Truss bridge structure frame section analysis by using Finite element analysis

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Abstract - *The Aim of the research study is to design a bridge structure with different sections of element using ANSYS tool and to execute a modal analysis of bridge problem. For 'I' section and 'L' section eight node solid element is selected and meshing is done individually for each modal. The material property of each material is selected as per literature database in ANSYS software. The modal analysis in ANSYS is completed to attain the Total deformation and mode shapes of bridge structure to stay away from the failure of the bridge. Furthermore, by way of the use of the applications with interactive graphical facilities, it is possible to generate finite detail models of complicated systems with vast ease and to obtain the results in a handy, with ease assimilated shape. This may save precious design time. More accurate evaluation of shape is structure by means of the finite element approach main to economics in materials and production also in enhancing the overall protection.*

Key Words: Bridge design, Modal analysis, Mode shape,ANSYS14.0, Static Analysis.

1. INTRODUCTION

The main purpose of this analysis was to develop a suitable and reliable examination methodology, specifically; a method for enhancing finite element bridge structure that can precisely forecast the static and dynamic reaction of bridges. Much of the preceding research concerned with estimating the dynamic reaction of bridges requisite the improvement of individual finite element models. In these studies, the instructions and actions used to describe these models were remarkably like, even for various bridges. A truss component is a two strength element that is subjected to axial loads either tensile or compression. The only 1D for a truss (bar) component is axial movement at each node. The cross sectional area and material behaviors of each part are typically assumed constant with its length. The element can interrelate in a two-dimensional (2-D) or three dimensional (3-D) configurations. Truss elements are usually utilized in investigation of truss structures. Thus, this study explained on increasing an interactive structure, including of a software package with ANSYS14.0 that would allow bridge design engineers to easily design Bridge. The theory of a truss is simple. The bridge structure is designed of top and bottom chords triangulated with diagonals in the meshes with the intention that each component holds purely axial load. Extra belongings do present but in a well-designed truss these will be of a secondary environment. A universal moment on a truss is carried as compression and tension in the chords. A global shear is optimizing as tension or compression in the diagonal members. In the simplified case, wherein joints are taken into consideration as pinned, and the loads are applied at the panel points, the loading creates no bending second, shear, or torsion in any particular component. Loads implemented in this kind of manner as to cause bending, shear, or torsion will commonly result in inefficient use of material. The truss or lattice girder is a triangulated framework of individuals in which masses within the aircraft of the truss or girder are resisted by way of axial forces in the individual participants. The phrases are commonly carried out to the planar truss. An area body' is shaped when the contributors lie in three dimensions.

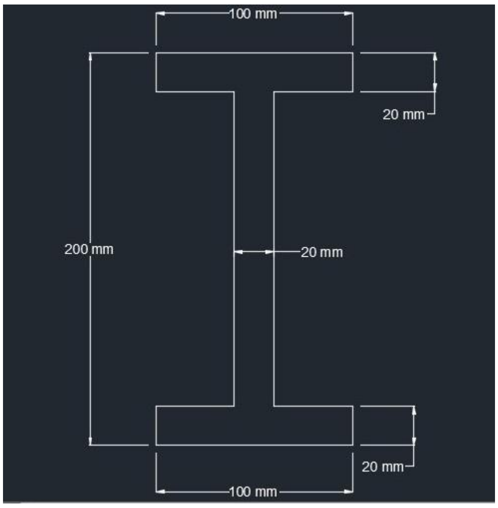
1.1 Finite Element Analysis:

Experimental Truss bridge structure was analyzed by with ANSYS that is associate with engineering simulation commercially used software package providing a complete group that extents the complete variety of physics, offering right to use to almost several field of engineering replication that a design method needs. The software package use it's tools to place a virtual product through a rigorous testing procedure like testing a beam below totally different loading circumstances before it turns into a considerable object. ANSYS will perform advanced engineering analyses quickly, safely and much by kind of contact algorithms, time based mostly loading options and nonlinear material models. During this study it familiar with carry out distinct modeling of Truss bridge structure investigates it below static loading conditions.

Bridge Type	Length (mm)	Height (mm)	Bridge (mm)
Type 'A'	8000	1718	2000
Type 'B'	8000	1718	2000

- **1.2 Modeling of Bridge structure**
- **Geometry of sections**

Two types of bridge structure design here, 'I' section and 'L' section used to designed bridge. Firstly bridge designed by using 'I' section beam and then second bridge designed by using 'L' section of beam. Geometry of 'I' section and 'L' section are described below. Structural steel used as material for designing of bridge structure.



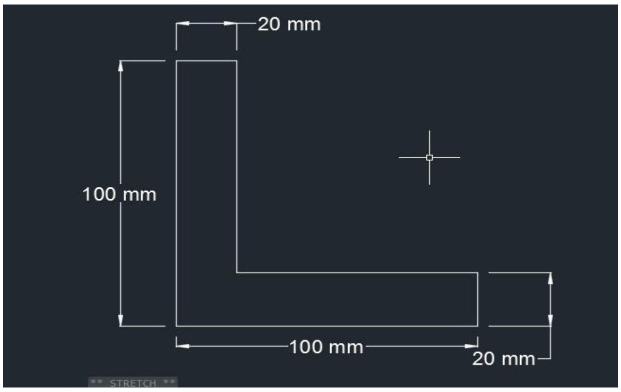


Figure: Dimensions of 'I' Section
Figure: Dimensions of 'L' section

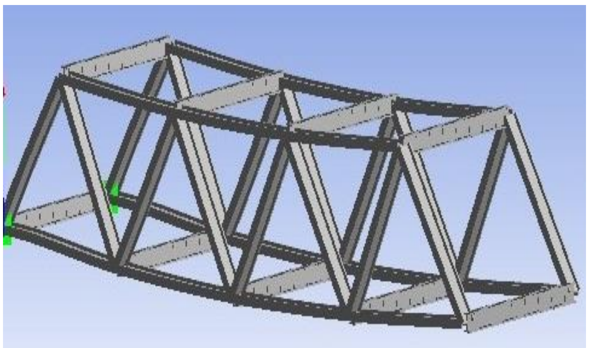
'I' section beam designed in two different designs, Truss Type 'A' and Truss Type 'B'. 'L' Section Bridge designed in two different designs, Truss 'A' and Truss 'B'.

- **Dimensions of bridge truss:** dimensions of bridge structure are described below.

Table: dimensions of bridge truss structure

- **'I' Section Bridge**

Bridge truss designed using 'I' section of two types, Truss Type 'A' and Truss Type 'B'. Figure shows the design of 'I' Section Bridge.



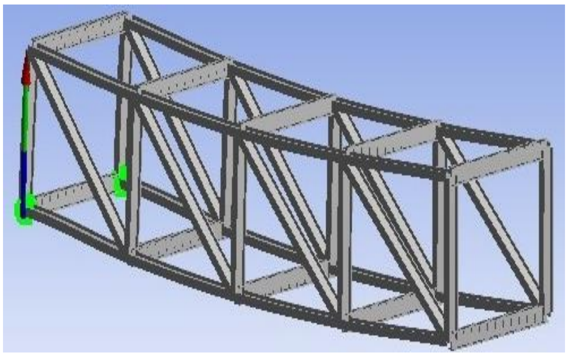
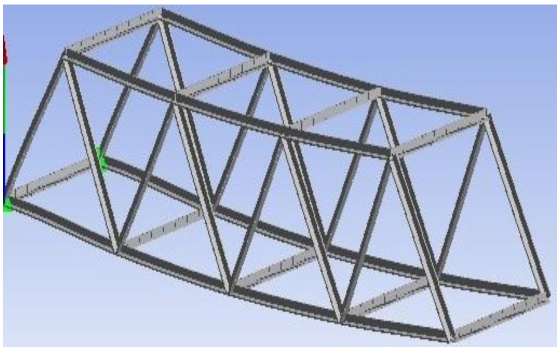


Figure: 'I' Section Bridge of Type 'A'
Figure: 'I' Section Bridge of Type 'B'

- **'L' Section Bridge**

Bridge truss designed using 'L' section of two types, Truss Type 'A' and Truss Type 'B'. Figure shows the design of 'I' Section Bridge.



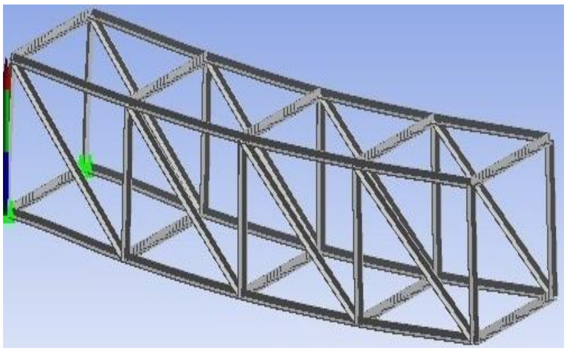


Figure: 'L' Section Bridge of Type 'A'
Figure: 'L' Section Bridge of Type 'B'

- **Applying Boundary conditions**

Applying boundary conditions on bridge, one end of bridge kept fixed support and on other end applying 10000 N load. In Type 'A' and Type 'B' bridge structure.

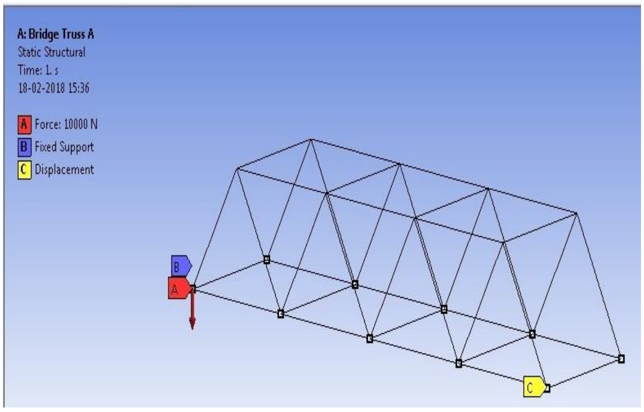


Figure: Applying Boundary conditions on Type 'A' Bridge Structure.

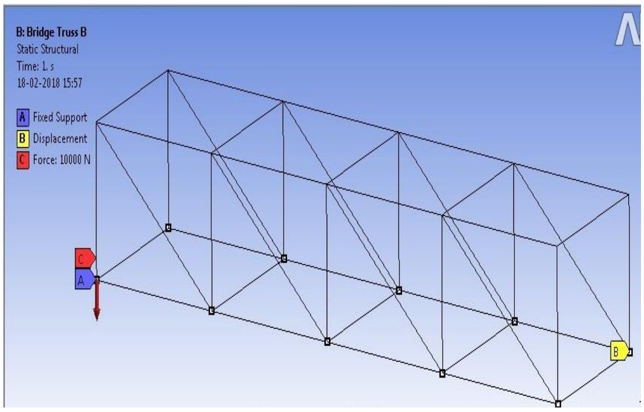
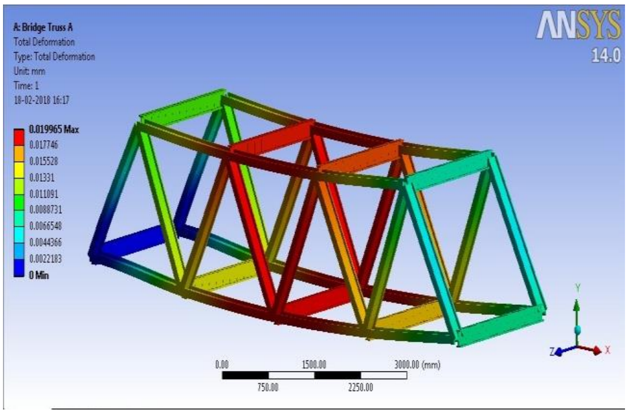


Figure: Applying Boundary conditions on Type 'B' Bridge Structure.

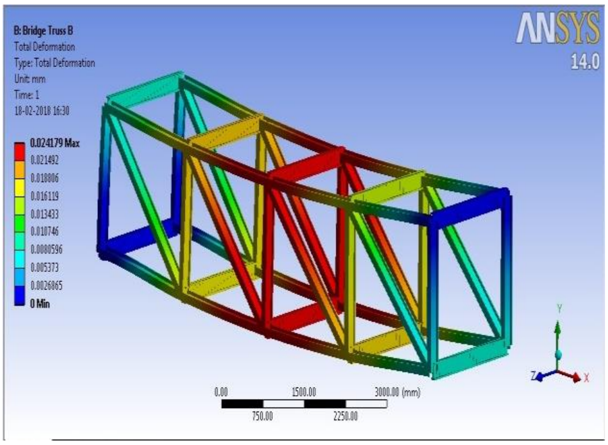
2. Test Results and discussion

The deflection occurred in bridge structure model is optimized and compared. Two types of section used in bridge element designing i.e. 'I' section and 'L' section. In 'I' section two type of bridge structure used for study i.e. Type 'A' and Type 'B' also In 'L' section two section two type of bridge structure used for investigation i.e. type 'A' and Type 'B'. Figure shows the deflection

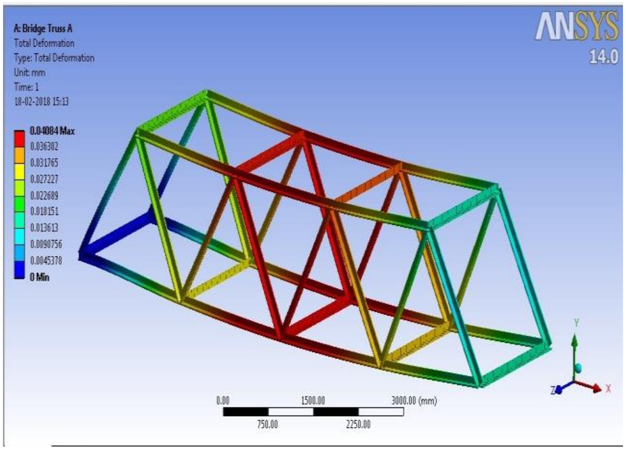
- **Deflections of bridge structure due to load**



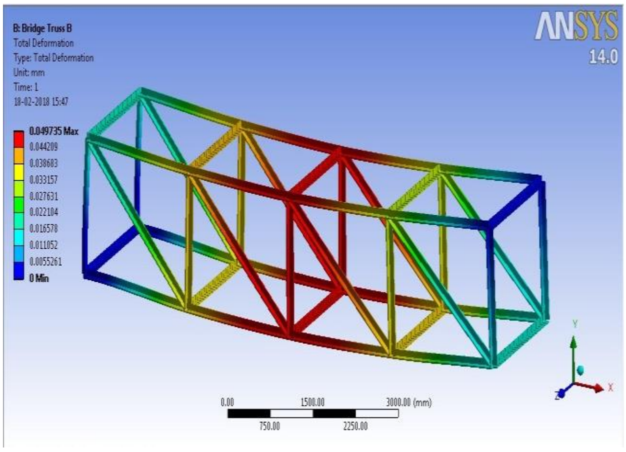
'I' Section Bridge Truss Type 'A' deformation



'I' Section Bridge Truss Type 'B' Deformation



'L' Section Bridge Truss Type 'A' Deformation



'L' Section Bridge Truss Type 'B' Deformation

Table shows the values of deformation developed in bridge truss structure due to load, and direct stresses generate in bridge structure.

Table: 'I' Section Bridge truss Type 'A' deformation variations due to load

I Section Truss 'Type' A			
Force (N)	Deformation	Direct stress	Force Reaction
10000	0.01996	0.28205	5004.405
12000	0.02395	0.33846	6005.286
15000	0.02994	0.42307	7506.608
18000	0.03593	0.50769	9007.930
20000	0.03992	0.56410	10008.811

Table: 'I' Section Bridge truss Type 'B' deformation variations due to load

I Section Truss 'Type' B			
Force (N)	Deformation	Direct stress	Force Reaction
10000	0.02417	0.32200	5004.607
12000	0.02901	0.38640	6005.528
15000	0.03626	0.483010	7506.910
18000	0.04352	0.57973	9008.292
20000	0.04835	0.64401	10009.214

Table: 'L' Section Bridge truss Type 'A' deformation variations due to load

L Section Truss Type 'A'			
Force (N)	Deformation	Direct stress	Force Reaction
10000	0.04084	0.56429	5006.209
12000	0.04900	0.67714	6007.451
15000	0.06126	0.84643	7509.314
18000	0.07351	1.01572	9011.177
20000	0.08168	1.12858	10012.419

Table: 'L' Section Bridge truss Type 'B' deformation variations due to load

L Section Truss Type 'B'			
Force (N)	Deformation	Direct stress	Force Reaction
10000	0.04973	0.64365	5006.674
12000	0.05968	0.77238	6008.009
15000	0.07460	0.96547	7510.011
18000	0.08952	1.15947	9012.013
20000	0.09946	1.28730	10013.348

Graphs shows the values of deformation developed in bridge truss structure due to load,

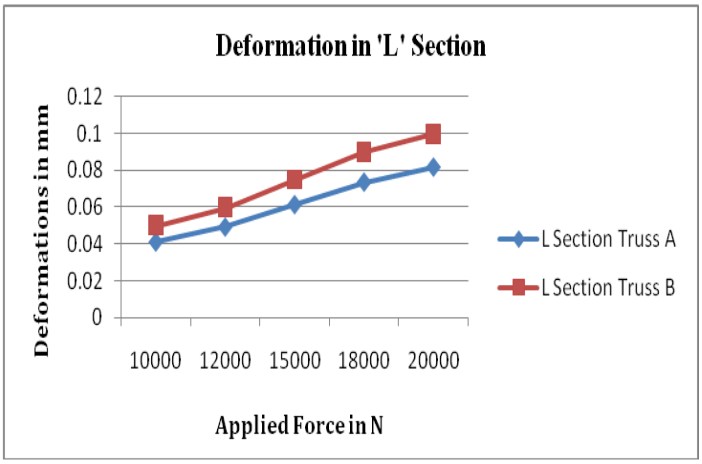


Figure shows deformation due to load of 'L' -section Truss Type 'A' and 'B'

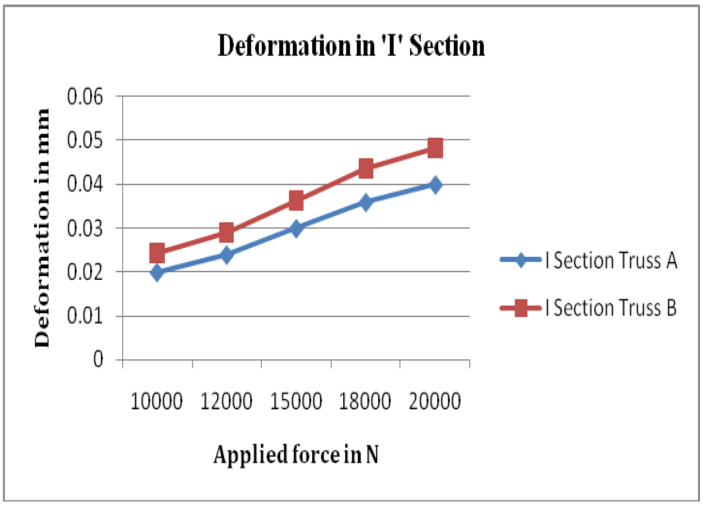
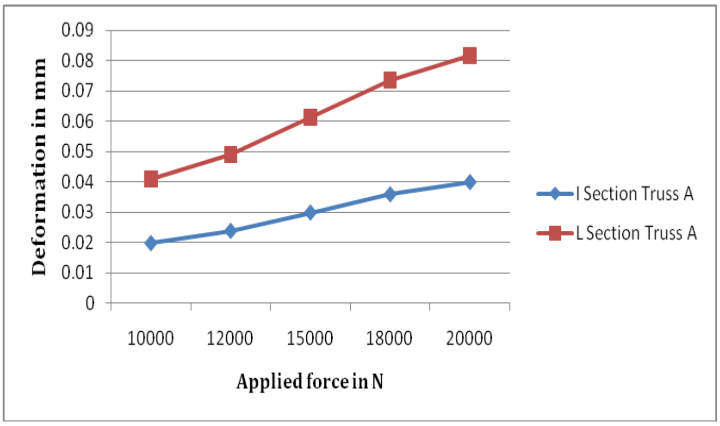
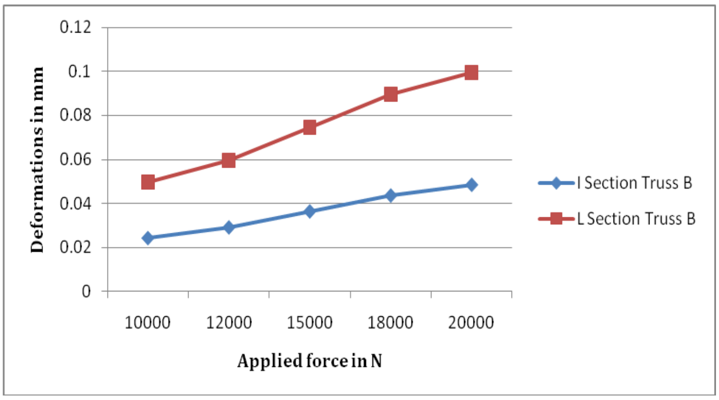


Figure shows deformation due to load of 'I' -section Truss Type 'A' and 'B'



Graph: Comparison of deformation b/w 'I' and 'L' Sections Truss Type 'A'



Graph: Comparison of deformation b/w 'I' and 'L' Sections Truss Type 'B'

3. CONCLUSIONS

The ANSYS analysis for this steel truss is done based on the standard loading system, and the results are within the limited preconditions sated by the standard value.

From this study we can conclude the ANSYS analysis for this truss is very insightful. The study has addressed the possibility of analysis and design of Truss bridges structure with locally available steel profiles. Even though the cost of local production is closer to importing it is still a good option since it helps in the capacity building of local design, fabrication and construction firms, creates job opportunities for many people and is a saving in foreign currency. For many short span temporary bridges in road construction projects.

As per above study, it is concluded that 'L' section bridge structure having more deflection in comparison of 'I' section therefore 'I' section suitable and acceptable for designing of Bridge truss structure.

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