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A REVIEW PAPER ON STUDY ON STRENGTHENING AND DRAINAGE OF FLEXIBLE PAVEMENTS

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Abstract *In India different types of pavement design have been used. Most of the roads constructed in India have flexible pavement. Pavement is designed to support the wheel load imposed on it from traffic moving over it. Some additional stresses are also imposed due to change in the climate and also due to heavy rainfall. Pavement should be strong enough to resist the external stresses and to distribute the external load and transfer the load through different layers to subgrade and the drainage system of roads should be good enough to discharge the rain water as quickly as possible. The study highlights the need for strengthening of pavement and ways to improve the drainage system for the road pavement of Raipur rani to Naraingarh which is a part of Jagadhari- Bilaspur-Sadhaura- Naraingarh- Raipur rani state highway (SH-01) for the stretch of 16.7 kms.*

This study also includes the collection of required field data like existing pavement structure, traffic data, pavement surface condition and rebound deflection by using Benkelman Beam Deflection (BBD) technique, laboratory investigations and finally on the basis of data analysis, design for overlay has been discussed for the road under study.

The second part of this highlights the drainage condition of the road length and need of improvement in the drainage system for a particular flexible pavement. Many ways are discussed to modify the drainage system of the existing road. Both surface and subsurface drainage systems are discussed in this study, as it includes the interception and disposal of runoff water from the surface as well as sub grade.

1. INTRODUCTION

Pavements are the key elements of infrastructure of the country, whose functions are to promote transport activities, economic activities and to improve the standard of living.

Flexible pavements are those, which on the whole have low or negligible flexural strength and are rather flexible in their structural action under the loads. The layers of flexible pavement reflect the deformation of the lower layers onto the surface of the layer. The flexible pavement layers transmit the vertical or compressive stress to the lower layer by grain to grain transfers through the point of contact into each granular structure. A well compacted granular structure consisting of strong graded aggregate can transfer the compressive stress through a wider area and thus forms a good flexible pavement layer. Highway drainage is the process of removing and controlling excess surface and sub-surface water within the right way. This includes interception and diversion of water from the road surface and sub-grade. The installation of suitable surface and sub-surface drainage system is an essential part of highway design and construction. Highway drainage is used to clear surface water from the highway. Good highway drainage is important for road safety. Roads need to be well drained to stop flooding, even surface water can cause problems with ice in the winter. Water left standing on roads can also cause maintenance problems, as it can soften the ground under a road making the road surface break up and as well lead to an accident from the road users.

Due to unexpected economic developments in the given region, the traffic loads on the arterial roads may increase at a rapid rate; the pavements also undergo higher distress due to the increased wheel loads and load repetitions. Under such circumstances no amount of routine and periodic maintenance can prevent rapid structural deterioration. Therefore the existing pavement is to be strengthened by providing additional pavement layer or overlaying one or more layers above the existing flexible pavement. The maintenance engineering should therefore carry out structural evaluation studies periodically and take the decision in time to provide the required overlay before structural damages take place

1.3 Definitions

Strengthening of pavement: Strengthening of pavement is defined as the process of providing the required Overlay on the existing pavements so that it performs more efficiently over a given design period of time under given dynamic and static load.

Traffic Volume: The total number of vehicles crossing a section of road per unit time at any selected period. Traffic volume is used as a quantity measure of flow, the commonly used units are vehicles per day and vehicles per hour.

Traffic Density: It is the number of vehicles occupying a unit length of lane of a roadway at a given instant, expressed as vehicles per kilometre on a roadway segment averaged over space, usually expressed as vehicles per km or vehicles per km per lane.

Average daily traffic (ADT): When the traffic volume counts are carried out only for a few days (3 to 7 days) the average daily traffic volume obtained is called average daily traffic (ADT).

Highway drainage: It is the process of removing and controlling excess surface and subsurface water within the right of way.

3 LITREATURE REVIEW

Hofstra and Klomp (1972) [1] found that the deformation in flexible pavements was greater in loading enforcement surface and gradually reduced depending on the depth. This is because the wheel tracking is a permanent deformation and thus increasing the depth increases the resistance and shear stresses are reduced. Asphalt with low shear strength, essential for resistance to repetitive loads of traffic, have intense display wheel tracking problem. The problem is more acute especially during the summer season, as high temperatures are observed on the roadway.

Jacobs (1995) [2] analyzed the stresses in a pavement structure consisting of three layers, with constant thickness for each layer, one Poisson's ratio for all layers, the same elastic modulus for base and subgrade layers, and three different elastic moduli for the AC layer. He concluded that the normal stresses at the bottom of the asphalt concrete layer were not affected by the tangential stress on the surface. The tensile stresses at the edge of the loaded area can be much higher than the tensile stresses at the bottom of the asphalt concrete layer.

Huebner et al. (2001) [3]concluded that the frequency of the load, as well as the size, variety and arrangement of the imposed loads determine the stress and the structural condition of the pavement. Furthermore, with regard to traffic loads, especially important is the pressure, the type of tire (e.g. studded tires damage the bituminous material) and the transverse position of the wheels. Thus the movement of vehicles causes damage to the roadway and eventually degrades its functionality.

Jitendra et al. (2013) [4] carried out a framework for quantification of the effect of drainage quality on structural and functional performance of pavement by identifying a simple framework for quantification of the effect of drainage quality on structural as well as functional performance of the pavement. They presented the structural and functional performance of the pavement in predicted terms of deflection and roughness respectively. Their study was useful to reduce the maintenance cost of highway pavement system and to preserve huge highway network in India.

Dipanjan (2014) [5] studied highway surface drainage system and problems of water logging and concluded that adverse roadway elements contributing to highway accidents were substandard roadway alignment or geometry, lack of shoulders and shoulder defects, absent or inappropriate pedestrian facilities, narrow and defective lanes and bridges/bridge approaches, roadside hazards, undefined pavement centre and edge lines, poor sight distances and visibility, unmarked and inappropriate design of intersections, serious allocation deficiencies along the route, haphazard bus stops, and others are causes of water logging problem in highway. This research traced that proper drainage is a very important consideration in design of a highway.

Magdi, (2014) [6] studied the impacts of poor drainage on road performance in Khartoum, a city in Sudan with two case studies; attempts were made to find out the reasons for road failure within the first five years as a result of poor drainage. In this quest, it was discovered that four basic reasons lead to early deterioration of road pavements in the study, these factors according to the research includes, poor drainage design and construction, poor maintenance structure, use of low-quality materials and no local standard of practice.

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