



A Review on Rolling Barrier System - Introduction to a New Road Barrier

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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.

KEYWORDS: Rolling barriers system, rolling barriers, accidents, horizontal curve, rolling barriers on horizontal curve.

I. 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. Rolling barrier is a type of a road barrier. There have many round shape plastics elements (nearly like as tire) that's should set up serially one by one that's connected by a stainless steel. The round shape elements can roll. When a vehicle hits the rolling barrier it will roll and divert the impact force rotate to forward. For this the crash vehicles have to remain in the same area though that was hit but it can save the lives of passengers. If there have a RCC barrier it cannot divert the impact force into forward and would try to break it and can go outside the road. If it hilly area, then the vehicle can fall down or vehicle can go opposite side of the road then another vehicle can hit the vehicle which is coming from opposite side. Both cases are can take lives of passengers. The rolling barriers do more than absorb impact energy. 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 vehicle crash test was performed on three different vehicles and the rolling barrier satisfied all the criteria such as small car, large car, bus. To minimize the number of accidents, a company called ETI (Evolution in Traffic Innovation) designed “Rolling Barrier System”.

1.1 What is Rolling Barrier?

The concept of rolling barrier is, a structure equipped with continuous pipes covered with urethane rings. Its general feature resembles an erected abacus. As the rolling barrier activates the rolling friction when vehicles hit the barrier, the rolling barrier reduces severity of traffic accidents. There has a rolling box which is attested with stainless steel. The rolling box can rotate when it will hit by traffic. It's made of special chemical compound like hard rubber which is capable to absorb the impact of the vehicle.

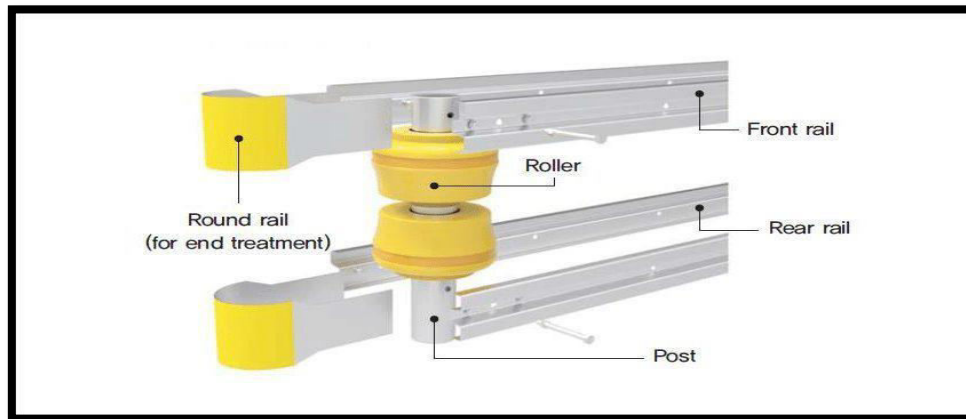


Fig no. 1. Components of Rolling Barrier

1.2 Purpose of using Rolling Barrier

1. To reduce the accident numbers.
2. To reduce the severity of accidents.
3. To reduce the damage to vehicles.
4. To reduce the injury to human body.
5. To save lives from accidents.

II. LITERATURE SURVEY

According to researches, the roller crash barriers are a system engineered to prevent fatal road accidents, by absorbing and deflecting energy from an out-of-control vehicle that crashes into them. The safety barriers are not the only precautions which have been taken to minimize accidents along the road. According to that the summary of few such researches is given below:

2.1 Kyung-Whan Kim et.al, (2004)-In 2001, there were 3,638 traffic accidents on the freeways of Korea, with 54.2 percent composed of vehicles that crashed into longitudinal barriers. Such accidents can be drastically reduced if more safe barriers are installed for traffic safety. A small Korean manufacturing company invented a new concept longitudinal barrier, the Rolling Barrier (RB), which has continuous pipes covered with urethane rings. This study aims to evaluate the effectiveness of the RB, and to understand the RB's characteristics of crash cushioning, how to correct the vehicle's running direction, and the required strength of barriers. Experiments with barrier performance and crashing vehicle behavior at curved sections using a 1.3-ton passenger car and a 3.5-ton truck showed satisfactory vehicle behaviour as they ran parallel with the RB after crashing. The structural problem of the RB was not found during the time of the crash.

2.2 Omer T simonyet.al, (2009) -To analyse the traffic safety situation in India, and to identify countermeasures for areas in which the total harm caused by crashes can be substantially and readily reduced. The report focuses on two aspects of traffic safety in India: challenges and opportunities. The first part of the report provides a comprehensive analysis of the current traffic safety situation in India. It is pointed out in this analysis that fatality rates have increased both on highways and in urban areas during the past few years. Theoretical models suggest that the number of fatalities in India is not likely to start to decline for many years to come unless new policies are implemented. Based on the present analysis, the following six areas are identified as having potential for substantially reducing fatalities in India



2.3 Rakesh Mehar et.al, (2013) – Represents the study about some basic concepts for a systematic approach for formulation of a road safety improvement program in India. The numbers of road accidents are increasing at an alarming rate in India. Thus, there is an urgent need for a systematic approach to improve road safety. Road safety improvement program is a systematic approach to reduce the injuries, fatalities, deaths and loss of public properties because of road accidents. In order to develop an effective road safety improvement program, it is required to collect relevant data and analyse accident record so that hazardous locations can be identified. Further, it is required to conduct studies on identified safety hazardous locations to identify remedial measures to reduce severity and number of accidents. Further, as it is not possible to implement all remedial measures identified due to limited resources available, it is also required to determine urgency of the safety measures identified.

2.4 Pawan Deshpande et.al, (2014) - Road accidents are a human tragedy. They involve high human suffering and monetary costs in terms of untimely deaths, injuries and loss of potential income. Although we have undertaken many initiatives and are implementing various road safety improvement program the overall situation as revealed by data is far from satisfactory. During the calendar year 2010, there were close to 5 lakh road accidents in India, which resulted in more than 1.3 lakh persons. These numbers translate into one road accident every minute, and one road accident death every 4 minutes. Unfortunately, more than half the victims are in the economically active age group of 25-65 years. The loss of the main bread winner can be catastrophic. Road traffic accidents are amenable to remedial action.

2.5 Shradha S Parsekar et.al, (2015) - Heseeks to highlight that Road traffic accident (RTA) is one of the major preventable public health problems and is on the rise which can be attributed to increase in the number of vehicles and lifestyle changes and risky attitudes. This paper is intended to search for available published information which in turn might help the policy makers as well as practitioners to make use of it. Methods: The information has been gathered from papers related to RTAs from various databases such as PubMed, Google scholar, government websites to get an overview in India for the last 15 years. Result and Conclusion: The burden of RTA was found to be considerably high globally as well as in India. RTA causes a number of effects which can be: economical, physical, psychological and social. The burden of RTA is on the rise which makes it necessary to take a multi-sectoral approach in its prevention and control.

2.6 Alkeshkumar B. Labana1 et.al, (2016) - Hefocused on the road transportation increases year by year, but the rate of road crashes also increases with it. India is one of the developing countries, where the rate of road crashes is more than the critical limit. This paper presents road accidents situation in India and literature review related to road accident and safety. In this paper also highlights of the objective of study, methodology and accidental data of a case study on Dahod to Jhalod section of N.H.113.

2.7 Premit Kumar et.al, (2016) - Hehas proposed an approach on Road accidents are increasing very rapidly. The Global status report on road safety 2015, reflecting information from 180 countries, indicates that worldwide the total number of road traffic deaths has reported at 1.25 million per year. According to official statistics 141,526 persons were killed and 477,731 injured in road traffic crashes in India in 2014. However all road injuries are not reported to the police. The actual numbers of injuries requiring hospital visits may be 2,000,000-3,000,000 persons. It reflects into every minute one road accident occurs and one death reported from every four minutes. Hence it is alarming situation for transportation agency to reduce this road accidents statistics. Traditional methods are applying for road safety like wearing seat belts, adequate road marking, proper signalling on intersection but it seems that these methods are not adequate to reduce road accidents, so it is necessary to provide some advance methods for road safety.

2.8 N. Naveen et.al, (2017) – He studied about Transportation plays a key role in the development of an area, but it happens only when the transportation is safe, rapid, comfortable and economy. A road is considered safe when only a few, or no accidents occur. Road and its surroundings, road users and vehicles are the elements contributing to road accidents. Pedestrians, bicyclists and two-wheeler motorized riders are the vulnerable road users. The loss of human life due to accident is to be avoided. Road safety audit (RSA) is a formal procedure for assessing accident potential and safety performance in the provision of new road schemes and schemes for the improvement and maintenance of existing roads. These Audit studies or analysis give scope for the reduction of accidents and helps us to provide safe, self-explaining and forgiving roads.

2.9 Hitesh Kumar et.al, (2017) - Hefocused on Road traffic accidents deaths and injuries occur worldwide. It was estimated that over 1.2 million people died each year on the world roads as a result of road traffic accidents. According to a survey by WHO, more than 3,200 people get killed and over 130 000 injured in traffic every day around the world.



Also, almost half of all fatal accidents involve pedestrians, cyclists and power two wheelers, collectively called vulnerable road users.

2.10 OmkarGholapet.al, (2018) - According to him now a day, in every 10 minutes, one human life is lost due to road crashes. In the world, India has world's largest heavy traffic and accidents also. It is necessary to provide the safety to roads. Road Safety Audit (RSA) is a procedure or method in which identification of existing or future road on basis of safety issues and provision of safety remedial measures on it. In this study, the section of road from "A.T.E.S. Faculty of Polytechnic, Akole to M/S. R. V. Traders Godown, Shekaiwadi (K.G.Road SH 44)" is undertaken. Road taken having considerable traffic during day time and some black spots on the road where accidents take place continuously.

2.11 to Yun Chen et.al, (2018) - According to him revealing the distinction between rolling and sliding at the nanoscale is crucial for understanding the nanoscale tribology. To address this issue, we studied the rolling and sliding of single-walled carbon nanotubes (CNTs) on graphene using density functional theory augmented with many-body dispersion (MBD) forces method. We find that the motion of CNTs on graphene is changed from sliding to rolling with increasing the CNT radius, in which Pauli repulsion dominates rolling and MBD interactions dictate sliding. In addition, armchair CNTs always generate larger barriers than zigzag CNTs with similar radius regardless of rolling and sliding.

2.12 Guozhu Cheng et.al. (2019) - The typical cases of roadside accidents are analyzed and the calculation results of the Bayesian network show that the probability of one or two turnover accidents is 0.939, which is consistent with the results of roadside accident simulation tests, proving the accuracy of the risk evaluation methods for highway roadside accidents. This proposed method can accurately calculate the probability of roadside accident and achieve a quantitative evaluation of the roadside accident risk.

2.13 ShoaibChoudhary et.al, (2019)- He focused on Road safety audit is conducted to minimize and prevent the road accidents and to take safety occurs and a human life is lost due to road accidents. So, it becomes necessary to make improvements and rehabilitation for newly build and existing roads. In road safety audit we also analyze factors affecting accidents from humans, vehicles and human involvement and other factor. This road safety audit has a vision to reduce the number of accidents taking place. Keywords: Road Safety Audit, Road Accidents.

2.14 Marco Montoya-Alcaraz et.al. (2020) –The study on the road safety analysis of high-risk roads. This project is located in the mountain range of Baja California, Mexico, in the Centinela–La Rumorosa highway and integrates accidental and pavement surface condition data, geometric design performance, analysis of traffic signals, and road safety devices present on the road using geodetic techniques. From this analysis they concluded that this procedure contributes to determining risk areas that promote accidents and generate a risk reduction plan to support future decision-making that guarantees better performance for road users.

2.15 VivekLodhia et.al. (2021) – He has shown effective use of rolling barriers on horizontal curve. Road accidents are increasing day by day and death due to accidents has also been increased. But accidents cannot be reduced due to increasing population and thus increasing vehicles on the road. If the accident does not cause death, it does damage to the driver and other passengers and also to the vehicle. The latest emerging technologies for safety of road is focusing on finding new ways/methods for reducing accidents and reducing damage due to accidents. 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. They conclude that, if properly designed, installed and regularly maintained, it can be proved to be life saving device for road users

III. ADVANTAGES AND LIMITATIONS

3.1 Advantages

1. Highly effective shock absorber.
2. Impact severity reduction due to its conversion into rotational energy.
3. Keep the vehicle on track and avoid deviation.
4. Self-luminescence to help drivers control vehicles during night time
5. Easy height adjustment of barriers for passenger cars and lorry.
6. Eco-friendly due to the use of Ethylene Vinyl Acetate (EVA).



3.2 Limitations

1. Availability of urethane resources is less.
2. Proper maintenance and inspection are required.
3. Requirement of labor for maintenance is more.
4. Heat treatment is required

IV. DISCUSSION

Every new invention has to be better than from its previous invention. Every invention has some advantages. Without advantages people or Government will not accept the invention. About rolling barrier, the first advantage of it, is safety of the vehicle and human. The features of barrier are –

1. **Shock absorbs system:** The hard rubber type material (the roller) can absorb the impact of the Vehicles. It reduced the speed of vehicle after hit the barrier. If car speed is 40km/h then the accident percentage reduced 80%. If a driver tries to control his traffic which is failed if that time the vehicle hit the barrier, then the speed will reduce and it will be in control.
2. **Convert shock energy to rotary rotational energy:** It is one of the great advantages of rolling barrier that disc. That's why the crashed vehicle tries to stay in the track. Not get out from the track. If there is a hilly area and its fail to stay in the track, then it will get out from track and can be happened fatalities.
3. **LED light:** one of the main features is the LED light which is operated by solar power can be helpful for the drivers. He can see the barrier in night clearly and the accident will be reducing in night.
4. **Stainless steel:** This one of the most important elements of rolling barrier. The roller is stand by supported by this stainless steel. Without it the barrier is unusual.
5. **Colour of barrier:** the color of the roller is yellow. Yellow color can focus with a long distance. Driver can see the barrier from a long distance and he will also alert from a long distance. That's why some concrete and steel barrier coloured in yellow.
6. **Reflective tape:** Reflective tape is a one kind of tape that can be bright when the flash of the vehicle will hit that tape. In every roller there use a reflective tape to alert the driver. It helps in night because when the light of vehicle hit the tape and it reflect clearly and alert the driver that there has a barrier.

V. CONCLUSION

During the study it has been observed that the roller barriers are extremely effective and its implementation has given signified results in reducing the road accidents at flat roads, curved roads sections, ramps, medians, entrances/exit ramps in the parking garage etc. steep curved roads as in the mountainous terrain. The conventional barriers protect other objects from collision, but it damages the vehicle heavily and it may even cause death of passenger of the vehicles. The use of rolling barriers can prevent the damage and loss of lives. It absorbs the shock energy and converts it into rotational energy. The accidents are the errors which are occurred or done by humans while on the usage of motor vehicles and also sometimes the nature creates problems like rainy and cold weather conditions for slippery surfaces of roads, which will create chaos situations and tends to hit the other vehicles or hit the barriers installed on the outer edge of the roads. There have some different of accident and crash. Accident means it just happened there had no way to prevent the accident but crash means it can be prevented the occurrence or can improve the situation to prevent the accident. These barriers are of different types and have their own characteristic features but the new idea is about the installations of the rolling barrier systems which will stop the accidents occurring to surpass the road to gravel or steep hill down or other part of the road, and also saves life of the people present inside the vehicle.

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