

An Alternative Method for Barriers: Rolling Barrier System

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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. (1). In India total accidents of 2014 are 489400 and in 2015 are 501423. Total number of persons killed in 2014 is 139671 and in 2015 are 146133. Total number of accidents on highways in 2014 is 137903 and in 2015 are 142268. (3). 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. The Rolling Barrier satisfied the ministry of construction and transportations, "Guidelines for Installation and management of road safety facilities". The Rolling Barrier can be effectively used in curved roads sections, ramps, medians and entrance or exit ramps in parking garages. (2). In this paper, the description and studies of Rolling Barriers are elaborated.

Keywords: Accidents, Government, Highways, Life, Rolling Barrier, Safe Barrier, Urethane, Vehicles.

I. INTRODUCTION

The Road accidents are an outcome of the interplay of various factors, some of which are length of road networks, vehicle population, human population adherence/enforcement of road safety regulations etc. Road accidents cause injuries, fatalities and hospitalization with serve socio economic costs across the country. Consequently, road safety has become an issue of concern both at national and international levels.

	Year-2014	Year-2015	Percentage Increase
Total Accidents	489400	501423	2.5%
Persons Killed	139671	146133	4.6
Accidents on Highway	137903	142268	3.2%

It is expected to be increased 40% of 2015 to 50% in 2016 and even more in future where the number of vehicles manufacturing is increasing and also the vehicles on road are increasing.(3)

India is one of the highest motorization growths in the world accompanied by rapid expansion in road network and urbanization over the years and is facing with serious impacts on road safety levels. The analysis of road accident data 2015 reveals that about 1,374 accidents and 400 deaths takes place every day on Indian roads which further translates into 57 accidents and loss of 17 lives on an average every hour in our country.(3)

A small Korean manufacturing company invented a new concept longitudinal barrier (the rolling barrier), 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. After the rolling barrier was installed at two downgraded and curved roads sections in Busan, the accidents at the sections were reduced by more than 50% in a year. This study aims to evaluate the effectiveness of the rolling barrier and understand rolling barrier's features in crash cushioning, correcting the vehicles running direction and required strength of the barriers.(2)



Fig1: View of Barrier Accident



Fig2: View of installed Rolling Barrier

II. BARRIER

Barriers or guard rails or longitudinal barriers or traffic barriers keep vehicles within their road way and prevent vehicles from colliding with dangerous obstacles such as boulders, sign supports, trees, bridge abutments, building walls and large storm drains. (4)



Fig3: View of Metal Barrier

III. TYPES OF BARRIER

Barriers are categorized in to two ways, by the function they serve and by how much they deflect when a vehicle crashes into them,

1. BARRIER FUNCTIONS:-

- Road side barriers are used to protect traffic from roadside obstacles or hazards.
- Median barriers are used to prevent vehicles from crossing over a median and striking an oncoming vehicle in a head on crash.
- Bridge barrier is designed to restrain vehicles from crashing of the side of a bridge and falling onto the roadway.
- Work zone barriers are used to protect traffic from hazards in work zones. (4)

2. BARRIES STIFFNESS:-

- Flexible barriers include cable barriers and weak post corrugated guide rail systems. They will deflect 1.6 to 2.6m (5.2 to 8.5 feet) when struck by a typical passenger car or a light truck.
- Semi rigid barriers include box beam guiderail, heavy post blocked out corrugated guide rail and thrie-beam rail. They deflect 3-6 feet (0.91 to 1.83m).
- Rigid barriers are usually constructed of reinforced concrete. They deflect in negligible distance. (4)

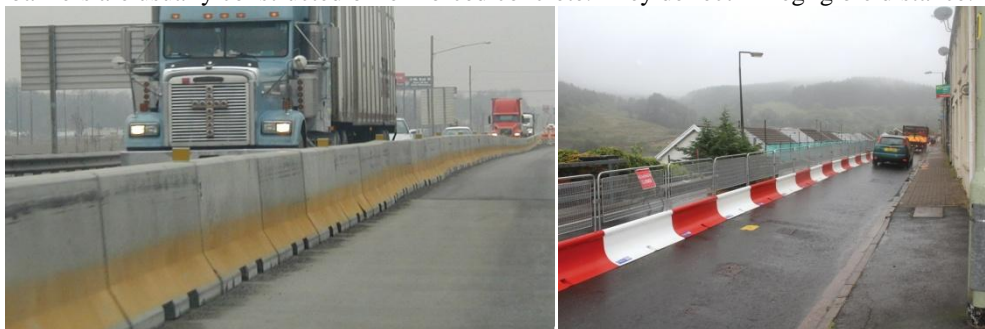


Fig4: View of Concrete and Plastic Barriers

IV. ROLLING BARRIERS

This consists of both flexible property and semi rigid property barrier stiffness. They are different in mechanism than other types of barriers also reduces the hazards or accidents. Urethane has become the material of choice in so many of today's performance driven applications because it exhibits extraordinary physical and mechanical properties that other materials simply can't match. (6)



Fig5: View of installed Rolling Barrier in Curved Path both in day light and night reflection system

V. FEATURES

- Made of special chemical compound like hard rubber.
- Easy to maintain due to separated barrels (recyclable).
- Stopper boards installed on the top and the lower part of the barrels to guide objects back to the road.
- Easy to adjust height, noticeable to drivers due to noticeable coloration and self-luminescence.
- Noticeable to drivers due to noticeable coloration and self-luminescence.
- Less costs to install (less post- 1 unit per 2m).

VI. HOW SAFETY ROLLER WORKS

- Roller absorbs collision shock (shock energy- rotational energy).
- Front rail absorbs second shock.
- Back rail absorbs third shock.
- Metal pipe inserted into strengthen post.

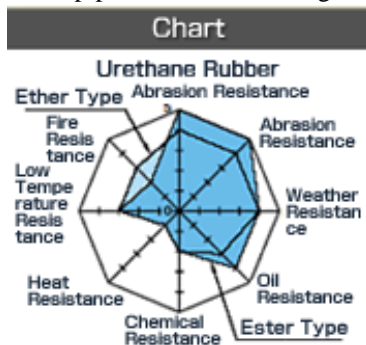


Fig6: Urethane characteristics graph

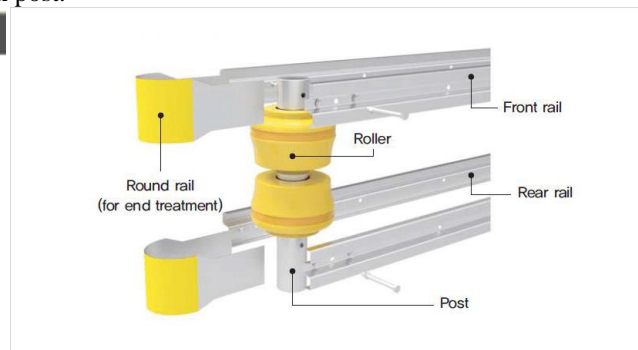


Fig7: Rolling Barrier parts arrangement

VII. TEST PERFORMANCE

SB5 crash test level:-

- Passenger safety performance -
 1. Theoretical head impact velocity (THIV) : 32.4km/hr (below 33km/hr)
 2. Post impact head deceleration (THD) : 9.9g's (below 20g's)
 - Scatter prevention performance- No scatters of the fifty barriers.
 - Test vehicle behaviour performance – Not over thrown or a sudden stop after collision.
 - 76.9% (Exit speed : 74.8km/hr) : 43.7% (Exit angle : 8.74 degree)
 - Synthetic results satisfied with criteria.
1. **Small car**
900 kg car, 20⁰ side collision. During the evaluation, it was observed that the ETI product sends an accident vehicle back to the normal moving track, protects occupants and second vehicle accidents.
 2. **Large Car**
10-ton truck, 15⁰ side collision. During the evaluation, it was observed that the ETI product changes the collision method to rotational friction to make collision continue for a long time and thus minimize momentary shock.

3. Bus

13-ton bus, 20⁰ side collision. During the evaluation, it was observed that the ETI product changes the collision method to rotational friction to make collision continue for a long time and minimize momentary shock. (9)

VIII. PROBLEMS

1. COST:-

Compared to other types of barriers like reinforced concrete, this rolling barrier which is made up of urethane, which is less cost, but while urethane resource availability is less compared to reinforced concrete.

2. HEAT TREATMENT:-

At high temperatures in summer season, the rubber characteristic feature is that it tends to low resistance property. So, that plays a major role in rolling barrier system but can be restricted or maintained by proper inspections periodically (once in two to four weeks or once in a month). Also a technique to cool down the heat is to sprinkle water on this rolling system, etc.

3. MAINTANANCE:-

Due to periodical inspection, maintenance of the rolling barrier system is in high level and labor work is more.

IX. IMPLEMENTATION

- Can be installed in curved road sections,
Ex: National highway 22 (highway to hell) is considered to be India's most dangerous highways, median barriers are used here which is made up of metallic materials. Instead of these barriers if we use rolling barriers then the accidents occurring will be reduced which gives us safety level to a bit higher range. (8)
- Ramps in city or state or national highways.
- Medians and entrance or exit ramps in parking garages.



Fig8: View of Curved Paths in Indian Highways in the regions of Himalayas

X. CONCLUSION

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. 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. As above explanations of barriers and their proofs tells us that the rolling barrier systems are a high priority towards safety, better than other types of barriers in terms of stiffness and strength, high positive results in the crash test performances, etc. Ultimately life is more precious than vehicles but when it comes to rolling barrier system usage, it safes life and also prevents maximum damage level of the vehicles. The rolling barrier systems are the future technology in Transportation Engineering.

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