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# Highway Maintenance with Rubber Rolling Barriers to Reduce Accident

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**ABSTRACT:** The highway transportation rank high in travel and also in reportable accidents. Nowadays, there are various changes in road network and infrastructure developments done in our country. But according to the statistical report “Road Accident in India 2012” released by the Government of India, Ministry of Road Transport and Highways the reportable accidents, injury and fatality rates were in increasing order for the past decade up to 2011 and there is only a slight decline in the year 2012. In these accidents a considerable amount of accidents are due to vehicle-divider and vehicle-barrier collisions. This paper suggests and devises flexible median divider using suitable material, so as to reduce the risk level during median divider accidents.

The government is always looking at the latest technology that can ensure safety of road users, as outlined in the construction industry transformation plan. The Development of a country depends on the connectivity of various places with adequate road network. Roads are the major channel of transportation for carrying goods and passengers. They play a significant role in improving the socio-economic standards of a region.

## I. INTRODUCTION

Development of a whole country depends upon transportation system and the transportation system should be well developed in roads, railway, waterways, and air ways. Developed transportation systems are essential for the development of a country as well as for reducing the cost of communication and arrival of daily commodities. It is seen that road transportation is the nearest to the people & easily travel to any places. The road network could serve the remotest villages of the vast country. People depend on roads and highway for the movement of a good transportation, for travel from one place to another, for service, for social and recreational purpose and many other activities necessary to the functioning of our complex society. But roads are not free from any failure of construction. If construction of road is done very carefully, the failure of road chances will be minimized to reconstruct. But for having mistaken in construction procedure and the defects of used materials, the road surface is failed. The maintenance of this failures is required to repair & also to increase the life of the road, to reduce operating vehicle and maintenance cost and to keep the road in serviceable condition. The based on structural and design purpose, road pavements are generally divided into two types as flexible pavement and rigid pavement. In the India flexible pavement is mostly constructed for having advantages than rigid pavement. But India is a developing country so rigid pavement also get the priority for construction. Now a days rigid pavement as roads with definite length, available fund, materials, equipment and workers according to the requirements. Most of the roads of the city are constructed and maintained by the Roads and Highway Department. Deteriorations of flexible pavements occurred every year due to poor quality of construction coupled as well as due to heavy rainfall and bad drainage condition. So, it requires more money for road construction as well as for the maintenance. However, the requirements are not satisfied. Because of these reason rigid pavements get constructed.

## II. LITERATURE REVIEW

### Mehedi Hasan

Total length of paved road in Rajshahi City is about 186.64 km (2011 census). It shows that about 23% of total road lengths are present in failure condition. This study shows an investigation to compute the flexible pavement’s failure types, to define and identify the causes, and select the best maintenance for that failures of flexible pavement within Rajshahi City.



There are many types of failures occur on the roads such as different types of cracks, potholes, raveling, water bleeding, corrugation and shoving, depression, and rutting. The possible causes of flexible pavement failures are improper bituminous mixes with poor quality of materials, heavy traffic loads, heavy rainfall, and bad drainage on pavement. The failures are gradually raised due to lack of proper planning, inspection, and treatment. These failures create different types of disadvantages like traffic jam, discomfort to the passengers as well as drivers, increasing vehicle operating, maintenance cost, etc. This study proves that the authorities practice maintenance procedures to repair the failures of pavement which are about 60% similar to the conventional road maintenance procedures. The authorities as Roads and Highway Department and Rajshahi City Corporation are suggested to do maintenance according to the requirements of urgent maintenance and availability of fund which is found in this investigation.

#### **Kunj Bihari Verma**

As we know that about 35% of total road in kota city are in very bad conditions the types of failures on the road such as water bleeding, edge cracking, rutting extra and some others also such as over loading of vehicles, traffic jam, accident of vehicles and many bad drainage systems. which make disc comfortable for the passengers in travel time. for maintenance use of the appropriate design structure of the highway. we have to avoid unnecessary congestion which make the road to damage. The highway maintenance include surface maintenance, traffic service, bridge maintenance and drainage maintenance extra.

Today we are not using the new ideas for maintenance of road for giving more strength, we are using low quality materials for maintenance in pavement road that in case more failure in road. The purpose of this study is to identify common defects of cracks and defects in kota city road and use good suitable maintenance process. I selected 10km of road for study. This survey has been explored for several reasons of cracking and the failure of many different types of pavement.

#### **Muhammad Farhan**

The latest emerging technologies for road safety focuses on finding ways to avoid or minimize road accidents to road users with special concern by reducing the causes of road accidents. As depicted by data of certain advanced countries like Korea, Malaysia, Australia, United States of America, the major number of accidents causing death was very high during a previous couple of years due to the increased number of vehicles on road, which is getting unmanageable. However, Urethane Rollers invented in Korea has served to re-direct the uncontrolled moving vehicles and to balance it again causing reduction of accidents. In this paper, a study is carried out to explain its need in India perspective for using "Rolling Barriers" (RB) which has minimized the accidents rate in the above-mentioned countries. Rolling barriers provides cushioning effect during a crash, reduces the high-speed effect, constitutes material resilience with stiffness and have other performance characteristics that reduce injury to occupants and damage to the vehicle. 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

#### **Mehedi Hasan**

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.

#### **Pathom Chaloywares**

The Development of Natural Rubber for Traffic Devices in Thailand has been researched in several years. The enormous budgets have also been invested for the increasing of rubber prices. One of Traffic Devices is the application of natural rubber sheets for the protection of motorists driving motorcycles as crashed through concrete barriers. The number of road side accidents on rural roads in Thailand is about 3 fatalities per 10 kilometers. Therefore, the 11.20 MTB per a Fatality of accident cost is evaluated to be 3,360 TB per km. This leads to the mitigation methods to remedy a symptom's motorist





from severity to moderate and mild respectively. The solution is to find the best practice of road barrier which is applied with natural rubber latex glued with concrete barrier. In addition, the composite materials will be calculated of the modulus of elasticity and properties such as, strength and durability. The simulation of crashes, finite element of materials, LRFD and Concrete Technology methods will be taken into consideration. The testing of material in Thailand will be firstly applied for these, for example the road crash testing under the standard of NCHRP – TL3 (100 kph) will be taken into account.

### III. METHODOLOGY

#### Parameters for location selection

##### Location:

Location of the spot for accident survey was chosen to be from LIC to Gaddigodam. Vehicles from Tahasil Office Bridge to NH 7 were counted. The reason of this site selection because that location is high turning point. There is cause lot of accident on police record.

##### Date:

Data for accidents level on particular location was collected on 15 June 2021. It was Tuesday from police station.

**Time:** Time of data collection accidents level study from 6:00 pm to 6:30 pm.

**Observation:** Classified Vehicle accidents.

**Equipment:** Plane sheet, Board, pen, scale, etc.

**Number of person:** Two

#### Methodology of reconnaissance survey

Before we have conducted a reconnaissance survey on the previous day of actual work. We just visited the spot of study after collecting the data. Next day we went directly to the spot.

### IV. OBSERVATION

#### Observation of accidents level on spot location of road

Table 6.2( a) Observation of yearly accidents on location

Sr. No.	Year	Total No.of Accidents ( in numbers)	Total No. of persons killed ( in numbers)	Total No. of person injured ( in numbers)
1	2016	179	15	164
2	2017	191	8	183
3	2018	214	13	201
4	2019	218	24	194

Table 6.2( b) Observation of types of vehicles accidents on location

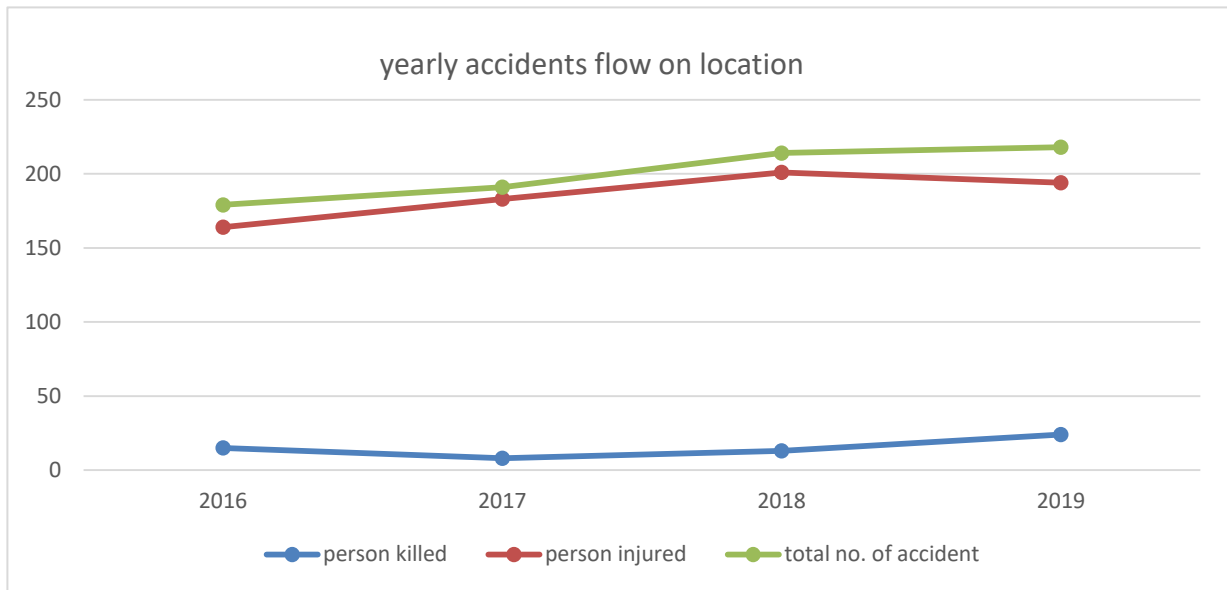
Sr. No.	Year	Types of vehicles					Total no. of accidents on road
		2 wheel	3 wheel	cars	trucks	others	
1	2016	57	29	64	17	12	179
2	2017	32	46	79	25	9	191
3	2018	14	53	60	24	15	214
4	2019	23	82	75	21	17	218

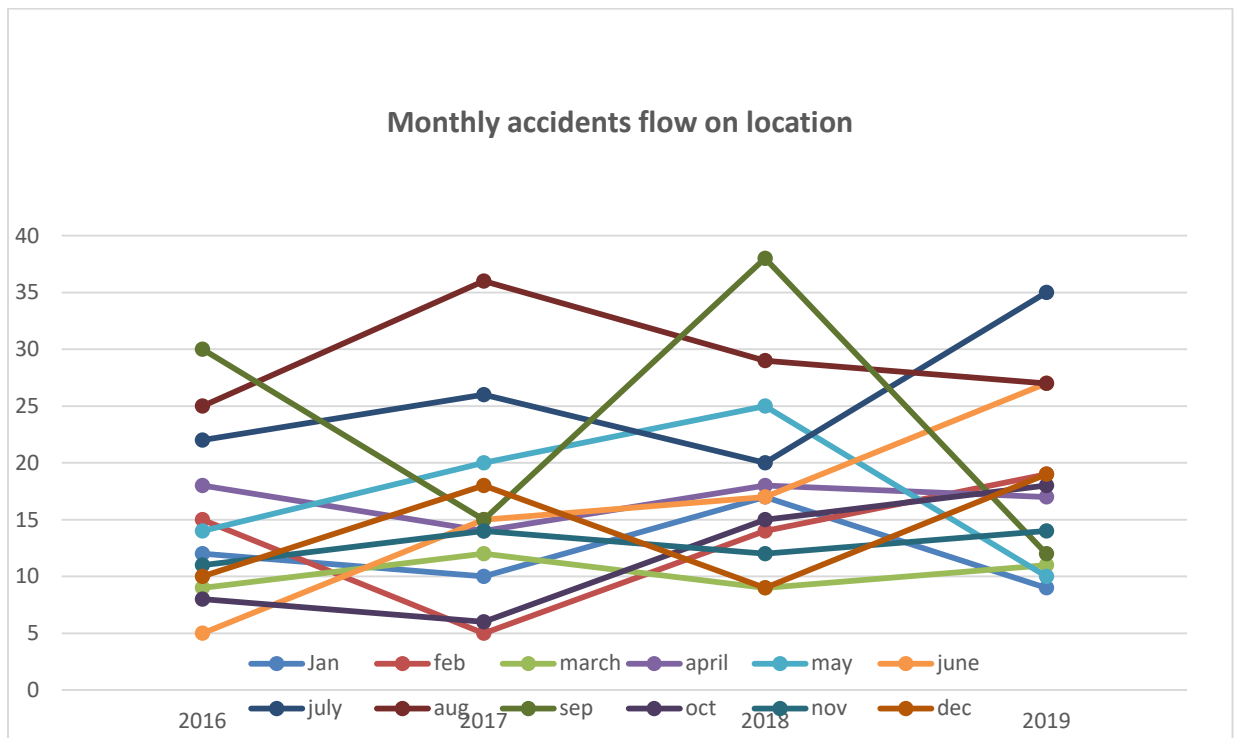
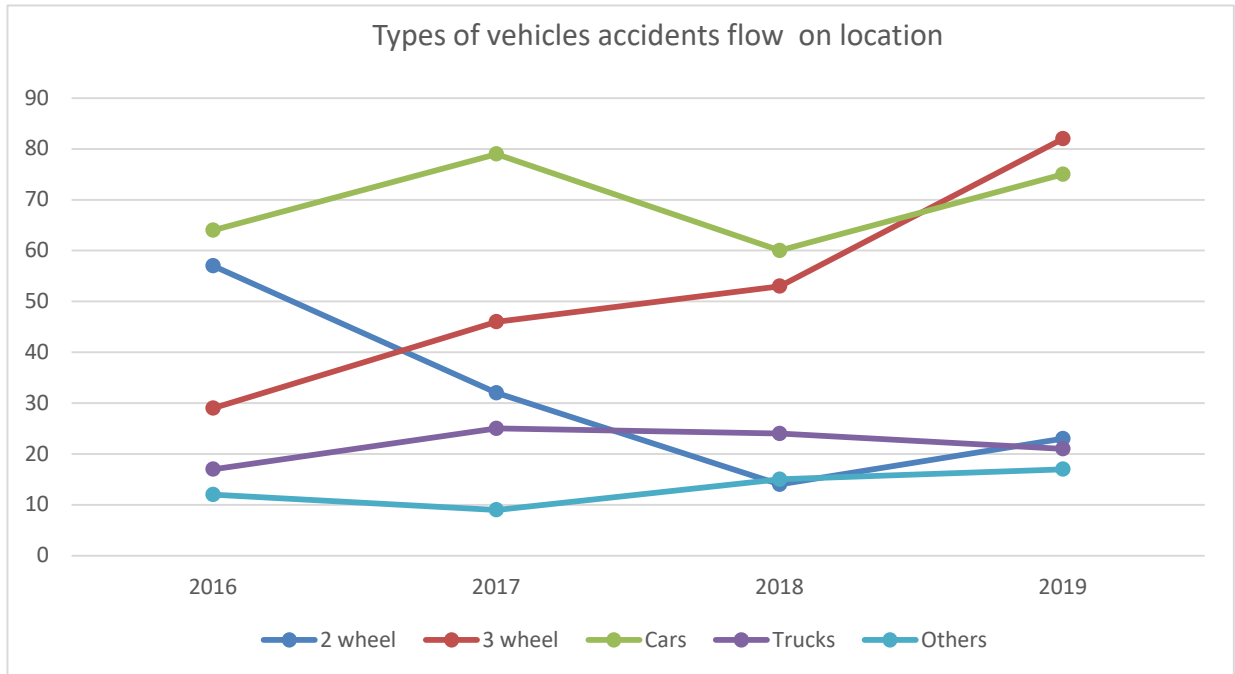


Table (c) Observation of monthly accidents on location

Sr. No.	No of accidents in Months	Year			
		2016	2017	2018	2019
1	Jan	12	10	17	9
2	Feb	15	5	14	19
3	march	9	12	9	11
4	april	18	14	18	17
5	May	14	20	25	10
6	June	5	15	17	27
7	July	22	26	20	35
8	aug	25	36	29	27
9	Sep	30	15	38	12
10	Oct	8	6	15	18
11	Nov	11	14	12	14
12	Dec	10	18	9	19

Graphical representation of accidents level on spot location of road





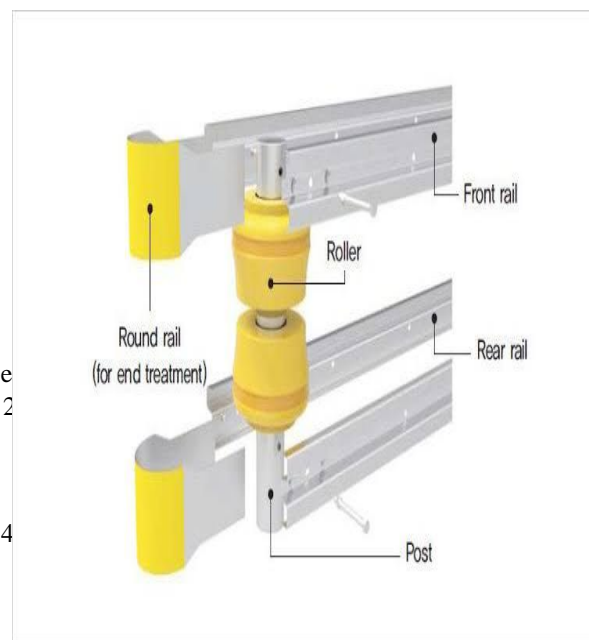
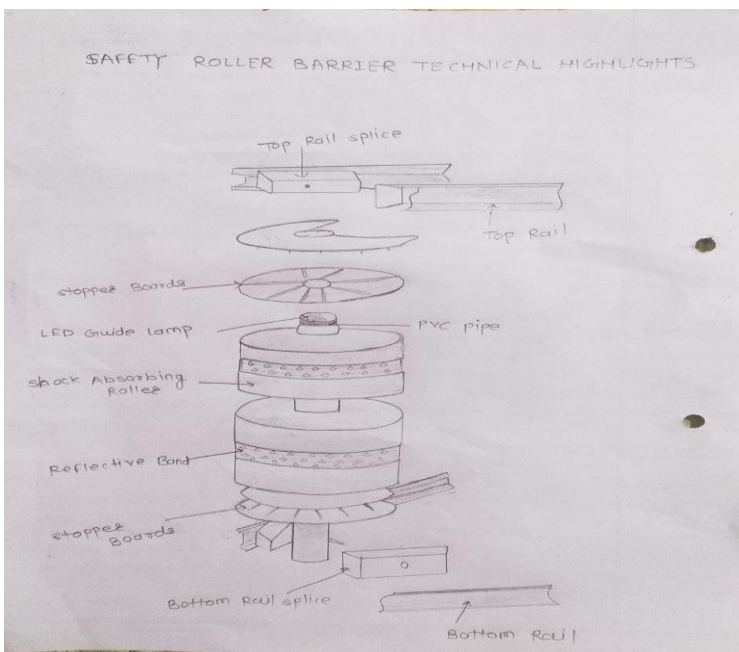
As the rolling barrier activates the rolling friction when vehicles hit the barrier, the rolling barrier reduces severity of traffic accidents. After installation of rubber rolling barrier the accident level can be decrease up to 80%.

**Cost**

This material is not introduced in India yet. So there have no specific costing about it. But in internationally there have the cost of rolling barrier. The features of rolling barriers are LED light, the hard rubber type plastic material (round shape), stainless steel, we use a lighting tape, when the vehicle’s light hit the tape it will brighter known as radium tape or reflective tape. The price of a roller is 40-45 USD (2965-3336 Rs). In this rate the LED light and the radium tape or reflective tape also included. But the price of the tape is 6 USD (445 Rs) per roll. The main thing of this barrier is the stand which is made of stainless steel. The price of stainless steel is 2-5 USD per kg (148 -370 Rs). Some company giving the whole part of the rolling barrier the cost of the total barrier is 230-290 USD per meter (17053-21501 Rs)

**Maintenance cost**

The main problem of rolling barrier is, its maintenance cost is very higher than concrete and steel made barriers. Due to periodical inspection, maintenance of the rolling barrier system is in high level. At high temperatures in summer season, the rubber characteristic material 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. Because of temperature or after crash the rolling barrier is damaged much so there need more maintenance. More maintenance means more labor work but advantage is that the maintenance system is easy. Just change the damaged roller of the barrier.



**7.2 Test:-**

**Passenger safety performance**

- Theoretical head impact velocity (THIV): 32.4km/hr (below 33km/hr)
- Post impact head deceleration (THD): 9.9 m/s-2(below 20 m/s-2)

**Test vehicle behavior performance**



- Not over thrown or a sudden stop after collision.
- 76.9% (Exit speed: 74.8km/hr): 43.7% (Exit angle: 8.74 degree)

## V. CONCLUSION AND FUTURE WORK

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 or improve the situation of 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. 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 Civil Engineering or Transportation Engineering.

The domain of material advancements in the last few decades we have developed exciting materials in engineering science. For materials election or fabrication of rolling barrier and cost factors will play a significant role. While selecting material for rolling barrier we need to see the properties required in the installed component. One of the most important properties in this regard is resilience and shock absorbing capacity, as this is the primary feature of the rolling barrier in absorbing the impact Energy imparted by the decelerating vehicle .Crash cushioning property plays an important role in fulfilling the main purpose of the rolling barrier. Another property which can add to the Functionality of the rolling barrier is thermal resistance, as large amount of heat is generated during the impact event. Using materials that are thermal insulators will ensure the proper working of the rolling barrier.

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