International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 05 | May - 2022 Impact Factor: 7.185 ISSN: 2582-3930

Analysis of Traffic Volume and Accidents for Rolling Barrier System at NH-06 Khamgaon

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Abstract - The government is always looking at the latest technology that can ensure safety of road users, as outlined in the construction industry transformation plan. A small Korean manufacturing company invented a new concept longitudinal barrier, (The Rolling Barrier) which had continuous pipes covered with urethane rings. This study aims to evaluate the effectiveness of the "Rolling Barrier" and to understand the Rolling Barrier's characteristics of crash cushioning, how to correct the vehicles running direction and the required strength of barriers. They convert that impact energy into rotational energy to propel the vehicle forward rather than potentially breaking through an immovable barrier. When a car hits the barrier, the rotating barrel converts shock from the vehicle to rotational energy. Upper and lower frames adjust tires of large and small vehicles to prevent the steering system from a functional loss. The Rolling Barrier can be effectively used in curved roads sections, ramps, medians and entrance or exit ramps in parking garages. In this paper, the description and studies of Rolling Barriers are elaborated. The latest emerging technologies for safety of road is focusing on finding new ways/methods for reducing accidents and reducing damage due to accidents. In a study it has been revealed that many accidents occur at horizontal curves. By using rolling barriers on horizontal curve, number of deaths, damage to vehicle or injury to human body can be minimized. Use of these rolling barriers have proved to be effective. It has been used in many developed countries and it should be used in India to minimize accidents.

***Key Words*:** Rolling barriers system, rolling barriers, accidents, horizontal curve, rolling barriers on horizontal curve.

1. INTRODUCTION

Road accident one of the leading causes of human death. Worldwide, yearly over 1.3 million people are killed in road traffic accidents 3,500 person daily. This is 8th leading cause of death. Road traffic deaths are accounted for 23% of all injury deaths worldwide. Every year, approximately 1.25 million people die as a result of a road traffic crash. These all are all types of crashes but there have another type of crash or accident. This type of crash or accident occurs at hilly area, roadside, at the median. To prevent vehicles from driving off the road, strong metal bars, commonly referred to as guardrails, run along a road's edge. There giving RCC barrier to prevent the head crashes. Sometimes these barriers can't give guarantee a driver's' safety. Sometimes provides some RCC round pillar nearly 3' height in hilly areas to prevent the vehicles would not fall from hill but it cannot give guarantee the safety of vehicles as well as passengers. For safety reason and saving the human lives we are introducing the rolling barrier.

Table 1 - Percentage of Impact of Vehicles on Various Objects (Source-Guido Bonin et. al.)

1.1 OBJECTIVES

Sr. No.	Objects of Impact of vehicles	Total Percentage
1	Concrete Barriers	23 %
2	Guard Rails	19 %
3	Flowerpots and Curb Stones	15 %
4	Bridge Wall	13 %
5	Overhead Bridge Pillar / Tunnel Wall	13 %
6	Trees	5 %

The efficient implementation of the rolling barrier will cater multiple objectives as discussed above, however Rolling Barriers can be applied resourcefully at following sites:

1. To study the annual variation of accident rate on selected stretch of two-lane road.
2. To study the factor impacting the severity of crashes involving side traffic barrier on horizontal curve.

2. METHODOLOGY

The methodology consists of selection and survey of project site, and observing data of traffic, designing, testing and conclusions of results. From this methodology the implementation of rolling barriers on project site is carried out.

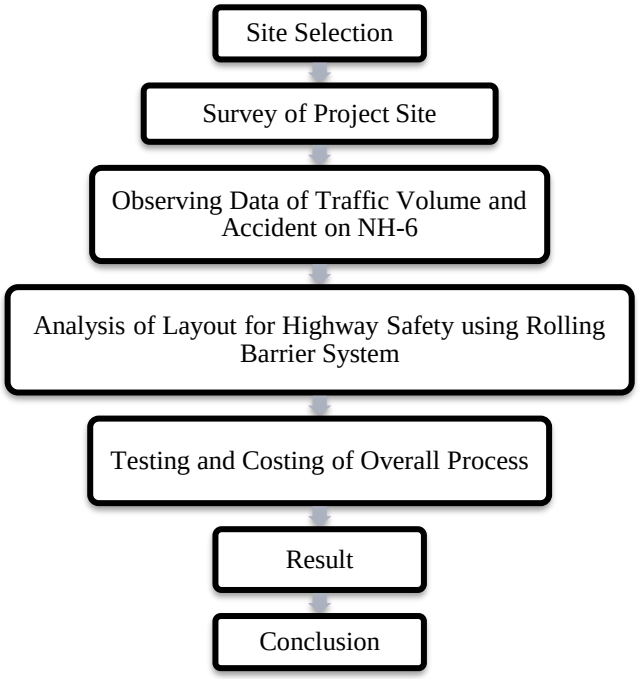

Fig. 1. Flowchart of Methodology

2.1 Site Selection - NH 06 Khamgaon Nandura Road, Near Parkhed Phata Survey of selection site is done by the data available by NH 06 depending on that basis a small section of curve path is been selected as a project site for designing Rolling barrier having speed limit 60kmph Vehicle movement on the NH 06 were very high and frequently all sort of vehicles pass through so many accidents do occur the place is more curve therefore using roller barrier will reduce the accident rate.

2.2 Survey of Project site - There is a sharp curve between Hotel Jugnu Khamgaon to Hotel Pardesi Parkhed Fata. The categories of vehicles include tempo, auto, and different types of two-wheelers, cars, mini-truck, bus, motor cycle, tanker, truck and bus. The information available for accident studies is the FIR (First Information Report) lodged in the police station. The data from these records of last six years (2015 – 2021) were extracted from the FIR record field under IPC no.

1. Date and Time of occurrence of accidents
2. Location of accident.
3. Details of accident i.e., injuries, fatalities and property damage.
4. Type of Hitting Vehicle.

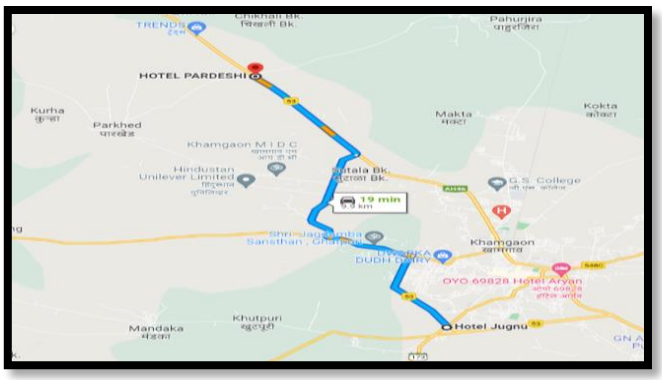

Fig. 2 - Location Map (Source-Google)

2.3 Observing Accident Data on NH-06 - National Highways are the arterial roads of the country for inter-state movement of passengers and goods. They traverse the length and width of the country connecting the National and State capitals, major ports and rail junctions and link up with border roads and foreign highways. The total length of NH (including expressways) in the country at present is 1,32,499 kms. While Highways/Expressways constitute only about 1.7% of the length of all roads, they carry about 40% of the road traffic.

Accident details during 2015-2021 on this road section are shown. Accident data were collection is year wise form each police station records and then sorted out.

2.4 Working Principle - As we can see from the number of fatal accidents on the expressway, this prevailing customary system has proven to be substandard. Whereas, the rolling barriers not only absorb the impact energy but also convert it into rotational energy, assisting the vehicle to stay on track and prevent overturning. As we can see from Fig that as soon as an automobile swerves from the actual path and hits the barriers laterally at any angle, the rollers convert the impact energy into rotational energy by rotating with the impact. The rotational energy not only helps to cut down the impact of the collision but also helps to propel the vehicle forward rather than potentially breaking through an immovable barrier.

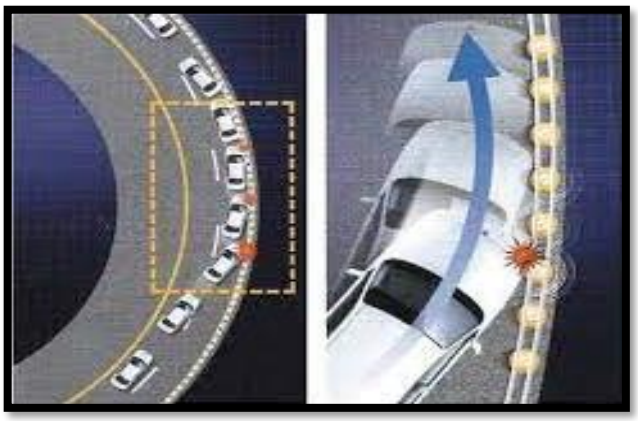

Fig.3 - Shows the precise working principle of the rolling barrier system.

2.5 Analysis - The road accident characteristics studied in this study include their total number, cause of accidents, nature of accidents and type of injury, type of vehicles involved and time of accidents.

- **Accident Rate Calculation –**

Accident Rate (2015)
Accident Rate = M/L
Where, M =Total no of accident
L = Road length
Accident Rate = 28/8
Accident Rate (2015) = 3.50
Similarly,
Accident Rate (2016) = 4.12
Accident Rate (2017) = 4.25
Accident Rate (2018) = 4.50
Accident Rate (2019) = 2.87
Accident Rate (2020) = 0.25
Accident Rate (2021) = 1.75

Table 2. Accident Rate (Source-NHAI Office)

Name of Road	Length	No of Accidents in a Year	
		No of Accident in Year	Accident Rate
2015	8	28	3.50
2016	8	33	4.125
2017	8	34	4.25
2018	8	36	4.50
2019	8	23	2.87
2020	8	2	0.25
2021	8	14	1.75

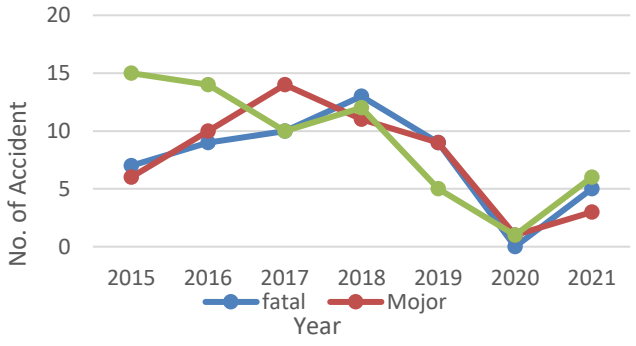

Fig. 4 – Graph of Annual Variation in Accident of Road

2.6 Testing and Costing

- **Testing -** It has been carried out by KSI global to compare normal and RB to measure the degree of damage imparted to the barrier during a vehicle impact of the crash test (test 1). It was observed that the conventional barriers experienced more damage in comparison to RB. In a similar crash test (test 2) a comparison is done between passenger car and heavy vehicle impact to Rolling barrier. It was seen that impact of passenger car delivered no damage to the RB, while slight damage is recorded in case of heavy vehicle.

- **Costing -** Each roller of this system costs near about INR.3200.The rollers system costs approximately 18 lakhs per 100 meter of roadway. The rolling safety barriers has self-luminescence so, it reduces the cost of luminescence's in night time After several crashes the rollers can be easily replaced with new rollers in low cost hence, whole system is not affected by crashing.

3 CONCLUSIONS

1. Accidents are the error of the human's while using motor vehicles and also nature creates problems like rain causing slippery roads. Fog causing low visibility, etc. Ultimately life is more precious than vehicles but when it becomes to rolling Barrier system usage, it saves life and also reduces maximum damage to vehicles leading to saving of both financial as well as human resources.
2. Rolling Barrier reduces the impact of collision, redirects the path of vehicle, convert impact energy into rotational energy. This reduces accidents and saves lives.
3. The Rolling Barrier system invented by Korean company is very expensive. So, if the material is replaced with low cost than aluminum string but equivalent to its strength. We can give yellow color top rail and bottom rail so that they can be visible at daytime as well as night time. We can also replace the expensive LED lights with cheap radium paper which reflects the light falling on it at night and it will not also trouble in daytime. We can apply red colored radium paper on at same places at top rail and bottom rail and also on rolling Barrier.
4. By implementing RB in the cities India will come in that group of countries who have already using this technology. The Indian highways records large number of accidents and this technology will definitely elucidate this problem in a highly efficient manner.
5. On this NH-06 accidents are increasing day by day as per the data mentioned above the large no. of accidents occur on horizontal curves 42% of collision is with barriers. The conventional barrier protect other objects from collision but it damages the vehicle heavily and it may even cause death of passenger of vehicle. The use of rolling barriers can prevent the damage of vehicle and loss of lives.

ACKNOWLEDGEMENT

We would like to show our gratitude to the Prof. Ruchira S. Ingole, Mauli Group of Institutions College of Engineering and Technology, Shegaon for sharing their pearls of wisdom with us during the course of this research

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