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Repairing of Potholes and Highway Maintenance

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Abstract: Potholes on pavement is the most common type of pavement failure, many research on enhancement of pavements resistance to developing potholes is being conducted since decades, yet the problem has not been completely tackled. Potholes typically develop as a result of the natural wear and tear on paved surfaces, such as roads and parking lots, over time. The development of potholes is accelerated by various factors such as weather conditions, heavy traffic, and the quality of the pavement material and construction. IRC 116: 2014 is the Indian Road Congress (IRC) code that outlines the standards and specifications for the construction and maintenance of roads and highways in India. It covers all aspects of road design, construction, and maintenance, including the repair of potholes. Pavement can be protected from potholes by regular maintenance, avoiding heavy vehicles, adequate drainage and using good quality materials. However the problem of potholes is very regular on Indian roads and that is due to improper design, quality of materials, lack of maintenance and inadequate drainage.

Keywords: Potholes prevention and repair, New materials, Sustainability

I. INTRODUCTION

Potholes are one of the most common road defects that occur on asphalt or concrete pavement surfaces. They can be defined as circular or irregularly shaped depressions that appear on the road surface and can range in size from a few centimeters to several meters in diameter. Potholes are caused by a combination of factors such as weather, traffic volume, pavement age, and quality of construction. Formation: Potholes are typically formed when water seeps into the cracks and crevices on the road surface, especially during wet weather conditions. This water then freezes and expands, causing the pavement to break up and weaken. As traffic passes over the weakened area, the pavement continues to break down, resulting in a pothole. Other factors that contribute to the formation of potholes include heavy traffic, poor drainage and poor construction. Potholes can have several negative effects on both vehicles and road users. Some of the most significant effects include vehicle damage, increased maintenance costs, safety hazards. There are several methods for repairing potholes, depending on the severity and location of the pothole. Some of the common repair methods include patching, milling and resurfacing, reconstruction. To prevent the formation of potholes, regular maintenance and repairs are crucial. Some preventive measures include regular pavement inspections, fixing drainage problems, and timely repairs to cracks and other pavement defects. Road authorities can also use materials such as high-quality asphalt and concrete mixes to improve the longevity and durability of the road surface.

II. LITERATURE REVIEW

The literature review paper related to study of potholes repairing was carried out, the main objective is to find a best possible method to prevent and repairing of potholes.

Cliff Nicholls et al [1] the unprepared patching of potholes with cold-mix asphalt (alternative 1a) incurs the highest costs compared to other patching strategies. The low patching survival of this strategy increases the total number of potholes to be repaired. the findings of the project have been summarised.

Linyu Li et al [2] This study investigates the influences of the joint surfaces of the pothole repairs and the types and dosage of tack coat materials on the bond strength and fatigue performance of the asphalt pavement potholes repair process through pull-out and four-point bending tests. By comparing the predicted values of the fatigue life regression model with the measured values, it was found that the error percentage was low. So, the model can be used to predict the fatigue life of the recommended pothole repair of asphalt pavement under different conditions.

Dax Patel et al [3] The repaired pavement with CPAM would soon re-appears as new pavement distress. Organosilane based chemical additives works for HMA and also cold mix. These additives are expected very helpful to solve de-bonding problems. Use of these compounds as antistripping additive in HMA and as a bonding agent in asphalt emulsion gave significant improvement, in moisture sensitivity and bonding in tack coat.

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Ahmad Zafar Merzakhill et al [4] Materials such as demolition waste, locally available or marginal materials and waste plastics were tested and found that all materials have their own advantages and disadvantages. Environmental impact of using such materials in road works, especially from the point of heavy metal leaching and ground water contamination is also required to be carried out before field usage.

Purva P et al [5] This research paper discusses the common problem of potholes on Indian roads during monsoons and the traditional methods of pothole filling that are unreliable and expensive. The paper explores different methods for repairing potholes and selects the best suitable method based on costing and quality parameters. The use of non-Newtonian fluid and geosynthetics are modern advancements in pothole repair materials. The paper also highlights the importance of durability in pothole repair and suggests the use of geo sheets and epoxy to improve durability. The article provides references to various studies and reports on pothole repair.

Chandrashekar Gowda K.N et al [6] The research paper proposes an economical and easy solution for repairing potholes on Indian roads and streets using a readymade stockpile cold patching mix made from local aggregates and cutback bitumen. The mix can be prepared in advance and remains workable for at least 6 months, making it suitable for use throughout the year, including the rainy season. The article includes information on the materials used, basic tests on aggregate and bitumen, and the methodology for mixing and placing the cold patching mix in potholes. The method is found to be suitable and effective for repairing potholes, allowing for fast patching and less disruption to traffic.

N. Naveen et al [7] This research paper examines the effects of potholes on vehicular traffic in Hyderabad, India. The study recommends preventative maintenance to avoid potholes and advises drivers to maintain their distance, watch their speed, and hold the steering wheel correctly when driving on roads with potholes. The primary cause of potholes is water, and they can lead to damage to vehicles and alignment problems.

Amit Patil et al [8] The research paper discusses the design and fabrication of a pothole repairing machine that uses plastic waste in mixes. The machine is lightweight, easy to operate, and can be used in both rural and urban areas. The waste plastic is shredded and mixed with hot bitumen to create a mix that can be used for pothole repair and pavement. The paper also discusses the causes of potholes, the materials used, the components of the machine, and the construction and working of the machine. The conclusion includes the proper proportion of materials used, the specific type of plastic to be used, and the potential for using the machine to make pavement from plastic waste.

Mehedi Hasan et al [9] This paper investigates the types and causes of pavement failures in Rajshahi City, Bangladesh, and recommends maintenance procedures to repair them. The study identifies various types of failures and their causes, such as poor quality of materials, heavy traffic loads, heavy rainfall, and bad drainage. The study recommends routine, periodic, and urgent maintenance to keep the roads in serviceable condition. The investigation found that most failures are surface failures, with cracks and potholes being the most common. The study recommends proper planning and designing, skilled inspectors, and effective maintenance procedures to address these failures.

Atul Kumar et al [10] This research paper discusses the importance of transportation infrastructure, particularly the road network, for economic, industrial, social, and cultural development of a country. It emphasizes the need for maintenance to ensure the longevity of the road network and discusses various types of pavements and their structural performance. The paper also highlights various studies on pavement defects, maintenance, and road deterioration. It concludes with a discussion on highway planning and design, emphasizing the importance of early decision-making in the planning and project development stages. The paper identifies different types of stresses and defects in highway systems and recommends maintenance decisions based on their severity levels.

Ubido Oyem Emmanuel et al [11] This research paper investigates the cause of road failure along a 60 km long Sagamu-Papalanto highway in southwestern Nigeria. The study conducted various tests to determine the soil properties and potential causes of road failure. The results showed that the low CBR, low MDD, and the class of subsoils are responsible for the cause of failure experienced in the study area. The major clay mineral that is predominant in the studied soil is kaolinite. The study concludes that these soils are unsuitable as road construction materials and hence, there is a need for stabilization during the reconstruction and rehabilitation of the road. The study recommends soil improvement methods before using the soils as road construction materials. Other contributing factors to the failure of the road include inadequate drainage system, poor pavement coating, and substandard construction materials.

Rahul Kisanrao Ubale et al [12] This research paper investigates the cause of road failure along a 60 km long Sagamu-Papalanto highway in southwestern Nigeria. The study conducted various tests to determine the soil properties and

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III. CONCLUSION

The numerous studies and research efforts conducted on pothole repair methods over the years. While the specific findings and recommendations may vary somewhat depending on the study, there are several general conclusions that can be drawn from the collective body of research. It is widely recognized that potholes are a persistent and costly problem for transportation infrastructure, particularly in areas with high levels of precipitation or freeze-thaw cycles. Potholes can cause safety hazards for motorists and cyclists, as well as damage to vehicles. There is no single "silver bullet" solution to pothole repair. Different methods may be more or less appropriate depending on the specific conditions and circumstances, such as the type and severity of the pothole, the climate, and the available resources and budget. Some of the most commonly used pothole repair techniques include filling with hot or cold asphalt, using patching materials like concrete or polymers, or employing infrared heating technology to soften and re-bond the surrounding pavement. Research has suggested that preventative maintenance is often more effective and cost-efficient than reactive repairs. Strategies like crack sealing, sealcoating, and pavement preservation can help extend the life of roadways and reduce the frequency and severity of potholes. There is a need for continued research and innovation in the field of pothole repair, as new materials, technologies, and techniques are developed and tested. The ongoing challenge of maintaining safe and reliable transportation infrastructure requires a collaborative and adaptive approach, drawing on the expertise of engineers, researchers, policymakers, and other stakeholders. Since the aggregates are non renewable and face lot of wear and tear and stripping there is a requirement to find a new material that can be used as an alternative for coarse aggregates used in road construction.

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