Prediction of Accident Model on Nh-16 along the Urban Limits of Vishakapatnam

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Abstract— Due to rapid urbanization India is a developing as a nation and safety of road is still in a rapid stage. Accident severity is increasing due to increasing in vehicle and population. Accident leads to deactivation, death, harm to health and property, social suffering and general deficiency of environment. The road traffic accident situation in India is shocking. Various studies show that there is one death at every 2.75 minutes because of road traffic accidents. Road Safety is obligatory to reduce accident involving both human and vehicles there by making the road safer and user friendly to traffic. The number of accidents is mounting up every year due to cumulative vehicles population. To develop road accident prediction model each and every parameter related with the accident is considered and a micro level analysis of road accident is planned. For micro level analysis road traffic accident data of last seven year (2015to 2018) from local police station is collected and a detailed analysis is planned on basis like Hour, year, location, type of collision, type of road, physical feature of road, age group, sex, weather condition etc. On source of this analysis effect of accident is identified. After analysis road traffic accident prediction models is developed based on dissimilar parameter.

Keywords: Accidents, Collisions, Prediction Model, Safety

I. INTRODUCTION

Road safety is considered as one of the most important problem facing in the modern society. It is mainly because of increasing in number of accidents due to increasing in personalized vehicles. According to WHO statistics (2016) about more than 1.35 million deaths on the world roadside and 20 - 50 million people injured every year in road accidents around the world

Accident is an unexpected event that interrupts the completion of an activity. The Predictable accidents are avoidable and unpredictable accidents are unavoidable. Road crash fatalities and casualties have been increasing over the past twenty years. The problem of road accidents around the world is increasingly becoming the main concern of the general public, particularly those in relevant government agencies such as the Ministry of Transport, Ministry of Works and the Traffic Police. It is a known fact that India has one of the highest accident rates in the world because of the rapid growth of motor vehicles in the recent past and the inadequacy of road systems and narrow streets dominated by slow moving vehicles.

Road traffic injury is now the leading cause of death for children and young adults aged 5–29 years, signalling a need for a shift in the current child health agenda, which has largely neglected road safety. It is the eighth leading cause of death for all age groups surpassing HIV/AIDS, tuberculosis and diarrhoeal diseases. The burden of road traffic injuries and deaths is disproportionately borne by vulnerable road users and those living in low- and middle-income countries, where the growing number of deaths is fuelled by transport that is increasingly motorized. Between 2013 and 2016, no reductions in the number of road traffic deaths were observed in any low-income country, while some reductions were observed in 48 middle- and high-income countries. Overall, the number of deaths increased in 104 countries during this period.

Of the 175 countries participating in this report, 123 have road traffic laws that meet best practice for one or more key risk factors. During this review period, ten additional countries (45 in total) have aligned with best practice on drink-driving legislation, five additional countries (49 in total) on motorcycle helmet use, four additional countries (33 in total) have aligned with best practice on the use of child restraint systems, and three additional countries (105 in total) on the use of seat-belts. Less progress has been made on adopting best practice on speed limits, despite the importance of speed as a major cause of death and serious injury.

II. LITERATURE REVIEW

Nachimuthu et al. (2017), their investigation bargains on expectation of street accidents for Chennai city utilizing framework progression approach. For this situation, the re-enactment street accident expectation demonstrates was produced from the base year 2016. Chennai City street accident information was gathered from 2006 to 2016 from Chennai city activity police. In this examination an endeavor is made to distinguish the different variables causing the street accidents. The street mishap forecast show was created utilizing components of human practices, vehicle variables and street factors.

Ramesh et al. (2017) made an endeavor to create street accident models for Hyderabad metropolitan City of India. This investigation was restricted to accident to mishap expectation models and distinguishing the dark spots in Hyderabad city.

Roberto (2017), introduces a novel mishap demonstrating methodology using an adaptable capacity named the trans log work that enables future research to embrace another understanding of the versatility of logical factors. This investigation exhibited the capability of the trans log work NB model to give new experiences into the manners in which that informative factors impact mishap recurrence.

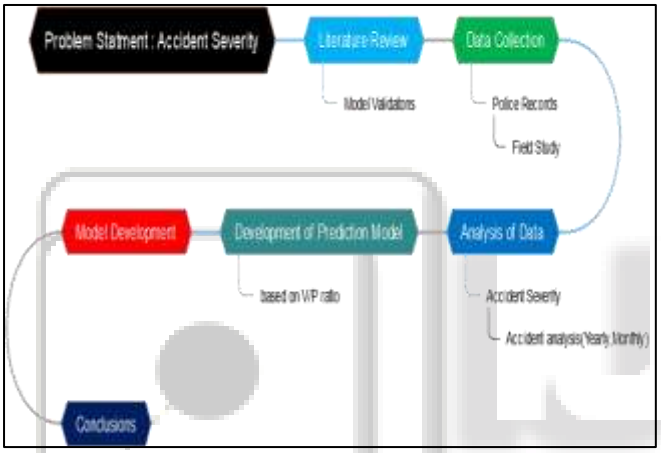
Moghaddam et al. (2016) introduced the examination on expectation of Accident seriousness utilizing counterfeit neuron organize method. This examination uncovered that ANN models can be utilized to gauge crash seriousness and noteworthy crash related elements.

Mustafa et al. (2015), an ANN approach in view of directed unbiased systems to evaluate the quantity of people lethally harmed in engine vehicle accidents and results demonstrated that ANN display is an approach in for viewing fatalities in engine vehicle crashes.

Van Petegem et al. (2014), analysed the road design risk factors for off-road crashes in the rural roads of Netherland. About 50% of all road traffic fatalities and 30% of all traffic injuries in the Netherlands take place on rural roads with a speed limit of 80 km/h. About 50% of these crashes are Run-Off-Road (ROR) crashes. The results comprise two important outcomes. One is a Crash Prediction Model (CPM) to estimate the relative safety of rural roads with a speed limit of 80 km/h in a network. The other is a small set of estimated effects of traffic volume and road characteristics on ROR crash frequencies.

III. EXPERIMENTAL PROCEDURE

A. Methodology



B. Study Location

Visakhapatnam is the largest city, commercial hub and financial capital in the state, third largest city on the east coast of India. The city was identified as one of the fastest-growing in the world, economically and demographically. It is a port city on the southeast coast of Bay of Bengal and often called as "The Jewel of the East Cost" and the "City of Destiny". The city is the headquarters to Eastern Naval Command of the Indian Navy. Its periphery consists of plains along the coast line while the interiors boast of the beautiful hills of the Eastern Ghats. The city is known for heavy industries, steel plant, seaport, natural harbour and shipyard. Visakhapatnam has developed into a major economic destination, it has the sectors like Industrial, Fishing, IT, Pharma, Export & Imports by Sea Trade etc., There are many SEZ's & Industrial corridors such as VSEZ, APSEZ, APIIC, industrial parks etc., The city is one of the tourism destination in the state, and the city is famous for beaches, caves and the eastern ghats as well as wild life sanctuaries. Visakhapatnam is considered as centre for education in the state, it has IIM. The population of the District was recorded as 20, 91,811 in 2019.

C. Preliminary Analysis

Year	Nature of Accidents			No. of	No. of Injuries	
	Fatal	Grievous	Minor	Fatalities	Grievous	Minor
2015	16	92	113	29	129	216
2016	14	48	42	14	62	74
2017	12	36	64	12	74	68
2018	15	42	53	18	54	64

Table 1: Accident details from 2015 to 2018

IV. RESULTS

Year	Accident rate based on Population
2015	12
2016	6
2017	6
2018	6

Table 2: Accident Rate based on Population

Year	Fatal Accident rate based on Population %
2015	29
2016	24
2017	21
2018	26

Table 3: Accident rate based on Fatal Rate

KM	LOCATION	Car/jeep	LCV	BUS	TRUCKS	HCV	TOTAL
682.90	Anandapuram	6978	1675	1789	22354	45	32841
704.90	Visakhapatnam	7984	2312	2102	23356	56	35810
741.256	Anakapalli	7623	1709	4140	21032	72	34578

Table 4: Average 7-day daily traffic

Nature of Accident	No. of Accidents	% of Accidents
Overturning	92	17
Head on collision	52	10
Rear end collision	48	9
Collision brush	52	10
Right angled collision	84	15
Skidding	86	16
Right turn collision	43	8
Hit tree	60	11
Hit n run	30	5
Total	547	100

Table 5: Analysis w.r.t Nature of Accident

Type of Area	No. of Accidents	% of Accidents
Near school or College	29	5
Near or inside a Village	42	8
Near a factory	38	7
Near a religious Place	52	10
In bazar	52	10
Near office complex	42	8
Near hospital	43	8
Residential area	42	8
Open area	30	5
Bus stop	34	6
Petrol pump	33	6
Pedestrian crossing	36	7
Effected by Encroachments	42	8
Recreation place	32	6
Total	547	100

Table 6: Analysis w.r.t location wise

A. Model Validation

The linear regression models are developed for prediction of total accidents, considering number of total accidents as dependent variable (Y) and vehicular population (V/P) ratio as independent variable(X). The models developed will take the following form:

$y = a + bx$

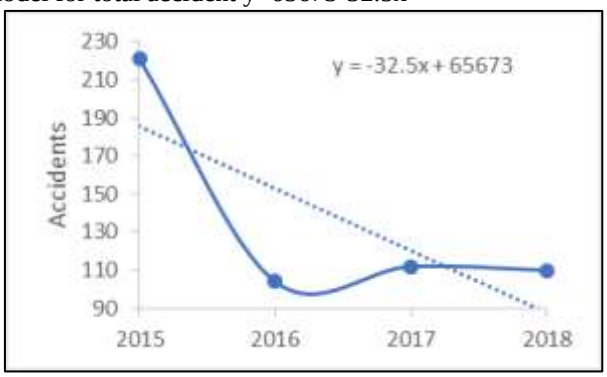
Where y = number of total accidents

x = population ratio (for year2015 to 2018)

b = Coefficient for Independent variable

a = Constant (Estimated parameter)

Model for total accident y=65673-32.5x



The multiple linear regression models are developed for prediction of total accidents considering number of total accidents as dependent variable(Y) and vehicular population as independent variable (X). Data for population for year 2015 to 2019 from Census is considered. Population considering as an independent variable and the multiple linear regressions are carried out.

The Models developed will take the following form:

$Y = b_1x_1+b_2x_2+\ldots\ldots\ldots\ldots+b_nx_n+a$

Where y = number of total accidents per year

X_1 = Volume of Motor Cars

X_2 = Volume of Jeeps

X_3 = Volume of Two Wheelers

X_4 = Volume of Buses

X_5= Volume of Ag Tractors

X_6= Volume of HCV

X_7= Volume of LCV

b_1, b_2, b_3, b_4, b_5 are coefficient

a = Estimate Parameter (Constant)

Vehicle	Count	V/P ratio
Motor Cars	2650	0.03
Jeeps	825	0.009
Two Wheelers	25460	0.29
Tractors	1011	0.01
Buses	456	0.005
Agricultural Tractors	820	0.009
HCV	1950	0.02
LCV	850	0.009

Table 7: Analysis of Vehicle Statistics

Model for total accident

$y=0.03x_1+0.009x_2+0.29x_3+0.01x_4+0.005x_5+0.009x_6+0.02x_7+0.009x_8+65673$

V. CONCLUSION & FUTURE SCOPE

A. Conclusion

On the basis of the analysis carried out the following conclusions were drawn-

1) During the last five years the number of killed peoples (accident severity) of the city is decreasing year to year.
2) The highest cause of the accident is fault of driver and 2W type of vehicle in the city.
3) Accident is increasing with increasing of type of vehicle and population
4) Maximum numbers of accidents are reported in the month of March and April.
5) Most accused type of vehicles causing accidents are the heavy vehicles like trucks and the victims are pedestrians and two-wheeler riders.
6) The accidents occurring during day and night are almost equal in proportions.
7) Highest numbers of accidents have occurred near the villages where the National Highway is passing.
8) Almost 90% - 95% of the cause of accidents is recorded as the fault of the driver.
9) Total Vehicular Traffic volume in that Motorized Vehicular volume, Segment length, V/C ratio, pedestrian volume, Speeds are showing negative results with accidents. If those are increasing accidents may also increase.

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