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Analysis and Design of Reinforced Concrete Solid Slab Bridge

Pooja Kumre[1], Abhay Kumar Jha[2], Barun Kumar[3]

[1]Research Scholar, [2]Professor, [3]Assistant Professor,
[1, 2, 3]Department of Civil Engineering, LNCT, Bhopal, Madhya Pradesh, India

ABSTRACT

Structural planning and analysis is an art and science of designing with economy, elegance and sturdiness. Structural designing requires an in-depth structural analysis on which the planning is predicted, to compete within the ever competitive market, The use of software can save many-man hours and efforts in structural analysis and an effort was made in the present study to achieve this objective. The purpose of this study is to analyze and design the solid deck slab bridge by STAAD-Pro and manual method under different loading conditions. And also the analysis results in term of shear, bending moment, axial force and deflection were checked by STAAD-Pro which is passes through many different load combinations. The maximum design moments resulting from the combinations of various loading cases.part 1 The study deals with the planning and analysis of Solid Deck Slab using Staad-Pro software. In this study solid deck slab having 8.2 m long span and the thickness of slab 0.65 m and the slab is simply supported. The drafting and detailing work was completed using AutoCAD software and thereafter the entire design work was completed using "Staad-Pro v8i ss6.

KEYWORDS: *Superstructure, Staad-Pro, Solid Slab, Analysis, Axial force, Bending Moment*

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INTRODUCTION:

A bridge may be a structure which is built to produce a passage over an obstacle like river, valley, or road, etc. The first bridge made by humans was wooden bridge in which they use the cut wooden logs for a simple support. Growth and rapid urbanization, there has been a limitless growth in traffic volume on highways over the previous couple of decades. To make sure smooth flow of traffic, numerous new highways and flyovers are being constructed. Study of structure shape, material, size, and selection should have supported engineering and economic criteria hence its study helps to decide the economic aspect during the design & construction of the bridge. Present research work developed to research the investigation made by different researchers within the field of economic and safe bridge design. The research work presents the summary of assorted research work & concludes with identified gaps within the research moreover as identified the object of required work. The primary bridge made in 1840 by using trusses with wrought iron as tension vertical and timber planks for all other members. Construction of bridge these days has achieved a worldwide level of importance.

SaibabuSundru (2018) An overview of the old bridge's condition is first presented, followed by an explanation of the reasons behind its demolition. Brief description of the flexural analysis of the new (old) bridge, which replaces the existing post-tensioned prestressed concrete girder. An explanation of the first stage prestressing of the I-girder and the second stage prestressing of the composite girder is given in figures. The load-carrying capacity of the one span of the replacement bridge with simple supports is assessed using proof load tests, which are mandatory under Indian standards. Sandbags were used to load the bridge up to a preset service load with impact concerns. They measured the deflection of the I-girders across and throughout the span of the bridge and compared it to calculated values. During loading and unloading, a linear response was observed. Based on results, theoretical estimations, and the criteria contained in codes of practice, prestressed concrete girder bridge spans can be deemed sufficiently capable of carrying loads, and therefore, has passed the test.

Gaur and Pal (2019) We have learned from the research that there is a gap in the research and objectives of the research in the field of the slab deck structure system. They provide a new perspective on the RC deck sab problem. It is possible to enhance the economic aspect of a deck slab bridge by evaluating its performance with different thicknesses. This will guide the design of a stronger, safer, and more economical bridge.

Kanathe and Kushwaha (2019) Precast concrete decks with prestressed surface conform to greater range of forces, moments, and displacements than plain beam decks. The Finite Element Method involves assigning a finite element number to each part of the structure so it can be analyzed separately. A nodal intersection is when two elements intersect. This has been taken into account when analyzing a bridge with the same IRC loading and span of 30 meters for critical loads. The results of analyzing these critical loads will then be compared to determine the most stable and economical section based on all factors, including forces, deflection, weight, and cost. Prestressed concrete deck slabs experience fewer variations than plain beam decks in terms of forces, moments, and displacements.

Pandey and Nagarajan (2020) Based on the results of this study, the grillage method has been used to model and analyse the superstructure in order to induce the three-dimensional effect, and the grillage method has been compared to the traditional effective width method. The purpose of this paper is to describe a design of a four-lane reinforced concrete T-beam bridge deck with track loading of IRC Class-AA with spans ranging from 25 to 40m. Based on manual calculations as well as STAAD Pro analysis software, it is observed that dead load bending moment increases almost squarely with span.

OBJECTIVES OF THE STUDY

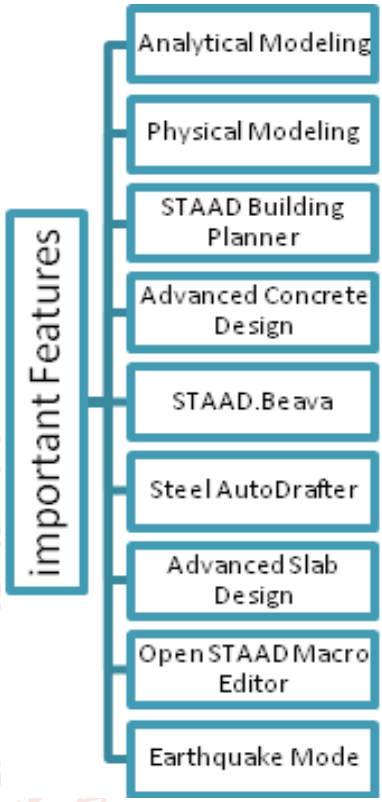
The main objective of the study is to perform the structural analysis of the solid slab (bridge deck) and to understand its behaviour under different load conditions. Thus the secondary objectives based on these conditions are:

1. To study the effect of load combination applied on structure.
2. To study the effect of variation in vehicle position along the longitudinal direction of the structure.
3. Effect of maximum bending moment and shear force value due to moving vehicle over the structure.

PROBLEM FORMULATION

In this study solid deck slab having 8. 2 m long span and the thickness of slab 0. 65 m and the slab is simply supported. The bridge analyzes and design by STAAD-Pro under different loading conditions. And also the analysis results in term of shear, bending moment, axial force and deflection were checked by STAAD-Pro which is passes through many different load combinations. The maximum design moments resulting from the combinations of various loading cases.

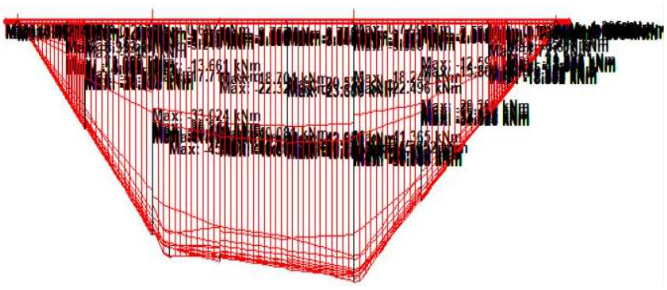
Important Features



Methodology

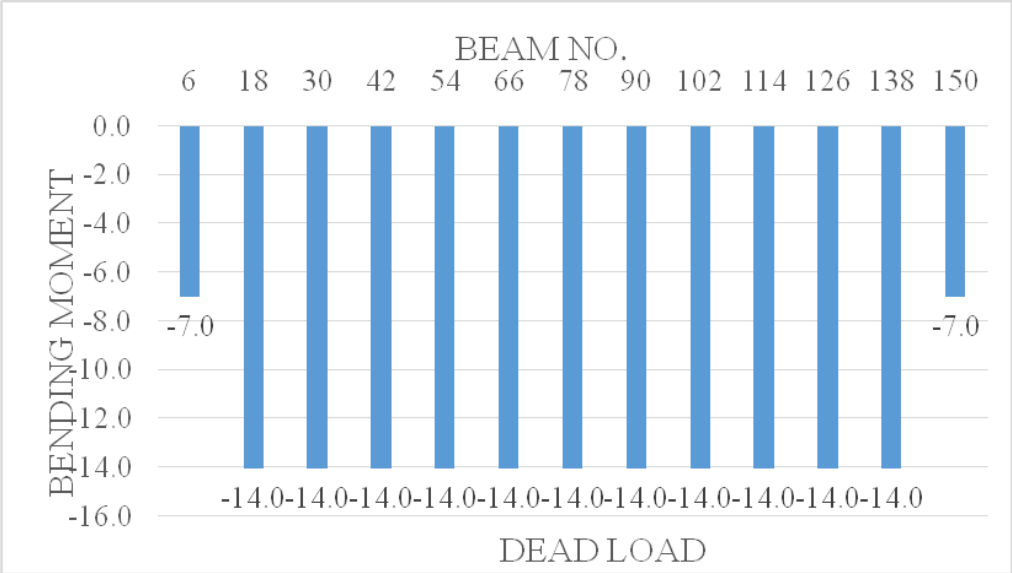
To achieve the above mentioned objectives our methodology is as follows:

1. Review the existing literature on topics of solid slab (bridge) structural for analysis.
2. Engineering properties of the materials (like modulus of elasticity, poisons ratio, ultimate tensile strength, etc.) to be used in analysis is inserted.
3. Modelling of the structure is done by using STAAD-Pro V8i software.
4. Generate beam geometry is done and element size is chosen in such a way that accuracy in analysis is ensured.
5. Provide slab thickness and material properties



Generation of Bending Moment

RESULTS AND DISCUSSION



Maximum Dead Load Moment

CONCLUSIONS

From the results obtained and graphs drawn for various loading variations it can be concluded that:

- Shear stress at a reference point vary with the variation in position of loads along the longitudinal edge.
- The maximum bending moment occur at center and decreases continuously from center to the edge of the beam
- The maximum shear force occur at the edge of the beam and decreases continuously toward the center of beam
- Total deformation, bending moment and shear force at a reference point decreases with the reduction in size of beam.

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