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THE EFFECT OF DRIVER BEHAVIOUR ON TRAFFIC SAFETY

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ABSTRACT

Motor vehicle accidents are a major cause of death. Many factors contribute to traffic accidents. Some involve planning, design, construction, operation, surface condition, and policing of the roadways. The most deadly factor is human error. This includes unawareness of traffic rules and roadway condition; lack of driving skills; poor judgment; failure to interact and adjust to prevailing roadway conditions; and most importantly, aggressive driving. Preliminary findings of a survey questionnaire conducted in this study show that improper engineering design, inadequate traffic control, lack of traffic management, and traffic congestion are the main factors leading to aggressive driving and road rage on National highway.The main objectives of this study are to identify behaviors and mistakes that drivers make; based on a questionnaire, which make us traffic accidents in Roadways and highlight their effect on traffic safety. Also, to propose effective countermeasures to reduce the frequency and severity of traffic accidents. The analysis is based on the questionnaire by using SPSS software to predict accident rates and compare the results with the model reports developed from the data collected by Drivers. The data for this study will be collected from a survey questionnaire which is distributed to a sample of drivers in Roadways. The data from the questionnaire will be analyzed and using in formation of regression.

Keywords—survey questionnaire; SPSS; traffic safety; countermeasures

I. INTRODUCTION

Road traffic safety refers to the methods and measures used to prevent road users from being killed are seriously injured. Typical road users include pedestrians, cyclists, motorists, vehicle passengers, and passengers of on road public transport. The basic strategy of a safe system approach is to ensure that in the event of a crash, the impact energies remain below the threshold likely to produce either death or serious injury. This threshold will vary from crash scenario to crash scenario, depending upon the level of protection offered to the road users involved. World health organization in the global status report on road safety estimates that road traffic injuries are 9th leading cause of death. However, in 2030 WHO predicts that in 2030 it is going to be 5th even before HIV /AIDS. Road traffic is a dynamic system dependent on the regulated relation between users, vehicles and environment. This is still a very simplified definition. It is a complex system with almost seamless number of variables, which can influence the probability of causing accidents. Today safety is one of the key challenges for transportation research. There is a broad scientific consensus that most of the traffic accidents are due to human error. Quantifying human factors that influence traffic safety requires valid and reliable indicators.More importantly most of the studies identified driving behavior and drivers attitudes, including excessive speed, to be the major contributing factors to traffic causalities. Aggressive driving has become norm on our Highways.

II. IMPORTANCE OF HIGHWAY SAFETY

As the number of motor vehicles and vehicles –miles of travel increases throughout the world, the exposure of the population to traffic accidents also increases. Highway safety is a worldwide problem; with over 500 million cars and trucks in use, more than 50,000 people die each year in motor vehicle crashes, and about millions are injured (WHO 2007). In the United States, motor vehicles accidents are the leading cause of death for people between the ages of 1-34 years and rank 3rd as the most significant cause of years of potential life lost, after cardiac disease and cancer (FHWA 2010, NHTSA 2010). In the United States between 1966 and 1992 the number of vehicle miles travelled has increased from about one trillion to 2.1 trillion, whereas fatality rates

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have declined from 5 per million vehicle miles to less than 2 per million vehicle miles. In 1994, there were fewer than 40,000 fatalities on the nation's highway, as opposed to 50,000 in mid -1970s (public security directorate 2010, DOT 2007, 2008). The total number of road accidents increased by 2.5 percent from 4, 89,400 in 2014 to 5, 01,423 in 2015. The total number of persons killed in road accidents increased by 1.4 percent from 4, 93,474 in 2014 to 5,00,279 in 2015. The severity of road accidents, measured in terms of number of persons killed per 100 accidents has increased from 28.5 in 2014 to 29.1 in 2015. [5] proposed a system about Efficient Sensor Network for Vehicle Security. Today vehicle theft rate is very high, greater challenges are coming from thieves thus tracking/ alarming systems are being deployed with an increasingly popularity .As per as security is concerned today most of the vehicles are running on the LPG so it is necessary to monitor any leakage or level of LPG in order to provide safety to passenger. Also in this fast running world everybody is in hurry so it is required to provide fully automated maintenance system to make the journey of the passenger safe, comfortable and economical. To make the system more intelligent and advanced it is required to introduce some important developments that can help to promote not only the luxurious but also safety drive to the owner. The system "Efficient Sensor Network for Vehicle Security", introduces a new trend in automobile industry.

Table 2.1: Accidents in Karnataka according to causes in the year 2016

Sl.No.	Cause of accident	No. of accidents	%	No. of deaths	%
1	**Fault of the drivers**	**31,922**	**72**	**7598**	**70**
2	Fault of cyclist	398	1	122	1
3	Fault of drivers of other vehicles	3865	9	966	9
4	Fault of Pedestrian	640	2	269	3
5	Fault of passengers	278	1	61	1
6	Defect in Vehicles	945	2	195	2
7	Poor light conditions	503	1	91	1
8	Defect in road conditions	565	1	160	2
9	Result of weather conditions	616	1	160	2
10	Other Causes	4279	10	1234	9
Total		**44011**		**10856**	

III. METHODOLOGY

The methodology and steps undertaken for collection and organization of data and presenting the findings of investigation the methodology of research indicates the general pattern of organizing the procedure for gathering valid and reliable data for the purpose of investigation. The methodology of the study includes the description of research design, population, sample size, sampling technique, development and description of tool, data collection procedure and method of analysis and the limitations of the study have been explained.

A. Data Collection

This study is based on a questionnaire of two parts: the first part aims to explore and study the aggressive behaviour of drivers. The second part aims to collect data about accidents and its main causes that are related to drivers' behaviours. The collected data will be used to form prediction regression models by using SPSS program (Statistical Package for Social Sciences) to predict accident and accidents rates in NH.

B. Methods used in Data Collection

Information gathering by surveying, a questionnaire method is used. A questionnaire is a written list of questions, the answers to which are recorded by respondents. In a questionnaire respondents read the questions, interpret what is expected and then write down the answers. In the case of questionnaire, as there is no one to explain the meaning of questions to respondents, it is important that:

1. The questions are clear.
2. Easy to understand.
3. Also, the layout of questionnaire should be such that to be easy to read and pleasant to eye.
4. The sequence of the questions should be easy to follow.

A questionnaire should be developed in an interactive style. This means respondent should feel as if someone is talking to them. In a questionnaire, a sensitive question or a question respondents may feel hesitant about answering should be prefaced by an interactive statement explaining the relevance of the question. It is a good

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idea to use a different font for these statements to distinguish them from the actual questions. The questionnaire conducted on driver behavior are as follows.

1. Age
2. Gender
3. Speed
4. Maximum Speed
5. Glaring Effect
6. Running Yellow light
7. Running Red light
8. Seat Belt Usage
9. Breaking Suddenly
10. Tailgating (Moving Close to Take Revenge)
11. Use of Verbal abuse
12. Improper Lane change (Without Signaling)
13. Illegal parking or stopping
14. Travel above Speed Limit Even has more than enough time to Reach Destination
15. Using Cell phones while driving
16. Overtaking other vehicles where prohibited
17. Drinking alcohol and driving
18. Fail to wear helmet
19. Accident details, if any.

C. Analyze the data using SPSS

i. Statistical Techniques

Treatment of data by applying appropriate statistical measure is must to justify the objectives of the study. The investigator followed the appropriate procedure in applying the proper statistical treatment for the analysis of the data in which includes, Chi square test.

ii. Chi square test (χ^2 - Test)

The chi-square test is a statistical test that can be used to determine whether observed frequencies are significantly different from expected frequencies. For example, after we calculated expected frequencies for different allozymes in the HARDY-WEINBERG module we would use a chi-square test to compare the observed and expected frequencies and determine whether there is a statistically significant difference between the two. As in other statistical tests, we begin by stating a null hypothesis (H0: there is no significant difference between observed and expected frequencies) and an alternative hypothesis (H1: there is a significant difference). Based on the outcome of the chi-square test we will either reject or fail to reject the null hypothesis.Chi-square may be defined as,

$$\chi^2 = \Sigma\ (Oi - Ei)^2\ Ei \sim \chi^2\ (n-1)\ d.f$$

Where,

Oi = Observed frequencies,

Ei = Expected frequencies, Expected value can be calculated from the formula = (Row Total X Column Total) Total Frequency

χ^2= the chi--square test statistic

O= Observed count or frequency

E= Expected count or frequency

N = Total number of observations

RT= Row total

CT= Column total

IV. DATA COLLECTION

This study is based on a questionnaire of two parts. The first part aims to explore and study the aggressive behaviour of drivers and the second part aims to collect data about accidents and its main causes that are related to driver's behaviour.

We conducted survey on Driver Behaviour for 1350 drivers the below table gives information about the number of respondents and place where we collected the data.

Table 4.1: No. of Respondents at different places

Sl. No.	Date	Place	No. of Respondents

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1.	17/03/17	Bagepalli Toll Gate	96
2.	23/03/17	Peresandra	112
3.	24/03/17	Chickballapur Bus Stop	155
4.	30/03/17	Pranav Hotel,Chadhalapura	165
5.	31/04/17	Nandi Cross	120
6.	06/04/17	Bagepalli Bus Stop	135
7.	07/04/17	Kamath Hotel, Ramdevanagudi	178
8.	13/04/17	SJCIT, Chickballapur	62
9.	14/04/17	SJCIT, Transportation Section	30
10.	15/04/17	Devanahalli Bus Stop	118
11.	16/04/17	Devanahalli Toll Gate	179

Table 4.2: Driver Aggressive Behaviour Vs Percentage of Respondents

Rank	Aggressive Behaviour	% of Respondents		Have You Ever Conducted this Behaviour	
		Yes	No	Yes	No
1	Speed	55	--	1350	0
2	Maximum speed	80	--	1350	0
3	Glaring	69.4	30.6	772	578
4	Running yellow light	58.6	41.4	718	632
5	Running red light	38.2	61.80	616	734
6	Fail to wear helmet and Seat Belt	36.0	64.0	605	745
7	Breaking suddenly	52.0	48.0	685	665
8	Tailgating	51.2	48.8	681	669
9	Taking revenge	30.6	69.4	578	772
10	Use of Verbal abuse	52.0	48.0	685	665
11	Improper lane change without signaling	48.6	51.4	668	682
12	Illegal parking or stopping	42.8	57.2	639	711
13	Travel above speed limit even have more time	68.40	31.60	767	583
14	Using cell phones while driving	51.6	48.4	683	667
15	Overtaking other vehicle where prohibited	32.0	68.0	585	765
16	Drinking alcohol and Driving	16.4	83.6	507	843
17	Accident details	44.2	55.8	646	704

V. DATA ANALYSIS USING SPSS

Table 5.1: Chi square test for Age of the driver and Speed of the driver

AGE of the driver (years)	SPEED in kmph					Total
	< 40	40 - 60	60 - 80	80 -100	> 100	
< 18	0	3	9	4	0	16

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18 – 30	65	290	243	154	30	782
30 – 45	27	163	100	57	21	368
45 – 60	42	80	34	18	3	177
> 60	0	4	3	0	0	7
Total	134	540	389	233	54	1350

Interpretation

Calculated χ^2	Degree of Freedom	Critical χ^2	Result
79.99	16	26.29	Null Hypothesis Rejected

Inference: Table 5.1shows a calculated χ^2 - value of 79.99 for 16 d.f. and a critical χ^2 - value of 26.29 at 0.05 alpha level. Since the calculated χ^2 - value is greater than the critical χ^2 - value, Null hypothesis is rejected. Thus, it indicates speed of the driver is not uniformly distributed on the age of the driver Or speed of the driver is depends on the age of the driver.

Table 5.2: Chi square test for Age of the driver and Alcoholic behaviour

AGE of the driver (years)	ALCOHOLIC		Total
	No	Yes	
< 18	0	3	16
18 – 30	65	290	782
30 – 45	27	163	368
45 – 60	42	80	177
> 60	0	4	7
Total	134	540	1350

Interpretation

Calculated χ^2	Degree of Freedom	Critical χ^2	Result
15.665	4	9.49	Null Hypothesis Rejected

Inference: Table 5.2 shows a calculated χ^2 - value of 15.665 for 4 d.f. and a critical χ^2 - value of 9.49 at 0.05 alpha level. Since the calculated χ^2 - value is greater than the critical χ^2 - value, Null hypothesis is rejected. Thus, it indicates Alcoholic behaviour of the driver is depends on the age of the driver.

Table 5.3: Chi square test for Age of the driver and Use of Mobile

AGE of the driver (years)	USE OF MOBILE		Total
	No	Yes	
< 18	9	7	16
18 – 30	293	489	782
30 – 45	172	196	368
45 – 60	85	92	177
> 60	4	3	7

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Total	563	787	1350

Interpretation

Calculated χ^2	Degree of Freedom	Critical χ^2	Result
14.595	4	9.49	Null Hypothesis Rejected

Inference: Table 5.3 shows a calculated χ^2 - value of 14.595 for 4 d.f. and a critical χ^2 - value of 9.49 at 0.05 alpha level. Since the calculated χ^2 - value is greater than the critical χ^2 - value, Null hypothesis is rejected. Thus, it indicates use of mobile phone of driver depends on the age of the driver.

Table 5.4: Chi square test for Age of the driver and Impatient behaviour

AGE of the driver (years)	IMPATIENT		Total
	No	Yes	
< 18	10	6	16
18 – 30	302	480	782
30 – 45	161	207	368
45 – 60	94	83	177
> 60	4	3	7
Total	571	779	1350

Interpretation

Calculated χ^2	Degree of Freedom	Critical χ^2	Result
16.436	4	9.49	Null Hypothesis Rejected

Inference: Table 5.4 shows a calculated χ^2 - value of 16.436 for 4 d.f. and a critical χ^2 - value of 9.49 at 0.05 alpha level. Since the calculated χ^2 - value is greater than the critical χ^2 - value, Null hypothesis is rejected. Thus, it indicates impatient behaviour of driver depends on the age of the driver.

Table 5.5: Chi square test for Age of the driver and Running Signal

AGE of the driver (years)	RUNNING SIGNALS		Total
	No	Yes	

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< 18	16	0	16
18 – 30	368	414	782
30 – 45	209	159	368
45 – 60	124	53	177
> 60	7	0	7
Total	724	626	1350

Interpretation

Calculated χ^2	Degree of Freedom	Critical χ^2	Result
54.151	4	9.49	Null Hypothesis Rejected

Inference: Table 5.5 shows a calculated χ^2 - value of 54.151 for 4 d.f. and a critical χ^2 - value of 9.49 at 0.05 alpha level. Since the calculated χ^2 - value is greater than the critical χ^2 - value, Null hypothesis is rejected. Thus, it indicates running the traffic signals behaviour of driver depends on the age of the driver.

Table 5.6: Chi square test for Age of the driver and Use of Seat Belt

AGE of the driver (years)	SEAT BELT		Total
	No	Yes	
< 18	10	6	10
18 – 30	240	542	240
30 – 45	122	246	122
45 – 60	65	112	65
> 60	0	7	0
Total	437	913	437

Interpretation

Calculated χ^2	Degree of Freedom	Critical χ^2	Result
12.628	4	9.49	Null Hypothesis Rejected

Inference: Table 5.6 shows a calculated χ^2 - value of 12.628 for 4 d.f. and a critical χ^2 - value of 9.49 at 0.05 alpha level. Since the calculated χ^2 - value is greater than the critical χ^2 - value, Null hypothesis is rejected. Thus, it indicates usage of seat belt of driver depends on the age of the driver.

Table 5.7: Chi square test for Age of the driver and Lane Change behaviour

AGE of the driver (years)	LANE CHANGE		Total
	No	Yes	
< 18	10	6	16
18 – 30	293	489	782

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30 – 45	180	188	368
45 – 60	108	69	177
> 60	7	0	7
Total	598	752	1350

Interpretation

Calculated χ^2	Degree of Freedom	Critical χ^2	Result
48.962	4	9.49	Null Hypothesis Rejected

Inference: Table 5.7 shows a calculated χ^2 - value of 48.962 for 4 d.f. and a critical χ^2 - value of 9.49 at 0.05 alpha level. Since the calculated χ^2 - value is greater than the critical χ^2 - value, Null hypothesis is rejected. Thus, it indicates sudden lane change behaviour of driver depends on the age of the driver.

VI.CONCLUSIONS AND SUGGESTIONS

A. CONCLUSIONS

1. It was found that the drivers' behavior is considered aggressive, according to the first part which represents the participant's opinion weather they listed the behavior as aggressive or not, and the second part which represent weather the participants conducted this behavior or not. It was found that the highest aggressive behaviors are as follows:
   - Excessive high speed
   - Impatience
   - Use of mobile phone
   - Alcoholic consumption
   - Running signals
   - Sudden lane change
2. There was a strong direct relationship between the driver behaviors and their exposure to accidents. In conclusion, the aggressive behavior increases the chance of exposure to accidents.
3. The main causes of traffic accidents, injuries, and fatalities that are related to driver behavior are:
   - Close following and tailgating
   - Lane violations and zigzag driving or passing
   - Being unfocused, and distraction
   - Yield violations for other vehicles and pedestrians
   - Sudden turning and stopping
   - Wrong u-turning and backing
   - Speeding over the speed limit
   - Violations of traffic signs and signals including running on red light

B. SUGGESTIONS

The following recommendations are needed to improve traffic safety:

1. It is recommended to improve the driver behavior through the following:
   - Increase enforcement
   - Education and awareness for drivers and pedestrians
   - Increase the role of the Police Friends and the Secret Police
   - Use high technology surveillance of driver behavior such as using stationary and moving radars and cameras.

- To have a daily news report through the T.V. and Radio stations about the daily traffic accidents, and to show the human losses and the injuries caused by these accidents, also to talk about the social and financial losses that can result.
- To force drivers who repeat traffic violations to suspend their driving license and to attend training courses concerning traffic laws and regulations.
- To increase the penalties for speeding, close following, running red light eating, drinking, smoking, using cell phones, zigzag driving, and yield violations.
- To start educating our children in schools about traffic safety rules and regulations. Also, encourage the students at university level to take traffic safety course.
- To encourage drivers to drive defensively and to obey traffic rules and regulations in all circumstances.
- To increase the number of traffic police patrols on the most hazardous and dangerous streets and intersections.

2. Widen the study area to include most areas, Municipality, and to include more variables in the regression models such as road geometric features and Traffic characteristics.
3. Train all the traffic personnel to deal with the statistics programs such as SPSS software and keep them updated with the recent studies and researches regarding traffic safety issues.
4. Update the traffic police personnel with the most common mistakes drivers make, and to give them monthly classes on dealing with traffic safety and congested traffic.
5. To have more collaboration and coordination between all traffic and transportation agencies to improve traffic safety and achieve the goal of reducing traffic accidents frequency and severity.
6. The urgent need to adopt and implement a practical traffic safety strategy that has clear targets, objectives, action plans, time frame, and legislations.

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