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A STUDY ON “ROLLING BARRIERS SYSTEM ON HORIZONTAL CURVES”

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ABSTRACT: The latest emerging technologies for safety of road is focusing on finding new ways/methods for reducing accidents and reducing damage due to accidents. 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. In a study it has been revealed that many accidents occur at horizontal curves. So, we have studied and promoted the use of a concept called “ROLLING BARRIERS”. 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

Barrier is a type of obstruction that tries to keep vehicles within their road lanes and prevent them from collision with obstacles or other vehicles. There are more chances of accidents on sharp horizontal curves. Barriers are provided on sides of horizontal curve. These barriers can reduce the number of accidents, but when vehicle collides with the barrier, it causes high damage to vehicle, injury to human body or even death. As after the collision the vehicle is not in control, it may be overthrown or suddenly stopped, causing high damage. A South Korean company called ETI (Evolution in Traffic Innovation) designed the “Rolling Barrier System”. It converts the shock energy into rotational energy. Rolling barriers are barriers with rollers installed on it. Rolling barrier activates the rolling friction when vehicle collides with it. The roller on the barriers start to roll when it is hit by a vehicle and prevents vehicle from being suddenly stopped or overthrown, and thus reduce the severity of accident. Its use can be proved more effective on horizontal curves, where most accidents occur.



Fig. Rolling Barriers on horizontal curve

1.1 Purpose of using rolling barriers:

- To reduce the accident numbers.
- To reduce the severity of accidents.
- To reduce the damage to vehicles.
- To reduce the injury to human body.
- To save lives from accidents

1.2 Advantages of rolling barriers are:

- It increases the safety of humans and vehicles.
- It has shock absorbent system, which reduces sudden shocks on vehicles.
- It converts shock energy to rotary rotational energy.
- It is easy to install, and maintenance required is also less than normal barriers.
- It gives good visibility at night also, with help of reflective tape.
- It has more serviceable life than normal barriers.
- It prevents sudden stoppage and overthrowing of vehicles after collision.
- It can be made by recyclable materials, thus it's eco-friendly.
- It may have high initial cost but the final cost is less as maintenance required is less and it has more life.

1.3 Installation of rolling barriers:

Installation of the rolling barriers can be done in main two ways: (i) On existing barriers (ii) By constructing new barriers

Rolling barriers can be fixed/attached to existing barriers also. Normally, when the existing barriers are concrete barriers, the rolling barriers can be mounted on the barriers along with all components. The rails are attached to the existing barriers and rollers are attached to the rails. It is difficult to attach roller barriers to existing steel barriers.

If the barriers are yet to be construct, then it is easy to directly construct new rolling barriers instead of installing on existing barriers. In new rolling barriers construction, vertical pipes/posts are directly installed on road. And then rails are attached to vertical pipes, to which the rollers are connected.



Fig. Installation of barriers on existing barriers & new barrier construction

1.4 Maintenance of rolling barriers:

Every single item needs maintenance to work properly till its design life. Maintenance is also needed in rolling barriers to work efficiently till its design life. Though rolling barriers needs comparatively less maintenance than ordinary barriers. It needs least amount of maintenance as it absorbs the shocks and converts shock energy into rotational energy. So, maintenance to be done for the damage is least. But after a certain period of time, some maintenance is required. Like the rollers

should be replaced at a certain period as it may be damaged after some collisions with vehicles or due to high temperature, the rubber of rollers loses its durability and resistance. The steel rails and pipes in rolling barrier system may be required to be replaced or repaired if it is deformed after collision. The reflective tape and LED lamps also need to be replaced or repaired after some time. For proper maintenance, regular inspection should be carried out to detect the defects and repair it before major problem occurs. Regular inspection should be carried out once in a month to avoid major defects. The initial cost of installing rolling barriers is higher, but maintenance required is least and the cost of maintenance is also low.

II. FUNDAMENTALS OF THE PROJECT:

2.1 Introduction to Barriers:

Barrier is a type of obstruction that tries to keep vehicles within their road lanes and prevent them from collision with obstacles or other vehicles. They are installed on both side of roads, especially on curves. The main use of barriers is to prevent collision of vehicles with other obstacles or vehicles. The barriers used maybe of steel, concrete or maybe even of cable. These barriers may be used as roadside barriers, median barriers, bridge side barriers or work zone barriers. They are rigid, they do not have much flexibility.

2.2 Problem Identification:

There are more chances of accidents on sharp horizontal curves. Barriers are provided on sides of horizontal curve. These barriers can reduce the number of accidents, but when vehicle collides with the barrier, it causes high damage to vehicle, injury to human body or even death. As after the collision the vehicle is not in control, it may be overthrown or suddenly stopped, causing high damage. Due to speed and weight of the vehicle, after collision with barrier, the vehicle driver loses his control and collision occurs. After hitting the barrier, vehicle is not able redirected to its path or it may be even overturned.

2.3 Introduction to rolling barriers:

Rolling barriers are barriers with rollers installed on it. The concept of rolling barrier is a structure equipped with pipes covered with roller rings. Rolling barrier activates the rolling friction when vehicle collides with it, and with rolling friction activated it reduces the severity of the accident. The roller on the barriers start to roll when it is hit by a vehicle and prevents vehicle from being suddenly stopped or overthrown, and thus reduce the severity of accident. Rolling barriers can be used as roadside barriers, median barriers, barriers on curves, etc. But its use can be proved more effective on

horizontal curves, where there is high chance of accidents.



Fig. Rolling barriers at night

III. DESIGN OF ROLLING BARRIER

3.1 Components of rolling barrier system:

- **Top rail:** There are two rails in rolling barrier system, which connects and supports the rollers horizontally. The upper rail is known as Top rail. It is like a guard rail, made of steel. Top rail splice is used to connect pipe with rails.
- **Bottom rail:** From the two rails, the lower rail is called Bottom rail. It also connects and supports the rollers horizontally. It is like a guard rail, made of steel. Bottom rail splice is used to connect pipe with rails.
- **PVC Pipe:** The rollers are installed on PVC pipes, which allows the rollers to rotate or roll freely. It is a vertical member connecting both the rails and rollers. It is made up of PVC or steel.
- **Stopper boards:** It is a disc like board, which is installed between rollers and rails, at both upper and lower sides. It is used to guide objects back to road.
- **Shock absorbing roller:** It is the main part of rolling barrier system. The rollers are usually made up of Urethane or recycled hard rubber. It absorbs the shock of vehicles, and convert impact energy into rotational energy.
- **LED guide lamp:** A small LED guide lamp is installed on PVC pipe. It is installed on top of PVC pipe.
- **Reflective band:** A reflective band is attached to the rollers to give better visibility at night. Yellow coloured reflective band/tape is used to increase visibility at night.

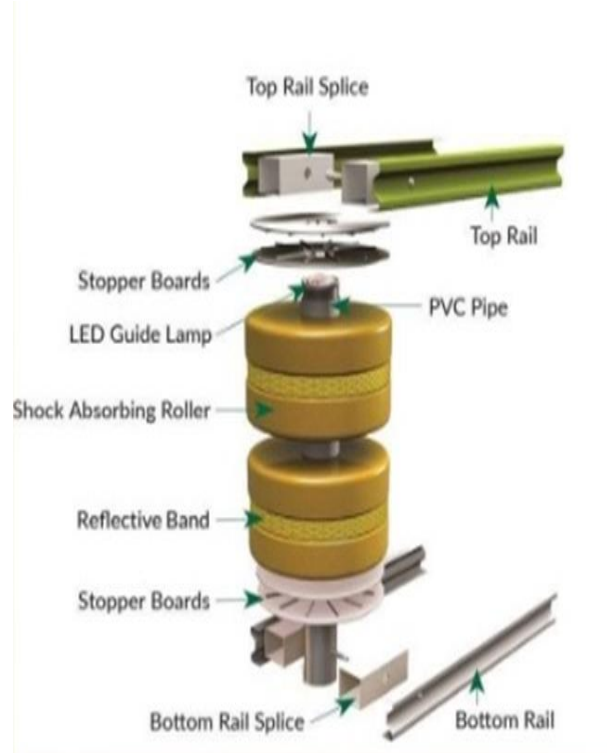


Fig. Components of rolling barrier system

3.2 Materials used in rolling barrier system:

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. It is a type of an artificial rubber. Urethane is flexible and malleable. It possesses non-brittle property along with elasticity.

Polyurethane is also used for rolling barriers. Polyurethanes are linear polymers that have a molecular backbone containing carbamate groups. They are unique in combining the strength of rigid plastics with the flexibility and elasticity of rubber. It also possesses non-brittle property along with elasticity.

Use of recycled artificial rubber is also possible.

3.3 Design specifications of rolling barrier:

Design of the rolling barrier is provided by the South Korean company "KSI". Here, the name of roller is given 'A'. The total diameter of the roller is 370mm and the rounded stainless steel's diameter is 246mm. The distance between one post to another post below the soil is 1400mm. A span's distance is 4200mm. Centre to centre distance between one roller and another roller is 700mm. The vertical distance from ground level to further is 1200mm and the height of upper side is 1000mm. All details are shown in figure.

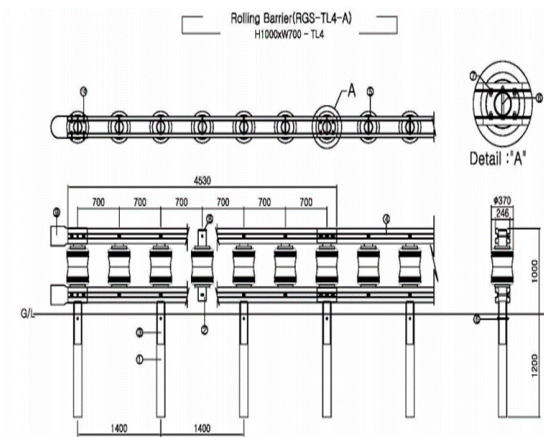


Fig. Design specifications of rolling barrier system

IV. CONCLUSIONS

In India, accidents are increasing day by day. As per the data mentioned above, a large number of accidents occurs on horizontal curves. 42% of collision is with barriers. 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 rolling barriers, made up of Urethane rubber, possesses both flexible and rigid property. LED light and reflective tape gives better visibility at night. So, the use of rolling barrier system can reduce the damage due to accidents. Its initial cost is higher but it does not need much maintenance as compared to concrete and steel barriers. Rolling barriers are used currently in many countries. It should be implemented in India seeing current situations to reduce the damage and loss of lives due to accidents. If properly designed, installed and regularly maintained, it can be proved to be life saving device for road users.

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