

# A Research Paper on Traffic Regulating System to Avoid Road Accidents and Traffic Jam at Signal Cross Road

Dr. Pritesh Prajapati<sup>1</sup>, Pragnesh H Prajapati<sup>2</sup>

<sup>1</sup>Professor of Kalol Institute of Research and Technology Centre

<sup>2</sup>Student of Master in Machine design Kalol Institute of Research and Technology Centre)

**Abstract:** Nowadays in india people are not aware about traffic rules and regulations. Generally people do not follow the traffic rules. It happens when even red light turns on still people do not stop their vehicle and try to cross the road. That is why due to lack of awareness of traffic rules and regulations traffic consumption is occur at cross road and accident may occur. So people getting trouble during transportation mostly at peak hours. We were think that to invent one system which can aware the people for awareness of traffic and reduce the trouble regarding to traffic consumption and accidents. So the system is 'Traffic Regulating System'. In which, we will decide to make wedge shape element for stopping the vehicle with the use of mechanically operated system which will not allow to cross the road while red light is on. This project is also applicable to BRTS .

## 1. Introduction

- In present time the main issue control the traffic violation or traffic jam.
- The need is to reduce the traffic violation or traffic jump by using instrument

Nowadays in India people are not aware about traffic rules and regulations. Generally people do not follow the traffic rules. It happens when even red light turns on still people do not stop their vehicle and try to cross the road.

That is why due to lack of awareness of traffic rules and regulations, traffic consumption is occur at cross road and accident may occur. So people getting trouble during transportation mostly at peak hours.

Another problem is that a large amount of energy is wasted at the speed breaker due to weight of the vehicle, every time a vehicle passes over it.

So to illuminate the street light at night we need to provide electricity from municipal electricity board. That could be

very costly and consuming high amount of resources. So that, overall cost increases.



**Figure:** Violation of traffic rule at red signal

## 2. Problem Formulation

As per Research data published by Govt of india Ministry of road transport highways , Transport research wing New Delhi

**Table 1.1: Road Accidents, Registered Vehicles and Road Length in India (1970-2017)**

Year	Road Accidents ('000)	Road Accident Deaths ('000)	Road Accident Injuries ('000)	Registered Vehicles ('000)	Road Length ('000 km)	Fatality rate (no. of accident deaths per 10,000 vehicles)	Vehicle density (no. of vehicles per km of road)
1970	114	15	70	1401	1,189	103.50	1.18
1980	153	24	109	4,521	1,492	53.09	3.03
1990	283	54	244	19,152	1,984	28.25	9.65
2000	391	79	399	48,857	3,316	16.15	14.73
2010	500	135	528	1,27,746	4,582	10.53	27.88
2015	501	146	500	2,10,023	5,472	6.96	38.38
2016	481	151	495	2,30,031	5,603	6.55	41.05
2017	465	148	471	NA	NA	-	-

**Table 3.1: Road accidents, fatalities and injuries by road category - 2016 & 2017**

Road category	2016			2017		
	No. of Accidents	Persons Killed	Persons Injured	No. of Accidents	Persons Killed	Persons Injured
National Highways	1,42,359 (29.6)	52,075 (34.5)	1,46,286 (29.6)	1,41,466 (30.4)	53,181 (36.0)	1,42,622 (30.3)
State Highways	1,21,655 (25.3)	42,067 (27.9)	1,27,470 (25.8)	1,16,158 (25.0)	39,812 (26.9)	1,19,582 (25.4)
Other Roads	2,16,638 (45.1)	56,643 (37.6)	2,20,868 (44.6)	2,07,286 (44.6)	54,920 (37.1)	2,08,771 (44.3)
<b>Total</b>	<b>4,80,652</b>	<b>1,50,785</b>	<b>4,94,624</b>	<b>4,64,910</b>	<b>1,47,913</b>	<b>4,70,975</b>

*Note: Figures in parentheses represents percentage shares in the total of respective columns.*

**Table 3.6: Accidents at road junctions by type of traffic control - 2017**

Traffic control	Number of accidents	Persons Killed	Persons injured
Traffic light signal	16563 (9.4)	4058 (7.5)	15547 (8.9)
Police Controlled	13577 (7.7)	4114 (7.6)	12590 (7.2)
Stop Sign	11140 (6.3)	3346 (6.2)	10812 (6.2)
Flashing Signal/Blinker	10549 (6.0)	2896 (5.4)	10644 (6.1)
Uncontrolled	124024 (70.5)	39560 (73.3)	124486 (71.5)
<b>Total</b>	<b>175853</b>	<b>53974</b>	<b>174079</b>

*Note: Figures in parentheses represents percentage in the total of respective columns.*

**Table 6.1: Road accidents by type of traffic rules violations - 2017**

Traffic rules violation	Number of accidents	Persons Killed	Persons injured
Over-speeding	3,27,448 (70.4)	98,613 (66.7)	34,3083 (72.8)
Driving on wrong side	29,148 (6.3)	9,527 (6.4)	30,124 (6.4)
Drunken driving/consumption of alcohol & drug	14,071 (3.0)	4,776 (3.2)	11,776 (2.5)
Use of mobile phone	8,526 (1.8)	3,172 (2.1)	7,830 (1.7)
Jumping red light	6,324 (1.4)	1,826 (1.2)	5,977 (1.3)
No violation & not known	79,394 (17.1)	29,999 (20.3)	72,185 (15.3)
<b>Total</b>	<b>4,64,910</b>	<b>1,47,913</b>	<b>4,70,975</b>

*Note: Figures in parentheses are percentage share in the total of respective columns.*

- From upper past data we can say this is very big problem so we should take some initiative to tackle or reduce accidents at traffic signal.
- By doing so we can save number of lives and it will lead to increase in GDP of india
- As the number of vehicles is increases this problem became major so all public should strictly follow traffic rules otherwise it will become very big issue.
- India has very worst record regarding this because lots of people are not follow rules , to reduce it we have to take initiatives.

### 3. Objective

I think that to invent one system which can aware the people for awareness of traffic and reduce the trouble regarding to traffic consumption and accidents at cross road. So the systemis 'Traffic Regulating System for Urban City'. In which, we decide to make wedge shape element for stop thevehicle with the use of mechanically operated system which will not allow vehicles to cross the road while red light is turn on.

On the base of observation, one conclusion has been carried out that lots of vehicles are passing through the road in urban city. For taking the advantage of weight of that vehicles we will produce electrical energy with the help of such mechanical elements. This both aspects can be applicable for BRTS project.

- The objective of this project is to design and FEM analysis of device which control the traffic violation
- Estimation of linear stress, strain and deformation of different materials by linear static structural analysis.
- Determination of mechanism at different divisions in order to evaluate whether the design is safe or not.
- Dynamic analysis to find the different modes and their natural frequencies in vibrational conditions.

#### 4. Methodology

- Geometric Modeling: Here the shapes are studied and are mostly two or three dimensional, although many of its tools and principles can be applied to sets of any finite dimension.
- Finite element Model: The three Dimensional Model created using UG is imported to FE software ANSYS and is meshed and that model is called as Finite elemental model.
- Linear Static structural Analysis.

##### Elements of traffic regulating system:-

For considering 4.2 meter wide road CAD model of traffic regulating system was prepared. Mechanism consist following components

- 1) Wedge
- 2) Foundation & base plate
- 3) Hydraulic cylinder
- 4) Reservoir
- 5) Hose pipe
- 6) Direction control Valve (DCV)
- 7) Pressure regulating valve (PRV)
- 8) Flow control valve (FCV)

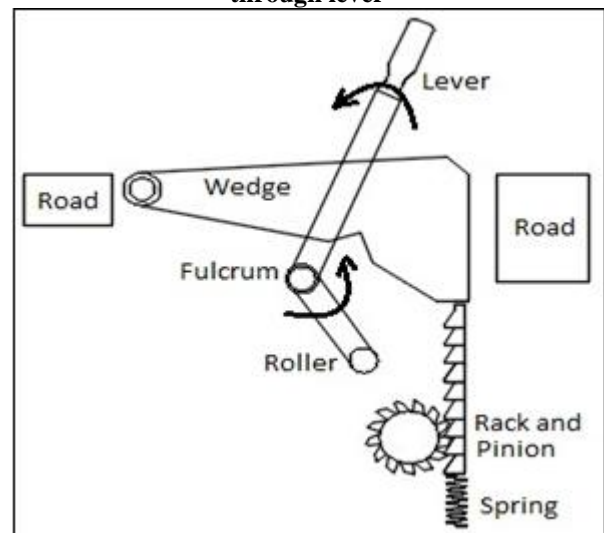
##### Working of Traffic regulating system (TRS)

- 1) At the time when red signal will turn on then DCV will be operated at its 1<sup>st</sup> position in which oil from reservoir it goes in filter and then enter in pump. Pump will supply this oil to DCV port, from DCV this oil will be flow to the flow control valve with check valve
- 2) Flow control valve will control flow of oil, it is use full to lift wedge slowly which is required to adjust lifting speed of wedge. More flow of oil cause fast lifting of wedge and less flow of oil cause slow lifting of oil.
- 3) Here we used 2 nos of flow control valve because at 1 meter TRS model has two cylinder, to control the motion of retraction of both cylinder we require 2 nos of FCV for both cylinder individually.
- 4) From FCV oil will enter at bottom port of both cylinder and pushes piston up ward and from upper portion oil will move return toward DCV and through DCV it goes to reservoir.
- 5) Now when green signal will turn on then for some of second 4 to 5 sec DCV will change its 2<sup>nd</sup> position, in this position through DCV oil enter upper portion of

cylinder and pushes the piston downward then in down portion oil will toward DCV through check valve & FCV so that oil will return fast as compare to 1<sup>st</sup> position and from DCV it goes to reservoir, By this wedge will move downward position.

- 6) After this position DCV will change its 3<sup>rd</sup> position in which all the port is isolated so wedge will remain downward for some period of time.
- 7) PRV is used when at the time of red signal if any vehicle will come on wedge it will create more pressure or back pressure toward system so as vehicle comes on wedge at its lifting time, PRV will open and wedge element will come downward automatically.

##### TRS working manually with producing electricity through lever



**Figure:** Line Diagram of manually operated TRS with produce Electricity

#### 5. Working

In this project we are going to make traffic regulating device which is manually operated by lever mechanism. Before 10 second of turning the red light on the wedge shape element comes out above the road surface up to certain height which will prevent the vehicle to cross the road.

Lever will move in anticlockwise direction and the roller will get fitted in the groove provided under the wedge. Because of this action wedge will be lifted from its position and reaches above road level up to certain level.

When the traffic signal turns green the lever will further operate in anticlockwise direction hence the wedge moves in downward direction and reaches up to 50 to 100 mm above road surface. When the vehicle passing from the wedge due to the weight of vehicle wedge will press down. Hence wedge will come in contact with the rack and pinion moves in downward direction. Due to this downward movement of rack which has been meshed with pinion, pinion will rotate. Pinion is mounted on the shaft so that shaft will rotate and the shaft is connected to the generator and generator will convert mechanical energy into electrical energy. The function of spring is to retract the rack to its original position.

**Analysis of 3D Model result at different load (Load of vehicles) conditions on wedge:-**

No.	Load Applied(Ton)	Equivalent(Von mises) Stress(Pa)	Max Principle Stress(Pa)	Min Principle Stress(Pa)	Total Deformation(M)
1	1 ton	8.50e6	8.46e6	9.39e5	3.255e-5
2	2ton	1.6466e7	1.4686e7	1.601e6	5.87e-5
3	3ton	2.443e7	2.0911e7	2.263e6	8.4929e-5
4	4ton	3.239e7	2.7136e7	2.9257e6	0.000111
5	5ton	4.0358e7	3.3361e7	5.587e6	0.000137
6	10ton	8.017e7	5.89e7	6.898e6	0.00026
7	15ton	1.2e8	9.56e7	1.0208e7	0.000399
8	20ton	1.598e8	1.267e8	1.35e7	0.00053

**6. Conclusion**

This research work explains how we can enforce mechanism such that peoples shouldn't break traffic rules. Here designed mechanism can withstand against very huge amount load on it but hydraulic cylinder lifting capacity is less because of optimizing power. Each and every forwarding stroke doesn't need that much power which we designed a hydraulic cylinder for it. Following significant outcomes of mechanism which stated below.

- 1) The mechanism can withstand against 20 ton capacity with the hydraulic cylinder in the retracted position.
- 2) Hydraulic cylinder capacity is 2 ton which means up to 2-ton load can be lifted by the mechanism. If the load exceeds than 2-ton hydraulic cylinder doesn't operate and it retains its retracted position.
- 3) Here selected isolate all ports of DCV which is middle position, means hydraulic cylinder retain its end position rigidly due to locking mechanism after completion of the stroke. This will resulting in any wrong sided vehicle can't retract hydraulic cylinder when cylinder in the extended position. Cylinder only retracts when the backward load exceeds than lifting capacity of the hydraulic cylinder because of the safety of mechanism.
- 4) While implementing this mechanism will resulting in a reduction of a number of traffic police required at a busy crossroad.

**7. Future Scope**

This thesis presents the "title". In this research work, static structural analysis is carried out to determine the stresses and deformation of mechanism. The same methodology for analysis adopted here provides enough scopes for future work in following directions.

- 1) Crash analysis can be performed to simulate impact between mechanism and vehicle.
- 2) Can also optimize mechanism by the ANSYS which is a powerful tool for geometrically optimization
- 3) By selecting advanced lightweight material can reduce the weight of the mechanism.
- 4) Some polymer material can be used for wedge which resulting in lightweight of mechanism.
- 5) After selecting material same analysis methodology which is adopted here can be used for analyse mechanism.
- 6) Can also use spikes to enforce traffic rules more rigidly.

**References**

- [1] [https://www.researchgate.net/publication/264706010\\_GENERATION\\_OF\\_ELECTRICITY\\_WITH\\_THE\\_USE\\_OF\\_SPEED\\_BREAKERS](https://www.researchgate.net/publication/264706010_GENERATION_OF_ELECTRICITY_WITH_THE_USE_OF_SPEED_BREAKERS)
- [2] <http://content.tfl.gov.uk/literature-review-of-road-safety-at-traffic-signals-and-signalised-crossings.pdf>
- [3] <http://www.monash.edu/muarc/research/our-publications/muarc053>
- [4] G.Krishnaiah, A.Rajani, P.Rajesh LITERATURE REVIEW ON TRAFFIC SIGNAL CONTROL SYSTEM BASED ON WIRELESS TECHNOLOGY
- [5] RED SIGNAL VIOLATION DETECTION MECHANISM IN VIZAG TO GO SMART article publish in THE HINDU newspaper on AUGUST 20, 2018 at 00:30 IST in VISAKHAPATNAM
- [6] Wrong side driving in Pune could 'kill your tyres' article publish in THE TIMES OF INDIA newspaper on 31 march 2018 at 22:22 IST in PUNE
- [7] <http://www.indiaenvironmentportal.org.in/files/file/road%20accidents%20in%20India%202017.pdf>
- [8] [https://www.researchgate.net/publication/319671413\\_Traffic\\_Rule\\_Violation\\_A\\_Weak\\_Link\\_in\\_Prevention\\_of\\_Road\\_Traffic\\_Accidents](https://www.researchgate.net/publication/319671413_Traffic_Rule_Violation_A_Weak_Link_in_Prevention_of_Road_Traffic_Accidents)
- [9] <https://www.nap.edu/read/22537/chapter/4>
- [10] [https://www.researchgate.net/publication/261721350\\_A\\_Survey\\_on\\_Awareness\\_of\\_Traffic\\_Safety\\_among\\_Drivers\\_in\\_Delhi\\_India/download](https://www.researchgate.net/publication/261721350_A_Survey_on_Awareness_of_Traffic_Safety_among_Drivers_in_Delhi_India/download)
- [11] <http://www.indiaenvironmentportal.org.in/files/file/road%20accidents%20in%20India%202017.pdf>