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Study and Evaluation of Precast Concrete Pavement

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Abstract:
This Paper aims at the study on evaluation of precast concrete pavement system. This paper presents the new system of development in the highway and road construction. This time we faces the many problem during the road construction like Long-term traffic restrictions which is belongs due to conventional cast-in-plane concrete pavements which have been used this pavement system also have short construction time, low production costs, long-term durability, low maintenance requirements etc. This paper show new precast concrete pavement (PCP) system. The main objective to review on precast concrete pavement (PCP) systems is to find the design methods which are used in transport infrastructure and better understanding of the current systems. This time we do not have the information to fully understand the precast concrete pavement (PCP) systems for the construction of entirely new pavements. In this paper we include the advantages and disadvantages of the precast concrete pavement system along with the method of construction. The suitability of precast panel for rapid construction would be based on the availability of precast concrete panel. The key consideration would be the pre-manufacture and storage of panel to faster construction in roads, highways.

Description: PRECAST CONCRETE, LITERATURE SURVEYS, PANELS, PAVEMENTS

I. INTRODUCTION

In our country recent years a lot of research has been done in precast concrete construction in many fields like buildings bridges metros etc. In highway and road construction we do not use this technology where as many country like Japan America china etc. also use this system which is very use full for improving the service life of the pavement as compare to the cast-in-place pavement system. With the help of precast concrete we provide a well-established construction technique. Concrete columns, beams, panels, slabs and other structural elements are cast in a specified place and then transported to the construction site for assembly.

the service life of pavement which is construct in site (Cast-in-place) these concrete pavements have been used for more than twenty years. These pavement constructions have Long-term traffic restrictions because of extensive and extended lane closures, long curing duration required to reach sufficient strength and the inability to place a material in all weather conditions increase the pressure on the use of systems with enhanced manufacturing technology. There are some advantages of precast concrete pavement cast in place concrete pavement system:

Reduce delay before opening to traffic: precast concrete pavement can be installing during night time and be ready to opened to traffic the following morning.

No joint raveling: Due to failure of early age, seduction or shallow joint cutting is terminated.

Minimal weather restriction on placement: The season of construction can be done in cold weather or during light rain.

Elimination of construction related early age failure: issues neither related to shallow cutting or late working do nor develop.

Better–quality concrete: The problem related to concrete distribution or flooring equipment operations, including the poor concrete consolidation and the finish of the concrete surface is eliminated.

Better concrete curing conditions:
Precast concrete panel is treated in controlled condition at the plant. Over the past ten year several U.S. highway agencies have adapted and implement PCP technology. In highway corridors where the high traffic volume and lane closure challenges at this condition we adopted the PCP system For the construction of highways we use the PCP work adopted at the night typically from 8p.m. to 6a.m. and with short closure. The substantial benefits of Precast concrete pavement technology have been obtained to achieve the four key features:

Concrete durability:
Precast panel can result the excellent concrete quality with respect to strength and durability.

Load Transfer at joint:
Now to include effective weight transfer on transverse joint of PCP system is available.

Constructability:
For the rapid installation of PCP system now techniques and equipment are available.

Panel support condition:
The techniques are improved for providing better and equal support.

TABLE.1. RECOMMENDED DESIGN CRITERIA FOR JPrCP SYSREM

Criterion	Value
Structural	
Cracked slab percent	20-30 %
Joint faulting	<0.15 in.
Joint spalling	Minimal
Material related distress	None
Functional	
International roughness index	150-180 in/mile
Surface texture – friction	FN(SN)>35
Surface texture – tire pavement noise	No criteria available, but surface should produce accepted level of tire pavement noise

KEY OF THE PROPOSED EXPERIMENT

The general concept of precast concrete pavement (PCP) design is based on the recognition of the same which has been established once. All the activities of PCP under traffic loading and environmental loading are not different that of like CIP concrete pavement. The US definition for long life concrete pavement is as follows-

1) The pavement will not exhibit premature failure and material related crises.
2) The service life of concrete pavement is 40+ year.
3) Pavement will have reduced potential for cracking failure and spalling.
4) Pavement will maintain desirable ride and surface texture.

Although we can say PCPs are used for provide long term service. And recently this service is to be used in US projects since less than 10 years.

The off side construction of precast concrete pavement provides many advantages these are-

1) No early age curling and warping issues.
2) Design strength of concrete from day one of installation.
3) Since the precast panel is usually fabricated the account is not designed for curling during storage and installation.
4) Precast panel contains substantial reinforcement.
5) The faulting which can be developed in PPCP is less important than the JCPs fault.

II. DISTRESSES IN PAVEMENT

Due to traffic and environmental conditions the precast concrete pavement (PCP) have different type of specific distresses.

1) **Material related distresses:** The distresses may include due to ASR and D-cracking in a freezing environment.
2) **Cracking:** Cracking is typically referred to as a stress-based distress. Transverse cracking may develop over a period of time due to repeated truck loading.
3) **Joint faulting**: Faulting is typically referred to as a deflection based distress. It may be develop with or without outward signs of pumping. Joint faulting is generally influenced by the type of load transfer provided at transverse joint base type and drainage needs.
4) **Spalling:**It may be develop due to incompressible in joint or cracks or poor quality concrete. Spalling may develop along joint or cracks.
6) **Roughness:** The effect of each distress type is additive and over time pavement roughness increases. Pavement smoothness is affected by the development of various distresses in the concrete pavement.

EXPERIMENTAL PROGRAM AND METHEDOLOGY

The design of precast concrete pavement (PCP) system bases, in part, on the expectation that the behavior of the established precast pavement should not be very different from the same traffic the cast-in-place pavement under the environment and the status of support, and that the performance of PCP should be comparative that of pavement application. The system design must also address address mechanical and functional that ate not present in CIP pavement.

Therefore the design of PCP system must address many consideration and features include these are:

1) Demarcation of structural design criteria.
2) Selection of panel sizes and joint layout.
3) Selection of the slab support system.
4) Thickness design.
5) Slab reinforcement design.
6) Joint design (including load transfer system, tie bars and other details)
7) Slab surface geometry.
8) Slab surface texture.
9) Other details, including grout ports, lifting mechanisms, utility opening, bedding grout distribution systems, etc.

A composite design approach is required for the interaction of many precast concrete pavement (PCP) design features that is the impact of panel dimensions on slab thickness and reinforcing requirements. It is proposed to determination of structural design criteria which is based on the types of structural distresses. And after this we done the selection of panel size which is to be 12*12 ft. panel size impacts many aspects like fabrication efficiency, ability to transport via truck, efficiency of transport, number and location of lifting anchors etc are to be generalized also. Also the panel reinforcement is to be provided which is resist the stresses.

III. CONCLUSION

This paper has examined evolution of precast pavement technology application in particular in the Soviet Union and more recently in Russia. The many aforementioned benefits show why concrete pavement is a sustainable choice. It can get an even more consistency rating if optimizing materials, design, and construction. The operational effect of truck fuel saving and light reflection can actually reduce to zero if carbon footprint of concrete pavement use in highways and road construction. Reduced frequency of maintenance procedures and lengthening the pavement life cycle also make concrete pavement a sustainable choice. The objective of the case presented in this paper to provide only the initial concrete pavement distress analysis. Sometimes the solutions led to specification or design changes, but not always, because the roots of the problem were speculated and could not thoroughly proven. The significant results were restoring a new pavement along with minimal infiltration repair techniques in functional and structurally

possible situation. This technology is very use full for our country.

IV. REFERENCE

[1]. American Concrete Institute (ACI). 2002. *Guide for Design of Jointed Concrete Pavements for Streets and Local Roads*. ACI 325.12R-02.

[2]. American Concrete Institute (ACI). 1956. "Structural Design Considerations for Pavement Joints." Report of ACI Committee 325. *ACI Journal, July 1956*. American Concrete Institute, Farmington Hills, MI.

[3]. California Department of Transportation (Caltrans). 2015. *Caltrans Proposed Protocol for Evaluation of Load Transfer Systems for Jointed Precast Concrete Pavements Version 1.0 (January 27, 2015)*.

[4]. Ontario Provincial Standard, *Construction Specification for Repairing Rigid Pavement with Precast Concrete Slabs*, OPSS 363, November 11, 2007.

[5]. Burnham, T.R., *Precast Concrete Pavement Panels on Minnesota Trunk Highway 62—FirstYear Performance Report*, Report MN/RD– 2007-19, National Technical Information Service (NTIS), Springfield, VA 22161, April 2007.

[6]. New York State Thruway Authority, *Pavement Evaluation Report, Interchange 23 to 24 Reconstruction and Widening D213002*, Albany County, NY, August 2004.

[7].Gopalaratnam, V. S., Donahue, J., Davies, B., Hall, L., Dailey, C., *Precast prestressed Panels for Rapid Full-Depth Pavement Repairs*, Structures 2006.