

The Efficacy of Rolling Barriers in India's Expanding Transport Sector- A Case Study Pune-Mumbai Highway

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ABSTRACT: This research paper highlights the importance of cost-effective investments in road safety within India's growing transport sector. The Indian government acknowledges the significance of infrastructure and transportation investments in effectively connecting cities and towns. One particular area of focus discussed in this paper is the implementation of "rolling barrier" technologies. These technologies aim to redirect errant vehicles onto the correct course and prevent vehicle overturning. Various factors contribute to road accidents, including the size of road systems, the number of vehicles, and the adherence to traffic laws by the population. The objective of this study is to assess the effectiveness of rolling barriers in enhancing road safety and to understand their crash-cushioning characteristics. Additionally, it seeks to determine the appropriate running direction for vehicles and the required barrier strength. It is important to note that the Rolling Barrier mentioned in this paper adheres to the "Guidelines for Installation and Management of Road Safety Facilities" established by the Ministry of Construction and Transportation, indicating its compliance with government standards for ensuring road safety. The rolling barrier technology can be safely utilized to protect curved road segments, medians, entry or exit ramps of parking garages, and other designated areas. In summary, this paper underscores the significance of investing in cost-effective road safety measures, such as rolling barriers, to enhance safety in India's rapidly expanding transport sector.

KEYWORD: Accidents, Government, Highways, Tremendous, Rolling Barrier, Urethane, Rotational Energy, Shock Energy.

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1. INTRODUCTION

The Safety Roller is a safety device designed to prevent fatal collisions by converting shock energy into rotational energy. It is specifically designed for areas with a high incidence of automotive accidents. Equipped with self-luminescence and distinctive colouring, the Safety Roller ensures easy identification and navigation for drivers. Its primary purpose is to redirect vehicles safely back onto the road or bring them to a controlled stop through shock energy absorption. By employing this technology, drivers have a higher likelihood of regaining control

of their vehicles and avoiding severe accidents.

Developed by a Korean company, the Safety Roller offers a solution to mitigate the detrimental effects of guardrails and potentially save lives. While guardrails can guide vehicles back onto the road, slow them down, or allow them to pass through, they do not account for all driving scenarios and road conditions. In India, national and state highways constitute a small percentage of the total road network but witness a significant number of accidents and fatalities. The prevalent issue of over speeding is often attributed to the high rate of accidents on Indian roads, as well as in many other regions.

The roller barrier, developed by the Korean manufacturer, employs an extended pipe-encased urethane ring that converts shock energy into rotational energy. Inspired by an abacus, this design alters the vehicle's direction and prevents it from turning around or penetrating the obstruction. By implementing innovative safety measures such as the Safety Roller or roller barrier, it is possible to reduce accidents and improve road safety by addressing over speeding and providing a means to redirect vehicles and protect occupants in the event of a collision.

Site Selection:

To address the safety concerns on the curved road, the decision has been made to utilize rolling barriers. These rolling barriers are specifically designed for curved areas of the road and have a speed limit of 100 km/h. The primary objective is to reduce the accident rate by implementing these barriers.

During the survey of the project site, it was discovered that Lonavla Ghat, a section of NH 48, exhibits severe curvature. This section accommodates various types of vehicles, including tempos, autos, cars, mini-trucks, buses, motorcycles, tankers, and trucks. To analyse accidents and gather relevant data for the project, the Highway Police Maharashtra State (HPMS) maintains records at the local police station. These records serve as a valuable source of information for accident analyses, facilitating the identification of patterns and trends.

2. METHODOLOGY

Study is carried out as per flow chart shown in Fig. 1.

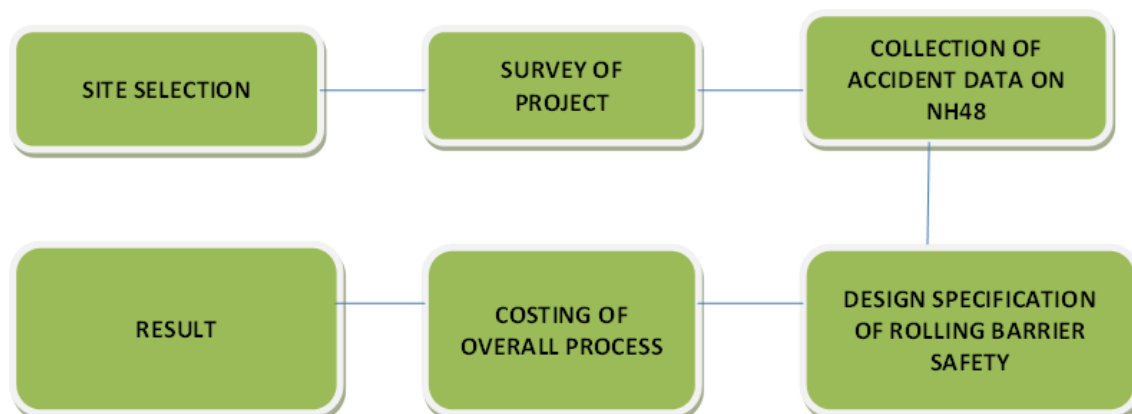


Figure 1 Flow Chart

2.1 Site Selection

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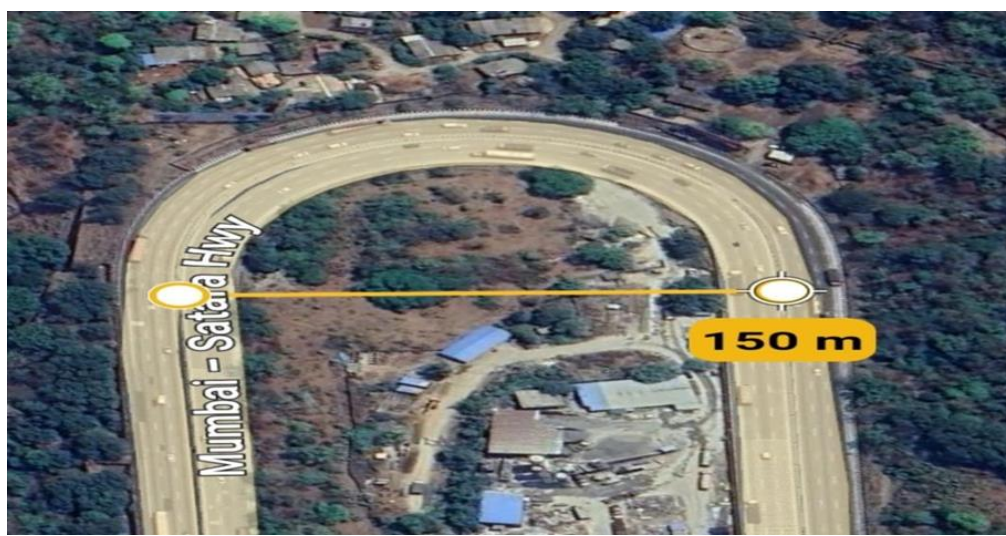
2.2 Survey Work

Highway NH 48, specifically the Pune-Mumbai route, has been selected for a comprehensive survey aimed at improving road safety. The survey will specifically focus on a short section of curved road within this highway for the design project. Due to the high volume of traffic and frequent passage of various types of vehicles on NH 48, it has experienced a significant number of accidents.

For this study, two specific locations have been selected based on the occurrence of a maximum number of accidents. These locations will serve as key points of analysis and investigation to identify potential improvements and implement effective safety measures. **Curve No. 1**

First curve is selected at location $18^{\circ} 46' 18''$ N and $73^{\circ} 21' 37''$ E on Pune-Mumbai Highway near Khandala.

Following are the details of curve No 1.



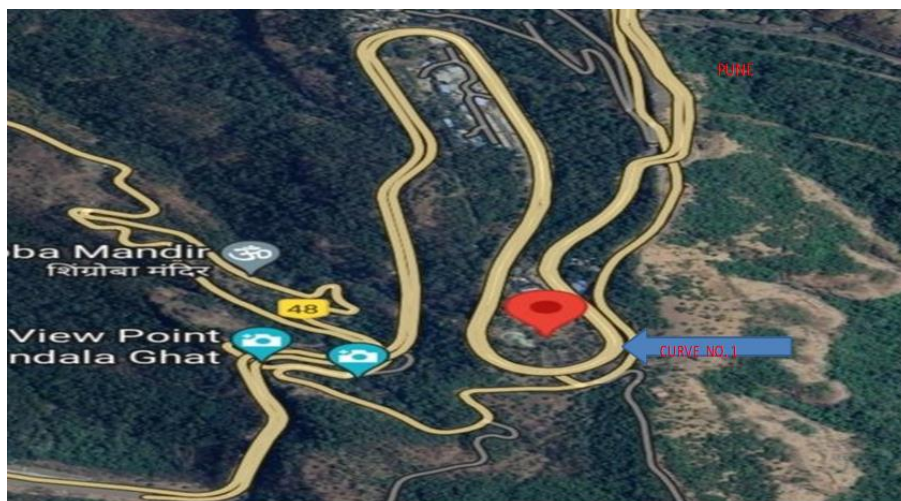
Source- Google Map

FIG. 2 The Cord Length of Road at Curve No 1

Survey Data:**Table No. 1 Observed Data of Curve No.1**

CURVE NO.	CORD LENGTH OF ROAD AT CURVE NO 1	RADIUS	DEGREE OF CURVATURE
1.	150 m	75 m	23°

Cord length of road at curve No. 1 is calculated using QGIS and RGIS software which is shown in Fig No2 and mentioned in Table No 1.

**Figure No. 3 The Ghat Section of Curve No. 1**

Above Fig. 3 showing the accidental points (sharp curve) on the curve number 1, where most of accidents are take place here due to sharp curve of road and monsoon also.

For the study purpose curve is divided into two parts i.e. Part I & II

Curve No. 1, Part I:**Figure No. 4 Showing the Curve Length**

This location is at 75 km from Pune to Mumbai. Figure No 4 showing that the rolling barrier applicable length, it is 0.4 miles (0.64 Km i.e. 640 meter).

Curve No. 1, Part II:

Curve number 1

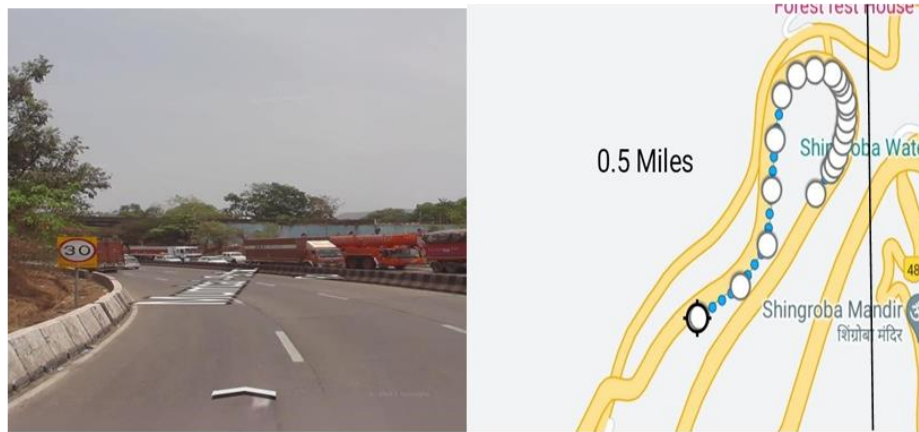


Figure No. 5 Showing The Curve and Its Length

This location is reached during the transportation from mumbai to pune. Above figure no 2.3.4 clearly showing that the rolling barrier applicable length is 0.5 miles (0.8 Km i.e. 800 meter).

CURVE NUMBER 2:



FIG NO 2.3.5 SHOWING THE GHAT SECTION OF CURVE NUMBER 2.



FIG NO.2.3.6 SHOWING THE CURVE AND ITS LENGTH OF CURVE NUMBER 2.

This location is reached during the transportation from MUMBAI to PUNE. Figure 2.3.6. showing that the rolling barrier applicable length is 0.2 miles (0.32 Km i.e. 320 meter).

PART II:

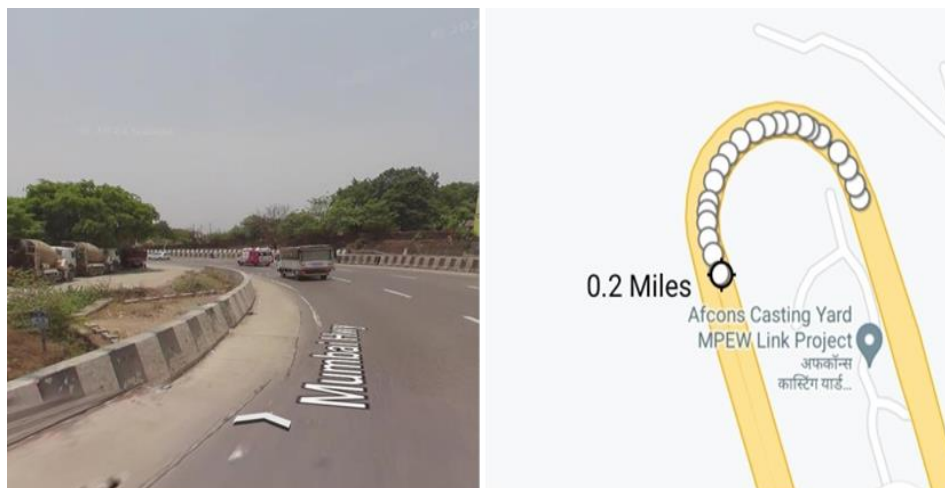


FIG NO.2.3.7 SHOWING THE CURVE AND ITS LENGTH OF CURVE NUMBER 2

This location is reached during the transportation from PUNE to MUMBAI. Figure 2.3.7 showing that the rolling barrier applicable length is 0.2 miles (0.32 Km i.e. 320 meter).

2.4 COLLECTION OF ACCIDENT DATA ON NH48:

In this table no. 2.4.1. we studied the total no. of accidents took place in last three years (2019-2021).

TABLE NO.2.4.1 CLASSIFICATION OF ACCIDENTS ON PUNE-MUMBAI HIGHWAY

SR. NO	YEAR	FATAL		GRIEVOUS INJURY		MINOR INJURY		WITHOUT INJURY	TOTAL ACCIDENTS
		CRASHES	DEATHS	CRASHES	INJURED	CRASHES	INJURED		
1.	2019	74	92	67	162	27	31	185	353
2.	2020	62	66	38	79	12	13	49	161
3.	2021	71	88	54	146	16	18	59	200

In 2019 there are deaths cases as well the accidents cases are more than 2020 and 2021. The above data expressed all the injured, fatal accidents and conditions of passengers. [5]

2.5 DESIGN SPECIFICATION:

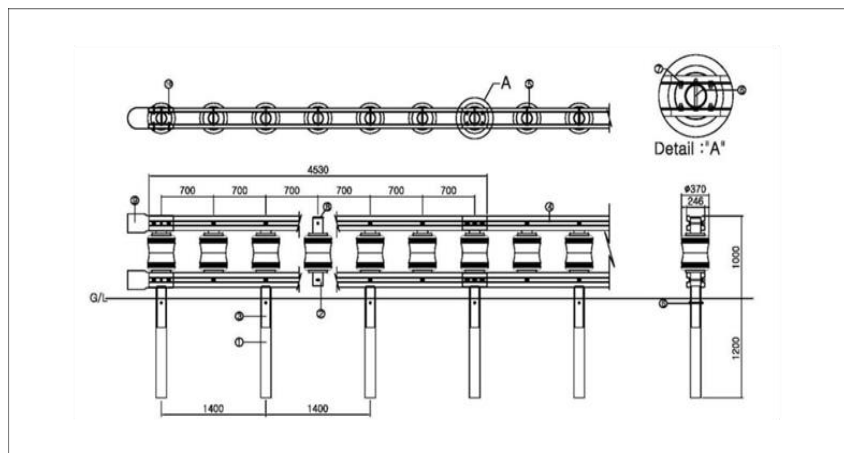


FIG NO.2.5.1 DESIGN SPECIFICATION OF ROLLING BARRIER

All dimensions of this design are in mm. The diameter of the rounded stainless steel is 210mm, and the total diameter of the roller is 370mm. There are 1400mm between each pillar and the surrounding soil. The length of a span is 4200mm. The center-to-center spacing between two rollers is 700mm. The height of the upper side is 1000mm, and the vertical distance from ground level (GL) to farther is 1200mm. There are stainless steel w rails, inner posts, and subposts. Rollers for shock absorbers, post caps, etc.[5] All information is provided in Fig. 2.5.1 above.

2.6 ESTIMATING AND COSTING OF OVERALL PROCESS:

Total length of curve = $640+800+320+320=2080$ meter Cost of rolling barrier is 38000 per meter.

Total cost = $2080 \times 38000=7.9$ cr

The cost of constructing the Mumbai Pune Expressway is Rs. 16.3 billion

The 94.5 km-long expressway connects Mumbai to Pune. It is considered one of the busiest thoroughfares in India.

Construction cost per km= $16.3/94.5=0.172$ billion (17.2 cr/km)

The rolling barrier cost is 7.9cr , hence as compared to the construction cost of road the total cost of RB is 0.4 to 0.5 %.

COMPANY DETAILS:

Mase Enterprises - Offering Eva/Pe Safety Rolling Barrier at Rs 38000 in Chennai, Tamil Nadu. Get Safety Barrier at lowest price | ID: 19897424762.

Brand: MASE

Color: Yellow and Orange

Size: 370 x 210

₹38,000.00

COMPANY DETAILS						
SR NO.	STATE	COLOR	SIZE	BRAND	FINISHING	RATE/METER
1.	CHENNAI, TAMIL NADU	YELLOW AND ORANGE	370×210	MASE ENTERPRISES	MASE	38000

3.CONCLUSION

From this study we concluded that that accidents primarily occur due to human errors while operating motor vehicles, as well as natural factors like rain and fog that can contribute to road hazards. The study also highlights the importance of prioritizing human life over vehicles. Additionally, the study emphasizes the effectiveness of rolling barrier systems in mitigating

the impact of collisions. These systems are designed to redirect the path of a vehicle and convert the energy from the impact into rotational energy, thereby reducing the severity of accidents and potentially saving lives. In addition to preserving human life, rolling barriers can also help minimize damage to vehicles, resulting in a preservation of both financial and human resources.

Overall, it seems that the study suggests rolling barrier systems as a valuable safety measure that can reduce accidents and their associated consequences.

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