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Performance and study of variousbridge girders

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Abstract-*According to various research papersthe design and analysis of various girders for steel and concrete by using v software STAAD Pro. And finite element method. In this project theto check the analysis of bridge by using software. Hence, in this project determine the static analysis of T, I and Box girder. In these three girders which can be determine which is effective and economical to bridges.Both models are subjected to I.R.C. Loadings to produce maximum bending moment..*

Keywords-T, I, Box girder, IRC Loading,SAP2000 Software, FEM.

I.INTRODUCTION

The boxes may be complete steel boxes with an overlay slab or an open box where the concrete slab closes the top of the box. The open top form of box girders, consisting of steel webs and a bottom flange, has only small top flanges sufficient for stability during concreting. The advantages of this form are that access to all parts of the section is available, which, e.g., facilitates welding, and that the web can be inclined which allows a larger span in the transverse direction of the bridge. A disadvantage of the open box is that the high torsional stiffness of a closed section is not present during construction until the concrete slab has gained strength, which makes it more sensitive to lateral instability during construction.

The typical multi-girder steel-concrete composite bridge, which consists of a number of steel girders with bracing in between and a slab on top, and a ladder deck bridge, which consists of two main girders with a number of secondary cross girders in between that support and act with a deck slab. Both provide a cost-effective solution and the choice between the two types depends on economic considerations and site-specific factors such as the form of intermediate supports and construction access. The guide describes the determination of design forces, identifies key features relating to the design of the different structural components and gives structural detailing advice.

The aim of the document is to provide guidance and experienced bridge designer on the design of cost-effective steel-concrete composite bridges. Many bridges built in the past 50 years are composite structures with decks constructed of reinforced concrete and supported by longitudinal steel girders.

Because of their normal deterioration, the introduction of new safety standards, and the increasing traffic volume and loads, a high percentage of the older bridges require rehabilitation or expansion.

II.SUMMERY OF PREVIOUS PAPER

There are various research paper various girders can be design for the various bridges and as per the loading and various software i.e ANSYS ,STADD Pro.etc.

In these paper manual calculation can be done by finite element method or other method

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as par the consideration. AASHTO specifications and Loadings as a one dimensional structure to the three- dimensional structure by using FEA.

REVIEW PAPER

1) Ioannis Vayas1,*, Theodoros Adamakos1, AndAristidis Iliopoulos:

In this research modeling steel composite straight bridges has been presented. The proposed model is based on the representation of steel I-girders through the use of equivalent trusses. The concrete slab is suitably represented by a set of bar elements. This paper discusses the extension of the model to skewed composite bridges. The presence of skew makes the analysis complicated and for this reason the grillage analysis is not always recommended. Phenomena like differential deflections of the main girders during concreting and lateral displacements of the flanges can be adequately predicted using the proposed model.

The new way for modeling composite bridges be used for stability analysis of skewed bridges.

2) Dr.MaherQaqish 1, Dr.EyadFadda 2 And Dr.EmadAkawwi :

In this research a simple span T-beam bridge was analyzed by using AASHTO specifications and Loadings as a one dimensional structure, then a three- dimensional structure was carried out by using finite element plate for the deck slab and beam elements for the main beam. Both models were subjected to 1.5 AASHTO Loadings and at certain locations to produce maximum bending moment and maximum shear. The results were analyzed and it was found that the results obtained from the finite element model are smaller than the results obtained from one dimensional analysis, which means that the results obtained from AASHTO loadings are conservative.

3) R.Shreedhar, SpurtiMamadapur :

In this research T-beam bridge decks are one of the principal types of cast-in place concrete decks. T-beam bridge decks consist of a concrete slab integral with girders. The finite element method is a general method of structural analysis in which the solution of a problem in continuum mechanics is approximated by the analysis of an assemblage of finite elements which are interconnected at a finite number of nodal points and represent the solution domain of the problem. A simple span T-beam bridge was analyzed by using I.R.C. loadings as a one dimensional structure. The same T-beam Bridge is analysed as a three- dimensional structure using finite element plate for the deck slab and beam elements for the main beam using software STAAD ProV8i. Both models are subjected to I.R.C. Loadings to produce maximum bending moment. The results obtained from the finite element model are lesser than the results obtained from one dimensional analysis, which means that the results obtained from manual calculations subjected to IRC loadings are conservative.

4) F Tahmasebinia, G Ranzi :

In this research Composite steel-concrete beams represent an economic form of construction used in both building and bridge applications. The composite action is usually provided by the presence of shear connectors welded to the top of the steel joist and embedded in the concrete slab. The flexural response is strongly dependent on the rigidity provided by these connectors. Initial studies in this area highlighted that their

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deformability needs to be evaluated and included in the modeling for an accurate structural representation.

For this purpose, different types of push-out tests have been proposed to date to describe the load-slip relationships of shear connectors. These relationships are usually used in numerical simulations when modeling experimental tests or performing parametric studies. In this context, the finite element model proposed in this paper intends to provide a representation of the composite behavior of floor beams without the need to rely on constitutive relationships obtained from push-out tests. The model is validated against experimental results available in the open literature carried out using simply-supported and continuous static configurations and based on composite beams with solid and composite slabs.

5) Darius Bacinskasa,*, ZenonasKamaitisa, DonatasJatulisa, ArturasKilikevicius:

In this research actual static and dynamic response of a newly constructed composite steel-concrete railway bridge with a single span of 32 m is investigated. The main objective of this investigation was to increase knowledge on the actual behavior of new innovative structure using field load testing and numerical simulation. Static and dynamic loads were applied by using two heavy locomotives 2M62 with the total load of 2328 kN. Five dynamic tests were conducted at speeds varying from 20 to 100 km/h. The outcomes of the static tests were maximum displacements of the bridge deck and that of dynamic tests were vibration characteristics, and in particular modal parameters such as vibration mode shapes, frequencies, damping ratios as well as dynamic amplification factors. Results of these investigations are presented in this paper.

Above theory indicates the separate work studies on composite bridge are done but at a same time no comparative study in girder are done. So there is a considerable scope for research work in this area of “Analysis and comparative study of Composite bridge by using FEM”.

6) S. Rana & R.Ahsan and S.N.Ghani

In Bangladesh, post tensioned simply supported prestressed concrete (PC) I-girder bridges are widely used bridge system for short to medium span (20m to 50m) highway bridges due to its moderate self

weight, structural efficiency, ease of fabrication, low maintenance etc. In order to compete with steel bridge systems, the design of PC I-girder Bridge system must lead to the most economical use of materials.

In this paper, cost optimization approach of a post-tensioned PC I-girder bridge system is presented. The objective is to minimize the total cost in the design process of the bridge system considering the cost of materials, fabrication and installation. For a particular girder span and bridge width, the design variables considered for the cost minimization of the bridge system, are girder spacing, various cross sectional dimensions of the girder, number of strands per tendon, number of tendons, tendons configuration, slab thickness and ordinary reinforcement for deck slab and girder. Design constraints for the optimization are considered according to AASHTO Standard Specifications.

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The optimization problem is characterized by having a combination of continuous, discrete and integer sets of design variables and multiple local minima. An optimization algorithm

called Evolutionary Operation (EVOP) is used, that is capable of locating directly with high probability the global minimum. The proposed cost optimization approach is compared with an existing project which leads to a considerable cost saving while resulting in feasible design.

METHODOLOGY

The main objectives of the proposed work are:

1) To study the structural behavior various girders for the composite bridge under Static analysis.

2) To identify the suitability of the girder for the composite Bridge.

3) Compare its results numerically to know the suitability of the various girders for composite bridges by using software.

Outline of Proposed Work or Methodology

In the proposed study the behaviour of Composite bridges under static loading will be observed and studied. Buckling analysis can be determined by using FEA Software. Different girders can be used for the study i.e. I, T, Box girder can be used. Comparing all the girder i.e. I, T ,Box etc. which is more effective for bridge is to be determine. The study of three dimensional modelling of load capacity and load deflection analysis with numerical study using a accurate as a relatively fine mesh finite element model bridges

FINITE ELEMENT METHOD

The finite element method is a well known tool for the solution of complicated structural engineering problems, as it is capable of accommodating many complexities in the solution. In this method, the actual continuum is replaced by an equivalent idealized structure composed of discrete elements, referred to as finite elements, connected together at a number of nodes. Thus the finite element method may be seen to be very general in application and it is sometimes the only valid form of analysis for difficult deck problems. The finite element method is a numerical method with powerful technique for solution of complicated structural engineering problems. It is mostly accurately predicted the bridge behavior under the truck axle loading.

The finite element method involves subdividing the actual structure into a suitable number of sub-regions that are called finite elements. These elements can be in the form of line elements, two dimensional elements and three- dimensional elements to represent the structure. The intersection between the elements is called nodal points in one dimensional problem where in two and three-dimensional problems are called nodal lines and nodal planes respectively. At the nodes, degrees of freedom (which are usually in the form of the nodal displacement and or their derivatives, stresses, or combinations of these) are assigned. Models which use displacements are called displacement models and models based on stresses are called force or equilibrium models, while those based on combinations of both displacements and stresses are called mixed models or hybrid models .Displacements are the most commonly used nodal variables, with most general purpose programs limiting their nodal degree of freedom to just displacements. A number of displacement functions such as polynomials and trigonometric series can be assumed, especially polynomials because of the

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ease and simplification they provide in the finite element formulation. This method needs more time and efforts in modeling than the grillage.

from the finite element method depend on the mesh size but by using optimization of the mesh the results of this method are considered more accurate than grillage. Fig. 6 below shows the finite element mesh for the deck slab and also for three-dimensional model of bridge.

Three- Dimensional Structures Composed of Finite Plate Elements **1.Advantages of Finite element Method The finite element method has a number of advantages; they include the ability to :**

Model irregularly shaped bodies and composed of several different materials.

Handle general load condition and unlimited numbers and kinds of boundary conditions.

Include dynamic effects.

Handle nonlinear behaviour existing with large deformation and non- linear materials.

2 Disadvantages of Finite Element Method

Commercial software packages the required hardware, which have substantial price reduction, still require significant investment

FEM obtains only approximate solutions.

Stress values may vary by 25% from fine mesh analysis to average mesh analysis.

Mistakes by the user can be fatal.

It takes longer time for execution.

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CONCLUSION

The composite bridge design the various girders by post or pre-stresssed. In this paper efforts will make to carry out the to check the strength of bridge by using software i.e STAAD Pro. According to various research papers, it has been found that composite bridge gives the maximum strength in comparison to other bridges. Hence, in this project or research papar determine the static analysis of T, I and Box girder by using FEM. The results obtained from the software in structural analysis are compare the results obtained from manual calculations.

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