Comparison of the Cellular Box Girder Sections in the Flyover Bridge

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Abstract:- **The principle objective of this project is to design and analysis of flyover using Csi-bridge. India being a mainly agriculture based country and due improvements in the industrial activities in the urban areas, the traffic congestion has become the hectic issue in the metropolitan cities. To overcome the traffic congestion issues the technical innovations are adopted. On the way of structural engineering the structures like overpass flyover and some other structures are adopted to crack the traffic issues. In this paper the behavior of the flyover structure has been studied for the single cell and multicell box girder flyover. Csi-Bridge software is used to analyze and study the parameters such as bending moment, shear force, torsion, axial force, displacement etc,.**

Keywords— Flyover, Box girder, Congestion.

I. INTRODUCTION

A flyover is a construction built to span physical obstacles such as a body of water, valley, or road, for the purpose of providing passage over the obstacle. Designs of flyover vary depending on the function of the flyover, the nature of the terrain where the flyover is constructed, the material used for construction and the funds available to build it. The flyover consists of number of spans with columns (piers), deck, and foundation etc. In order to construct a flyover all these elements are to be analysis and designed properly. For large construction this process of designing and analyzing become complicated when done manually time taking and sometimes lead to errors so in order to meet these problems software's are used. The computer software's are the ones which can perform this action of analysis and designing with minimum errors with in short period of time such that the designing of complex flyover become easier while using software's. Some of the famous software's which are generally used for analysis and designing of structure are Staad pro, Csi-bridge, Ansys, SAP etc., A flyover has three main elements. First the substructure i.e, foundation transfers the loaded weight of the bridge to the ground. It consists of components such as columns (Also called piers) and abutments. An abutment is the connection between the end of the bridge and the road carried by the earth; it provides support for the end sections of the flyover. Second, the superstructure of the flyover is the horizontal platform that spans the space between columns. Finally, the deck of the bridge.

II. OBJECTIVES

- ❖ To study the traffic congestion problems in the multiple road junctions in the urban areas.
- ❖ To analyze the overpass flyover bridge as per the IRC norms using Csi-BRIDGE software.
- ❖ To assess and compare the results for single cell and multi cell box girder sections of the flyover bridge.
- ❖ To study the behavior of the structures in different load cases and combinations.

III. METHODOLOGY

Modeling:

Flyover with the box girder section and pier with rectangular section. Box girder is of trapezoidal cross section. Two different models are modeled with single cell box girder and another with multi-cell box girder. The geometrical model is modeled with post tensioned load with different pre stressed loads.

Basic data adopted for the respective structure:

- Horizontal layout data:
  Total length : 300m
  Radius of curved layout : 572m
- Vertical layout data : Span interval : 20m
- Elevation : 1.2m increased to each span upto 8m elevation at the station of 140m to 160m.
- Lane data :
  Number of lanes : 2
  Width of single lane : 5m

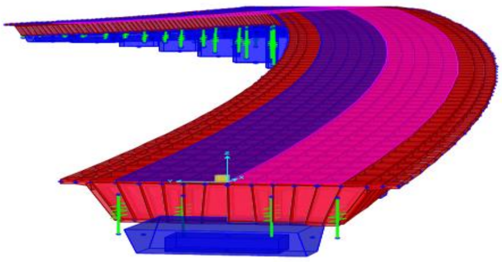


Fig-1 Lane details

Frame properties:

omponents	Section	Dimension
Pier	Rectangular section	Width: 4m Breadth: 2m
Pier cap	Trapezoidal	Top width : 6m Bottom width : 4m Depth : 2 m

Girder properties:

General data	Value	
Bridge section name	Box girder section	
Material property	M60 concrete	Fe 500 steel
Total width	12m	
Total depth	3m	

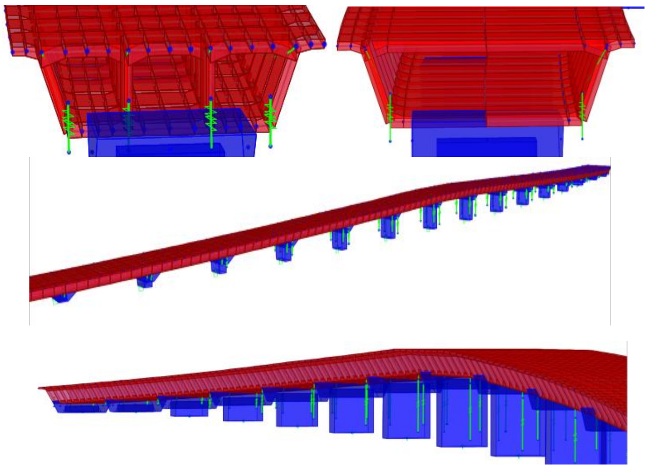


Fig-2 Flyover bridge model in Csi-Bridge.

Load patterns:

Table-1 Load patterns

Load pattern	Load	Auto lateral load considered by the software
Dead load	Self weight	IS:875-2015
Vehicular live load	IRC class AA	IRC:6-2000
Wind load		IS:875-2015
Earthquake load		IS:1893-2016
Prestress load	Prestress	IS:1343-1980

Prestressed tendon system:

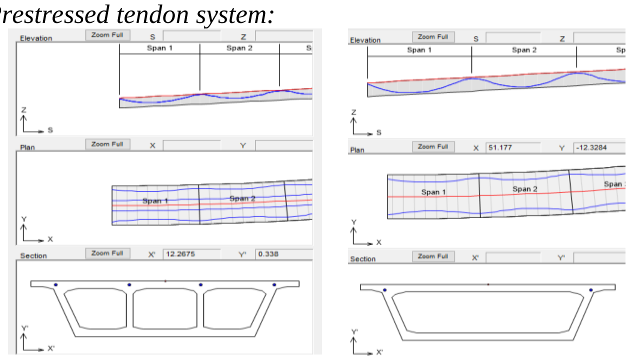


Fig-3 Prestressed tendon system

Results and discussions:

The analysis of the respective flyover structure is done with Csi-Bridge software. The analysis outputs parameters are axial force, shear force, moment and torsion in the force parameters. The different types of displacements are also notified such as vertical displacement, transverse displacement, longitudinal displacement and average longitudinal rotation for both the single cell and multicellular box girder flyover.

The deformed shape of the entire span of the flyover is as shown below,

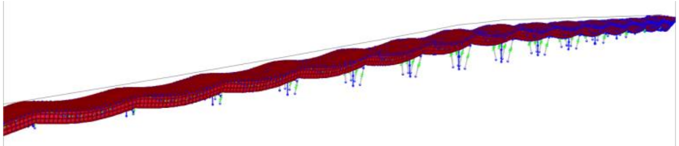


Fig-4 Deformed shape of the flyover bridge

The variations in the result parameters are shown in the graphical representation as below,

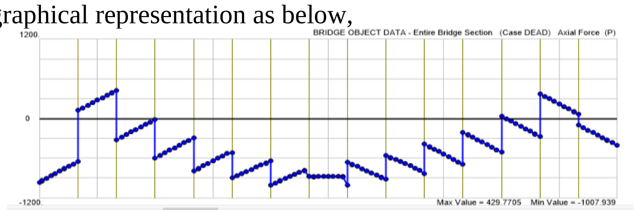


Fig 5. Axial force diagram

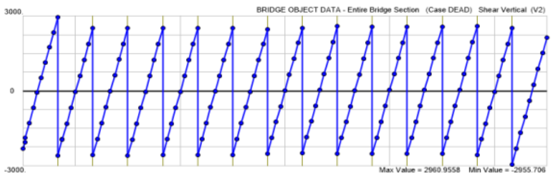


Fig 6. Shear force diagram

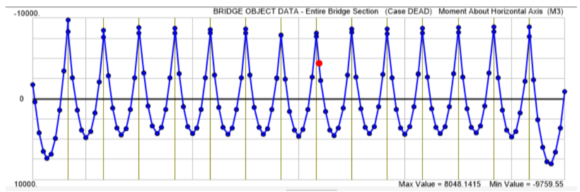


Fig 7. Bending moment diagram

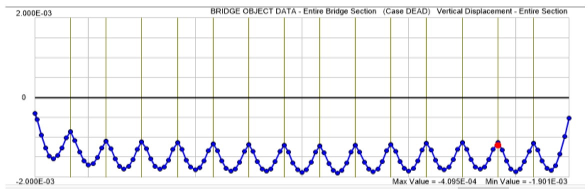


Fig 8. Vertical displacement diagram

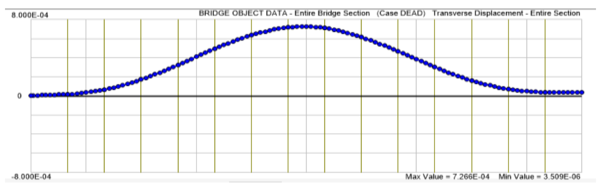


Fig 9. Transverse displacement diagram

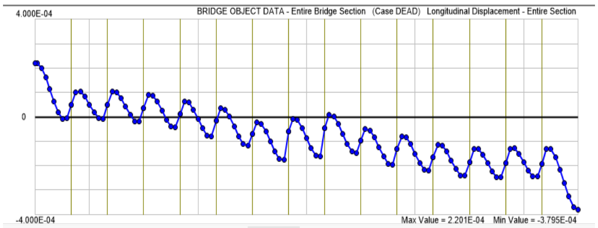
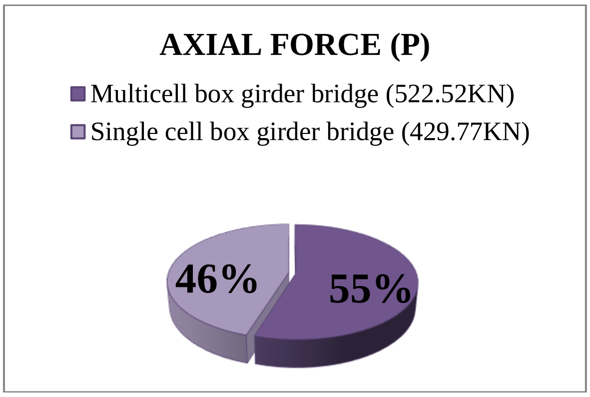
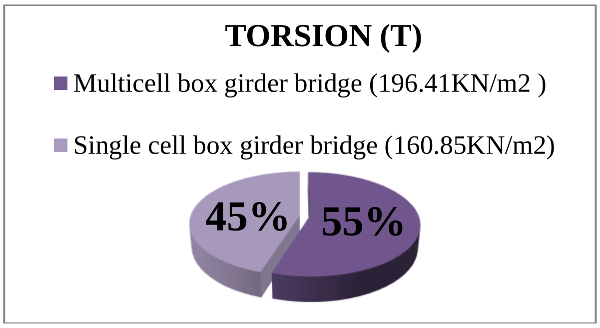


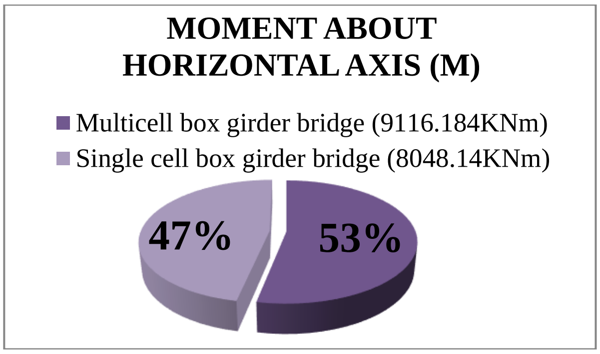
Fig 10. Longitudinal displacement diagram

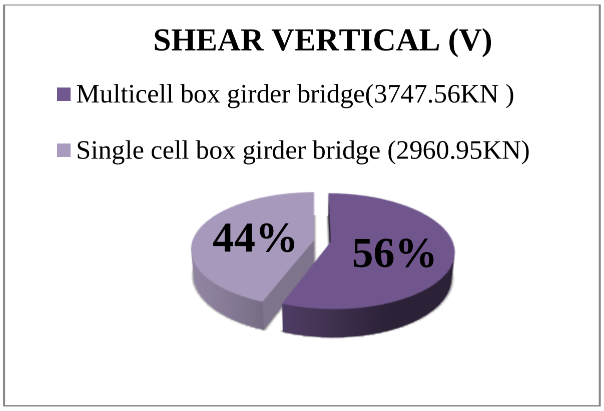
Comparison of results:

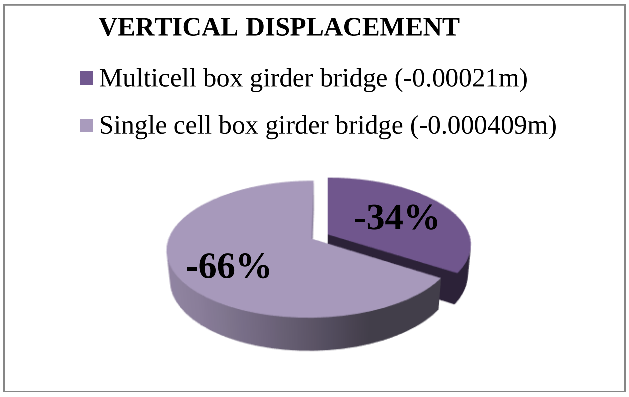
The results parameters of the both single cell and multi cell box girder flyover bridge are compared.

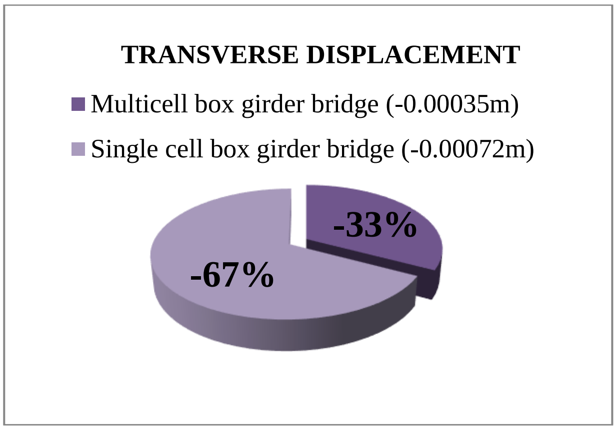


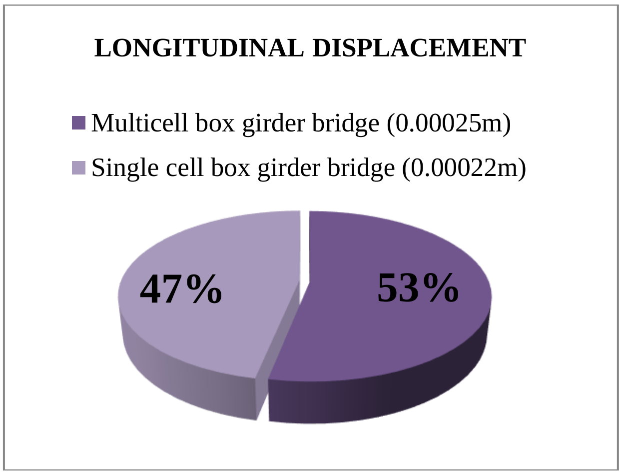












CONCLUSIONS:

- In the current project the road traffic congestion problem is analyzed in the multiple road junction in the urban area.
- The results in both the cases are compared such as axial force is 9% less in case of single cell box girder.
- The vertical shear force is 12% lesser in the single cell box girder bridge.
- The bending moment by 6%, the displacement by 6% lesser in the single cell box girder flyover bridge when compared to the multi cell box girder bridge.
- A comparative study between multi cell and single cell pre-stressed concrete box girder sections has been done. This study shows that the single cell box girder is most fitted and economical crosswise for two lane Indian national road bridges.

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