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Comparative Study of Girders for Bridge by Using Software

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ABSTRACT
According to various research papers, it has been found that composite bridge gives the maximum strength in comparison to other bridges and the design and analysis of various girders for steel and concrete by using various software for composite bridge design for girder. In this project, efforts will make to carry outto check the analysis of girder by using SAP2000 software. Hence, in this project determine three girders which can be effective to the composite bridges.
Keywords- T, I, Box girders, SAP2000 Software.

I. INTRODUCTION

Steel beams supporting concrete slabs have been used to form the basic superstructure of large numbers of deck bridges for many years. Since 1945 the number of composite bridges being built has significantly increased. The pressure of steel shortage in Germany after the Second World War forced engineers to adopt the most economical design method available to be able to scope with the large amount of reconstruction of bridges and buildings destroyed. Composite bridges are structures that combine materials like steel, concrete, timber or masonry in some combination. The behavior of the composite structure is heavily influenced by the properties of its component materials. the use of a concrete slab on a steel girder uses the strength of concrete in compression and the high tensile strength of steel. Looking at the basic behavior of a composite structure there are two fundamental effects that need to be considered: the differences between the materials and the connection of the two materials. Stronger, stiffer materials like steel attract proportionally more load than materials such as concrete. If there is no connection then the materials will behave independently, omitting the positive effects, but if adequately connected the materials act as one whole structure. Most common composite structures are either precast, prestressed concrete beams with an cast concrete slab or steel girders with a concrete slab. Composite structures can be used for a wide range of structures such as foundations, substructures, superstructures and for a diverse range of bridge structures like tunnels, viaducts, footbridges and cable stayed bridges.

Steel-concrete composite box girders may advantageously be used for bridges with long spans, for bridges with significant horizontal curvature or simply for aesthetic reasons
 In order to provide safer and greater speed of traffic, the roadway is built as straight as possible Box girders, have gained wide acceptance in freeway and bridge systems due to their structural efficiency, better stability, serviceability, economy of construction and pleasing aesthetics.

II. REVIEW PAPER

1)Ioannis Vayas1,*,Theodoros Adamakos1, And AristidisIliopoulos: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.MaherQaqish1,Dr.EyadFadda2AndDr.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) FTahmasebinia, 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 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.

III.   METHODOLOGY.

1)To study the structural behavior of bridge under Static analysis.
2)Compare its results to know the suitability of the girderfor composite bridges by using SAP2000.

3.1 Guidelines For Using Sap2000

Click on new for a new model, This asks us to select a new template and gives various options for the same as in the figure 1 given below. Select Grid only.
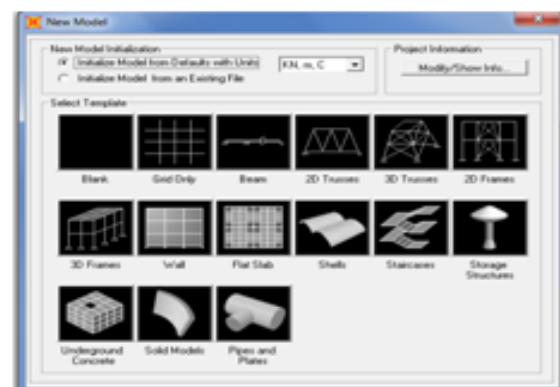

Figure 1

After selecting Grid only, the following figure appears asking for the number of grid lines in every direction and also the grid spacing in all directions. As per your design, give the values for grid lines and click on OK. Remember: Grid lines are the lines passing through the center of columns in both the directions.
X direction- horizontal grid lines in plan
Y direction- vertical grid lines in plan
Z direction- vertical grid lines in elevation.
After having provided the values for grid lines, the software generates the model for the given values as shown in figure. The model is seen both in plan and 3D simultaneously.
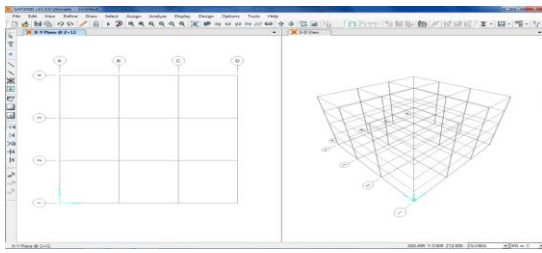
defining material property for slab and bridge: click on define, select section properties, select slab sections, click on add new property ,applying load patterns for the model. select define, click on load patterns. type load pattern name, type, self-weight and then click on add new load pattern and the load pattern is being saved. repeat the process for various load patterns. give load patterns as dead, live, earthquake, superimposed.

note: for dead load, the self-weight multiplier is 1. and for the rest all is considered as 0. for superimposed load, the type is super dead.

3.2 Applying Time Histories:

Select Define, click on Functions and then select time history. Select the function type and click on From File. Then click on add new function Type a function name for the time history eg. Bhuj. Click on browse and select the text file of Bhuj. Open the text file having time history data of Bhuj and change the header line to skip in SAP2000 and change accordingly. Mention the header line to skip, prefix character to skip and number of points per line. Click on Display graph and click on OK when the graph is displayed. And thus apply the same procedure for various time histories.

### 3.3 Applying Load Cases For The Model:

After having given the time histories for every. Select on Define, click on Load case data. As per all given time histories, all the time histories are added here. Click on add new load cases. A window appears as shown in figure. Mention load case name add change the load case type as Time history.
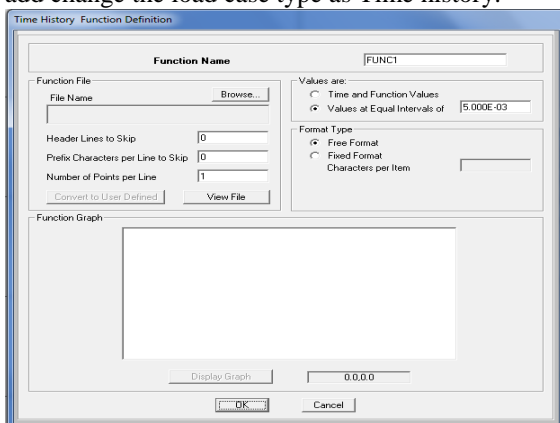
Figure

Change load applied data, Select load type as Acceleration. Change the name to U1. and function as Bhuj. Scale factor is 1 and then click on Add.Modify the time step data as per the text document of time history.Give the time output step size as 0.005.
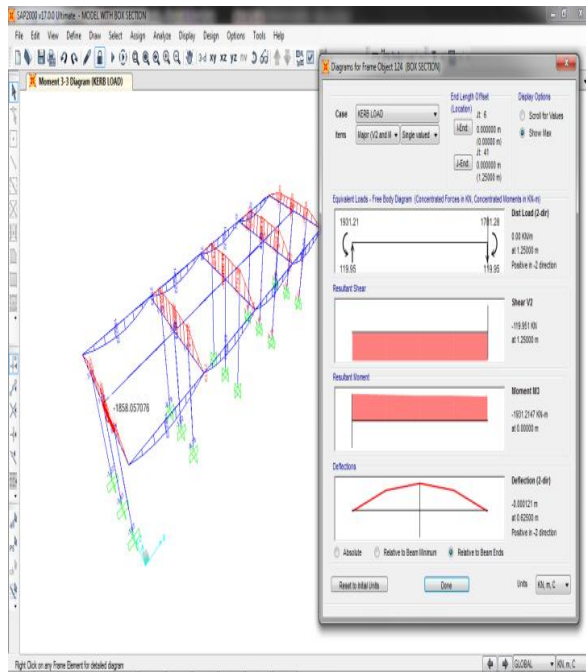And then click on OK.
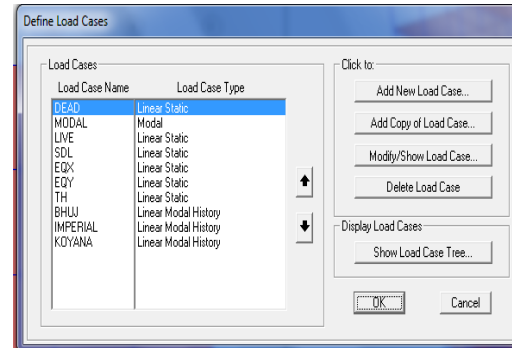
Figure

IV. PROBLEM STATEMENT

The problem taken for the comparison, typical bridge span without prestressing or post tensioning is considered, the bridge is analysed for the two continuous spans with three pier in series to get the proper load distribution on the pier. The CLASS A loading is considered or the analysis as per IRC code.

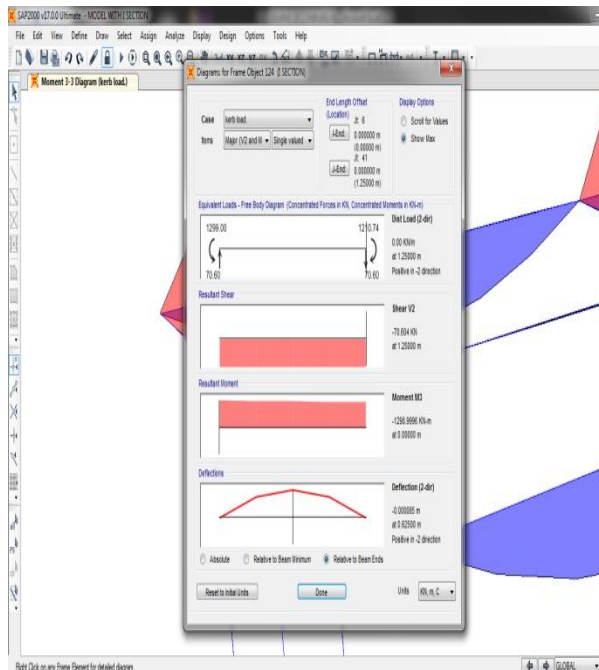|	
Clear Width of roadway	7.5m
Average thickness of wearing coat	0.08m
Cross section of deck slab	0.2m
Thickness of deck slab	0.2
Cross girders spacing	4m
Depth of main girder	

Live load is placed at center
Overall span=25ft, Girder spacing=12ft
Number of girder =5   Fck= 25mpa
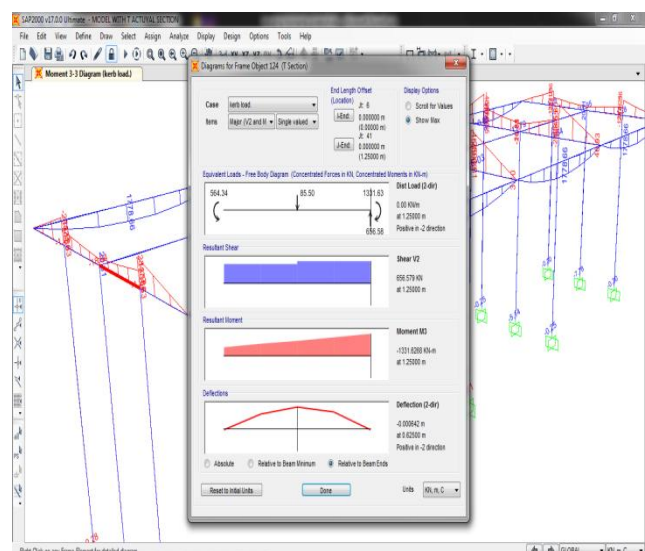
BM For T-Girder

BM For BOX-Girder

DISP (MM)

BM by SAP

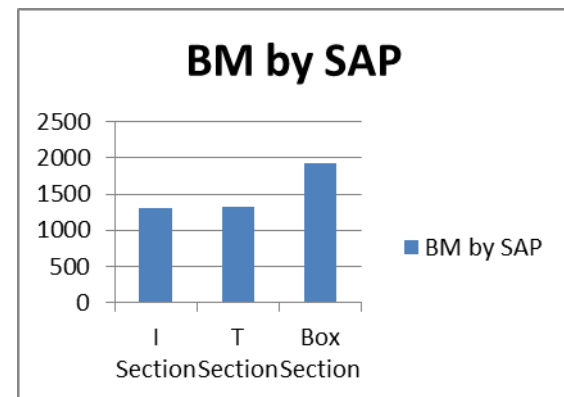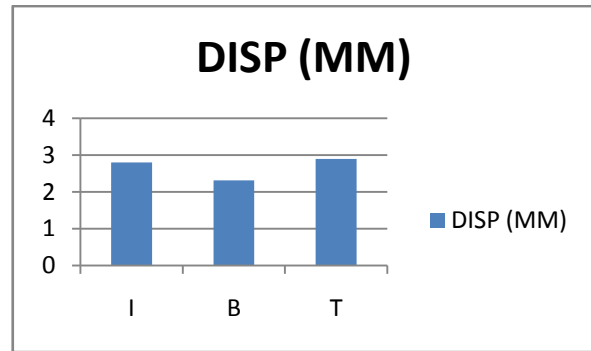| SR.NO.	Type of Girder	Bending Moment
1	I-Girder	1298
2	T-Girder	1331
3	Box Girder	1931

BM For I-Girder

V.   RESULT

Graph showing variation in maximum bending moment for different sections by software analysis. It is observed that the variation is much more in case of box section Graph showing variation in maximum displacement for different sections software analysis. It is observed that the displacement is much more in case of T section.

VI.   CONCLUSIONS

Every section has its own significance according to the load carrying capacity. The I section is having single we band double flanges because of this I section helps to counter react the bending moment and bending stresses. Box section is having two webs and two flanges making it more strengthful against torsion but not that much in flexure. Whereas in T section only one flange and web is the which results in low resistance against torsion.

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