Comparative Study of RCC Bridge for Central Zone of India for Different Sections of Girder

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Abstract— Construction of bridge has always been one of the most fascinating challenges to man from the time, immemorial man has found many ways to cross river and even today one can find persons crossing turbulent rivers in the north crouching over inflated buffalo. All design parameters confirm to IRC standards. In this we have analyzed 20mts RCC concrete I- beam, T-beam and box girder bridge, and by using STAAD PRO V8I software. The aim of this thesis work is to investigate the section of girder which can provide most suitable section in terms of minimum shear force, bending moment and displacement.

Key words: I-beam girder, T-beam girder, box girder, comparison, bending moment, shear force, deflection

I. Introduction

A bridge is a structure built to connect physical obstacles without closing the way underneath such as a body of water, valley, or road, for the purpose of providing passage over the obstacle. Designs of bridges vary depending on the function of the bridge, the nature of the terrain where the bridge is constructed and anchored, the material used to make it, and the funds available to build it. Bridge decks are subjected to excessive wear and tear, making them the most susceptible to early deterioration and degradation among other bridge components.

II. Research Methodology

A. *Steps to be followed*

Present thesis work is being done in following steps:

- Modelling of bridge deck with the three types of girder for central zone of India.
- Modelling has to be done in STAAD-PRO.
- Comparison of result.
- Study for optimum design.
- Study and comparison of cross section in terms of base shear, moment at base, size of cross-section on the basis of design given by software.

For thesis work some of the constraints are being kept constant so that comparison of the three types of bridge girder can be carried out with an unbiased method. For the same, some of the design constant are kept constant and are as follows:

- Design of two lane bridge girders for IRC Class-A loadings.
- Span= 20m

B. *Deck Bridge specification*

- Deck concrete= M-25
- Footpath width= 1.25m
- Carriageway width= 7.5m
- Total width= 7.5+2(1.25) = 10m
- Spacing of girder= 2.5m
- Design of deck slab is not part of the problem; however the RCC slab is designed as continuous slab with 5m spans and footpath designed as cantilever slab.

Above are the design constants details to be used in analysis of all the three types of bridge girders.

1) *Step 1: Modeling of bridge*

Modeling of bridge deck in comparison with three types of girder for central zone of India.

2) *Step 2: Assignment of dimension*

Assignment of dimension to girder

3) *Step 3: Support*

After modeling type of support has to be provided to each bridge deck. Here we have taken one support as hinged and another as fixed.

4) *Step 4: Loading*

In present research work two basic loadings are provided and structures are being analyzed on the basis of these two loading proving, the two basic loadings are:

1) Dead load
2) Live load

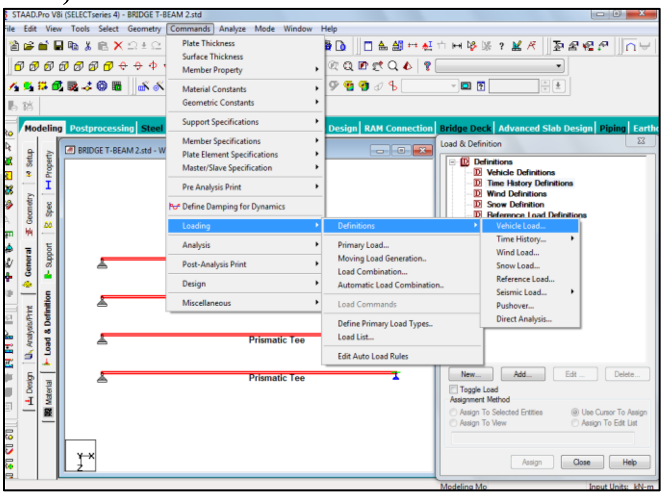

Fig. 1: Steps for loading

5) *Step 5: Structure analysis*

After modeling completion, analysis has to be performed for the structure. For analysis first one has to go on perform analysis and the one has to go for run analysis.

6) *Step 6: Post processing*

After analysis completion post processing has to be selected and result of analysis has to be extracted for all the three types of structure.

III. Result Analysis

A. *Displacement*

After load application deformation follows. Deformation is in the form of displacement in vertical direction. In this thesis work displacement result are taken directly from software analysis result.

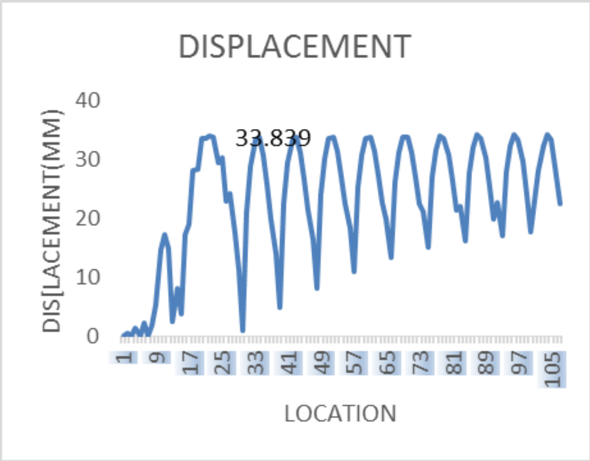

Fig. 2: Displacement for Box Girder

Comparative displacement chart for all the three type of girder is as follows:

I-Beam	T-Beam	Box Girder
24.3	18.5	33.8

Table 1: Displacement comparison

Comparative result of displacement can be shown as follows:

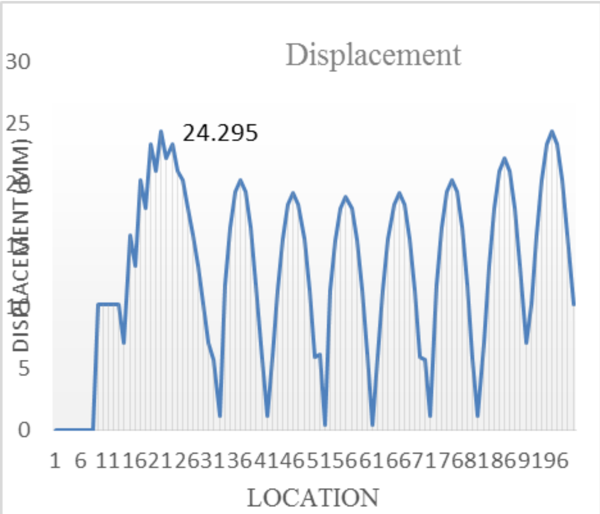

Fig. 3: Displacement for I-Girder

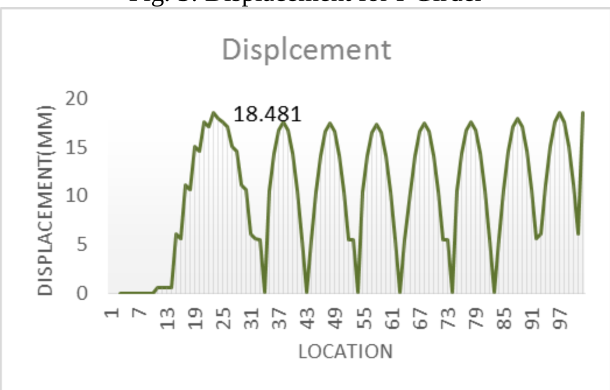

Fig. 4: Displacement for T-beam Girder

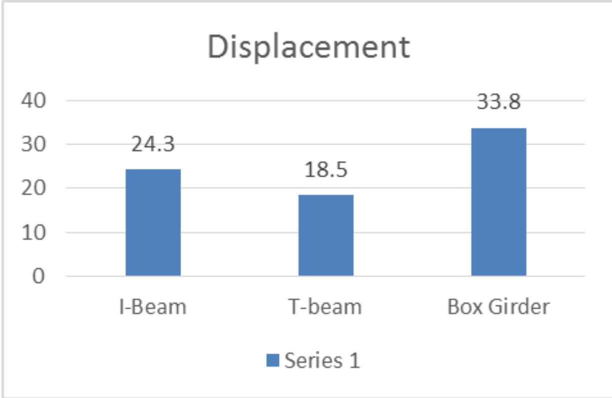

Fig. 5: Comparative Displacement

B. Shear force:

Shear force at support are the reaction given by the support for the load which is being acting on the structure and reaction is given by the support on which the whole structure is resting. In this thesis work one end pinned support is taken in software and on the other end fixed but support is assigned to give it real support condition.

It can be represented as follows:

I-Beam	T-Beam	Box Girder
2846	2620	2216

Table 2: Shear force Comparison

Shear force can be represented as follows:

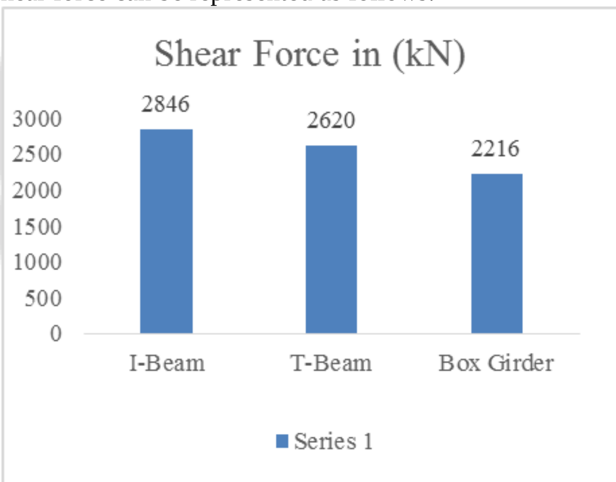

Fig. 6: Shear force Comparison

C. Bending Moment:

Bending moment same as shear force, bending moment comparison has been directly taken from software result. Highest value of bending moment is taken from analysis result. Results are being depicted as follows:

I-Beam	T-Beam	Box Girder
14231	8116	8290

Table 3: Bending Moment Comparison

Bending moment can be represented as follows:

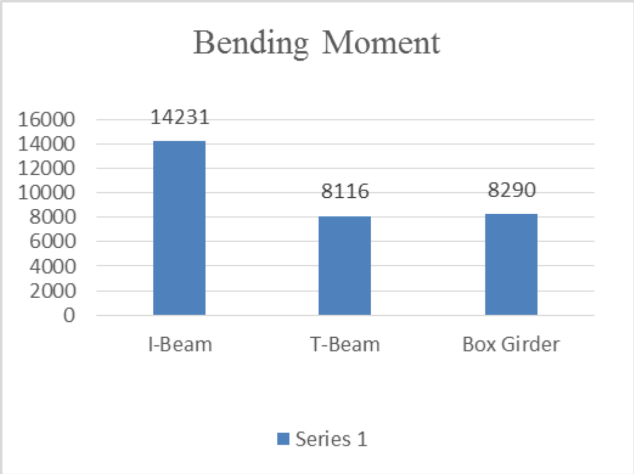

Fig. 7: Bending moment

IV. CONCLUSION

This chapter deals with the conclusion of result from analysis chapter. The conclusion drawn from analysis result of present thesis work is as follows:

1) Maximum displacement can be seen in box girder which is 33.8mm and minimum displacement can be 18.5mm in T-Beam Girder in vertical direction.
2) Maximum shear force can be noticed in I-Beam Girder which has value of 2846 KN and minimum shear force can be observed in box girder which is 2216 KN.
3) Maximum bending moment can be seen in I-Beam Girder which has value of 14231 KN-m and minimum value is 8116 KN-m which can be observed in T-Beam girder.
4) Since the minimum value of displacement and bending moment is acquired by T-Beam and also the Shear force is in middle so therefore, T-Beam is the most economic and optimum section for IRC Class A loading .

Force	Displacement	Shear Force	Bending moment
Minimum value	18.5	2216	8116
Maximum value	33.8	2846	14231
Type of girder	T-Beam	Box Girder	T-Beam

Table 4: Minimum & Maximum values of forces and type of girder

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