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A Review Paper On Analysis Of T-Beam Along With Deck Slab

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Abstract:- Bridge design is a difficult subject, with the most significant aspect being the study of loads and their distribution on structural members. A basic T-beam bridge was investigated utilizing IRC loadings and the program STAAD Pro V8i. The major goal of this study is to analyze the bridge's T-beam and compute the values of bending moment, shear force, and deflection for different span ranges and compare the findings with the program STAAD Pro V8i. Carbon's approach and other methods were utilized in this article to investigate the load distribution on the girder. The distribution of the live loads among the longitudinal girders must be calculated in order to compute the bending moment due to live load in a girder and slab bridge. There are several ways for estimating load distribution.

Key words: T-Beam, Compressive Membrane Action, Punching Shear, Bridge Deck Slab

I. INTRODUCTION

A bridge is a structure constructed to span physical impediments such as a road, valley, or body of water without shutting the passage beneath. A bridge is an essential component of any transportation system. Bridges of various types are used all around the world. Adair created the first reinforced concrete bridge in 1871, a 15-meter-span bridge across the Waveney in Homers Field, England. In India, reinforced concrete is increasingly being used for road bridges. T-beam bridges have been frequently employed in spans ranging from 10 m to 25 m. Bridge design is a complicated challenge that requires inventiveness and practicability while meeting the fundamental needs of safety and economics. Based on years of observation, study, and development, the concerned government agencies and professional institutions have been involved in the specification and code of practice. All highway bridges in India must be built in compliance with the India Roads Congress (IRC) Code, which is mandated by the Ministry of Road Transport and Highways of the Government of India. The Indian Railway Standard (IRS) Code, specifications established by the Indian Railway Research, Design and Standard Organization (RDSO), should be followed while designing a railway bridge.

II. LITERATURE REVIEW

1. **David A.M Jawad (2010)** The dynamic behavior of concrete T-beam bridge decks owing to heavyweight vehicles is investigated in this work. The finite element approach is used to construct a three-dimensional model of a real T-beam bridge deck design using the ANSYS 5.4 computer system. The deck is created with 20-node brick pieces. The vehicle model uses axle loads and combinations that conform to the "permit vehicle" loading model. The case study is taken into account for static, free vibration, and forced vibration analysis. The dynamic loading for forced vibration analysis is a sinusoidally variable load with a magnitude equal to 10% of the axle load and a forcing frequency equal

to the bridge deck's first (fundamental) frequency, imitating a situation of resonance. Dynamic amplification factors for vertical displacement, normal stress in the longitudinal direction, and shear stress are assessed at various places on the bridge deck. The numerical findings demonstrate a general tendency toward higher values than the AASHTO design code. It is also determined that the values of dynamic amplification factors are response dependant, implying that different types of dynamic application factors should be used for bridge deck analysis.

2. **Praful N K (2015)** The Bridge is a construction that allows passage over an impediment while keeping the path beneath open. It is possible that the needed passage is for a road, a train, pedestrians, a canal, or a pipeline. T-beam bridge decks are a common form of cast-in-place concrete deck. Tbeam bridge decks are made out of a concrete slab that is integrated with the girders. The finite element technique is a generic structural analysis approach that approximates the solution of a problem in continuum mechanics by analyzing an assemblage of finite elements that are interconnected at a finite number of nodal points and represent the issue's solution domain. Using rational techniques, a basic span T-beam bridge was studied as a one-dimensional structure with I.R.C. loadings. The same T-beam bridge was analyzed as a three-dimensional structure utilizing finite element plate for the deck slab and beam elements for the main beam using STAAD ProV8i software, with three different spans of 16m, 20m, and 24m. Both FEM and 1D models were subjected to I.R.C. Loadings to obtain maximum bending moment, shear force, and structural deflection. The findings of the finite element model are smaller than those of the one-dimensional analysis, indicating that the results of hand calculations exposed to IRC loadings are cautious.

3. **Prof. Dr. Srikrishna Dhale (2018)** For four separate scenarios, we utilized the piegurds curve to calculate the bending moment. For a vehicle load, we measure shear force and bending moment. We verify the depth then from that depth we design the bridge in STAAD- pro then we evaluate the bridge for outcomes. It has been discovered that the IRC 70R vehicle has the greatest influence on the sections. In this paper, a comparison of the 'Tee Beam Girder' with the 'Box Girder' is made. This is useful when there are two types of girders that may be utilized for the same span; in such instance, the more cost-effective one should be chosen.

4. **Tangudupalli Mahesh Kumar (2017)** Before designing any structure, we need understand the structural components, the specifications of the components, the loads to be addressed in the design of the structure, and the analytical ideas. So this thesis provides a quick overview of the definition of a bridge, its categorization, the loads to be considered, and the various methodologies to be used for the analysis of a T-Beam deck Slab Bridge. This project examines the basic T-Beam Deck Slab. Slab with Longitudinal and Cross Girders in T-Beam Deck Slab? Girders have been examined using three distinct Rational Methods (Courbon theory, Guyon-Massonet, and Hendry Jaegar) for four different IRC Loadings (Class-AA, Class-A, Class-B, and Class-70R) and three different national Loadings (AASHTO Loading, British Standard Loading, and Saudi Arabia Loading). This project also compares all of the above-mentioned loads and methods, and the same bridge is studied as a three-dimensional structure using the program STAAD ProV8i. Analysis of bridge girders entails calculating the moments and shear forces produced in the longitudinal and cross girders at various places for the aforementioned loadings. The Moments generated in the Slab owing to IRC Loadings Only were also studied. For this Project, a basic example problem from the text book (Design of Bridges by N. Krishna Raju) might be used, as well as some of the curves and graphs.

5. **R.Shreedhar (2015)** The T-beam Bridge is a composite concrete construction made up of a slab panel, a longitudinal girder, and a cross girder. The current study is primarily concerned with the design of longitudinal girders in accordance with IRC: 112-2011 and IRC: 21-2000. Until date, girders in India have been designed and built in accordance with Indian Road Congress requirements as per IRC: 21-2000 code, which employs the working stress approach. The Indian Road Congress just issued another code, IRC: 112-2011, for the design of prestress and RCC bridges utilizing the limit state approach. In this respect, the current study was carried out to determine how the design of IRC-112 varies from that of IRC-21, and an attempt was made to investigate undefined parameters of IRC: 112-2011, such as the span to depth (L/d) ratio. The current study is being conducted on the design of a longitudinal girder utilizing the "working stress approach" in accordance with IRC: 21-2000 code specifications and the limit state method in accordance with IRC: 112-2011 code requirements. It has been discovered that an L/d ratio of 10 in the working stress approach and an L/d ratio of 14 in the limit state method are the most desirable. The number of materials necessary in the limit state approach is compared to the quantity of materials required in the working stress method, and it is discovered that the limit state method may save up to 25% to 30% of the materials required.

6. **Y. Kamala Raju (2018)** The current study on Practices in civil engineering for sustainable community development has been undertaken to satisfy four out of the total eight Millennium Development Goals of the United Nations in order to improve the quality of life of the global community by raising awareness in everybody involved. This research is especially timely given the United Nations Decade of Sustainable Development. Civil engineering has four goals: successful irrigation water management, safe drinking water, environmental sustainability, and a sustainable transportation system. This research is an inspiration for these aims since it investigates Reinforced Cement Concrete bridge deck design and its dynamic response to urban growth in transportation networks. The Indian Roads Congress (IRC) Bridge Code: IRC 21-1987 is used to construct a Reinforced Cement Concrete bridge deck. The bridge deck is intended for IRC Class AA tracked vehicle loading. M. Pigeaud's design curves are utilized to calculate Moment Coefficients in two directions for the deck slab. Courbon's approach is used to design the longitudinal girders. The dynamic response of the bridge deck to moving loads is investigated using the British Standard Code of Practice BSCP-117 Part-II - 1967. This is based on Lenzen's criterion for determining the relationship between Natural Frequency and Vibration Amplitude. A C language computer program is developed to design the interior slab panels of the Reinforced concrete bridge deck in order to arrive at the reinforcements and depths for a specified length of the width of the slab panel and thickness of the wearing coat with Grade of concrete M-25 and Grade of steel Fe-415 High Yield Strength Deformed (HYSD) bars. A potential Global Partnership for overall development including universities, consulting firms, government agencies, and nongovernmental groups will also be addressed.

7. **L.P.Huang (2017)** The load distribution factor (LDF) is a critical metric for assessing the functioning of existing bridges. However, few scholars have investigated the change in transverse load distribution coefficients of beams before and after existing bridge enlargement and strengthening. A reinforcing method for enlarging longitudinal and cross beams was presented to solve such an issue. To simulate the widening reinforcement of an existing bridge, a Finite element (FE) model was built. Load distribution factors for all girders were analyzed in the cases of different position, quantity, and stiffness of cross beam, different added width of girder, different existing bridge stiffness, and different connection system. The results reveal that the LDF of side beams drops by the greatest amount following bridge strengthening, considerably improving the load-carrying condition of the girder. However, following strengthening, the LDF at the fulcrum increases by 30%. Therefore, some strengthening measures are necessary in these positions. The quantity, position and dimension of cross beam have not much influence on the LDF of each girder. The LDF of beams are smaller when the widened girders are connected rigidly to the old girders than that hinge connected to. The LDF of each girder shows not much difference when the main beams are connected to widened girders with rigid or hinged connection, respectively. This study is meaningful for the development of widening and reinforcement design of existing bridges.

8. **Anushia K Ajay (2017)** the infrastructure available in a country judges the development of that country. Highway which allows the flow of human beings and material is a major part of infrastructure. Tee-beam bridges forms the major proportion of bridges constructed on the highways. IRC codes are developed and reused from time to time based on the research work carried out all over the world. IRC 112-2011 replaces two codes of practice IRC 21-2000 and IRC 18-2000. Also IRC 112-2011 introduces limit state method of design of RCC bridges. Single span two lane bridge is subjected to IRC class AA tracked loading by varying the span is analyzed using software VB6.0. Inthis study parametric studies are conducted on various bridge super structural elements. The study is mainly focused on the economical depth of a longitudinal girder for different span. Nomograms are also developed which can be used as a handy tool in the design of T- Beam Bridge.
9. **Sudarshan Prabhakar Patil (2017)** Reinforced concrete bridges with different types of deck slab have been widely used for both road and railway bridges. The most common type is the slab deck used for short span bridges. For medium span in the ranges of 12 to 25 m T- Girder and slab deck is widely used. In the case of T Girder and deck slab type, the slab span in two directions since it is cast integrally with main girder and cross girder. The deck slab is generally designed for either by 70 R loading or class AA Tracked wheel loading. IRC recommends bridge designed for class AA loading should also be checked for IRC class A loading. However in conventional analysis many of the important considerations are ignored by the various designers, which proved out to be somewhat unrealistic during the pragmatic conditions. For an assessment of the load carrying capacity of a bridge, one needs to know the maximum bending moment and the shear force included in the beams or girders of the bridge by vehicular loads. These maximum design load effect can be calculated by the conventional method such as Courbon's method. The main objective of study is to analyse super structure for IRC Class AA loading (Tracked vehicle) and IRC Class A loading to compute the values of bending moment, shear force and deflection for span range from 16 to 24 m. The analysis of super structure of different sections and spans is carried out by Courbon's method using MS Excel and by using STAAD.pro software. The bending moment and shear force results obtained by STAAD.pro were less up to 18 m span when compared to results obtained by MS Excel and vice-versa as the span increased. The safe design section is obtained by deflection criteria
10. **Abrar Ahmed (2017)** the development of the nation is mainly from agricultural and industrial activities, so, it is required to facilitate the proper transportation by providing the Flyovers and Bridges. For constructing the flyovers or the bridges we find many types of section among which T-beam and box type are very popular. In order to find out the most suitable section, this project looks on the work of analysis, design and cost comparison of T-Beam and Box girders for different spans. The purpose of this study is to identify the suitable section for bridges of different spans. The Prestressed concrete sections have been considered in this case as the spans designed are more than 25 metres for which the Reinforced concrete sections are uneconomical. The aim and objective of the work is to analyse and design the sections for different Indian Road Congress, IRC vehicles. This has been done by analysing the structure by CSI bridge software and validating with manual results by developing the Microsoft Excel Sheets using Working Stress Method and by adopting Courbon's theory. It is found that the IRC 70R vehicle producing maximum effect on the sections. Cost comparison has shown that the T-beam girder is suitable for spans up to 30metre, as we go for higher spans the depth of T-beam girder increases drastically which makes it uneconomical. Therefore for higher spans the box girder is suitable. The result of this analysis can be used to find the suitable section for respective spans. From the obtained results we can conclude that the software results are acceptable and can be adopted for the design of substructures also.
11. **M.G. Kalyanshetti (2013)** -In order to compute the bending moment due to live load in a girder and slab bridge, the distribution of the live loads among the longitudinal girders has to be determined. There are many methods to estimate load distribution. In this project Courbon's method is used to estimate the load distribution as it very popular and widely used because of its simplicity. But the Load factor obtained by Courbon's method is constant for all spans and this indicates the effect of variation of span is not at all considered. Therefore it is proposed to study "effectiveness of Courbon's theory" for various spans of bridge by varying number of longitudinal girders. In this project STAAD software is used in which bridge models are analyzed using grillage method. Finally load factor obtained from grillage

analogy are compared with the Courbon's load factors to find out the difference and to obtain a new equation which considers the effect of span. The detailed study is carried out for four lane and six Lane bridges of spans 15m, 20m, 35m, 30m, 35m using IRC class A loading by varing a number of longitudinal girders. Also the study reveals that Courbon's theory gives higher values of bending moments for exterior girder. Therefore the problem of over estimation of load on exterior girder is solved by using Modified Courbon's equation.

III. CONCLUSION

With the innovation and current growth in bridge building technologies, we now have multiple alternatives for selecting bridges from various types, different techniques of analysis, and which also meet different factors such as economy, safety, stability, and aesthetic perspective of sub-structure. Introduction and diverse types of bridges addressed in this study, as well as the selection of different types of bridges in civil engineering building technologies.

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