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THE IMPACT OF ROAD SURFACE DISTRESS ON CAPACITY

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ABSTRACT – This research aims to investigate the impact of road surface distress on the capacity of the road. Road capacity is a critical factor in the efficient and safe movement of traffic. Road surface distress such as potholes, cracks, and rutting can significantly affect road capacity and lead to reduced traffic flow, increased travel time, and higher vehicle operating costs. To achieve the research objective, data on road surface distress and traffic flow are collected from a range of different road types and locations. The collected data are analysed using statistical methods to identify correlations between road surface distress and traffic flow. The results of this research provide insights into the relationship between road surface distress and road capacity, which can be used to improve road maintenance and design practices. By understanding the impact of road surface distress on capacity, transportation agencies can prioritize maintenance and repair activities to maximize the capacity of the road network and reduce the negative impact of road surface distress on road users.

Keywords: Road surface; Distress; Capacity

1. INTRODUCTION

The road network is a crucial component of the Sri Lankan transportation system, and its maintenance and management are critical to ensuring the efficient movement of goods and people. During a certain period after a road is opened to traffic, several deformations and cracks, including potholes, transverse, longitudinal, and alligator cracks, begin to appear on the road surface. The impact of road surface distress on capacity has become an issue of concern in the Sri Lankan Road network, as it can affect the safety, sustainability, and economic viability of the transportation system [1]. They also contribute to numerous issues including accidents, reduced movement rates, capability reduction, and excruciating discomfort status [2]. As a result of a mix of heavy traffic, inadequate design and construction, and poor maintenance, road surface distresses are a prevalent issue in Sri Lanka. Since numerous factors contribute to the failure and deterioration of pavements, the topic of pavement distress or failure is complicated [3]. A total of 100,000 km of roads, comprising rural roads, provincial roads, and national highways, make up the nation's road network [1]. Several of these roads have only one lane, and both vehicles and pedestrians use them frequently [1]. The surface of the road can also be harmed by weather conditions, such as prolonged periods of rain or flooding. Since previous study [4] showed the critical necessity for empirical investigations to quantify and simulate the extent of capacity loss brought on by pavement surface deformations only focusing on the reason for the capacity loss due to the distresses and methodologies to detect road surface distresses. According to some earlier findings, deformations significantly affect the maximum capacity of continuous road connection sections [5]. Despite the country's extensive road network and easy access to almost every area, Sri Lanka nevertheless faced major maintenance issues [6]. Therefore, the main aim of this research is to investigate the impact and the relation of road surface distress on capacity and identify the factors that influence this relationship in the context of Sri Lanka. Further, the study assesses how different types of road surface distress affect Sri Lankan traffic capacity of the road, to discern the critical thresholds of road surface distress that result in capacity reductions there, and to create models that can forecast how road surface distress will affect Sri Lankan road capacity.

2. MATERIALS AND METHODS

Firstly, a literature review related to the impact of road surface distress on capacity helps to understand to research gap. The research gap addressed in this study lies in the specific understanding of how road surface

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distress affects road capacity in the context of Sri Lanka's transportation system. While previous research [6] has explored the general impact of road surface distress on road conditions, there is a lack of comprehensive studies that focus specifically on the Sri Lankan Road network.

In order to collect data, it is expected to conduct a traffic survey on a selected road segment in Avissawella-Colombo Road at Ambatale which currently has a distressed pavement. The data are expected to be collected in a road section in Ambatale during July 2023 as identified in the literature. The data regarding the following categories are collected.

Road Geometrics

- Road Length
- Road Width
- Number of lanes
- Type of terrain

Geometrical and Structural Properties of the Distress Zone

- Type of Distress- Potholes
- Width of distress zone
- Depth of distress

Data related to road geometrics and geometrical and structural properties of the distress zone are collected manually using a tape.

Traffic data (Vehicle volume, Vehicle Speed, Vehicle Type)

Traffic data are collected under two sections.

1. With distress section
2. Without distress section

The data are collected using two video cameras for each section. The observation is based one-direction traffic flow. The data collection is to be done during the peak hours, which are recognized as 8:30 a.m. - 9:30 a.m. and 4:30 p.m. - 5:30 p.m. The collected data are expected to analyse using a non-linear regression model to see how much capacity is lost due to road surface distress. The dependent variable is capacity, and the independent variables are the level of surface distress and traffic flow.

3. RESULTS & DISCUSSION

Previous studies have consistently shown a negative correlation between road surface distress and road capacity. As supported by the literature, this study also expects to find that road capacity decreases as road surface distress increases. Additionally, factors such as traffic volume, weather conditions, and pavement design have been identified as significant contributors to road surface distress and road capacity. Consequently, this research is anticipated to provide valuable insights into the implications of these findings. Understanding the relationship between road surface distress and road capacity will guide road maintenance and management strategies in Sri Lanka, helping authorities prioritize activities to optimize the road network's capacity and enhance the overall experience for road users.

4. CONCLUSIONS

The key findings of the study will be summarized, and any recommendations for future research or improvements in road maintenance to maximize road capacity will be presented. This research will provide valuable insights into the relationship between road surface distress and road capacity, which could inform the development of effective road maintenance and management strategies. The practical applications of this study's findings are of paramount importance for transportation authorities in Sri Lanka. Understanding the relationship between road surface distress and road capacity will enable authorities to prioritize maintenance efforts. By focusing on roads experiencing severe distress and likely capacity reductions, resources can be efficiently allocated to maximize the road network's overall capacity. By identifying factors contributing to road surface distress, authorities can implement design improvements to mitigate distress development and minimize capacity loss over time. Transportation authorities can utilize the study's results to develop effective traffic management strategies. By accounting for road surface distress and its impact on road capacity, traffic flow can be better managed to reduce congestion and optimize road usage. Addressing road surface distress and optimizing road capacity will lead to safer and more efficient travel for road users. Reduced traffic congestion and smoother road conditions will result in decreased travel times and lower vehicle operating costs. In conclusion, this research provides valuable insights into the relationship between road surface distress and road capacity in the context of Sri Lanka. By elaborating on the practical applications, transportation authorities can leverage this knowledge to implement effective road maintenance, design, and traffic management strategies, ultimately enhancing the performance and safety of Sri Lanka's transportation system.

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