Open access Journal International Journal of Emerging Trends in Science and Technology

Performance Evaluation of Continuous Reinforced Concrete Pavement

Authors

Sagar Ranmale[1], Rakesh Shinde[2], Rahul Kumar[3]

[1]Student, Department of Civil Engineering, Dr. D.Y.Patil Institute of Engineering & Technology Pune, Maharashtra, India

Email: *Sagarranmale7777@gmail.com*

[2]Student, Department of Civil Engineering, Dr. D.Y.Patil Institute of Engineering & Technology Pune, Maharashtra, India

Email: *Shinderakesh05@gmail.com*

[3]Student, Department of Civil Engineering, Dr. D.Y.Patil Institute of Engineering & Technology Pune, Maharashtra, India

Email: *rahulrtaj.raj340@gmail.com*

Abstract

Performance is key factor for selection of pavement type. In the present study performance evaluation on four Continuous Reinforced Concrete Pavement (CRCP) projects have been carried out by actual site survey. For performance evaluation different parameters explaining the nature of cracks, punch-out and spalling have been considered. The observations for all cases have been presented in detail in this paper. The comparison between CRCP and pavement quality concrete (PQC) road of same life span and traffic condition is also discussed in this paper. From the entire study, it can be concluded that performance of CRCP is better than conventional PQC pavement.

Keywords: *Pavement, CRCP, PQC, Performance evaluation.*

Introduction

Indian road network is second largest road network in the world [1]. Construction industry is second largest economic activity in India after agriculture. Under construction activity every year maximum amount have been spent on road development by Indian government. But due to increase in population, load on transportation sector is increasing day by day. Hence to overcome this difficulty CRCP technique is an alternative.

In CRCP pavement reinforcement in longitudinal as well as transverse direction is used. There are no transverse joints except construction and terminal joints in CRCP. Reinforcement serve to keep cracks closed as keeping the crack tight is essential in maintaining load transfer through aggregate inter locked [2].

Designing of CRCP involves dimensioning the different geometric pavement feature such as thickness, longitudinal and transverse reinforcement, construction joint, slab width, shoulders and pavement transitions, based on site specific traffic, climate and foundation parameter [2]. Thickness for a given design traffic depends on flexural strength of concrete and the foundation class [3]. For longitudinal reinforcement 16 mm diameter deformed steel bars are used and transverse steel must be 12 mm diameter deform bars at 600 mm spacing [4].

The main advantages of using CRCP technique are eliminating transverse joints. Due to elimination of transverse joint smooth riding can be achieved. CRCP pavement are only type suitable were large or significant differential movement or settlement is expected [3].

Performance Evaluation Methodology

Checking performance of object with respect to fulfillment of its basic purpose is called performance evolution. There are number of methods available for checking performance of pavement i.e. visual inspection by actual site survey, testing and interpretation of test result, statistical analysis methods and computer based methods etc. In the present study, 'visual inspection by actual site survey' method has been used for performance evaluation. First of all some parameters were finalized on the basis of design fundamentals of CRCP. Which are crack length, crack width, crack depth, crack spacing, punch-out and spelling .Crack parameters are measured in mm and punch-out and spelling are measured in number. For same traffic condition and life span all parameter are check and observation are compared.

Case Study

In this paper five case studies on performance of CRCP and PQC have been discussed in detail. Table 1 gives the details of five cases, out of which case no. 5 is under construction. Hence performance evaluations of first four case studies have been carried out.

Table 1: List of CRCP Projects Studied

Sr. No.	*Name of Project & Location*	*Year of Construction*	*Length of Road (m)*
1.	CRCP Patch at Kalasagar, Pimpri, Pune.	2006	61
2.	Trinity Landmark LLP. Bhugaon, Pune.	2011	2000
3.	Khadakwasla Backwater, Pune	2014	9000
4.	Bhoirwadi, Hinjewadi Phase-3, Pune.	2014	200
5.	D.Y.Patil Medical College Campus, Pimpri, Pune. (Under construction site)	2015	200 (Till date)

Kalasager CRCP patch is the first sample stretch on Mumbai-Pune expressway. For the survey, road was divided in 10 m patch and observed critically for the selected parameters. In Table 2 observations of first 10 meter patch have been given and observations for remaining road were recorded in similar way.

Table 2: Observations for first 10 meter patch of CRCP

Sr. No.	*Chain-age*	*Length*	*Width*	*Depth*
1	0	-	-	-
2	1.2	1.22	1.5	2
3	3.65	1.37	1	2.5
4	5.8	3.65	1	3
5	7.3	3.04	1.5	3
6	9.4	0.60	2.0	2.5

Such six patches in Kalasager CRCP road were observed and the observations for CRCP and PQC were compared, for fist four case studies. For all CRCP projects observations have been taken in similar manner the complied observations are presented in Table 3.

Observation

After conducting survey of all four CRCP projects, the observations were compared and studied critically. The compiled observations are presented in Table 3.

Table 3: Complied Observations

Sr. No.	**Parameters**	**CRCP**	**PQC**
1	Avg. no of cracks	6 No.	75-80 No.
2	Avg. length of the cracks	2.44 m	0.6 m
3	Avg. width of the cracks	2.5 mm	2.5 mm
4	Avg., depth of the cracks	2 mm	2 mm
5	Avg. spacing between cracks	1.88 m	-
6	Spalling	0 No.	2 No.
7	Punch Out	0 No.	2 No.

Result and Discussion

In this study it has been observed that higher numbers of cracks were present in PQC as compared to CRCP. These cracks made lead to spalling or punch out in future in the PQC pavement. The patterns of cracks observed are also different in both cases.

Conclusion

Performance evaluation by visual inspection survey has been carried out for four CRCP roads. The observations and failure pattern have been analyzed carefully. The patterns of crack in CRCP are transverse line type whereas in PQC pattern of crack are tree type. The number of crack in CRCP is much less compared to PQC under same length and same traffic conditions. In CRCP no punch-out problem observed whereas PQC is affected by punch-out. Spacing between cracks are much more in CRCP as compared to PQC, whereas depth and width of crack are almost same in both. CRCP offer joint less surface finish for smooth riding and comfort of passengers. CRCP offer long-term performance, little or no maintenance to be carried out overtime and durability of pavement. Smoothness is very high compare to bitumen surface.

Acknowledgement

Special thanks to Mrs. Deepa A. Joshi Assistant Professor, Dr. D.Y.Patil Institute of Engineering & Technology Pune, India for her valuable guidance. The author of this paper wish to thank Dr. R. K. Jain, Principal Dr. D.Y.Patil Institute of Engineering & Technology Pune, India for his support and Mr. Sanjay Nayak and Mr. Nikhil Mali, Infraking Consultants Pune for their valuable guidance.

References

1. Gajendra Haldea, discussion paper 2013-11, public private partnership in national highways: Indian prospective, April 2013.
2. Continuous Reinforced Concrete Pavement Design and Construction Guidelines, April 2011-draft layout.
3. Mr. Sanjay B Nayak, Continuous Reinforced Concrete Pavement-The Most Advance Rigid Pavement Technology On Global Arena, ICST-2K14-CE-179.
4. DMRB $ BRITPAVE.