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RESEARCH ARTICLE

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DEVELOPMENT OF REGRESSION MODEL FOR ROAD ACCIDENTS BASED ON ROAD PARAMETERS BY USING SPSS

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ABSTRACT

In fast developing countries such as India, transportation plays a vital role. Every phase of development is ultimately depending on transportation, basically road transportation. Mode of travel changes from location to location based on distance, facilities available or provided and conditions. In the current scenario, number of vehicles are drastically increasing on the roads thus causing most uncertainties in the society. These uncertainties in the form of delays, health issues, environmental pollution and accidents causing inconvenience to the fellow traveler and every individual in the immediate vicinity. The goal of this research is to predict accidents at a section or road stretch using various major parameters causing accidents such as road condition (Physio-geometrical characteristics, environment effect etc.) and previous accident data.to determine the accident frequency based on geometric features of the road, time and season and to evaluate most predominant parameter influencing accidents.

The study area used in this particular dissertation is a corridor of length roughly 10KMs starting from Chandanagar to Kukatpally (JNTUH) via National Highway 65. It covers major intersections at Chandanagar, Miyapur X-roads and JNTUH Kukatpally. Using the generalized linear regression equation accident prediction model is developed. SPSS is used in developing this accident prediction model.

Results of this dissertation shows that accident are majorly dependent on traffic volume, horizontal radius of the curve, uncontrolled median openings and basic geometric parameters of the road.

Keywords: Accidents, SPSS, geometric parameters

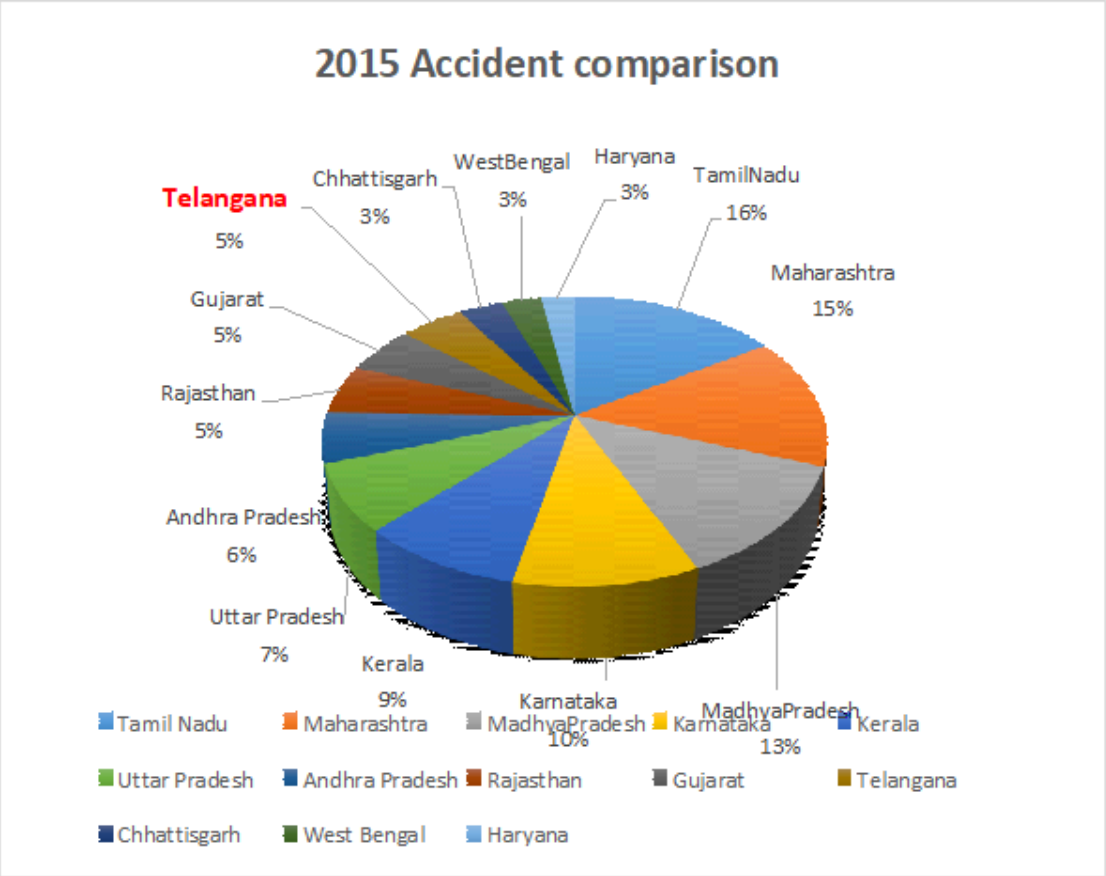
INTRODUCTION

In 2016, India has the second largest road network in the world, spanning a total of 3.33 million kilometers. This is used to transport over 65 per cent of all goods in the country and 80 per cent of the total passenger traffic. National highways are expected to reach 100,000 kilometers by the end of the 2017 from 97,135 kilometers in FY15.

Sales of passenger vehicles increased at a CAGR (Cumulative Annual Growth Rate) of 10.3 per cent to 3.2 million during FY05–15 Sales of commercial vehicles increased at a CAGR of 4.2 per cent to 6,97,083 during FY10–15 Rising per capita income and growing middle class coupled with easier access to finance and a wider price range of vehicles have boosted car sales. It shows the growth of personal motor vehicles recorded in India by year according to official data (Transport Research Wing (TRW), 2016). The official registration data over represent the number of vehicles in actual operation because vehicles that go off the road due to age or other reasons do not get removed from the records. This is because personal vehicle owners pay a

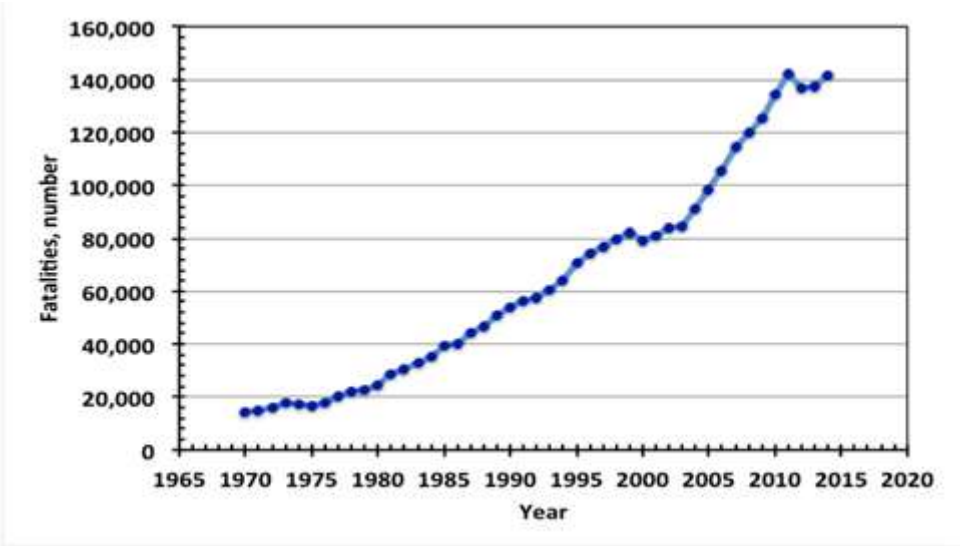
lifetime tax when they buy a car and do not de- register their vehicles when they junk them.

1.1 Recent accident survey in India



1.2 Accidents in the World

Motor vehicle accidents kill about 1.2 million people a year world-wide and the number will grow to more than 2 million in 2020 unless steps are taken, a study released by the World Health Organization (WHO) and the World Bank has found. WHO has revealed in its first Global Status Report on Road Safety that more people die in India due to road accidents than anywhere else in the world, including the most populous country, China.



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NEED AND OBJECTIVES OF THE STUDY

There has been an advancement in the use of technology in solving the problems related to various traffic issues. Research is going on continuously in this field to improve problems related to accidents. Number of methods and models have been developed. Extensive survey data has been used to predict the accident rates and also the relation between various parameters and road accidents.

Number of researches have shown that accidents are most unpredictable and research is being carried out to determine the main causative factors for accidents. Accidents are most common type of incidents on a daily basis. Since this study is limited to road parameters and other features, many models and theories are referred and the possible simplest solution in the form of Linear Regression Model is considered.

OBJECTIVES

- To predict accident rate based on geometric features of the road, speed and traffic volume characteristics.
- To evaluate most predominant parameter influencing accidents.
- To suggest easily implementable engineering solutions to curb accidents

2. RESULTS

Complete accident data along with the severity of accidents are collected, location of accident, condition of pavement, physical characteristics of road such as road width, width of the shoulder, sight distance, number of junctions, signaled or non-signaled, width of road at intersections, traffic volume at various stretches, and traffic trends are also collected.

Table no:2.1 Data collection areas

S. NO	Zones	Divisions	Police Stations
1	Balanagar	Kukatpally	Kukatpally
			Miyapur
			Chandanagar
2		Balanagar	KPHB

Table no:2.2 Accident data for year 2013

Name of the P. S		Year 2013	
	Fatal	Non-Fatal	Total
Chandanagar	34	100	134
Miyapur	48	176	224
Kukatpally	64	173	237
Total	146	449	595

Graphical representation of accidents in year 2013

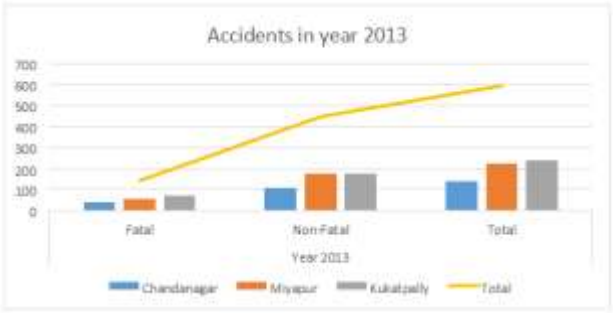
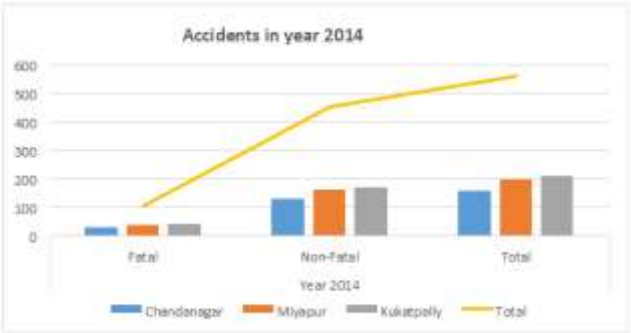


Table no:2.3 Accident data for year 2014

Name of the P. S		Year 2014	
	Fatal	Non-Fatal	Total
Chandanagar	29	127	156
Miyapur	36	159	195
Kukatpally	41	167	208
Total	106	453	559



Graphical representation of accidents in year 2013

Procedure for model development

Step 1: Determine a road network with more number of accidents

Step 2:Collect basic geometric parameters of the road

Step 3:Collect accident data in that location at their respective sources

Step 4:Group the data accordingly with the requirement and arrange them in the required respective procedure in MS Excel.

Step 5: Transfer the data from Excel into SPSS software

Step 6: Develop a multi linear regression model

Step 7: Validate the model by R, R^2 and adjusted R^2 values .

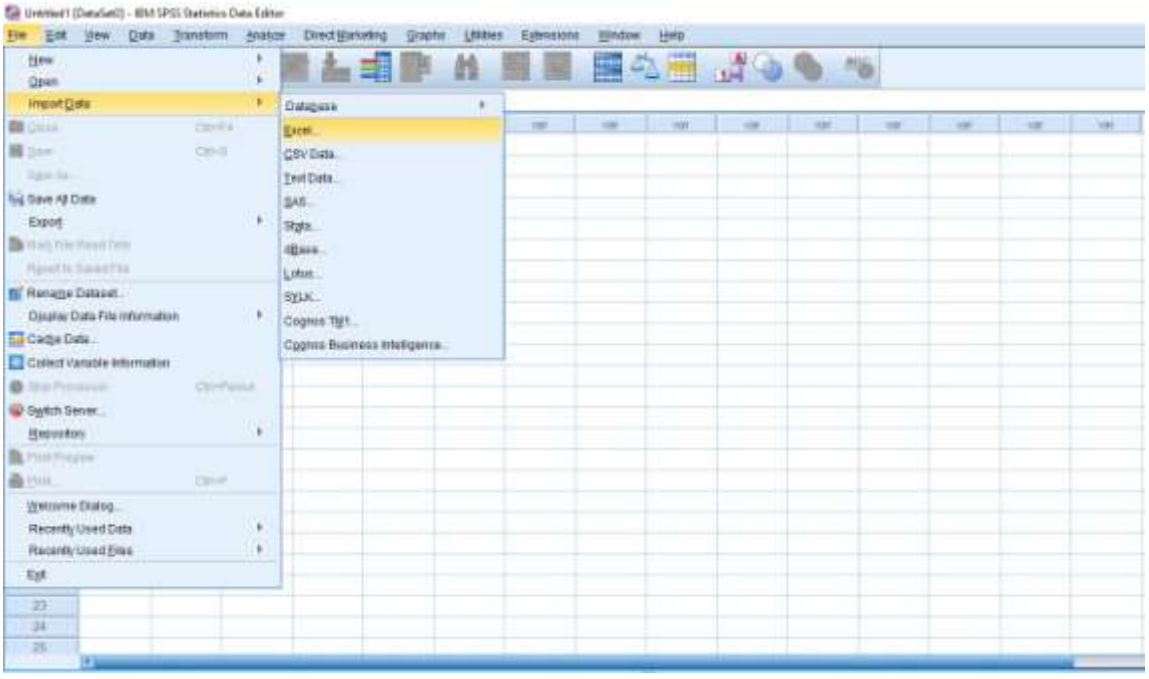
Step 8: Check the significance of various parameters

Step 9: - Finalize the model.

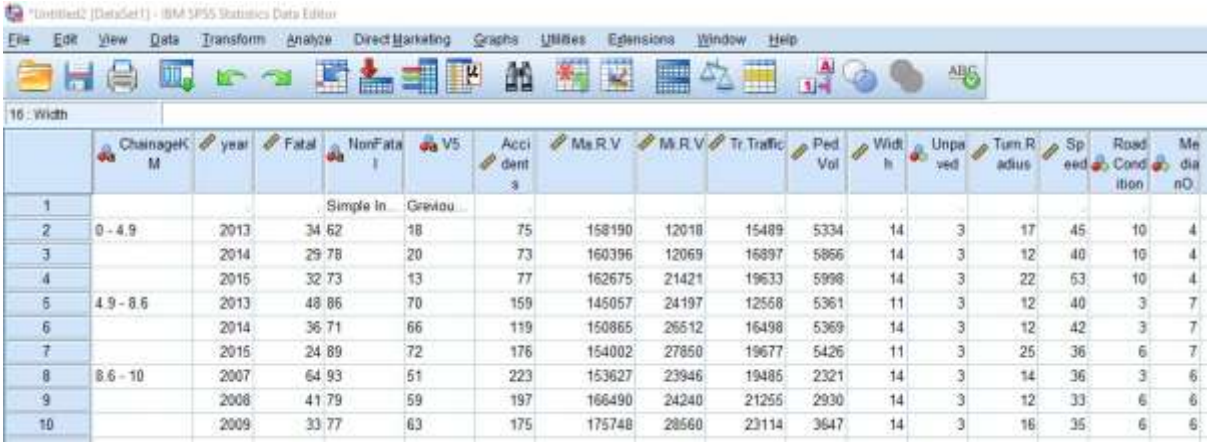
Table no:2.4 Total collected data of accidents and road parameters in year 2013,14 and 2015

Chainage (KM)	year	Fatal	Non-Fatal		Accidents	Traffic Volume	Turning Traffic	Ped. Volume	Road Width	Shoulder Width	Turn. Radi.	Speed	Road Condition	Median Openings
			Simple Injury	Grevious Injury										
0 - 4.9	2013	34	82	18	134	180068	18645	5334	14	3	17	45	10	4
Chandanagar	2014	29	97	20	146	177887	19647	5866	14	3	12	40	10	4
	2015	32	90	13	135	192602	26573	5998	14	3	22	53	10	4
4.9 - 8.6	2013	48	106	70	224	45268	15784	5361	11	3	12	40	3	7
Miyapur	2014	36	93	76	205	190393	19683	5369	14	3	12	42	3	7
	2015	24	101	72	197	194302	24861	5426	11	3	25	36	6	7
8.6 - 10 Kukatpally	2013	64	122	51	237	199496	25340	2321	14	3	14	36	3	6
	2014	41	98	59	198	217890	26438	2930	14	3	12	33	6	6
	2015	33	91	63	187	219317	29682	3647	14	3	16	35	6	6

Clip of screen of SPSS Transferring the data



Clip of screen of SPSS Transferred data:



	ChainageKM	year	Fatal	NonFatal	V5	Accidents	Ma.R.V	Mi.R.V	Tr.Traffic	Ped Vol	Width	Unpaved	Turn.Radius	Speed	Road Condition	Median0
1				Simple In	Greviou											
2	0 - 4.9	2013	34	62	18	75	158190	12018	15489	5334	14	3	17	45	10	4
3		2014	29	78	20	73	160396	12069	16897	5866	14	3	12	40	10	4
4		2015	32	73	13	77	162675	21421	19633	5998	14	3	22	53	10	4
5	4.9 - 8.6	2013	48	86	70	159	145057	24197	12568	5361	11	3	12	40	3	7
6		2014	36	71	66	119	150865	26512	16498	5369	14	3	12	42	3	7
7		2015	24	89	72	176	154002	27850	19677	5426	11	3	25	36	6	7
8	8.6 - 10	2007	64	93	51	223	153627	23946	19485	2321	14	3	14	36	3	6
9		2008	41	79	59	197	166490	24240	21255	2930	14	3	12	33	6	6
10		2009	33	77	63	175	175748	28560	23114	3647	14	3	16	35	6	6

Table no:2.5 Model Raw Format of variables

Model no.	1	2	3
(Constant)	631.521	147.245	-364.28
Traffic volume	0.001	-0.001	0.002
Tr. traffic	0.008	0.001	-0.005
Ped. vol	-0.029	0.0204	-0.031
Width	2.061	-1.85	1.564
Turn. radius	1.191	-2.204	-1.394
Speed	0.124	0.105	-0.208
Road condition	-2.931	-1.956	-2.543
Median openings	0.913	0.953	0.905
Correlation Co-efficient (r)	0.994	0.974	0.824
R^2	0.989	0.95	0.679
Adjusted R^2	0.982	0.933	0.633

The so obtained model gives a rough estimation of the variation of the accident rates with different parameters. Influence of each parameter is likely known. This model can be generalized to many other situations by altering few parameters.

These values are written as

Y= 631.5+1.0E -04MRV +0.8E-04TT - 2.9E-02PV +2.061W +1.191TR +0.124S– 2.931RC + 0.931MP

Where,

Y	Accident rate
MRV	Major Road Volume
TR	Turning Traffic
PV	Pedestrian Volume
W	Width
TR	Turning Radius
S	Speed
RC	Road Condition
MO	Median Openings

3. CONCLUSION

In this dissertation we are going to explain about how the variation of road parameters is influencing the accident rate. Conclusions of this model gives the variation of the accidents with different parameters. Accidents are gradually increasing on the Cyberabad since past few years. Thus this analysis is done in order to determine the parameter contributing mostly towards accidents. The findings of this dissertation give a reasonably good explanation towards the accidents.

- Accident rate prediction is done based on the geometric parameters, speed and traffic volume using multiple linear regression model.
- Major road volume, pedestrian volume and median openings are mainly responsible for the accidents as predicted by the regression model.
- Simple and easy to enforce solutions has been given.
- Accident rate in terms of number of accidents per km-year increases with traffic volume. But the accidents rate in terms of number of accident per millionvehicle kilometer-year (MVKY) decreases with increase in traffic volume.
- Accidents rate per MVKY increases during the study year, whereas, both injury and fatality rate per MVKY show a declining in trend over time.
- Accident prediction model developed in the present study show that number of accidents per km-year increases with AADT and decreases with improvement in road/shoulder condition.

Further scope of study

To conduct structured interviews using a questionnaire of rural and urban people who have met with the accidents and also the number of injured people from the hospitals to know in detail about the nature and reason of the accidents so as they can be further researched to prevent more future accidents. Further research should add to knowledge and to explain why there are higher accident risks among pedestrians on national highways.

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