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A Review Paper on"Use of Different type of Slab systems in Railways"

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***Abstract*: -**

India is a country with high population growth and also comes among the highest population having countries. India holds the second position in population rank on the world level with 1,336,286,256 (1.3 billion) people (recorded in May 2016), more than a sixth part of the world's population. India also has a dense network of railways connecting almost parts of the country for business and general purposes. Here in India railway system is divided in four segments which are East central railways, West central railways, North central railways, South central railways. An Indian railway is the most commonly system used for travelling by Indian peoples.With the increase in population Indian railway system also requires to be upgraded for the further enhancement to complete the population needs. In this literature study techniques and methods used worldwide are studied to provide a new and modernised railway system to the Indian Peoples depending on the Indian railways for travelling purposes.

Keywords*: -Railways, U-Slab, Environment, Construction, Management.*

Introduction: -

Indian Railway system is known to be the most busy rail line system in which millions of peoples travelling per day. Railway ministry also invests huge amount of money per year for the maintenance and development of railway system for the better transport of the Indian population.For the improvement various research and development is going on by railway engineers to provide some advancement in Indian railways.Indian Railways is also the safest means of transport so new techniques are implemented keeping the thought of safety of peoples in mind.

There are various authorities in India assigned by the Indian government for the approval of research and development works and granting permissions for the construction or changes in railway systems. If we go on looking for the foreign rail route system which uses high quality techniques and measures for the safety and advancement some ideas can be adopted for the

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advancement of Indian railways also. So in order to have the advancement in Indian rail line system a literature study is performed in this research work in which various slab systems were studied which can be modified or changed for the improved efficiency and performance.

Literature Review: -

Castro dale and White[1] studied that a combination of post-tensioning with splicing of girders presents attributes of high performance and feasible construction. Implementation of splicing technology has the potential to extend the simple spans by approximately 50 percent and at the same time presents a simple and cost-effective solution.

Kaar et al.[2] investigated the development of continuity in precast, prestressedconcrete bridge girders used in conventional designs for extending span lengths. Theconventional design used deformed reinforcement in the CIP deck slab over the girders toprovide continuity designed for resisting the live loads.

Kaar et al.[3] carried out tests on theconnection detail where the deformed rebar in the deck slab is made continuous over thesupports and resists the negative bending moment. This detail also included the use of diaphragm over the piers extending laterally between the girders on either side. The width of thediaphragms was greater than the spacing between the ends of the girders, which helped toprovide lateral restraint to strengthen the concrete in compression. The results from this studyfound that this continuity connection detail was desirable as it permits sufficient redistribution ofmoment and is simple to construct and relatively economical.

Mattock and Kaar[4] carried out additional tests on the continuity connection for precast, pre stressed concrete bridge concrete girders with introduction of details for resisting the positive moments resulting from creep and shrinkage. They conducted static and dynamic load tests on half-scale component specimens of a two-span continuous connection between girders with CIP deck and diaphragm. The results from the static tests confirmed the results determined by Kaar et al. (1960). From the dynamic test using repeated pulsating loads applied to the free ends of the girders, the researchers found that the connection can potentially resist an in definite number of applications of design loads without failure. However, the width of the cracks and the resulting flexibility of the connection were found to increase. They tested two connection details for positive moment resistance: (i) fillet welding the projecting ends of the reinforcement bars to a structural steel angle, and (ii) bending the projecting ends of the reinforcement to form right angle hooks and lapping them with the longitudinal diaphragm reinforcement. Results from this test showed that the performance of the welded detail was satisfactory compared to the hooked detail both at service load and ultimate strength with careful attention to the welding. Brittle fractures in the reinforcing bars were observed in the hooked detail. It was suggested to use an inside radius of the hook larger than the bar diameter and a minimum distance of 12 times bar diameter from the edge of the precast member to the inside face of the hook to develop the yield strength of the reinforcement bars.

Oesterle et al.[5]presented a research study through NCHRP Report 322 on the development of procedures to compute design moments in precast, pre stressed bridge girders made continuous through the continuity connection in the CIP deck slabs and diaphragms at bridge piers. Experimental investigations of concrete creep and shrinkage for the continuous bridges were included to evaluate time-dependent material behaviour as a part of the analytical study. The test results indicated that it is difficult to overcome the positive moment cracking without the presence of pre-compression of the splice due to positive thermal gradients. The uncertainties in the design of the continuity connections that were addressed in this research study include the prediction of elastic, inelastic, time-dependent, and ultimate positive and negative moments at the location of the connection. For this study, information on the current state-of-the-practice was extracted from literature review and a survey of state DOTs, bridge designers, and pre casters. Some of the results of the questionnaire indicated that the decision to reduce the mid span moments due to the negative moment continuity effects does not appear to be related to whether or not the positive moment reinforcement is present at the pier connection.

Mirmiran et al.[6]conducted a research study on positive moment cracking in the diaphragms of simple-span pre stressed girders made continuous. This study was aimed at investigating precast bridge girders that can be made continuous for live loads by providing a moment connection over the supports. The researchers achieved this by placing negative moment reinforcement in a CIP deck over the support and by placing a diaphragm between the girder ends. The study also recommended that "a minimum amount of positive moment reinforcement equivalent to 1.2Mcr" should be used to limit the crack width in the diaphragm and to avoid significant loss of continuity, where Mcr is the cracking moment of the diaphragm section.

Newhouse et al.[7] carried out a study on continuity connections over the support at Virginia Polytechnic and State University. The goal of this research was to recommend appropriate continuity details for the precast concrete bulb-tee (PCBT) girder sections. They developed and tested three continuity details using PCBT-45 girder sections. The first two continuity details consisted of a full continuity diaphragm with a CIP deck. Test 1 was carried out on specimens with pre stressing strands extending out from the ends of the girders and bent to form a 90-degree hook. Test 2 involved specimens with #6 U bars bent into a 180-degree hook extending out from the bottom of the girders . Test 3 was carried out on a third continuity connection detail that consisted of the slab only, which was cast continuous over the girders. The spacing between end faces of the adjacent girders was 12 in., 13 in., and 3 in. for Tests 1, 2, and 3, respectively.

Newhouse et al.[8] found that the Test 2 specimen with 180-degree bent U bars wasslightly stiffer with very small crack openings at the bottom interface as compared to the Test 1specimen under static and dynamic loads. The results from this investigation showed that thethermal restraint moments were more significant than the restraint moments due to creep andshrinkage. Based on this study, it was suggested to design thegirders as simple spans for dead and live loads for service conditions, and to assume a fully continuous system for ultimate strength conditions.

Conclusion: -

From the above literature study various methods and techniques were studied to provide a new and advanced technique to the railway rail route improvement and betterment. In India Delhi Metro Rail system is using the advanced techniques for the comfortable travelling of Indian peoples. Delhi metro rail system uses U-slab system of defined span length for the railway lines and is also showing good performances till now so a similar method can also be used in the Indian railways for new west central railway project of 3rd Line railway in Madhya Pradesh.

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