iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** VI **Month of publication:** June 2017

DOI:

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

Volume 5 Issue VI, June 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Study on Road Accidents and Safety Measures along Selected Roads in Tiruchirappalli, India

Dr. G. Nagasubramaniyan[1], N. Satyanarayan[2]
[1]Associate Professor, Dept. of Humanities and Social Sciences, National Institute of Technology Tiruchirappalli 15, India
[2]M. Tech Transportation Engineering and Management, Dept. of Civil Engineering, National Institute of Technology Tiruchirappalli 15, India.

Abstract: ***One of the undesirable features of road transport is its poor record of road safety. Majority of accidents are due to over speed of vehicles irrespective of speed limits in urban areas. Road accidents cause heavy loss to the families of people met with accidents, charges incurred in hospitalization and treatment and damages to vehicles and property. So it is necessary to improve road safety and transport facilities to tackle the vehicle mobility problems in our country. Engineers who specialized or specializing in Transportation Engineering have to endeavour a lot to solve the traffic congestion problem all over the world where in India is also not exceptional. Faulty traffic signalling systems, inadequate, narrow road spaces and overtaking tendency of drivers create pro-longed traffic congestion. Currently, this study introspects the importance of road safety and preparation of safety audit in Indian scenario taking Tiruchirappalli as the study area. In order to study road accidents and road infrastructure in five routes namely 1.Williams Road 2.EVR Puttur Road 3.Convent Road 4.Bishop road 5.Victoria road.***
Keywords: Speed, Accidents rates, Road Inventory Survey, Congestion, Road Safety Audit, Multiple Linear Regression.

I. INTRODUCTION

Road transport is the backbone of modern society and plays a vital role in Nations economy. Transportation in urban areas is highly complex because of the modes involved, the multitude of origins and destination, the amount and variety of traffic. The transport development is still not able to meet the urban mobility demand. Despite the on-going improvements in this sector, several aspects of undesirable problems due to out-dated infrastructure and lack of investments in major parts of the country. The demand for infrastructure has been rising year by year with the current infrastructure being unable to meet the traffic demands of the people. Hence it is pervasive that the Transportation engineering discipline has to have a focus on highway safety with view to reduce road accidents. The safety on highways can be improved by implementing counter-measures in one or more general categories of the vehicle, the driver or the roadway.

A. Urban Road Safety Management In Trichy Town

The most elementary method of road safety management is by imposing speed limits and it should be compatible with the road design. Safety management is simply a way of adopting various methods such as legislation, road layout measures, awareness, campaigns or advanced technology to help in regulating the speed of vehicles. Safety management is not necessarily about reducing speed, but to a considerable extent it is about planning and designing the road layout and road network in such a way that an appropriate speed is obtained. The most commonly used technique in speed management is known as “Traffic Calming”. This technique has mainly been used in local areas to reduce the speed or the traffic flow. Some of the safety implementing management measures include: Speed limits that are in alignment with design of the road, Traffic calming, Driver education and Public announcements, Traffic signal synchronization to encourage less stops if legal speeds are maintained. Signs that provide speed feedback to drivers to increase their awareness of speeding, minimize number of accidents.

B. Urban Road Safety Audit Toolkit Parameters

Checklist parameters information is listed below from the source of Urban Road Safety Audit (URSA) 2013 by the Ministry of Urban Development (MoUD) are 1.Speed measure, 2.Footpath and pedestrian accessibility, 3. Lighting for road users, 4. Signage, 5. Motorized vehicle safety, 6.Intersection. We shall use the concepts behind the road safety in a nutshell.

II. OBJECTIVES

A. The objective of this study is to assess the road infrastructure score by using road safety audit

B. To develop a statistical relationship between road accidents and other factors like traffic volume, speed measure, road length

and road infrastructure leading to road accidents.

III. METHODOLOGY

It is proposed to study the movement of vehicles in Tiruchirappalli City Corporation area. The observations reveal that there are many road accidents take place due the serious influx of vehicles into the city. Hence an attempt is made to study the occurrences of accidents, various factors responsible for causing accidents in the study area in order to establish the reason, causes for road accidents.

The five roads 1.Williams road 2.EVR Puttur road 3.Convent road 4.Victoria road 5. Bishop road have been covered in the study in order to assess the road accidents. Secondary data about accidents for the selected road network have been collected and recorded for the period covering 2012-2015 through Government sources. The number of fatal and non-fatal accidents occurring along the roads and the number of victims met with accidents have been analyzed in percentages form for the period 2013-2015 from the data. Primary data on traffic volume count has been collected for the selected roads during peak hour i.e. from 5.30 PM to 6.30 PM and percentage analysis has been used to find the number of accidents.. For assessing the road infrastructure, table 1 shows weightage of parameter, design elements involves checklist parameters 1.Speed 2.Footpath and pedestrian accessibility 3.Signage 4.Lighting 5.Motorized vehicle safety and 6.Intersection are taken from the source of Urban Road Safety Audit(URSA) given by the Ministry of Urban Development (MoUD). With a view to get results for the collected data Multiple Linear Regression analysis is used to analyse the primary and secondary data collected for the study keeping dependent variable is road accidents and independent variables such as traffic volume, road length, spot speed and road infrastructure.

Table 1 Weightages of different road access mode type

Access Mode Type	Speed	Footpath and Pedestrian accessibility	Lighting	Signage	Motorized vehicles safety	Intersections and Midblock
Weight	4	4	3	2	1	1

(Source: Urban Road Safety Audit toolkit given by Ministry of Urban Development in the year 2013.)

IV. DATA ANALYSIS

A. Accident Scenario In Tiruchirappalli

Accident data (source: Tiruchirappalli Traffic Police Control Room) analysis gives an overview of the number of fatal and non-fatal accidents occurring in Tiruchirappalli city. The table 2 shows the number of accidents occurred in selected five roads for the period covering 2012 to 2015. It can be seen that, Williams, EVR Puttur, Convent contribute to more number of accident which is mainly due to over speeding and lack of proper speed management.

Table 2 Number of Accidents on the selected roads

SL.NO	ROAD NAME/YEAR	2012	2013	2014	2015
1	WILLIAMS ROAD	15	19	17	14
2	EVR PUTTUR ROAD	18	17	17	16
3	VICTORIA ROAD	14	15	12	14
4	CONVENT ROAD	10	12	11	12
5	BISHOP ROAD	16	10	11	13

From the above Table it is clear that road accidents are decreased in year 2015 when compare to year 2014. In the year 2013 number of accidents are occurred more as one compare remaining years. The cited table reveals that EVR-Puttur road is prone to more accidents than the other roads.

Volume 5 Issue VI, June 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

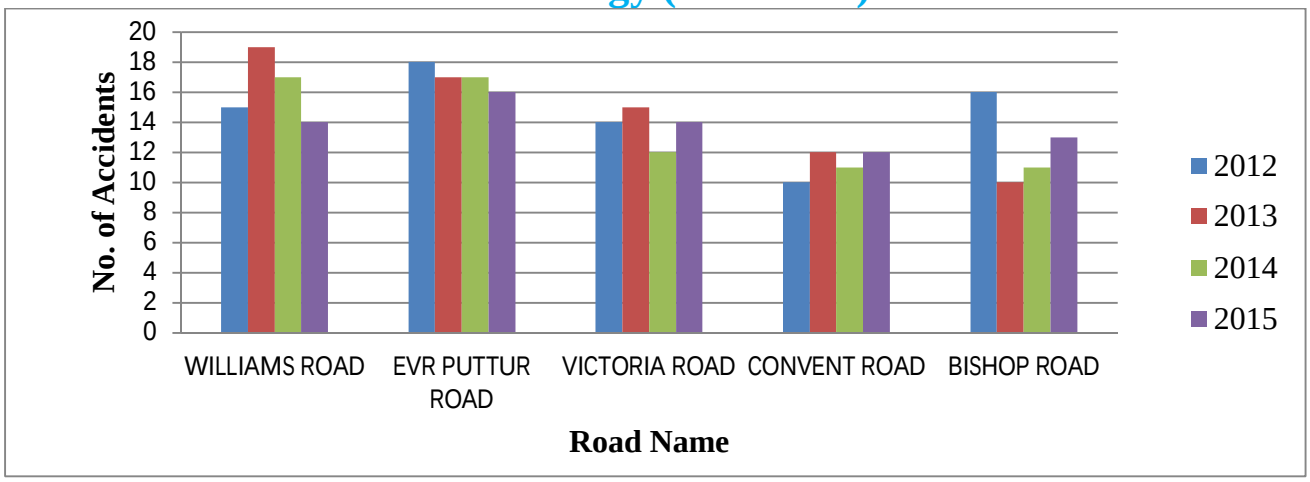


Fig 1 Bar Chart Of Road Accidents

The figure 1 shows the Yearly analysis of accident data on selected roads between the years 2012 and 2015. Further the above chart portraits that accident rate has been decreasing all roads except the Convent road. More accidents occurred in Puttur road and less number of accidents occurred in convent road between the years 2012 and 2015 when compared to other roads chosen for the study.

B. Traffic Volume Studies

Traffic volume count has been carried out by manual method by taking surveys along the study area i.e. along the selected five roads. The volume count analysis along the study area is carried out and analyzed according to IRC: 106-1990, "Guidelines for Capacity of Urban roads in Plain areas". The rate of flow of traffic at a particular road section is the service volume of the road.

C. Traffic Volume Analysis

The volume count surveys and analysis have been carried out for the selected five roads for peak hour traffic within the city by manual methods which conform to the IRC:106-1990. The peak hour volume along the five roads i.e. Williams, EVR Puttur, Bishop, and Victoria road are shown in the Table 3.

Table 3 Traffic Volume Counts on the selected road network

SL. NO.	ROAD NAME	PCU/hr	
		Up (%)	Down (%)
1	Williams Road	2679 (23.1)	2808 (27.1)
2	EVR Puttur Road	2871 (24.8)	2147 (20.7)
3	Bishop Road	1932 (16.7)	1345 (13)
4	Victoria Road	1846 (15.9)	2054 (19.8)
5	Convent Road	2237 (19.3)	1992 (19.2)

Table 3 states that EVR Puttur road has more Traffic Volume with 5018 PCU per hour in both directions whereas it can be inferred that Victoria road has Traffic Volume with 3900 PCU per hour.

D. Comparative analysis of Traffic volume

The traffic characteristics changes along with time period. The traffic volume during the 2013 and 2016 are compared to analyze the

Volume 5 Issue VI, June 2017
ISSN: 2321-9653

changes that have occurred in the traffic characteristics. The figure 2 shows the comparison of the peak hour volumes during the these two years.

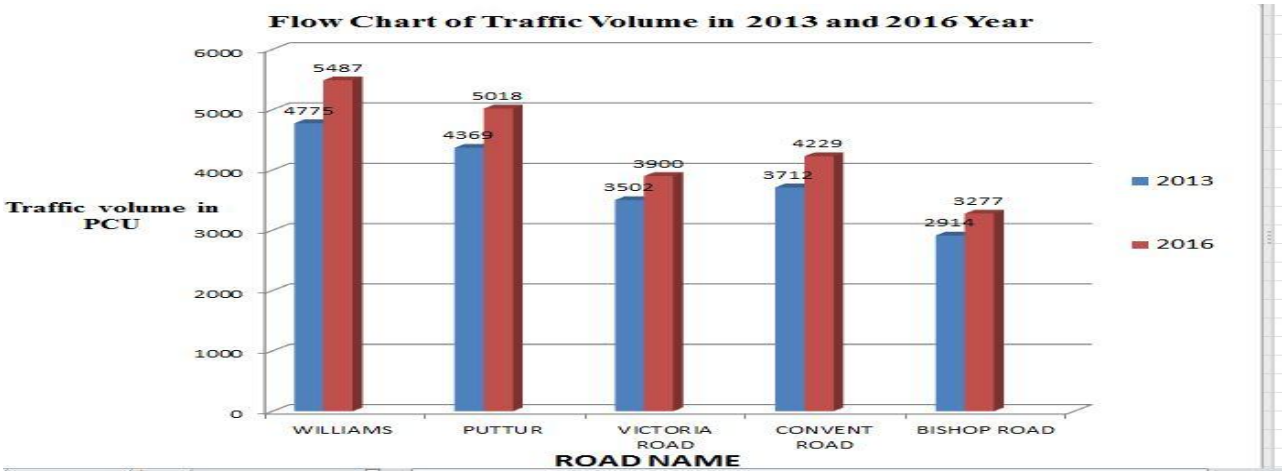


Figure 2 Comparison of Peak Hour Volume (2013 and 2016)

From the figure 2, Traffic volume in Williams road is increased from 4775 to 5487 PCU/hr. between the year 2013 and year 2016 and in Bishop Road it is 2914 to 3227 PCU per Hour in these periods in Victoria road it is gone up from 3502 to 3900 PCU per Hour between these period 2013 and 2016.

The peak hour volume increases from 2013 to 2016 for Williams, EVR Puttur, Bishop, Victoria, Convent road since the number of registered vehicles are increasing year by year. The Table 4 shows the model share of Two-Wheeler, Car, Bus/Truck and others (Auto, cycles)

Table 4 For percentage mode share of Two-Wheeler, Car, Bus/Truck and others (Auto, cycles)

SL. NO	NAME OF ROAD	Total PCU/hr.		2-Wheeler (Percentage)		Cars (Percentage)		Bus/Truck (Percentage)		Others(Auto, Cycles) (Percentage)	
		2013	2016	2013	2016	2013	2016	2013	2016	2013	2016
1	Williams	4775	5487	64	65	18	17	6	7	12	11
2	Puttur	4369	5018	69	65	15	18	4	6	12	15
3	Victoria	3502	3928	65	67	16	13	6	7	15	13
4	Convent	3712	4229	68	64	17	16	3	4	12	16
5	Bishop	2914	3227	64	66	18	17	6	7	12	10

From the table 4 it is clear that almost 70-85 percent of the traffic volume is comprised of Two-Wheeler and cars. All type of

Volume 5 Issue VI, June 2017
ISSN: 2321-9653

vehicle composition is gone up to 11 to 13 percentage during these three years (2013 and 2016). The percentage of Two-Wheeler is increased in Williams, Victoria and Bishop roads at two percent in 2016 than 2013. The percentage is decreased in Puttur and Convent road at four percentages in 2016 than 2013. Car percentage is increased in Puttur and Bishop road at two percentage remaining all roads, it is decreased up to 1.5%. Bus/Truck volume is increased in all roads with average 1.5 percentage annually. Others (Auto, Cycle) vehicle compositions is increased in Convent road and Puttur road at 3.5%. This vehicle volume decreased in Williams, Victoria, Bishop Road at 2 percentage in the period between year 2013 and 2016.

E. Road Infrastructure Score By Urban Road Safety Audit

Road infrastructure scores have been given to the selected roads based on the checklist parameters are taken from the source of Urban Road Safety Audit (URSA) 2013 given by the Ministry of Urban Development (MoUD) in India Overall quality measure parameters score for all roads have been given in table 5

Table 5 Overall quality measure parameters score to all roads

Access Mode Type	Quality score	Weight	Total Quality score on Williams road	Total Quality score on EVR Puttur road	Total Quality score on Victoria road	Total Quality score on Bishop road	Total Quality score on Convent road
Speed	100	4	400	400	400	400	400
Footpath and Pedestrian accessibility	26	4	104	156	196	136	248
Lighting	35	3	105	150	105	150	150
Signage	20	2	40	80	80	120	120
Motorized vehicles safety	20	1	20	80	80	40	80
Intersections and Midblock	67	1	67	49	68	48	68
Total score			49	59	62	59	62

F. Summary Of Road Infrastructure Score

From the recommendations of Urban Road Safety Audit (URSA) by Ministry of Urban Development (MoUD) 2013 all the five roads scored 100 in speed measure, so as for quality measure in speed all the roads are good condition. Footpath and pedestrian accessibility quality measure for Williams road and Bishop road are in very poor condition, Convent road and Victoria road are in good condition. Lighting for pedestrian quality measure for Williams road and Victoria road are in medium condition, Bishop road, EVR Puttur road and Convent road are in good condition. Signage quality measure for Williams road is in poor condition. EVR Puttur road and Victoria roads are in medium condition. Bishop road and Convent road are in good condition. Motorized vehicle safety quality measure for Bishop road is in medium condition,. Williams road is in poor condition, EVR Puttur road, Convent road and victoria road are in good condition. Intersection parameter quality measure for Bishop road and EVR Puttur road are in medium

condition, Williams road, Convent road and Victoria road are in good condition.

G. Multiple Linear Regression Analysis

In statistics, linear regression is an approach for modelling the relationship between a scalar dependent variable y and one or more explanatory variables (or independent variables) denoted X. The case of one explanatory variable is called simple linear regression. For more than one explanatory variable, the process is called multiple linear regressions.

Here dependent variable is also called as the regressed variable or study variable, while independent variable is also called as repressor variable or explanatory variable. In this analysis number of road accidents kept as dependent variable and traffic volume, road infrastructure score, road length, spot speed are treated as independent variables.

Regression of dependent variable Accident data and independent variables Traffic Volume in PCU per Hour, road infrastructure score, length of the road, average speed of vehicles by using Microsoft Excel gave the Linear relationship:

Y = 0.000218*X(Traffic volume in pcu per hour)+0.153404*W(Average speed) -0.00391*Z(Length of the road) -0.23734*S(Road infrastructure score)+24.85242 with $R^2 = 1$. Regression analysis summary output has been shown in table 7.

Table 6 Multiple Linear Regression Analysis:

Road Name.	Traffic Volume in PCU per Hour	Speed in km/hr.	Road length in meters	Road Infrastructure score	No of Accidents in 2015
Williams	5487	34	930	49	16
EVR Puttur	5008	31	690	59	14
Victoria	3900	28	840	62	12
Convent	4229	29	720	71	14
Bishop	3277	28	920	59	10

Table7 Regression analysis summary output:

Variables	Coefficients	Lower 95%	Upper 95%	Lower 95.0%
Intercept	24.85241847	24.85242	24.85242	24.85242
traffic volume	0.000217988	0.000218	0.000218	0.000218
Speed	0.153403776	0.153404	0.153404	0.153404
Distance	-0.003908318	-0.00391	-0.00391	-0.00391
Infrastructure score	-0.237336906	-0.23734	-0.23734	-0.23734

Multiple Linear Regression equation is:

Y = 0.000218*X+0.153404*W-0.00391*Z-0.23734*S+24.85242 where is Y is a depending variable that is number of accidents and independent variables such as X is a traffic volume, W is a Average speed, Z is a Road length and S is a road infrastructure score. By the equation from regression analysis is clearly inferred that if traffic volume and average speed on the road increases then number of accidents on the road increases. If road infrastructure and road length increases then road accidents on the road decreases.**(**please refer appendix 1 result of Multiple Linear regression analysis **)**

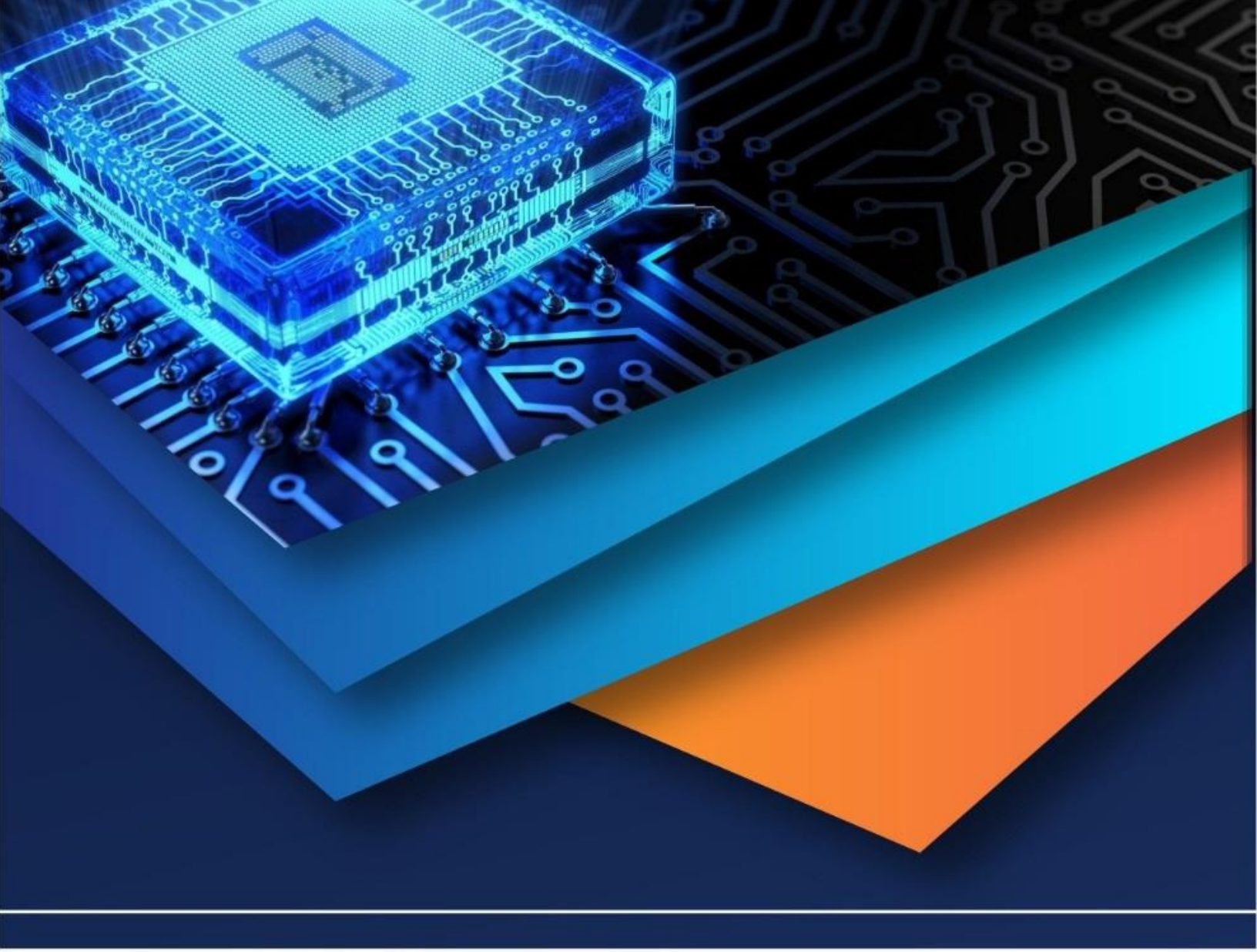
V. CONCLUSION

The analysis of Traffic volume and accident analysis clearly suggest the need for Road Safety Audit must be prepared in Tiruchirappalli traffic authority. Number of vehicles increase the congestions parameters, irrespective lane behaviour causing problem to regular movement of traffic. From this study, it is found that, Williams, Convent road have high traffic volume. Convent road has more infrastructure score and Williams road has less infrastructure score as compared to remaining three roads. So improvement of road infrastructure is needed in Williams road for Footpath and pedestrian accessibility, Signage and Motorized vehicle safety parameters. Improvement of road infrastructure is need in Bishop road for Motorized vehicle safety and footpath and pedestrian accessibility parameter. The vulnerable road users should be warned or message should be enforced to follow the rules and regulations to assure the safety of traffic at any stretch of the road. For reducing accidents on the roads speed of vehicles and

traffic volume on the road have to be decreased and road infrastructure has to be increased.

WORKS CITED

[1] Bagi, A.S. and D.N. Kumar (2007) Study on Road Accidents and Safety Audit on Urban Roads. IOSR Journal of Mechanical and Civil Engineering (IOSRJMCE), 2, 92-97.
[2] Ghosh, S.K., M. Parida and K. Uraon (2004) Effect on road safety by roadway condition, traffic and manmade features. International journal of civil engineering and technology (IJCIET), 32, 12-17.
[3] Gunasekaran, K. and S. Kartikeyan (2016) Road Accidents Analysis in TNSTC, Madurai-Forecasting and Prevention. Conference on Transportation Systems Engineering and Management (CTSEM), 3, 117-126.
[4] IRC: SP: 88-2010, Manual on Road Safety Audit, 35-46.
[5] Jaiswal, A. and A. Batore (2016) Effect on road safety by roadway condition, traffic and Manmade features. International Organization of Scientific Research (IOSR), 7, 42-48.
[6] Joshua, R. J. (2013), A Method to Quantify Road Safety Audit Data and Results. International Journal of Civil Engineering and Technology (IJCIET), 18, 32-39.
[7] Mahmud, K.L., Anjali and V. K. Ahuja (2012) Study on Non Motorized vehicles behavior on Urban Roads. International journal of civil and environmental engineering, 14, 35-42.
[8] Maxwell, B., G. Gopalkrishna and A. Adnan (2011) Study on Evidence-based road safety practice in India. International Organization of Scientific Research (IOSR), 24, 48-54.
[9] National Crime Records Bureau (2014), Ministry of Home Affairs, 4, 34-39.
[10] Palma, A.D., Saransh and S.K Khajal (2011) Study on Road congestion and Road accidents on Urban roads. International Journal of Civil Engineering and Technology (IJCIET), 12, 91-96.
[11] Satya, R. V. Traffic Congestion Impacts under Indian Conditions- A case study on Trichy Roads. M.Tech Thesis, National Institute of Technologies, Tiruchirappalli. Thesis, 2013.
[12] Shivam, G., Paramjeet and V. K. Ahuja (2012) Study of accidents due to High Vehicle Density and Road Condition and their Remedial Actions. International journal of Engineering and Sciences, 9, 38-44.
[13] Sikdar, P.K. and J.N. Bhavsar (2009) Impacts of Roadway condition and manmade features on road safety. International journal of civil and environmental engineering, 17, 78-84
[14] Vinay, A. Road Safety Audit of Selected Roads in Tiruchirappalli city. M. Tech Thesis, National Institute of Technologies, Tiruchirappalli. Thesis, 2013.
[15] Zegeer, C.V. and M. Bushell (2010) Pedestrian crash trends and potential countermeasures from around the world. International Organization of Scientific Research (IOSR), 18, 26-32.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY