SJIF Impact Factor: 6.260| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 5 | Issue: 1 | January 2020 - Peer Reviewed Journal

STRENGTHENIG OF L- SHAPED BEAM BY INTRODUCING STIFFENER ELEMENTS AND ANALYSING BY FINITE ELEMENT METHOD

Akash Shrivastava
M.E. Scholar, Department Of Mechanical Engineering, Jabalpur Engineering College, M.P, India,482001.

Saurabh Gupta
M.E. Scholar, Department Of Mechanical Engineering, Jabalpur Engineering College, M.P, India,482001.

Prateek Shrivastava
M.E. Scholar, Department Of Mechanical Engineering, Jabalpur Engineering College, M.P, India,482001.

ABSTRACT
The field of engineering deals with making strengthnous structures which is found to be useful in real life applications. Beams are important members dealing with strengthening of structure, as the take up the load and make structure fit to use. In automobile engineering L-shaped beams is one of majorly used structures. One of the main requirements is to reduce the deformation of the structures which can be achieved by providing supports such as stiffeners. In this paper we propose the design for L-shaped beams and analyses and compare it with original beam structure on the basis of deformation, equivalent elastic strain and equivalent stress.
KEYWORDS: *L shaped beam, ANSYS, stiffeners, structures, deformation*

1. INTRODUCTION

Beams are important members used in many of engineering applications to withstand transverse shear load. In case of structural members used in automobile structures such as designing of chassis flat structural steel members are bend into various geometries such as hexagonal, C-shaped, L shaped, T shaped, I shaped etc. thus requiring higher strength the thickness of members are increased which directly causes increased weight of the structure and due to increased material usage cost of structure increases which directly effects the end customers buying the products at higher prices.

Thus there is a need to reduce its weight of the member at the same time increasing its strength which can be done by introducing mechanical structures such as stiffeners which are in a spaced manner which directly reduces the overall weight of unnecessary material usage and increases strength of the structure.

In automobile industry one common usage is of L shaped beams used in the chassis design. Thus there lies possibilities to make modification in the structure and increase its strength for practical practices.

2. OBJECTIVE

The project deals with strengthening of L shaped members with the use of stiffeners of same material as that of parent material and is welded in spaced manner. The analysis of the structure is to be performed by Finite Element Method by the use of CAD analysis software i.e. ANSYS.

3. MATERIALS

Material properties of industrial grade A36 structural steel established by ASTM international is taken into consideration for our specimen with following properties,

- modulus of elasticity, E= 200GPa
- Poisson's ratio, m= 0.3
- Bulk modulus, K=166.67GPa
- Shear modulus, G=76.923GPa
- Diameter of specimen rod, d=0.02m
- Thickness of plate = 0.005m
- Length of both legs= .05m

On analysis deals with assuming the beam as a cantilever loading, the L shaped section with 1000N of loading at one end and fixing it at the other end.

SJIF Impact Factor: 6.260| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 5 | Issue: 1 | January 2020 - Peer Reviewed Journal

4. CAD SOFTWARE

In the designing industry there are prominent use of design and analysis software, which have the abilities to provide highly accurate results. Here CATIA V5 version by DASSAULT and analysis software ANSYS 2019 R3 by Ansys Inc. has been used in the designing and analysis purpose has been performed in our project.

3.1. Preparation of model in designing software

For the preparation of CAD model; we used 3D modeling software CATIA V5 R20 by Dassault Aviation. In this topological specification were tried for the modeling as per requirement and then the format was converted as per Ansys specification.

3.2. Analysis performed in ANSYS software

A three dimensional L shaped beam have been developed to stimulate for structural steel using ANSYS software. ANSYS is a reliable software well known for its accurate results. It analyzes the materials under test by dividing the complete geometry into large number of smaller geometries which are bounded by points known as Nodal Points. Now is converted into stiffness matrices based on loading condition and is analyzed by finite element method.

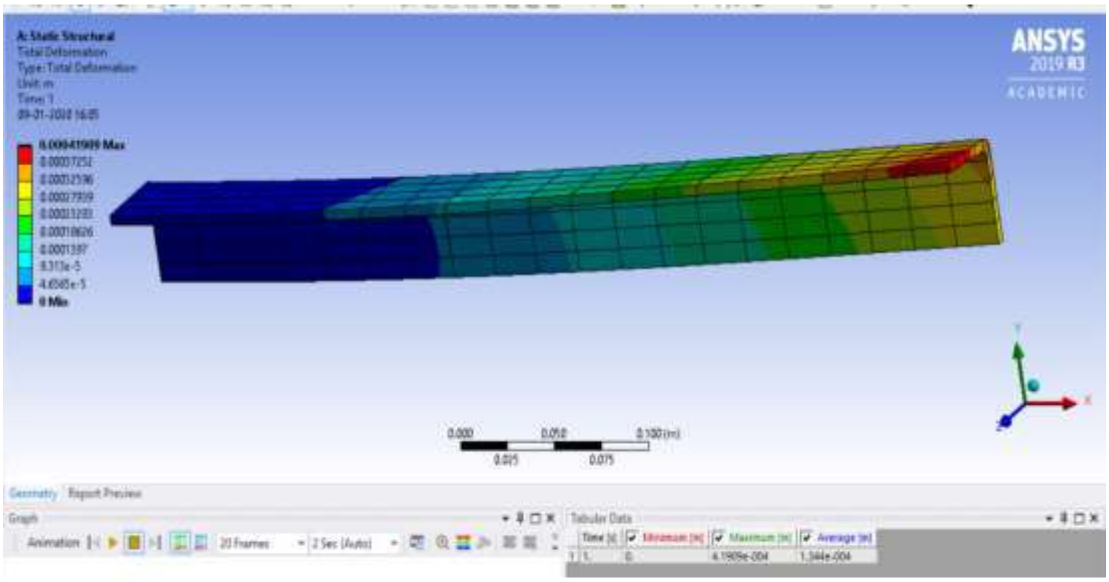

Fig 1. L-shaped shaped beam for deformation

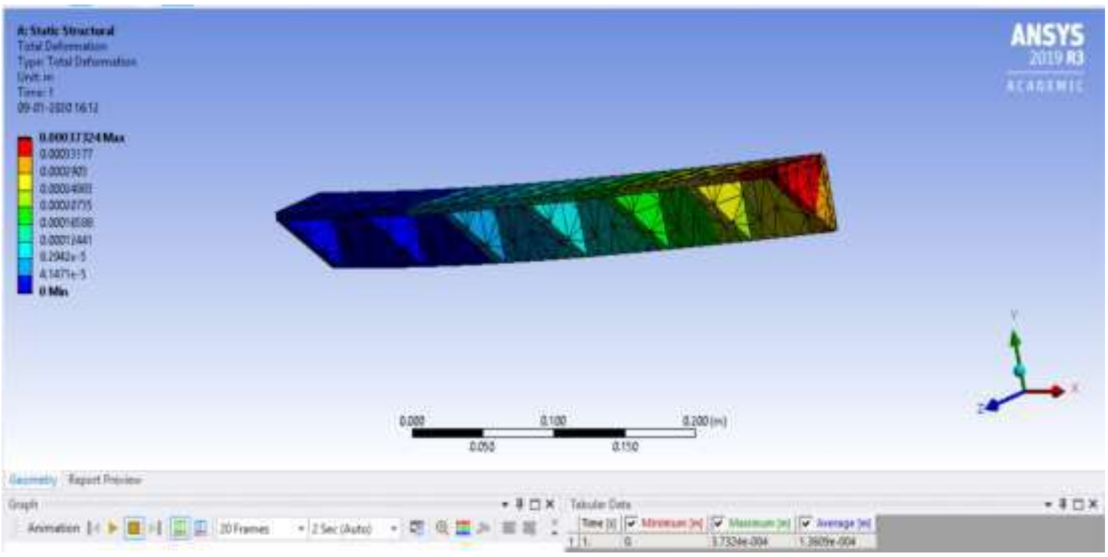

Fig 2. L-shaped stiffened beam result for deformation

SJIF Impact Factor: 6.260| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 5 | Issue: 1 | January 2020 - Peer Reviewed Journal

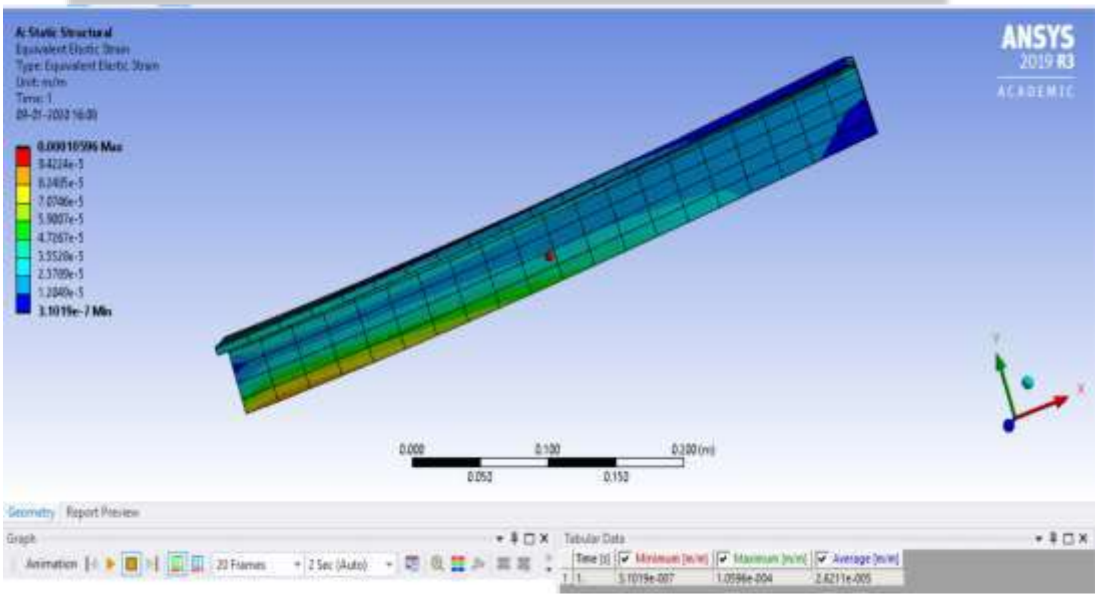

Fig 3. L-shaped beam result for equivalent elastic strain

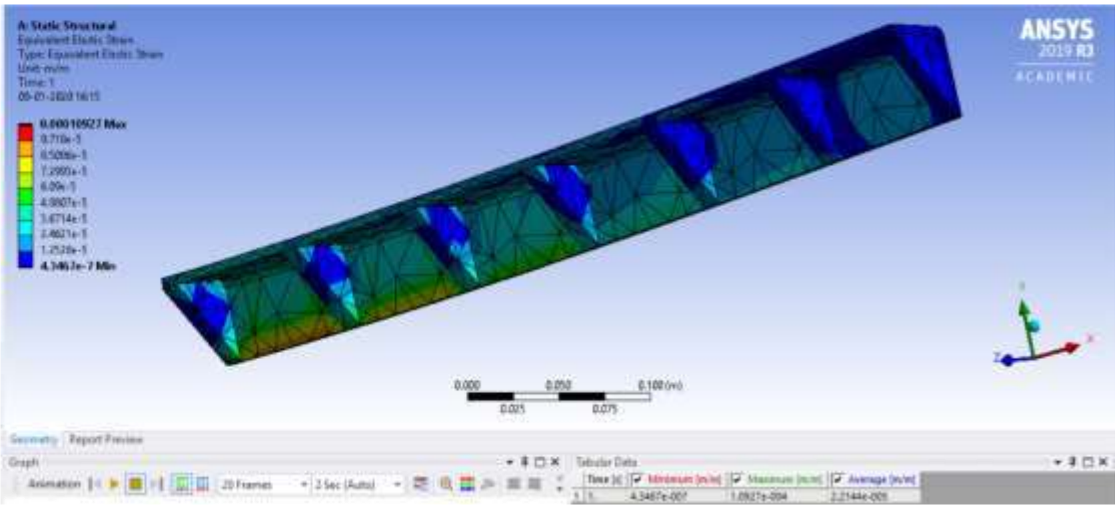

Fig 4. L-shaped stiffened beam result for equivalent elastic strain

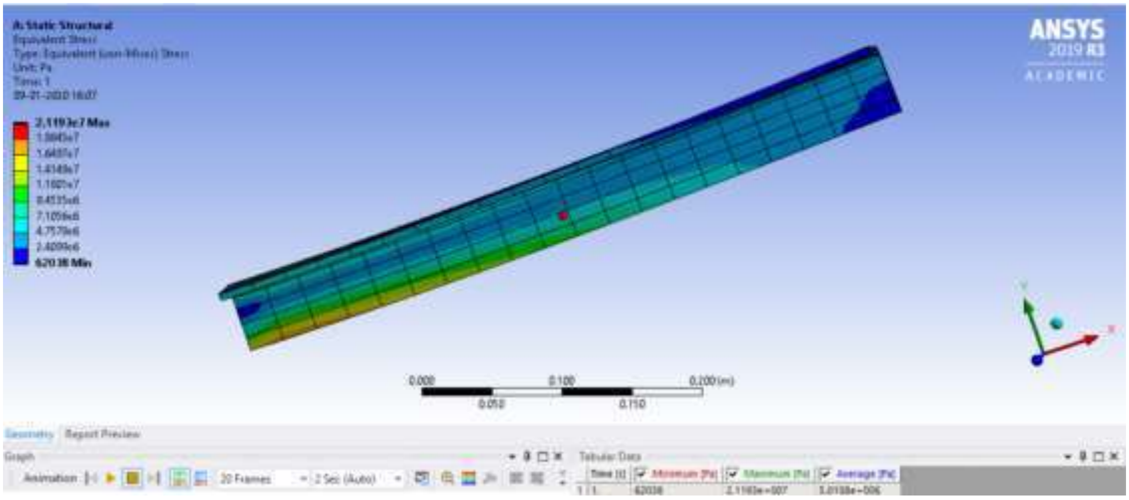

Fig 5. L-shaped beam result for equivalent von mises stress

SJIF Impact Factor: 6.260| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 5 | Issue: 1 | January 2020 - Peer Reviewed Journal

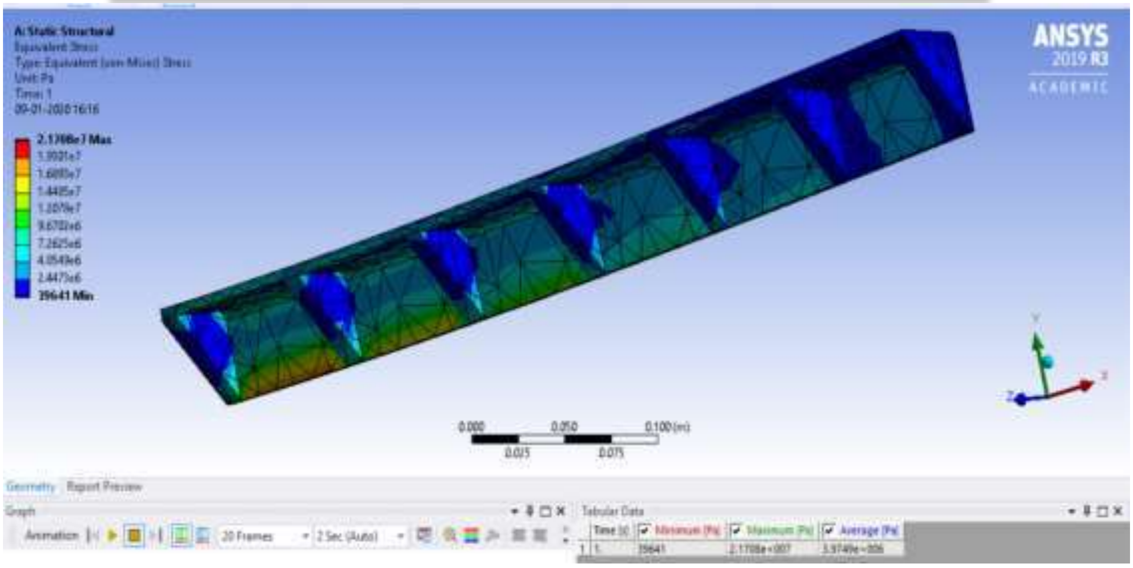

Fig 6. L-shaped stiffened beam result for equivalent von mises stress

5. RESULTS

Table 1

Summary of the results found for specimens under test

S. No	Component	Equivalent elastic strain in m/m	Equivalent (vonmises) stress in Pa	Total deformation in m
1	L shaped beam	0.000026211	2.1193 X 10^7	0.0004190
2	L shaped beam with stiffener	0.000022144	2.1708 X 10^7	0.0003724

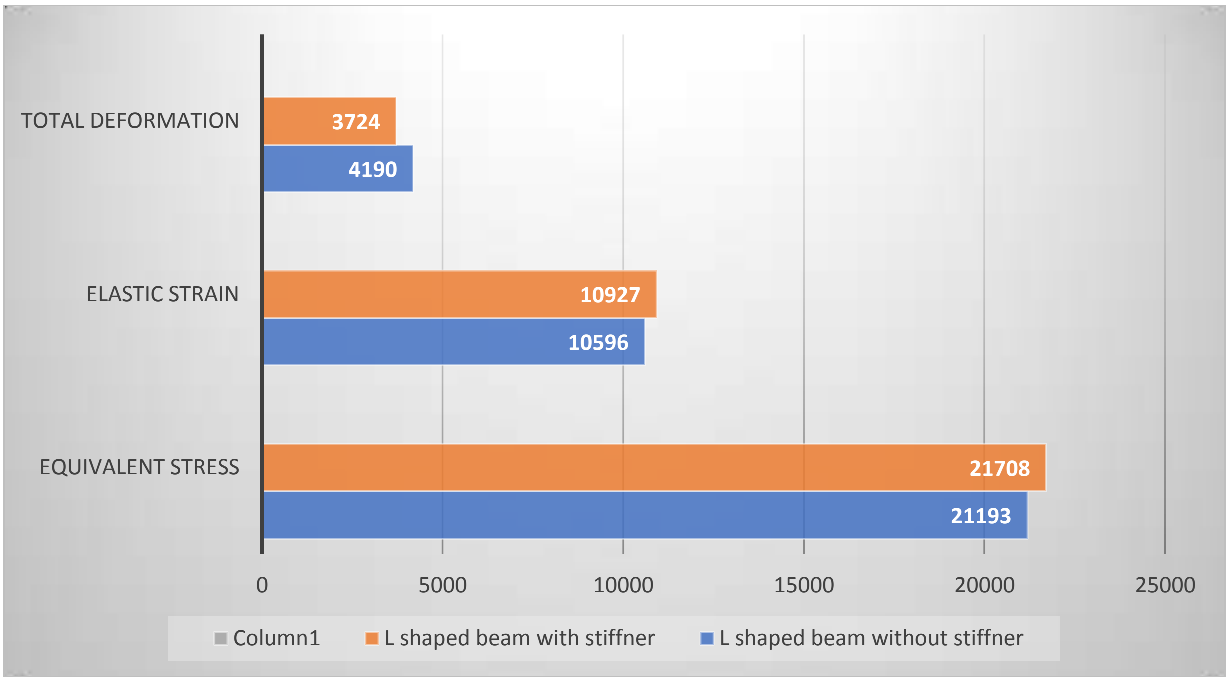

Fig.7. Results of test under various parameters

SJIF Impact Factor: 6.260| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 5 | Issue: 1 | January 2020 - Peer Reviewed Journal

6. CONCLUSION

On the basis of deformation, it was found that deformation decreases with 11.12% for beam with stiffeners. Strain energy and elastic strain were found almost equal for beam with and without stiffeners. And one of the main criteria for design of beams for various applications is deformation which has been reduced with implementation of stiffeners in this project.

7. REFERENCES

1. *Sylvain Arkia, Jean-François Ferrero, Steven Marguet, Jean-Max Redonnet, Alexandre Aury, strengthening of a curved composite beam by introducing a flat portion, Composite Structures 222 (2019) 110863.*
2. *Pietro Foti, Filippo Berto. Evaluation of the Strain Energy Density Value without the Construction of the Control Volume in the Preprocessing Phase of the Finite Element Analysis, Procedia Structural Integrity 18 (2019) 183–188. [3]Sheng Lei, Li Li, Wei Tian, Min Lei. Direct method for second-order sensitivity analysis of modal strain energy Journal of Sound and Vibration 462 (2019) 114926.*
3. *Dr. Sadhu Singh. Strength of Materials book. Khanna Publication 3rd edition 1988.*
4. *Richard G. Budynas and J keith. Mechanical Engineering design. McGraw hill publication 9th edition.*
5. *Nguyen Dinh Duc a,b,* , Seung-Eock Kim b , Duong Tuan Manh a , Pham Dinh Nguyen a,c. Effect of eccentrically oblique stiffeners and temperature on the nonlinear static and dynamic response of S-FGM cylindrical panels, Journal of thin walled stiffener 146 (2020) 106438.*
6. *R.R. Meyer, Buckling of 450 eccentric stiffened waffle cylinders, J. RaeS. 71 (1967) 516–520.*