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# Analysis of Deck Bridge with Pre-Stress Deck Bridge under IRC Loading Conditions a Review

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## INRODUCTION

A bridge deck is the portion of a bridge that acts as the roadway in the support of vehicular or pedestrian traffic. While deck parts like trusses, girders, rails, arches, posts and cantilevers assume a number of forms and types, there are relatively few bridge deck types given the utilitarian nature of the component. Deck types are defined by the materials from which they are made and the manner in which those materials are fit together.

The Finite Element Method involves subdividing the actual structure into a suitable number of sub-regions that are called finite elements. The intersection between the elements is called nodal. This has been considered to analyze the bridge having same IRC loading and Span 30 m for critical load. After analyzing these critical loads, the results will be compared in terms of forces, deflection, weight and most importantly cost of each type to determine the most stable and economical section.

## Literature Survey

### General

**Haymanmyintmaung, (2017)** In this study, the integral bridge with a various span length of 40m, 50m, 60m and 70m non-skew and skews angles of 15°, 30°, 45° and 60° were designed and modelled in SAP2000 software. The parameters investigated in this analytical study were the skew angle, span length and stress reduction methods. The geometric dimensions of the Integral Bridge and the loading used followed AASHTO commonplace specifications. Static analysis and dynamic nonlinear time history analysis were performed to assess the seismic performance of the integral bridge. The analysis results in terms of shears and bending stresses, axial force and deflection were checked by the allowable stress method. Extreme stresses that exceed allowable limit were reduced by using six different stress reduction methods. The propose of this study was to analyze the behaviour of integral, skew angle, and to reduce extreme stress of integral bridge under dynamic loading. In skew angle bridge, cross frame member stress increases greatly as the skew bridge tend to rotate during a seismic event, which can cause excessive transverse movement. MSE+HLAC method was the best stress reduction method for all non- skew and skew angle bridge. According to the analysis result, integral bridge maximum skew angle can be extended up to 60° and span length up to 60 m can be extended using stress reduction method under extreme seismic loading.

**Yogita Gupta (2017)** The shallow foundation is generally provided on non-erodible strata or where scour depth is less. It is conjointly desirable for low perennial flow or standing water condition. In the present case study, the shallow foundation is adopted for box type bridge. The total length of the bridge is 132.98 m, consisting of eight units of RCC box. Each unit is composed of three cell boxes. The bottom slab of the box unit is acted as raft foundation, founded 500 mm below ground level. River bed protection work is provided on both the upstream and downstream side along the whole length of the bridge as it is founded above scour level. The bridge collapsed during the monsoon just after two years of service. The present paper explains the cause of failure. This study on the failure of the bridge illustrates the importance of bridge review before and when the monsoon amount and therefore the importance of timely maintenance. Standard specifications of Indian Road Congress for the stream bed protection work also are enclosed.

**Kapil Kushwah. al. (2018)** The bridge is a structure imparting passage over an impediment without remaining the way under. The desired passage may be for a road, a railway, pedestrians, a canal or a pipeline. T-beam bridge decks are one of the predominant sorts of forged-in vicinity concrete decks and consist of main girders, cross girders which imparts lateral tension to the deck slab and deck slab which runs among T-beams constantly. Bridges are exceedingly investment systems and vital landmarks in any country. Besides being crucial links in transportation device. strength, protection and economy are the Three key capabilities that cannot be left out before the finalization of kinds of bridges. While Deciding the forms of bridge, spans and other parameters are to be studied cautiously to fulfil Out the need of suitability to site situations. the analysis of a three span two lane T-beam bridge is carried out by varying the span of 10m, 15m, 18m, and number of longitudinal & cross girders using software Staad Pro v8i. In order to obtain

maximum bending moment and shear force in girder, maximum Stresses in slab and maximum reaction and moment at the support, the bridge models are subjected to the IRC class AA Tracked loading system and concluded that with the increase in shear force, bending moment and deflection in the girder and variation of stresses in slab. Key Words: Deck slab, Class AA Loading,

**Ankur Gupta al. (2018)** A Girder bridge is a bridge that utilizations braces as the methods for supporting the deck. A bridge comprises of three sections: The Foundation of projections and bearings and Substructure of projection and dock and The Superstructure (brace, bracket, or curve) and deck. A Girder bridge is likely the most usually fabricated and used bridge on the planet. Its fundamental plan, in the most improved frame, can be contrasted with a log extending from one side to alternate over a stream or river. All bridges comprise of two principle parts: the substructure, and the superstructure. The Superstructure is everything from the bearing cushions, up - it is the thing that backings the heaps and is the most unmistakable piece of the bridge. The Substructure is the establishment, what exchanges the heaps from the superstructure to the ground. The two sections must cooperate to make a solid, durable bridge. Prestressed Concrete is fundamentally concrete in which interior worry of reasonable extent and dispersion are presented pressure coming about because of outer load are concentrated to wanted degree. In this research work we are analyzing a girder bridge with the effect of prestressed concrete and compare it with general deck bridge. In terms of finite elemental analysis, forces and cost analysis. Here it is concluded that implementation of prestressed deck is resulting in economical, stable and load resisting member

**Mosheb Kaloop. al. (2019)** This paper aims to evaluate the behavior of Dorim-Goh bridge in Seoul, Korea, under static and dynamic loads effects by ambient trucks. The prestressed concrete (PSC) girders and reinforcement concrete (RC) slab of the bridge are evaluated and assessed. A short period monitoring system is designed which comprises displacement, strain and accelerometer sensors to measure the bridge performance under static and dynamic trucks loads. The statistical analysis is used to assess the static behavior of the bridge and the wavelet analysis and probabilistic using Weibull distribution are used to evaluate the frequency and reliability of the dynamic behavior of the bridge. The results show that the bridge is safe under static and dynamic loading cases. In the static evaluation, the measured neutral axis position of the girders is deviated within 5% from its theoretical position. The dynamic amplification factor of the bridge girder and slab are lower than the design value of that factor. The Weibull shape parameters are decreased, it which means that the bridge performance decreases under dynamic loads effect. The bridge girder and slab's frequencies are higher than the design values and constant under different truck speeds.

**Phamvan Hung. al. (2019) this** paper presents the design proposal of the prestressed concrete slab (PSCS) track used for highway-railroad grade crossings in Vietnam. A new type of highway-railroad grade crossings is being proposed to replace the traditional panel crossings made by reinforced concrete, asphalt concrete and rubber. Numerical simulation was carried out to analyze the structural behavior of the PSCS. The results show that the structural proposal of the PSCS meets the requirements of stability and strength under the standard loads of truck and train engines recommended in Vietnamese specifications.

**David Hester al. (2019)** This article proposes a bridge damage detection method using direct rotation measurements. Initially, numerical analyses are carried out on a one-dimensional (1D) simply supported beam model loaded with a single moving point load to investigate the sensitivity of rotation as a main parameter for damage identification. As a result of this study, the difference in rotation measurements due to a single moving point load obtained for healthy and damaged states is proposed as a damage indicator. A relatively simple laboratory experiment is conducted on a 3-m long simply supported beam structure to validate the results obtained from the numerical analysis. The case of multi-axle vehicles is investigated through numerical analyses of a 1D bridge model and a theoretical basis for damage detection is presented. Finally, a sophisticated 3D dynamic finite element model of a 20-m long simply supported bridge structure is developed by an independent team of researchers and used to test the robustness of the proposed damage detection methodology in a series of blind tests. Rotations from an extensive range of damage scenarios were provided to the main team who applied their methods without prior knowledge of the extent or location of the damage. Results from the blind test simulations demonstrate that the proposed methodology provides a reasonable indication of the bridge condition for all test scenarios.

**Sunil Yadav al. 2019** Concrete slab is an important two dimensional or planar element, used in all types of structures such as floors and roof covering. Bubble Deck slab is a futuristic method which can effectively eliminate all the concrete from middle of slab by replacing it with High Density Polyethylene Balls (HDPE) and provides thermal insulation. In this technique, the reinforcement mesh acquires, allocates and attached the balls at exact position and also stabilizes the lattice. By this technique structural weight can be reduced from 25% to 50.The main aim of this study to comparatively study of Bubble Deck slab and conventional slab under cost analysis, load bearing capacity .i.e. strength and efficiency too and also families and create awareness to all. The advantages of this technique are less energy consumption - both in production, transport and carrying out, less emission - exhaust gases from production and transport, especially CO2.

**Problem identification**

- There is very limited research which focuses on suitability of materials has been done in past researches using Staad pro V8i Software were conducted on different materials including RCC, pre-stressed concrete however information on techno economic feasibility of materials to be used in bridges is lacking.
- In this study, a comparative study based on different type of bridges i.e. Deck type and Pre-stressed deck type using finite element analysis in STAAD PRO is prepared, considering same loading class 70-R as per I.R.C. loading with Sesmic Effect consideration.

**Objectives**

The objectives of the research are outlined below:

- To analysis model of the girder deck Bridge in STAAD-Pro & SAP 2000.

**Conclusion**

Deck Slab with prestressed concrete decks lower variationsin terms of forces, moments & displacements, in comparison with plain beam deck.

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