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Review on Continuous Reinforced Concrete Pavement

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Abstract: *To sustain heavy vehicular traffic, strong and durable pavements are necessary. In India Vehicular traffic increasing at a high rate hence along with existing technology in pavements engineering, alternative advance techniques will be required. Continuous Reinforced Concrete Pavement (CRCP) is a new concept being applied in India at experiment level. In this study CRCP technique discussed in detail, this paper also focuses on various advantages on CRCP technique. The review of literature for various aspects other than economy is presented in this paper.*

Keywords: *CRCP, PQC, Performance, pavement, crack.*

I. Introduction

In India flexible pavement is commonly used for pavement design. But due to increase in traffic volume it is necessary to improve the quality of road pavement; Continuous Reinforced Concrete Pavement CRCP technique can be better alternative to overcome the demerits of other type of pavement

The continuous reinforced concrete pavement namely suggest continuous reinforcement is provided in longitudinal as well as transverse direction, without transverse joint except construction joints and terminal joints necessitated by existing conditions at the site. In CRCP, reinforcement serves to keep the cracks closed and tight together.

The main hindrance in using CRCP as a paving alternative is relatively high capital cost primarily due to the large amount of reinforcing steel used in this type of pavement [1]. However, based on life-cycle cost analysis, in some cases the present value of CRCP can be lower than that of Jointed Plain Concrete Pavement (JPCP); it is depend on the amount of traffic to be carried.

It is found for one particular project that the life-cycle cost of CRCP was about five percent lower than that of Jointed Plain Concrete Pavement (JPCP) based on a 50 Year analysis period [2].

The reduction in life-cycle cost of CRCP is due to the fact that it requires little to no maintenance and this in turn also reduces user delay cost.

II. History Of CRCP

As on today CRCP is widespread in the world especially in the United States and Europe.

The United States first used this concrete pavement in 1921. Several road tests were conducted during the 1940 to 1950. Today over 50,000 kilometers of highway length have been built in CRCP, according to a Federal highway Administration report published in October 1998, the technology started to be used more extensively in 1960's [3].

In Canada, in 1958, multiply CRCP sections with various designs were constructed on portion of the Trans-Canada Highway near Calgary, Alberta. In Europe CRCP has been used in France, Belgium, Netherland, United Kingdom and Spain [3]. Belgium built its first CRCP section in 1950. This country has made extensive use of this type of concrete pavement since 1970. Several projects were conducted since then to arrive at the current design. It is interesting to note that this country use CRCP not only in its highway but also on its country roads and National Highway [4]. France has used CRCP since 1983 and to date; it has over 600 kilometers as well as several rehabilitations project underway.

In India, first CRCP sample stretch road executed on old Pune-Mumbai Highway under Pimpri chinchwad Municipal Corporation (PCMC), Pune having traffic @200 Maximum Single Axle Load (MSAL). Further six more projects have been executed with private developers in Pune (Maharashtra) region and some are under construction [5].

III. Design Essentials

Designing a CRCP involves dimensioning the different geometric pavement features such as thickness, longitudinal and transverse reinforcement, construction joints, slab width, shoulders, pavement transitions based on site-specific traffic, climatic and foundation parameters.

The crack spacing, Crack width, steel stresses, and bond development length generated as function of reinforcement restrain and climatic conditions, each affect the CRCP structural integrity in the long terms. The amount of longitudinal reinforcement is determined so as to control cracking and to ensure structural continuity of the pavement. The aim pursued is a great number of cracks fine enough to ensure proper aggregate interlock which leads to a higher load transfer efficiency. In CRCP the presence of continuous reinforcement set into the cement concrete and by the omission of transverse joints other than construction and terminal joints. Whereas in pavement quality concrete (PQC) volumetric changes (due to temperature and moisture) results in the development of large numbers of evenly distributed hairline cracks appearing at random [6].

It is important that precautions are taken during the CRCP design, material selection and construction process so that a crack pattern develops that minimize development of pavement distresses. The main distress parameters which are of concern in CRCP are transverse cracking, spalling, punch-out and steel rupture [7].

IV. Advantages

CRCP has many advantages over PQC. The use of reinforcement and elimination of joints are the main reasons of these advantages.

Advantages of CRCP are listed below:

1) In any kind of rigid pavement other than CRCP it is mandatory to introduce transverse as well as longitudinal joints to avoid cracks due to thermal stresses as well as from vehicular moments, where in CRCP Reinforcement in the concrete nullify the stress.
2) Due to introduction of Reinforcement load bearing capacity of pavement increases.
3) Case studies from other countries show life-cycle of CRCP is more than the other rigid pavement.
4) Little or No maintenance is required for CRCP.
5) It is under research now whether the thickness of slab affects due to introduction of reinforcement but in India, especially in Pune by using lower thickness some private roads have been developed, and it is successfully carrying the load from last five years.

V. Conclusion

There are many advantages of CRCP such as better long-term performance, little or no maintenance. However more research work is needed in the field of CRCP to formulate design codes and application in field. Use of CRCP drastically can reduce import of bitumen there by leading to saving of foreign currency. Concrete can withstand even the heaviest traffic loads. There's no need to worry about ruts, shoving effects common with asphalt pavement. CRCP is not conventional method because of its high initial cost, lack of skilled labor and lack of specific design.

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