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Review Paper on Defects in Rigid Pavement

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Abstract: ***In this project Pavement failure is defined in terms of decreasing serviceability caused by the development of cracks and ruts. Before going into the maintenance strategies, we must look into the causes of failure of rigid pavements. Failures of rigid pavements are caused due to many reasons or combination of reasons. Application of correction in the existing surface will enhance the life of maintenance works as well as that of strengthening layers. It has been seen that only three parameters i.e., unevenness index, pavement cracking and rutting are considered while other distresses have been omitted while going for maintenance operations. Along with the maintenance techniques there are various methods for pavement preservation which will help in enhancing the life of pavement and delaying its failure. The purpose of this study was to evaluate the possible causes of pavement distresses, and to recommend remedies to minimize distress of the pavement. The project describes lessons learnt from pavement failures and problems experienced during the last few years on a number of projects in India. Based on the past experiences' various pavement preservation techniques and measures are also discussed which will be helpful in increasing the serviceable life of pavement***

Keywords: Defects in Rigid Pavement

I. INTRODUCTION

A highway pavement is a structure consisting of superimposed layers of processed materials above the natural soil subgrade, whose primary function is to distribute the applied vehicle loads to the sub-grade. The pavement structure should be able to provide a surface of acceptable riding quality, adequate skid resistance, favorable light reflecting characteristics, and low noise pollution. The ultimate aim is to ensure that the transmitted stresses due to wheel load are sufficiently reduced, so that they will not exceed bearing capacity of the sub grade. Two types of pavements are generally recognized as serving this purpose, namely flexible pavements and rigid pavements. This chapter gives an overview of rigid pavement, layers, functions, and pavement failures.Rigid pavements are composed of a PCC surface course. Such pavements are substantially "stiffer" than flexible pavements due to the high modulus of elasticity of the PCC material. Further, these pavements can have reinforcing steel, which is generally used to reduce or eliminate joints.

II. LITRETURE REVIEW

Sharad.S.Adlinge et al., states the Pavement failure is defined in terms of decreasing serviceability caused by the development of cracks and ruts. Before going into the maintenance strategies, we must look into the causes of failure of bituminous pavements. Failures of bituminous pavements are caused due to many reasons or combination of reasons. Application of correction in the existing surface will enhance the life of maintenance works as well as that of strengthening layers. It has been seen that only 3 parameters i.e. unevenness index, pavement cracking and rutting are considered while other distresses have been omitted while going for maintenance operations. Along with the maintenance techniques there are various methods for pavement preservation which will help in enhancing the life of pavement and delaying its failure. He also evaluated the possible causes of pavement distresses, and recommended the remedies to minimize distress of the pavement. [1]

Prof.Akshar Patel et al., Pavement deterioration is a serious problem for the road and traffic sector in almost every country. There are basically two types of pavements which are used for transportation of goods as well as passengers or people. Due to continuous movement of vehicles on roads the different types of pavement failures like fatigue cracking, rutting and thermal cracking, potholes are observed. The resurfacing of flexible pavements will enhance the life of pavements as well as it strengthens existing layers of pavements. [2].

Woods and Adcox et al. pavement failure may be considered as structural, functional, or materials failure, or a combination of these factors. Structural failure is the loss of load carrying capability, where the pavement is no longer able to absorb and transmit the wheel loading through the structure of the road without causing further deterioration. Functional failure is a broader term, which may indicate the loss of any function of the pavement such as skid resistance, structural capacity, and serviceability or passenger comfort. Materials failure occurs due to the disintegration or loss of material characteristics of any of the component materials. [3]

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Amandeep Mehra et al., Potholes are an indication of structural surface failure and they result from growth of a break in the surfacing, often as a result of severe alligator cracking as shown in Plate 2. Once water enters pavement layers, the base and/or subgrade become wet and unstable, and the resultant degradation leads to rapid growth of pothole area and depth. if the potholes are numerous or frequent, it may indicate underlying problems such as inadequate pavement or aged surfacing requiring rehabilitation or replacement. Water entering pavement is often the cause, and could be caused by a cracked surface, high shoulders or pavement depressions ponding water on pavement, porous or open surface, or clogged side ditches. [4]

Hankins, K., Y. C. Suh et al.. The development of high concrete temperatures could cause a number of effects that have been shown to be detrimental to long-term concrete performance. High concrete temperatures increase the rate of hydration, thermal stresses, the tendency for drying shrinkage cracking, and permeability and decrease long-term concrete strengths and durability as a result of cracking. Data from the Texas Rigid Pavement database were analyzed to reveal whether there are increased numbers of failures as the air temperature at placement increases. It was shown that this was the case for both major coarse aggregate types: limestone and siliceous river gravel. The results of the analysis emphasize the importance of concrete temperature control during concrete pavement construction in hot weather conditions. Most states specify a maximum concrete temperature at placement to mitigate the detrimental effects of placement during hot weather. The specified limit remains the same irrespective of the type of mineral or chemical admixtures used.

To produce specifications that encourage contractor innovation and the use of improved materials, modern specifications should account for these materials to ensure improved concrete performance under all placement conditions. To provide improved performance for sections paved under hot weather conditions, it is proposed that the continuously reinforced concrete pavement reinforcement standards be redesigned to provide steel quantities for specific use during hot weather conditions and that an end-result specification that limits the maximum in-place concrete temperature during hydration be implemented. [5].

M. Y. Darestani et al.. The structural adequacy of a rigid pavement can normally be predicted based on its structural response to the applied loads. While considerable knowledge of pavement behaviour under static loads is available word-wide, only a very limited number of studies have been carried out in the past to determine the effect of dynamic loads on rigid pavement deteriorations. Hence, opinions differ as to which type of load (static or dynamic) results in greater values of base deflection or flexural stress. In the present study, a rigid pavement test section consisting of two jointed reinforced concrete pavements and two jointed plain (unreinforced) concrete pavements was constructed and tested under both quasi-static and dynamic truck loads. Truck load was allowed to wander at predetermined locations on top of the instrumented pavement. Nominal speeds from 5 km/h to 55 km/h were used in the study.

Various devices including strain gauges, displacement transducers, vertical accelerometers and thermocouples were installed at different depths along the test section. A total of 5184 time history responses of the test section were recorded. Results indicate the importance of dynamic analysis in rigid pavement design. [6].

Milind V. Mohod et al. The last century has seen an intensive process of urbanization in rural as well as metro cities. This has led to a need of rapid construction of roads and transportation infrastructure. The demand for better roads and services required researchers, designers and builders to explore innovative and cost effective engineered products to satisfy increasing demand that would economize the construction as well as increase durability. Pavements are essential features of the urban communication system and provide an efficient means of transportation.

Flexible pavements are preferred over cement concrete roads because of their certain advantages like they can be strengthened and improved in stages with the growth of traffic. The flexible pavements are less expensive in regards to initial cost and maintenance. The concrete pavements nowadays are becoming more popular in India because of the steep rise in the cost of bituminous pavement. The largest advantage of using rigid pavement is its durability and ability to hold a shape against traffic and difficult environmental conditions. Although concrete pavement is less expensive but has less maintenance and good design life. The main objective of this study is to present a comparative review on suitability of pavement depending on various parameters such as material, loading, longer life, cost effectiveness etc. [7]

III. CONCLUSIONS

The serviceability and longevity of rigid pavement constructions depend on the rate of pavement deterioration which is a function of factors such as material properties, climatic effects and vehicle load characteristics. There are different pavement restoration techniques used on our site, based on type of distress. In most of the situations the rehabilitation of the pavement is affected by full depth repairs. Insufficient funding often limits the timely repairs and rehabilitation of the pavements.

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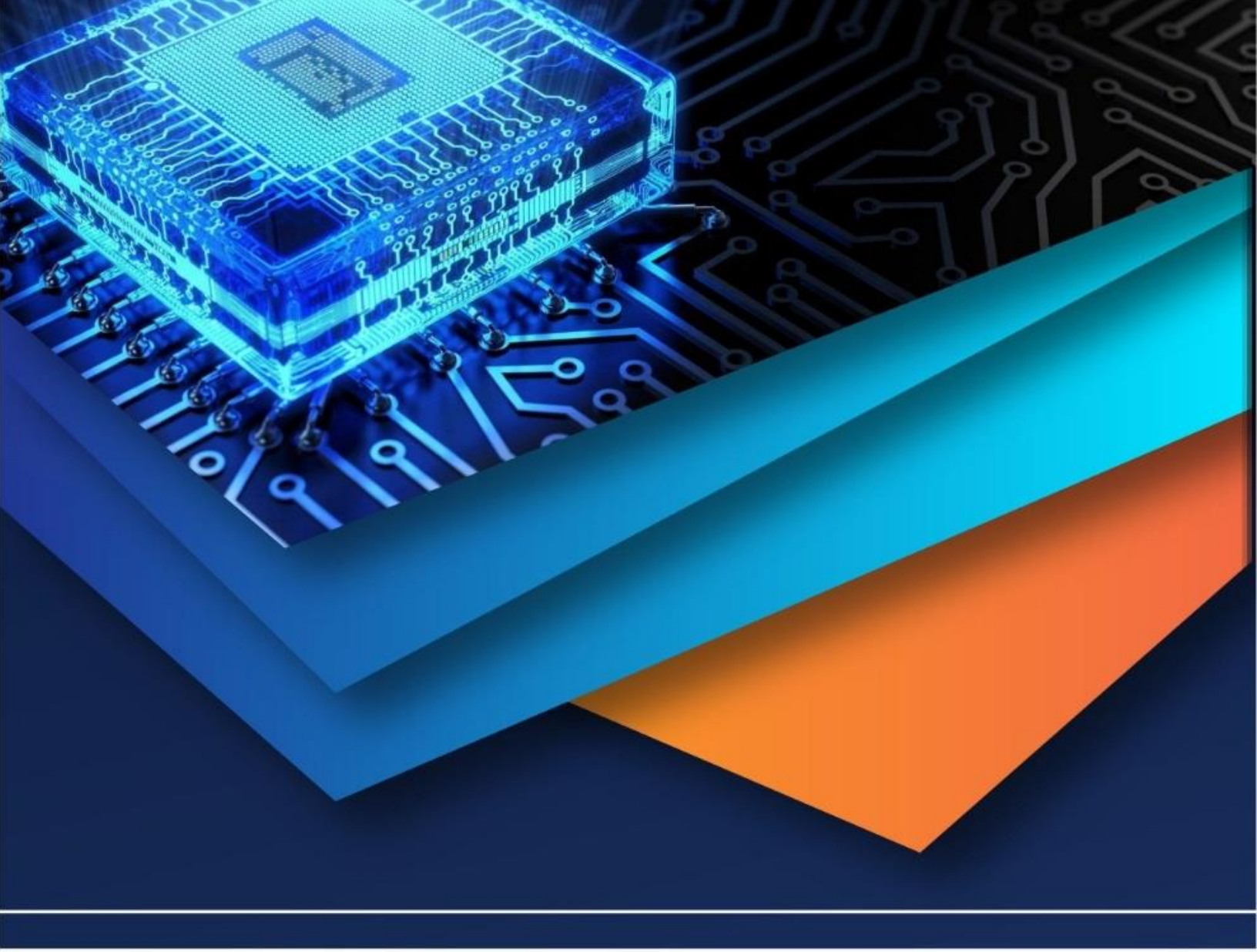

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