference 2014.

May-June 2020
ISSN: 0193-4120 Page No. 8892 - 8901

6. Mr. Pranav Dholiya1 Mr. Praful Shinkar2 (2016), "Lane-changing in traffic streams", IJSRD - International Journal for Scientific Research &Development| Vol. 4, Issue 02, 2016
7. A Fyhri (2019), " Transportation Research Part F: Traffic Psychology and Behaviour", Volume 60, January 2019.
8. Jacob de Naurois et al (2019)," The Role of Journey Purpose in Road Traffic Injuries: Abayesian Network Approach", Journal of transportation published: 02 Dec 2019.
9. Malin, I. Narros and S. Innamma (2019), "Accident risk of road and conditions of different road types", Accident Analysis & prevention, volume 122, January 2019.
10. Aidan Feeney, Jonathan J. Rolison, Salissou Moutari, Shirley Regev (2018), " What are the factors that contribute to road accidents? An assessment of law enforcement views, ordinary drivers opinions, and road accident records", Accident analysis and prevention, volume115, June2018.
11. B.V. Wee, F. Wegman, M. Hagenzieker, P. Schepers and R. Methorst (2014), " A problem of the safety of vulnerable road users in Montenegro", International Journal of Injury Control and Safety Promotion volume25, June 2018.