



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 1, January 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.569

9940 572 462

6381 907 438

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Performance Analysis of Steel Concrete Composite Section

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ABSTRACT: Buildings in high-seismic areas must be designed with particular attention to their lateral stability during extreme earthquakes. Nonlinear phenomena in structural mechanics such as nonlinear material behaviour, large deformations or contact problems have become standard modelling tasks. Because of a rapid development in the hardware sector resulting in more and more powerful processors together with decreasing costs of memory it is nowadays possible to perform simulations even for models with millions of degrees of freedom. In a mathematical sense the finite element solution always just gives one an approximate numerical solution of the considered problem. Sometimes it is not always an easy task for an engineer to decide whether the obtained solution is a good or a bad one. If experimental or analytical results are available it is easily possible to verify any finite element result. However, to predict any structural behaviour in a reliable way without experiments every user of a finite element package should have a certain background about the finite element method in general. In addition, he should have fundamental knowledge about the applied software to be able to judge the appropriateness of the chosen elements and algorithms.

KEYWORD: FEM, Composite, RCC

I. INTRODUCTION

The use of composite structures is increasingly present in civil construction works. Steel-concrete composite beams, particularly, are structures consisting of two materials, a steel section located mainly in the tension region and a concrete section, located in the compression cross-sectional area, both connected by metal devices known as shear connectors. One type of these connectors is called head studs as The main functions of these studs are to allow for the joint behavior of the beam-slab, to restrict longitudinal slipping and uplifting at the elements interface and to take shear forces. Double steel-concrete composite continuous beam is a new structural system developed on the basis of single steel concrete one, in which there is also a bottom reinforced concrete slab connected to a steel profile in the negative moment regions through the head studs, therefore with two interfaces. Comparing with the traditional single steel-concrete composite continuous beam, its advantage is that effectively limits the crack width of the negative moment area, and also improves the stress state of section, so that it is suitable to the composite continuous beam with a larger span. The mechanical properties of the double composite beam obviously depend on their respective properties and interactions. In the negative applied.

Bending moment area, the concrete slab cracks under tension and then the interface slip occurs between steel profile and concrete slab, with non-linear features, it makes great impact on the structure of the internal forces and deformation. Therefore, it is necessary to present a finite element model to study the mechanical properties of the double steel-concrete composite beam in negative moment regions.

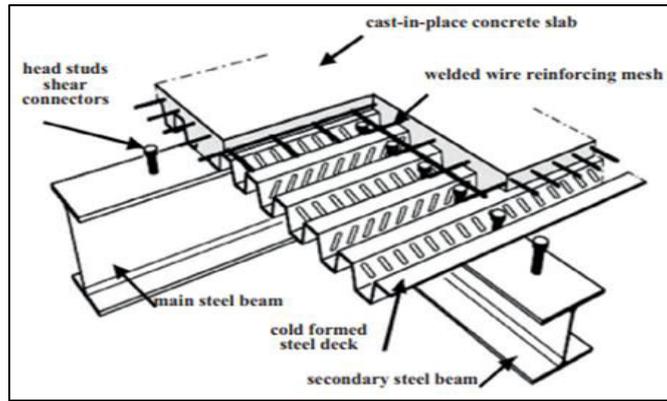


Fig 1 Composite Structure with Metal Decking

II. PROBLEM STATEMENT

The project study involved two stages. The primary data was gathered through a Literature survey targeted by web searches and review of e books, manuals, codes and journal papers. After review the problem statement is defined and 3 specimens are taken up for detail study and analysis purposes. This project execution follows the flow chart given below: The following flow chart describes the layout of this project briefly.

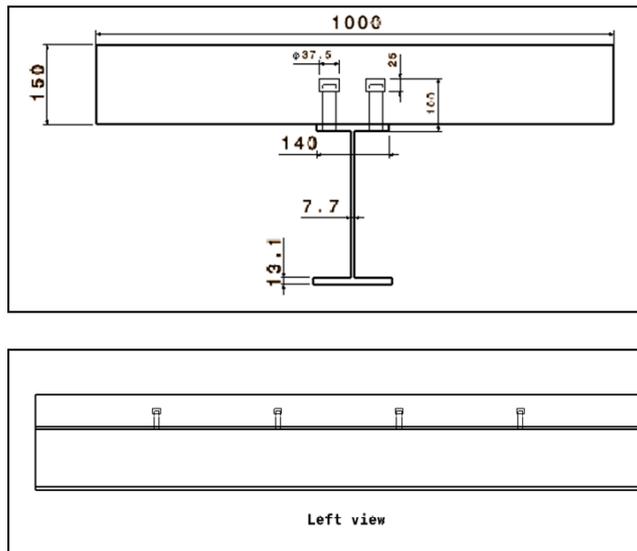


Fig. 2 Dimensions of Composite beam model

III. MODELING

Model 1	RCC beam
Model 2	Headed studs
Model 3	T-shape beam
Model 4	Headed studs with Steel Plate

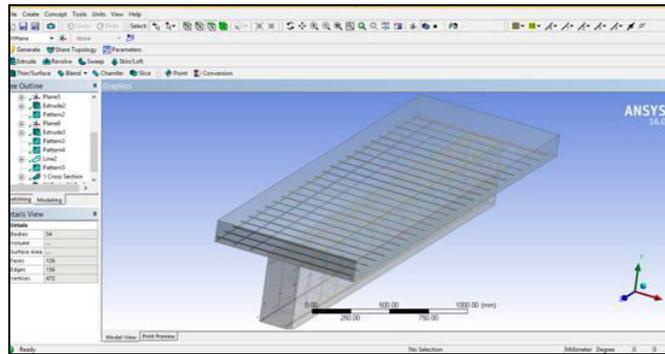


Fig 3 RCC beam

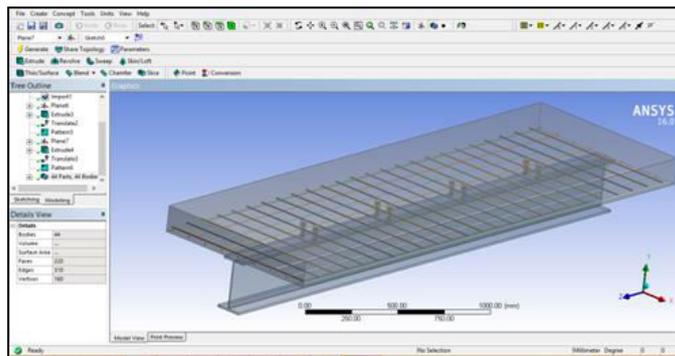


Fig 4 Headed studs

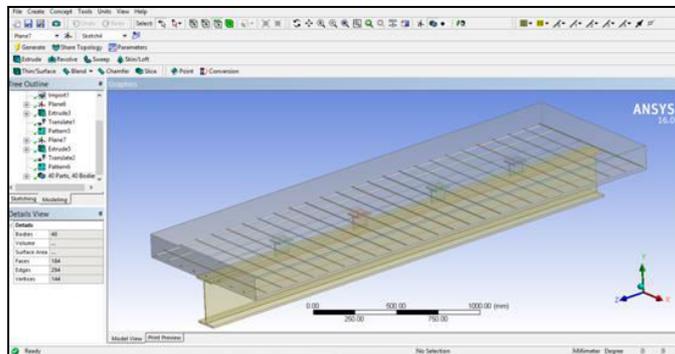


Fig 5 T-shape beam

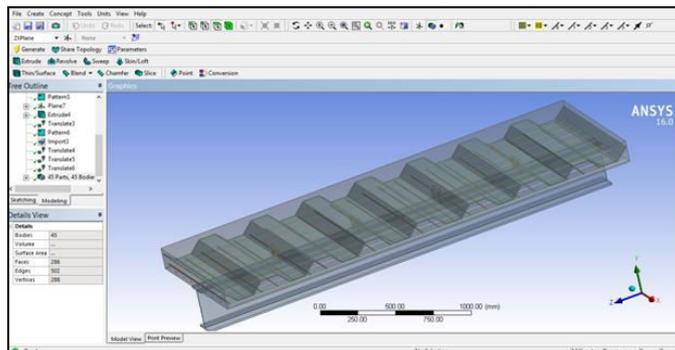


Fig 6 Headed studs with Steel Plate



IV. RESULTS AND DISCUSSION

A. Total Deformation:

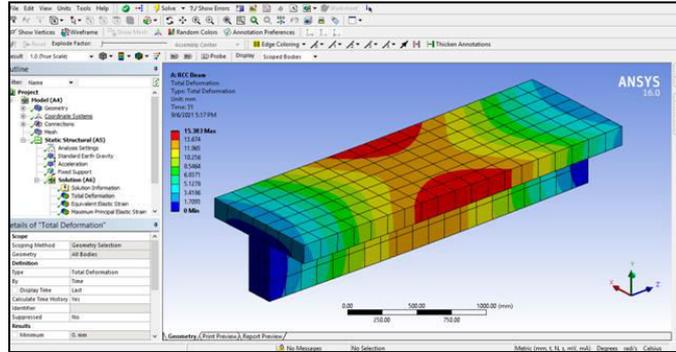


Fig 7 Total Deformation of RCC beam

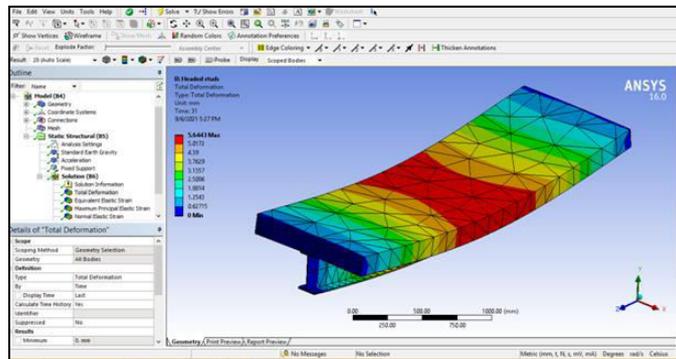


Fig 8 Total Deformation of Headed studs

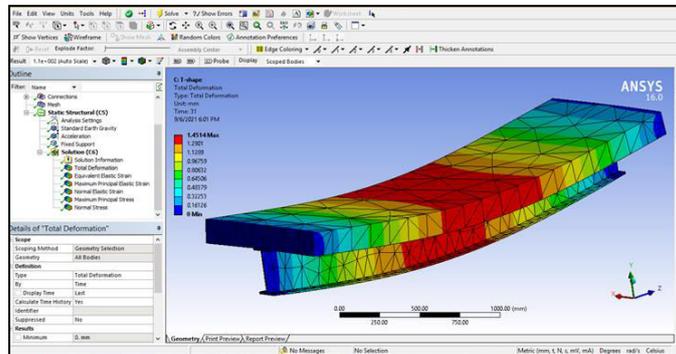


Fig 9 Total Deformation of T-shape beam

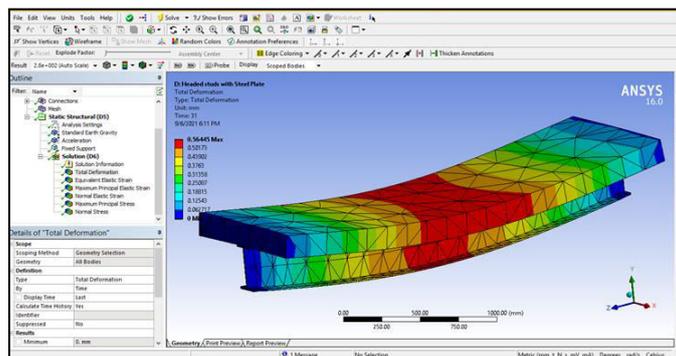
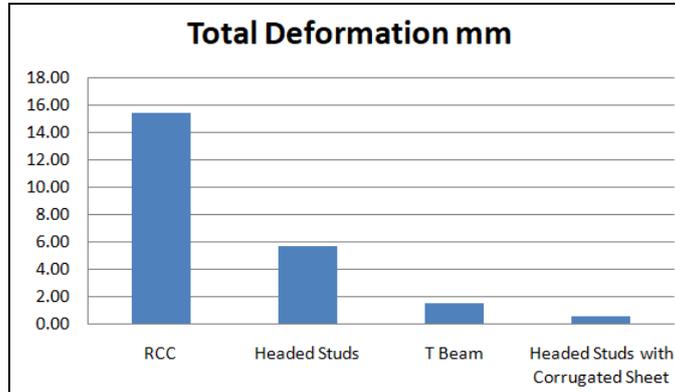


Fig 10 Total Deformation of Headed studs with Steel Plate



Table 1: Total Deformation

Total Deformation mm			
RCC	Headed Studs	T Beam	Headed Studs with Corrugated Sheet
15.38	5.64430	1.45	0.56



Graph 1: Total deformation

The graph 1 describes the results of Total Deformation in mm, as we see in the graph, maximum deformation can be seen in the RCC Beam , results of total deformation for headed studs , t-beam stud and headed stud with corrugated steel is also shown. The deformation is shown in mm.

B. Maximum Principal Stress:

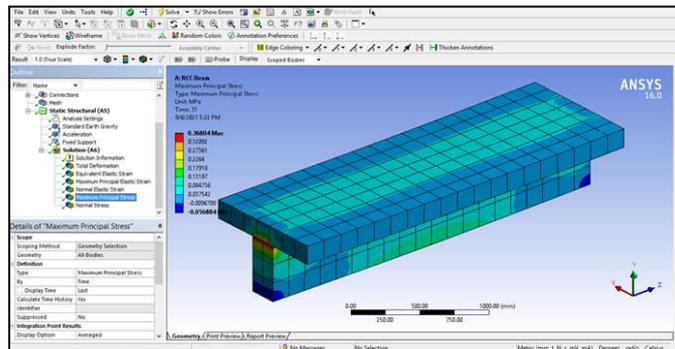


Fig 11 Maximum Principal Stress of RCC beam

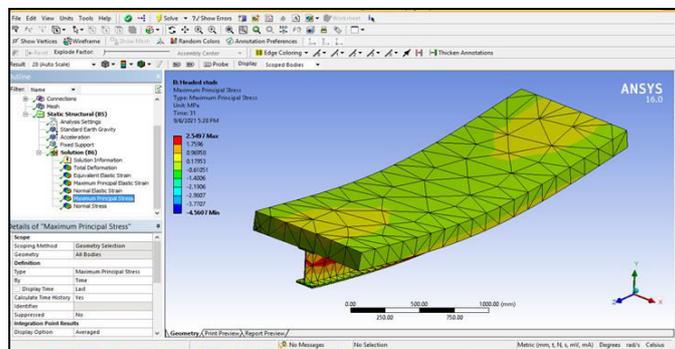


Fig 12 Maximum Principal Stress of Headed studs

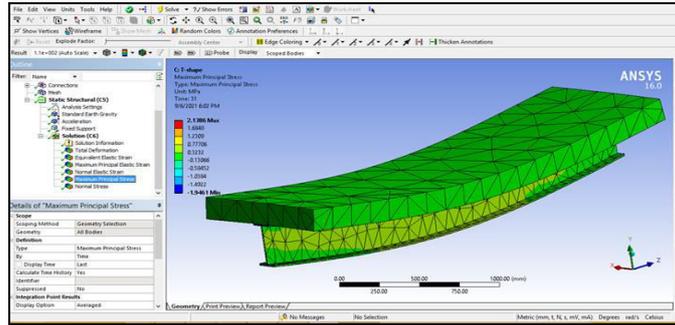


Fig 13 Maximum Principal Stress of T-shape beam

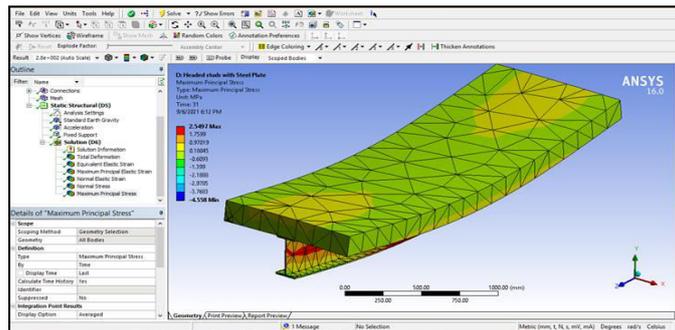
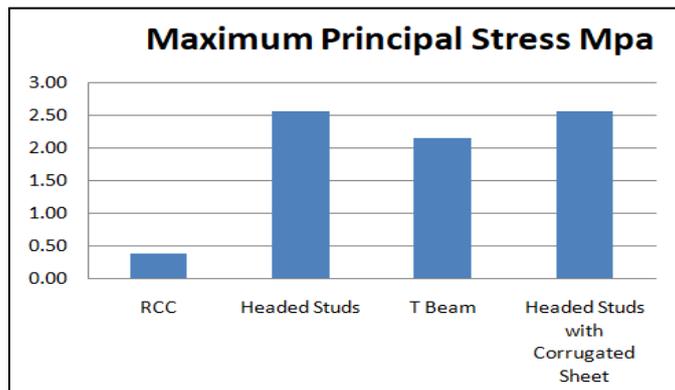


Fig 14 Maximum Principal Stress of Headed studs with Steel Plate

Table 2: Maximum Principal Stress Mpa

Maximum Principal Stress Mpa			
RCC	Headed Studs	T Beam	Headed Studs with Corrugated Sheet
0.37	2.54970	2.14	2.55



Graph 2: Maximum Principal Stress Mpa

The graph 2 Shows the results of Maximum Principal Stress in (Mpa), as we see in the graph, Maximum Principal Stress(Mpa) can be seen in the headed studs and headed stud with corrugated steel whereas RCC Beam , results of Maximum Principal Stress, t-beam stud is also shown. The Maximum Principal Stress is shown in MPa



C. Normal Stress (MPa)

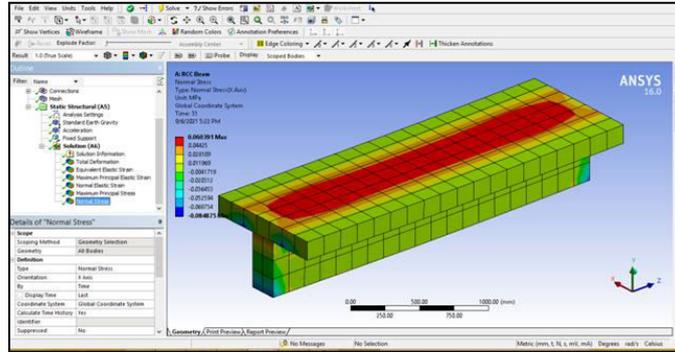


Fig 11 Normal Stress of RCC beam

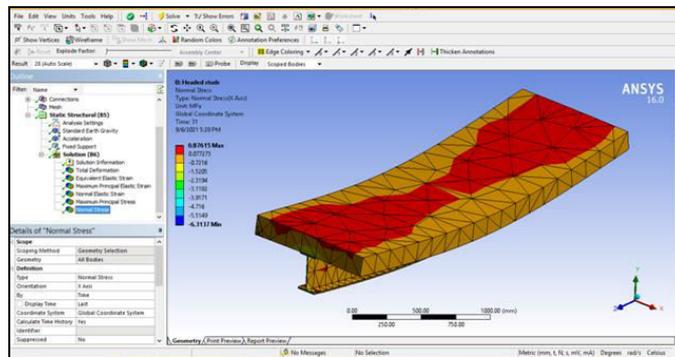


Fig 12 Normal Stress of Headed studs

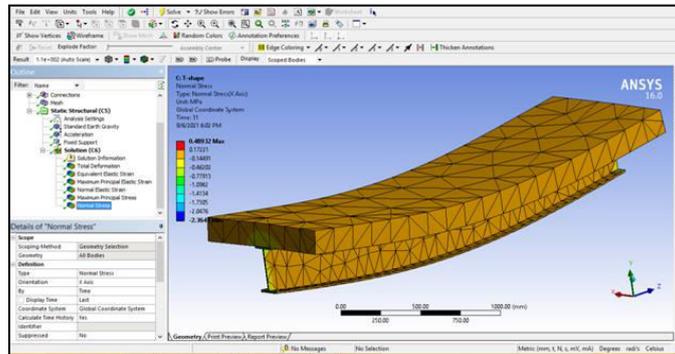


Fig 13 Normal Stress of T-shape beam

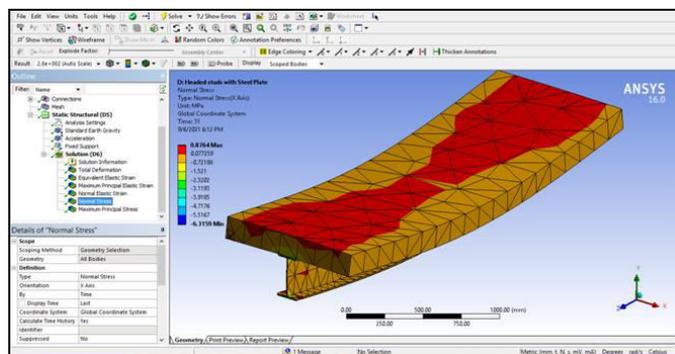
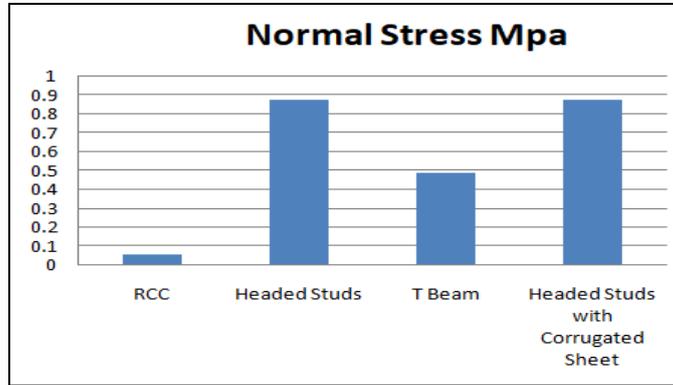


Fig 14 Normal Stress of Headed studs with Steel Plate



Table.3: Normal Stress Mpa

Normal Stress Mpa			
RCC	Headed Studs	T Beam	Headed Studs with Corrugated Sheet
0.060391	0.87615	0.48932	0.8764



Graph 3: Normal Stress Mpa

The graph.3 Shows the results of Normal Stress in (MPa), as we see in the graph, maximum Normal Stress (MPa) can be seen in the headed studs and headed stud with corrugated steel plate, whereas RCC Beam, results of Normal Stress ,t-beam stud is also shown. The Normal Stress MPa is shown in MPa.

D. Maximum principal elastic strain (MPa)

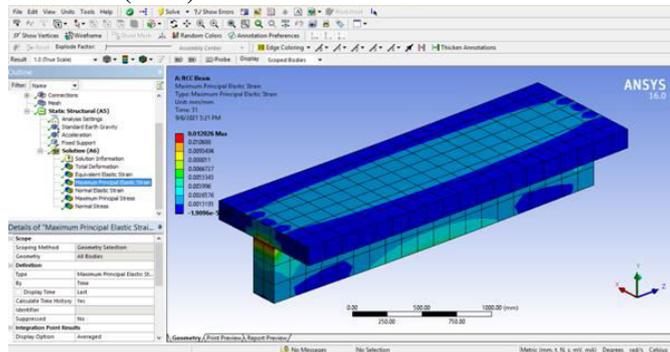


Fig 11 Maximum principal elastic strain of RCC beam

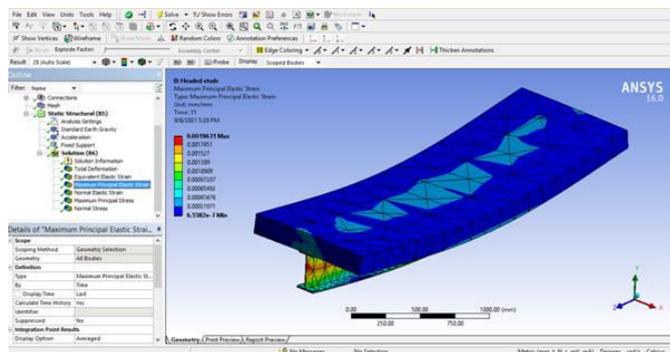


Fig 12 Maximum principal elastic strain of Headed studs

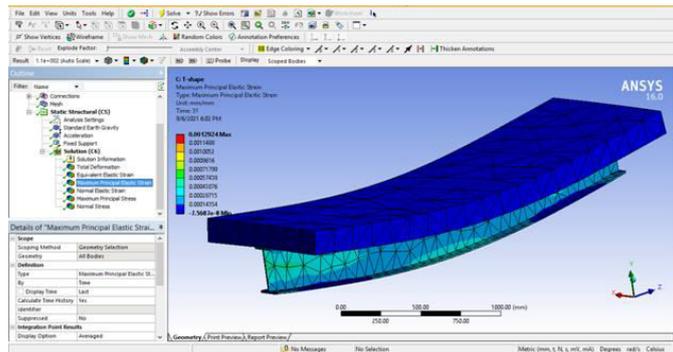


Fig 13 Maximum principal elastic strain of T-shape beam

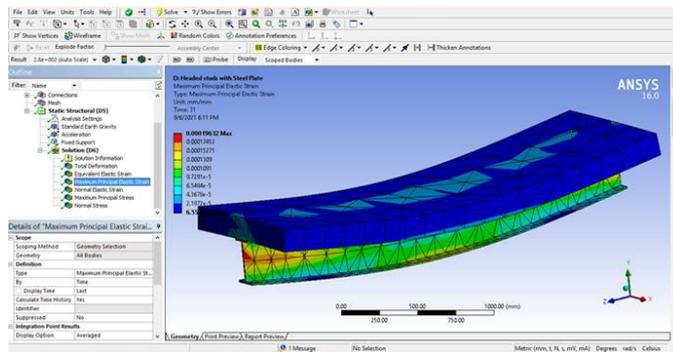
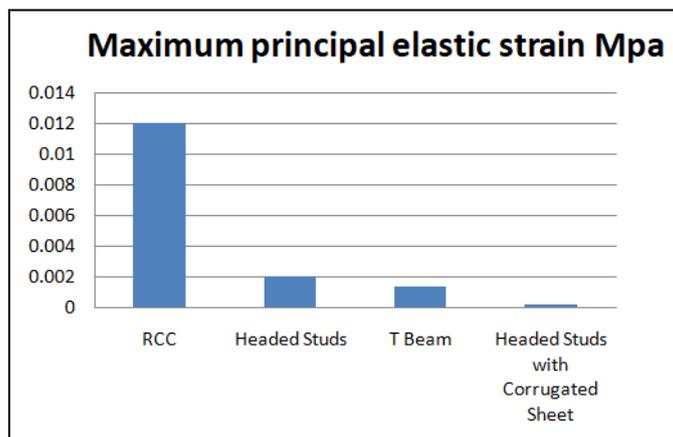


Fig 14 Maximum principal elastic strain of Headed studs with Steel Plate

Table 4: Maximum principal elastic strain Mpa

Maximum principal elastic strain Mpa			
RCC	Headed Studs	T Beam	Headed Studs with Corrugated Sheet
0.012026	0.0019631	0.0012924	0.00019362



Graph 4 Maximum principal elastic strain (Mpa)

The graph 4 Shows the results of Normal Stress (MPa), as we see in the graph, maximum Normal Stress (MPa) can be seen in the headed studs and headed stud with corrugated steel plate, whereas RCC Beam, results of Normal Stress ,t-beam stud is also shown. The Normal Stress MPa is shown in MPa

III. CONCLUSION

In this work variation in height, diameter and shape of shear connectors has been considered. Based on this analytical study following conclusion can be drawn.

1. The proposed three-dimensional model provides the opportunity to develop insights that would be virtually impossible using experimental tests, due to costs and, especially, the dispersion of material properties that inevitably occurs in laboratory

work. For instance, in the investigation of the influence of the level of shear connection, the concrete strength effect could be easily disregarded by the consideration of a fixed value for this property.

2. Based on this study, it is seen that the continuation of the shear connection beyond the beam supports of simply supported beams can affect not only the overall system response, but also the slip and the stud force distributions along the beam.

3. In further investigation the influence of shear connectors are studied, from that work it can be concluded that three diameters and three height values of for shear connectors were used, and it was observed that increasing the height of the connector does not necessarily increase the load limit, the vertical displacement and the longitudinal slip, but increasing the diameter of the connector increases the limit load, the vertical displacement and the longitudinal slipping in the slab-beam interface. Further it is observed that shape of cross section of shear connector also matters in behavior of composite beam. The shear connectors having rectangular cross section are found more effective than those with circular cross section for arresting the deflection of composite beam

REFERENCES

- 1) Q.Q. Liang 2005 “Strength Analysis of Steel–Concrete Composite Beams in Combined Bending and Shear” Journal of Structural Engineering, 131(10),1593-1600.
- 2) Atif M. Abdel Hafez, M.M. Ahmed, A.S. Alamary, A.M. Mohmoud 2012 “Behaviour of simply supported composite concrete steel beam with corrugated web under vertical loads” Journal of Engineering Sciences, Assiut University, Vol. 40, No 1, pp.93-108
- 3) David Leaf and Jeffrey Laman. 2013 “Testing and analysis of composite steel concrete beam flexural strength “ International journal of structural and civil engineering research . Vol. 2, No. 3
- 4)Shwetawagh and, Dr. U. P. Waghe. 2014 “Comparative Study of R.C.C and Steel Concrete Composite Structures” International Journal of Engineering Research and Applications Vol. 4, Issue 4, pp.369-376
- 5)Dr. D. R. Panchal 2014 “Advanced Design of Composite Steel–Concrete Structural element” International Journal of Engineering Research and Applications Vol. 4, Issue 7(Version 2), pp.124-138
- 6)EhabEllobody and Ben Young 2014 “Behaviour and Design of Composite Beams with Stiffened and Unstiffened Web Openings” Advances in Structural Engineering Vol. 18 No. 6 2015 893
- 7) Prof. Vijay S Sawant, Prof. Yogesh R Suryawanshi, Aniket V Renavikar. 2015 “Survey on Comparison of Steel and Concrete Composite Beam Column Connections” International Journal of Innovative Research in Science, Engineering and Technology Vol. 4, Issue 4,
- 8)Anju. T, Smitha. K .K 2015. “Finite Element Analysis of Composite Beam with Shear Connectors” International Conference on Emerging Trends in Engineering, Science and Technology pp.179 – 187
- 9) Li Xiayuan, Wan Shui, Zhang Jiandong, Liu Wenjuan Zhang Fengping 2015 “Shear capacity of steel-concrete composite beams with Hybrid Full Web and Truss System” 4th International Conference on Sustainable Energy and Environmental Engineering. Pp.171-175
- 10) Richard Frans1, Herman Parung, AchmadBakriMuhiddin, and Rita Irmawaty. 2017 “Finite element modelling of composite castellated beam” MATEC Web of Conferences 138, 02009 , DOI: 10.1051/201713802009
- 11)Tiejiong Lou, Theodore L. Karavasili. “Numerical assessment of the nonlinear behavior of continuous prestressedsteel-concrete composite beams” Science Direct, Engineering structures 190,116/127

IS CODES:

- i. **IS 456 : 2000** -Plain and Reinforced Concrete Code of Practice. - BUREAU OF INDIAN STANDARDS, NEW DELHI.
- ii. **IS 3935:1966** – Code of PracticeFor Composite construction.
- iii. **IS 11384:1985** – Code of PracticeFor Composite constructionin structural steel and concrete.
- iv. **IS 800 : 2007** - Code of PracticeGeneral construction in steel

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