

Road Maintenance Effect in Reducing Road Accident

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Abstract— Road transport acts as a linchpin of modern social club and economy now days. It is really hard to imagine life without it. Huge road network and road traffic because increasing number of road accidents. Road accidents are a subject of great personal tragedy, social and economic losses. Road accidents are increasing at an alarming rate day by day. Inadequate and delayed care is one of the significant factors causing road safety degradation. Therefore it is important to road engineers know all the road deficiencies that are commanded to maintain at a higher floor to maintain the route network in good and secure condition. Various road deficiencies such as large potholes, shoulder drop off, absence of necessary traffic furniture and so on are affecting road safety adversely. However road maintenance is limited to filling pothole, cleaning drainage facilities without replacing traffic signs, route crossing off, safety rails and other safety features essential to produce a safe road network. Thither is a need for maintenance of all road distresses components so road network remains in good and safe status for a longer duration. Hence, this study presents a road accident trends in India and identifies various maintenance deficiencies and their effects in road accidents. Thus, this study shows how poor road maintenance increases road accidents. This field also identifies the strength of improved road maintenance, conditions such as improved road surface condition, presence of proper traffic furniture and so on in reducing road accidents. Thus, it is expected that this study will be useful for road engineers in understanding how proper road maintenance affects in reducing road accidents.

Key words: Road Accident, Road Safety, Road Maintenance

I. INTRODUCTION

Huge road network and traffic growth causes deterioration of the road network continuously. Consequently, road accidents are increasing at an alarming rate day by day. Every year, more than 1.17 million people perish in road crashes around the Earth. As per data register, by the World Bank, it is identified that the majority of these deaths, approximately 70 percent take place in developing nations like India. More than 1.2 million people are killed in road accidents, worldwide every year— that's approximately 3,000 deaths daily, 500 of them are kids. Road accidents are a subject of great personal tragedy, tremendous social and economic costs in terms of valuable lives lost, medical treatment, insurance and damage to public and individual property. Rapidly positive change in the number of traffic accidents is becoming a bigger movement of public health problem and economy losses, representing 1-3% of total Gross Domestic Product (GDP) in most of the countries worldwide. Inadequate and delayed maintenance of roads is one of the significant factors of having road accidents. Adequate and timely maintenance of this huge road network is a very important project for the road engineers to hold this road network in a unspoilt and safe condition [4]. For

adequate and timely maintenance a simple but effective monitoring and evaluation system is required and this system also helps to track progress of road safety actions and to estimate the safety impact. Often, maintenance of road components is determined up to filling potholes, improving drainage conditions and so on and road side development like replacing road signs, shoulder drop-off are most of the times ignored[14]. Several road distresses conditions like big potholes, shoulder drop-off, absence of traffic furniture and so on affecting road safety tremendously. Recognition of the effects of major road deficiencies towards road accidents is the most basic and effective task to distinguish the meaning of proper care. Effectiveness of improved road conditions would help to determine the importance of maintenance of each road deficiency. Hence, it is required to infer the importance of major road distresses components towards road safety. Therefore, the primary aim of this work is to spotlight the significant effects of road maintenance in reducing road accidents.

The paper consists of four sections. First section introduces this subject and identifies the need of the student. Second section presents road accident trends in India. Third section presents the effects of poor maintenance in road accidents and identifies the effectiveness of improved road conditions in reducing road accidents. Last section presents the important conclusions drawn based on this study.

II. ROAD ACCIDENT TRENDS IN INDIA

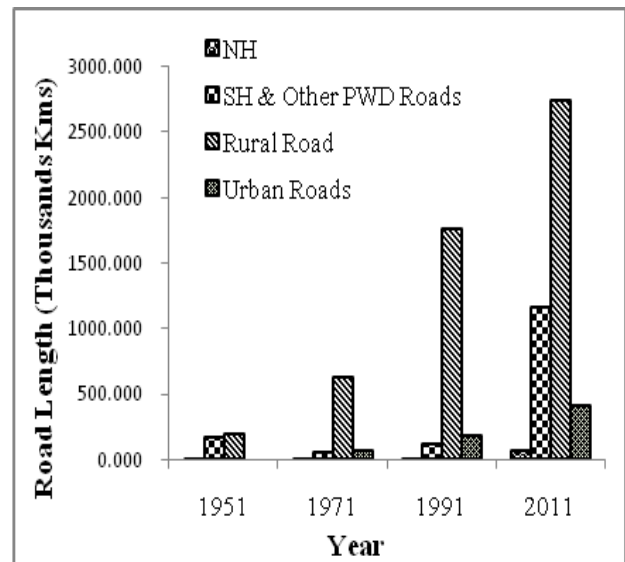


Fig. 1: Growth trend in road length of classes

India takes in huge road transport and road transport sector has implicit a vital part in the Indian economy. Roads in India hold an estimated 60% of freight and 80% of passengers. India takes in the second largest road network in the creation. The total road network in India constitutes of 200 km of Expressways, 79,243 km of National Highways,

1,31,899 km of State Highways, 4,67,763 km of Major District Roads, 26,50,000 km of Rural and Other Roads [12]. The total road length in India increased more than 11 times during the 60 years between 1951 and 2011. From 3.99 lakh kilometer as on 31st March 1951, the road length increased to 46.90 lakh kilometers as on 31st March 2011 [8]. The growth trend in road length of different categories is presented in Figure 1 given below.

Road systems all over the globe are getting gradually congested and unsafe with every day. Between 1970-71 and 2001-02, the total number of registered vehicles in India has increased 31 times. Nevertheless, the road length in the same period has increased by only 2.71 times. India takes in only around 1% of the world's vehicles, but accounts for as much as 6% of the world's accidents. Therefore, expansion in the road network, the surge in motorization and a developing population of a country contribute towards increasing numbers of road accidents, road accident injuries and road accident fatalities. Road accidents are a growing worldwide problem. The total of 4,40,123 road accidents happened in India in the year 2011. Road accidents are increasing enormously day by day and resulting in several road safety problems on highways. The details of increasing number of accidents in India are represented in Table 1. 50 one thousand thousand people worldwide are believed to be injured in road crashes each year, 15 million seriously. Every hour, approximately forty people under the age of twenty-five die in road accidents globally. On an average, 20 percent of total no. By people killed in traffic accidents in developing countries are under the age of fifteen. This is twice as high as in the developed world. In India, there is one road accident every minute, and one fatal accident every fourth minute. There are as many as thirty-five accidents per thousand vehicles, and the drivers involved in road crashes are in the age group of 20-40 years. Two-wheel horses and cars contribute to 50 percent of the total accidents.

Year	Total Number of Accidents	Number of Persons Killed	Accident Severity*
2002	4,07,497	84,674	20.8
2003	4,06,726	85,998	21.1
2004	4,29,910	92,618	21.5
2005	4,39,255	94,968	21.6
2006	4,60,920	105,749	22.9
2007	4,79,216	114,444	21.1
2008	4,84,704	1,06,591	22.0
2009	4,86,384	125,660	22.8
2010	4,99,628	134,513	23.9
2011	4,97,686	1,21,618	24.4

Table I: Details of Road Accidents in India

*Accident Severity: No. of Persons Killed per 100 Accidents

Road accidents results in huge economic and social losses and these accidents have a major impact on the country's economy, costing an estimated Rs. 300 billion.

Therefore, Reduction in road accidents has become a major concern for the regulatory authorities in India. Indian road safety situation is ten times worse when compared to the developed countries of the world, which leaves much to be done in the field of Road Safety Management. Road safety is defined as the absence of crashes, injuries and fatalities. The term "safety" implies that

there are no occurrences of accidents. Although unwanted, crashes and fatalities are unavoidable incidents of the transportation system. The road transportation is cursed with road accidents. Road safety status is the reflection of traffic culture and it is extremely poor in India. Therefore, the goal of a safe system should be to ensure that accidents do not result in fatality or serious human injury and hence there is need to check how to improve maintenance conditions of roads.

III. EFFECT OF MAINTENANCE IN REDUCING ROAD ACCIDENTS

This section presents that how poor maintenance of various road components causes increase in road accident and it also presents the effectiveness of improved maintenance components in reducing road accidents. Previous section presented the inadequate and delayed maintenance of road way components is one of the important causes of increase in number of road accident. However, literatures review on ill effects and effectiveness of maintenance components towards road safety is very limited and there is no proper checklist for identification of maintenance components to improve road safety for road engineers. Literature review indicated that most of the studies to assess the maintenance focus only on surface distress related maintenance components and other important maintenance components like adverse geometrical condition, improper furniture condition and other obstructions hazardous conditions are being ignored or neglected. Poor road surface conditions have direct effect on safety like shoulder drop-off creates safety risk to the road users by restricting the drainage from the roadway and causes failure of road way by allowing the water to penetrate into subgrade. Poor geometrical conditions enhance the risk of accidents like improper sight distance at curves and intersection causes more chances of hitting with unexpected obstruction on carriageway and intersection without island causes unregulated traffic flow. Proper maintained and well located traffic furniture is also an important aspect to improve road safety. Poor drainage conditions and other conditions also causes the safety hazardous conditions such as water ponding on road surfaces, ditches side slope etc. affects the motorists harmfully and traffic obstructions causes problem in visibility. Therefore, how poor maintenance of road deficiencies increasing road accidents is presented in detailed in the following tables. Maintenance of these components is cheap and it is useful to improve road safety in economic manner. Therefore, identification of critical maintenance components and their ill effects on increasing road accidents is the first and most important task of assessing the maintenance needs for improving road network safety. Hence, this section is presented to develop an understanding of effects of road distress maintenance in reducing road accidents.

Road engineer should be aware of all maintenance components that are required to maintain for road safety improvement. Maintenance of these road deficiencies is having very important role in reducing road accidents. Therefore, this study identifies the effectiveness of improved road conditions are presented in different charts given below. Effects of poor surface conditions on road safety are presented in Table II given below.

S.No	Poor Surface Condition	Effects on road safety*
1	Rut depth(> 20 mm)	Causes out of control to vehicles
2	Skid resistance (0.6 to 0.35)	Enhance skidding of motorist vehicles.
3	Edge wear	Hazardous on moving the vehicle from roadway to shoulder.
4	Potholes, Undulations	Causes to vehicle damage and swerve suddenly
5	Shoulder Drop-off(>75mm)	Create safety hazardous to road user
		Allow water to penetrate into subgrade
		Restrict drainage away from the roadway
6	Unsealed shoulder surface	Vegetation Create secondary ditches and inhibit drainage
		Debris, stones on shoulder create unsafe condition for vehicle that leaves the road way

Table II: Effects of Poor Surface Condition on Road Safety
The effectiveness of improved road surface conditions in reducing road accidents is presented in Figure 2.

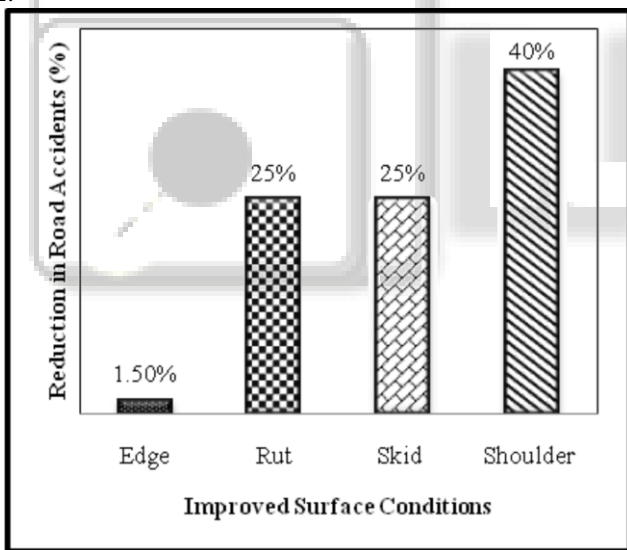


Fig. 2: Effectiveness of improved road surface condition in reducing road accidents

Table III presents how poor geometrical conditions result hazardous to the road users and increases road accidents.

S.No	Poor Geometric Conditions	Effects in road accidents*
1	Improper road width	Causes traffic congestion on road
2	Median absence	Causes unregulated traffic flow
3	Improper sight distance	At curves, intersections chances of hitting an object are more with unexpected obstruction on carriageway.

4	Improper gradient	Can lead to drainage problem
5	Improper super elevation	Friction between tyre and road surface becomes much higher hence Increases the risk of accident
6	Intersection without islands	Causes heterogeneous traffic flow

Table III: Effects of Poor Road Geometrical Conditions in Road Accidents

The effectiveness of improved road geometrical conditions in reducing road accidents is presented in Figure 3[1], [2], [6].

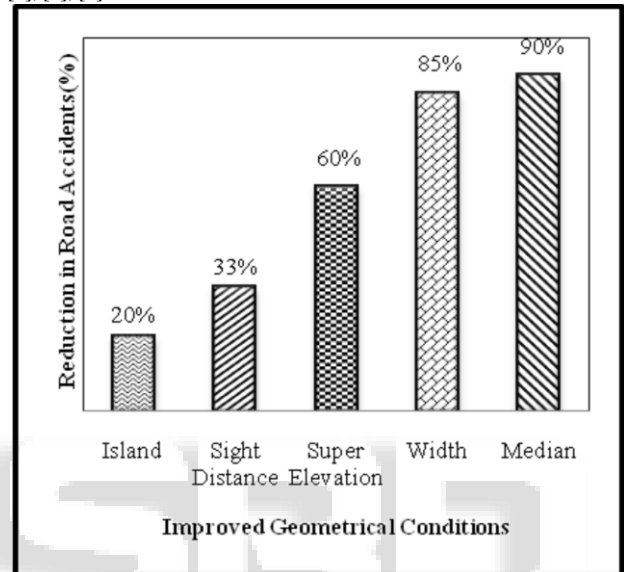


Fig. 3: Effectiveness of improved geometrical condition in reducing road accidents

The effects of poor traffic furniture condition in road accidents are presented in Table IV.

S.No	Poor Traffic Furniture	Effects in road accidents*
1	Faded road marking	Promote Irregular traffic flow
		Reduce the smooth flow of traffic
2	Improper traffic signs, traffic signal	Unable to convey the information regarding road features due to poor visibility
		Loose the confidence of driver due to improper location
		May lead to violation of control system
3	Poor street lighting	Creates confusion to the road user
		Dangerous during night
4	safety barrier absence	Creates unsafe condition to pedestrians
		At sharp drop-off can cause safety hazardous

Table IV: Effects of Improper Traffic Furniture in Road Accidents

The effectiveness of improved road furniture conditions in reducing road accidents are presented in Figure 4.

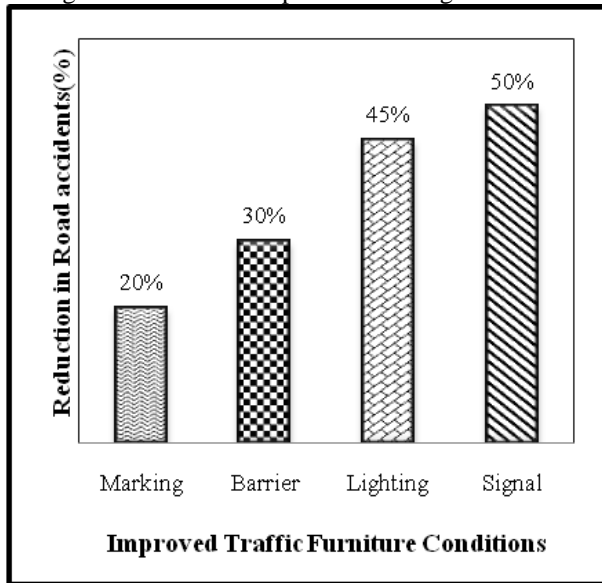


Fig. 4: Effectiveness of improved traffic furniture condition in reducing road accidents

Table V given below presents how poor maintenance of road drainage condition increases the chances of road accidents.

S.No	Poor Drainage conditions	Effects in road accidents*
1	Water ponding on surface	Vehicle cannot be steered or stopped easily
		Very dangerous for motorcycles and bicycles.
		Heavy vehicles can create rut on wheel path
2	Ditches side slop	To steep and deep ditches can cause the vehicle to roll over
3	Damage Drainage structure	Safety hazardous to the motorists
4	Traffic Obstructions	Causes problem in visibility, Increases hitting chances

Table V: Effects of Poor Road Drainage in Road Accidents

Based on above discussion, it may be concluded that timely and adequate maintenance is very important in improving road safety.

IV. CONCLUSIONS

This work shows the effects of maintenance in reducing road accidents. Grounded on this field, the important conclusions are summed up as follows:

- Enormous growth in road accidents causes great losses in terms of societal and economic losses. Hence, adequate and timely maintenance of a road network is asked to better road safety.
- Various road deficiencies such as poor surface conditions, shoulder drop off, improper lighting etc.. Causes an increase in road accidents. Therefore, maintenance of these road deficiencies has a very important part in reducing road accidents.

- This written report also identifies how poor maintenance of road deficiencies, increasing the hazards of road accidents like big pothole causes to vehicle damage and swerve on the spur of the moment, the improper sight distance at curves and intersections increase the prospects of running into an object with unexpected obstruction on carriageway and so forth
- This field also identifies the strength of improved road surface condition in reducing road accidents. It is identified that improved road surface conditions can reduce 1.5% to 40 % of accidents.
- This field identifies the strength of improved geometrical condition in reducing road accidents. It is identified that improved geometrical conditions can reduce 20 % to 90 % of accidents.
- This field identifies the effects of the improved traffic furniture condition in reducing road accidents. It is identified that improved traffic furniture conditions can reduce 20 % to 50 % of accidents.

Grounded on this work, it may be concluded that timely and adequate care is really significant in improving road safety. Withal, it is farther urged that more works need to be carried on to verify maintenance effectiveness in cutting road accidents. It is anticipated that this work will be useful for roadengineers in understanding how road maintenance affects in reducing road accidents.

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