JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

A REVIEW ON DESIGN AND ANALYSIS OF RCC T-BEAM BRIDGE SUPERSTRUCTURE

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Abstract : A bridge is a structure erected across a road, river, or railway to allow people and vehicles to go from one side to the other. Comparative studies are undertaken to select the most suitable section in bridges of various span lengths. The major goal of this work is to use software and manual approaches to investigate the impacts of T beam and Box girder bridges of varied spans under shifting loads. The analytical and design methods used are determined. The bridges are intended to withstand various IRC vehicle loads, and the TBeam deck and box girder systems are investigated. The software's results are compared to those obtained using manual techniques. The parametric analysis is carried out on parameters like Bending Moments and Shear Forces.

IndexTerms - T-Beam Bridge, Superstructure, IRC Codes, AASHTO, STAAD Pro

I. INTRODUCTION

A bridge is a structure erected across a road, river, or railway to allow people and vehicles to go from one side to the other. T-beam is a reinforced concrete bridge with a cross section that resembles a series of T-beams and a monolithic floor slab with supporting beams. It is a load-bearing structure that may be made more structurally efficient by inverting T beams and linking the tops of the beams with a floor slab or bridge deck. A box girder bridge is one in which the main beams are made up of hollow box-shaped girders. Prestressed concrete, structural steel, or a mix of steel and reinforced concrete make up the box girder. These bridges are often employed as elevated rail transit infrastructure.

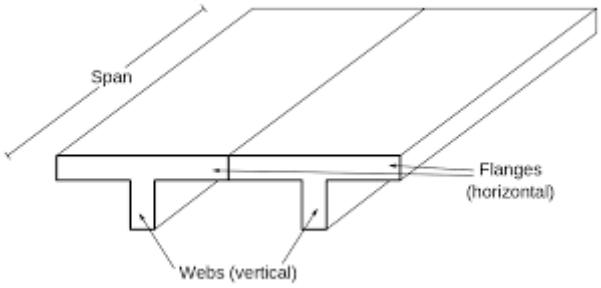

Fig 1:- T Beam Sketch

Fig 2:- T Beam Bridge in existence

II. LITERATURE REVIEW

- **Priyanka Dilip P, Fahad P. P. [1]** A box girder bridge is an evident bridge sector in which main longitudinal girders are provided in the hollow box shape. The box girder are constructed using steel or the concrete after prestressing or they are also constructed in the form of composite or reinforced concrete section. The typical cross section of box girder is rectangular, square and trapezoidal. In this paper, the analysis and design of 240m span of two Lane Bridge is carried out. A trapezoidal crosssection of post tensioned box girder bridge with two cells is analysed using different design loads using the IRC code for loads and load combinations i.e. IRC:6-2014 which includes different loads such as Super imposed dead load, Dead loads, moving loads, Prestresssing force. SAP 2000 is used to analysed the post tensioned box girder bridge using v 19 software. Post tensioning anchorages is carriED OUT BY THE FREYSSINET SYSTEM.
- **Phani Kumar, S.V.V.K.Babu, D. Aditya Sai Ram [2]** Bridge are used for connecting highway, roadways and railway in the whole world has high level of importance in construction sector. Prestress girder bridges are extremely popular in bridge engineering field as they are more stable, serviceable, economical and structurally efficient and gives aesthetic appearance. In this thesis, prestressed concrete T-Girder and Box Girder bridges analysis and design are carried out. IRC:112-2011 is used for analyzing the bridges. IRC:112 is a new generation code. The design provisions given in new code differs from previous codes. The previous codes are IRC:18 for prestressed concrete structures and IRC:21 for reinforced concrete structures. IRC:112 based on limit state method and IRC:21 and IRC:18 are based on working stress method which is the main difference between IRC:21 and IRC:112-2011.
- **Sanket Patel, Umang Parekh [3]** The bridges are used for different purposes from the very beginning of human civilization. Innumerable bridges of various kinds and of various materials have been built from times immemorial. Design of medium span highway bridge system requires careful selection of structural element in preliminary stage. The motive behind present study is to prepare some useful interface for preliminary design of bridge system. The most economical design can only be found by comparing few different designs. Particular set of conditions can be used to find the most economic design. Economy can be achieved by separately or simultaneously considering one or more of the following factors: span, superstructure cross section, cost of prestressing steel and concrete consumption. The present study includes parametric study on prestressed concrete girder bridge superstructure.
- **Pragya Soni, Dr. P.S. Bokare [4]** The bridging activity is as old as human civilization. Innumerable bridges of various kinds and of various materials have been built from times immemorial. Design of medium span highway bridge system requires careful selection of structural element in preliminary stage. The motive behind present study is to prepare some useful interface for preliminary design of bridge system. The most economical design can only be found by comparing few different designs. Particular set of conditions can be used to find the most economic design. Economy can be achieved by separately or simultaneously considering one or more of the following factors: span, superstructure cross section, cost of prestressing steel and concrete consumption. The present study includes parametric study on prestressed concrete girder bridge superstructure.
- **Jagdish Chand, Ravikant [5]** Sometimes, the way may have barrier or obstacles in the form of river or valley. So, without changing the alignment, a pathway or passage is provided over the barrier or obstacles. Both longitudinal girders and cross girders have been considered in this study of design of bridge girders. Girders are constructed for the individual span of the bridge which is taken as 25m. The size for longitudinal girders and cross girders are taken as2000x500 mm is 1500x250 mm respectively. The spacing between the three longitudinal girders is taken as 2600 mm c/c and between cross girders as 5000mm c/c. Software STAAD Pro is used to carry out the design of girders. For analysis bridge girder, Three same models are prepared in the STAAD pro and IRC codes, Euro codes and AASHTO loadings are applied. Shear force, bending moment and area of steel is determined from the models according to these different loadings from both longitudinal girder as well as cross girder. The whole analysis is carried out in STAAD Pro and tables and graphs are used to compare the results.
- **R.Shreedhar, Spurti Mamadapur [6]** A simple one span of T-beam bridge was analyzed as a one dimensional structure by using I.R.C. loadings. Software STAAD ProV8i is used to analyse the same T-beam bridge using finite element plate for the beam girder elements for the main beam and deck slab. The one span of bridge is analysed as a three-dimensional structure. Models are analysed for different IRC loadings .Both the models are subjected to I.R.C. Loadings to produce reactions, shear force and maximum bending moment. Manual calculations subjected to IRC loadings are also carried out and are conservative. The results obtained from the finite element model are lesser and the results obtained from one dimensional analysis are more.There are so many types of bridges where T-beam bridge decks are one of the most important and prefered type of concrete decks. It is cast in-situ type bridge deck.T-beam bridge decks consist of a concrete slab and girders which are connected together monolithically. In continuum mechanics, solution of a problem is approximated by the analysis of an assemblage of finite elements. In this process, finite elements are interconnected at nodal points of finite number and this process is used to represents the solution domain of the problem. This is analysed by the finite element method which is generally used for structural analysis.
- **T. Sujatha ,Y. Yadu Priya [7]** Pre-stressed concrete bridges can carry better live loads. In the field of bridge engineering, the use of pre-stressed concrete bridge decks has been increased in modern days.IRC bridge codes are used to carry out the analysis. The analysis is carried out using IRC provisions. T-beam bridge decks are one of the major and extensively used type of cast in-situ concrete decks. They are consist of a concrete slab integral. T-beam bridge decks are provided with girders. In this method, an equivalent idealized structure is used to replace the actual continuum .STAAD Pro is the general method which is used to analyse the structure. Single span t-beam bridge is analyzed which is a two lane bridge. Different spans are considered where the width is kept constant. The spans which are considered such as 25m, 30m, 35m, 40m. IRC class AA and IRC 70R tracked loading system are used to test the bridge to obtain maximum reactions, maximum bending moment and shear force. From the analysis it is observed that shear force and bending moment in the girder increases with the increase in the span,. It is also observed that courbon's method and finite element method have no significant variation when the results of shear forces and bending moments obtained.
- **Sharu.E ,Nivedhitha M and Gowtham Raja M [8]** A bridge is a structure which provides a passage on a valley or an barrier by keeping clear the way beneath. The required passage may be for pedestrians, a road, a railway, a canal or a valley. In the world, many of the bridges are failed due to various reasons. But mostly improper design is the vital reason behind bridge failure.

Therefore proper designing is required .R.C.C T-BEAM Bridge in a proper manner. We referred standard code books, standard procedures, and previous research to make a design in a good manner. The span of the bridge which is being of 3 lanes. The clear cover of the reinforcement is taken as 40mm. The bridge is designed with all the components like Deck, Girders, Bearing, Pier cap, Pier, Pile cap, Pile, Abutment and so on and the configuration by IRC loadings. These components are designed based on IRC loadings and it is being examined with the authentic loading. This bridge has also been checked for its seismic resistance capacity. Finally we are bridge with the overloading currently due to congestion factor on the bridge life span of T-beam Bridge.

- **Prof. R.B. Lokhande ,Abrar Ahmed [9]** 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. T-beam and box type are very popular types of section for constructing the flyovers or the bridges. This project looks on the work of analysis, design and also compares the cost of T-Beam and Box girders for respective spans in order to find out the most suitable section. The purpose of this literature is to determine the most economical and proper section for bridges of respective spans. In this case, the Pre-stressed concrete sections have been considered. The spans which are designed are more than 25metres.The purpose of this literature is to determine the most economical and proper section for bridges of respective spans. In this case, the Pre-stressed concrete sections have been considered. The spans which are designed are more than 25metres for which it is uneconomical for the Reinforced concrete sections. The objective and aim of the work is to design the sections for different IRC loadings which are given in IRC codes and also analyzing it for those loadings. 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 noticed that the IRC 70R vehicle loading creating maximum bending moments and reactions on the sections. Cost comparison of bridge is done and the results has shown that the 30metre spans T-beam girder is suitable, as we go for higher spans the depth of T-beam girder increases drastically which makes it uneconomical Therefore it is concluded that the box girder is suitable for greater spans. The analysis result can be used to find the most suitable and economical section for respective spans of bridge. From the obtained results we can conclude that the software results are reasonable and it can be adopted for the design of substructures.
- **Sudip Jha, Cherukupally Rajesh, P.Srilakshmi [10]** 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. T-beam and box type are very popular types of section for constructing the flyovers or the bridges. This project looks on the work of analysis, design and also compares the cost of T-Beam and Box girders for respective spans in order to find out the most suitable section. The purpose of this literature is to determine the most economical and proper section for bridges of respective spans. In this case, the Pre-stressed concrete sections have been considered. The spans which are designed are more than 25metres.The purpose of this literature is to determine the most economical and proper section for bridges of respective spans. In this case, the Pre-stressed concrete sections have been considered. The spans which are designed are more than 25metres for which it is uneconomical for the Reinforced concrete sections. The objective and aim of the work is to design the sections for different IRC loadings which are given in IRC codes and also analyzing it for those loadings. 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 noticed that the IRC 70R vehicle loading creating maximum bending moments and reactions on the sections. Cost comparison of bridge is done and the results has shown that the 30metre spans T-beam girder is suitable, as we go for higher spans the depth of Tbeam girder increases drastically which makes it uneconomical Therefore it is concluded that the box girder is suitable for greater spans. The analysis result can be used to find the most suitable and economical section for respective spans of bridge. From the obtained results we can conclude that the software results are reasonable and it can be adopted for the design of substructures.

III. CONCLUSION

With the advancement of bridge building technology, we now have a variety of options for selecting a bridge from a variety of types and analytical techniques that meet a variety of criteria, such as cost, safety, and structural strength. Different forms of bridges, techniques of analysis in civil engineering construction technology, and the selection of acceptable types are all explored in this review.

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