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Fea Analysis of Steelvoided Beam Using Soldworks Simulation Software

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ABSTRACT

A steel is one of the most utilized construction material, as a result of its many advantages that it has, such as low cost , long service life (when properly mixed, placed and cured) , ease of construction and high compressive strength. Modern civilization web opening provide for environmental services like duct, cable, and other various purpose. Fiber reinforced polymer (FRP) and Epoxy carbon fiber, composites strengthening becoming nowadays a commonly accepted and widespread technique. In present work steel voided beam is selected as specimen to perform FEA research for various shapes of web openings in voided beam. The shapes selected are Plain beam, circular web opening beam, triangular web opening beam and rectangular web opening beam respectively. The research also analyzes and compares all web opening shape cases with four different beam materials, the materials used for research are Epoxy Carbon Fiber, Fiber Reinforced Aluminum, Plain Carbon Steel, and SS304 respectively. The results were compared for stress, strain and deflection for all combination of cases.

Key Words: Finite element analysis, SolidWorks, Steel voided beams, web opening beams, web opening shapes, Epoxy carbon fiber beam, Fiber reinforced aluminum beam, Plain carbon steel beam, SS304 beam, Deflection, Stress, Strain.

1. INTRODUCTION

FEA has been used in engineering applications. It is applied using steel models. The beam column joint is subjected to large forces during severe ground shaking and its behavior has a significant influence on the response of the structure. A number of commercial finite element analysis codes are available (ABAQUS, ATENA, ANSYS, NASTRAN, Hypermesh, etc.) for the analytical study of structures.

Conventionally reinforced concrete (CRC) structures may lead to corrosion of the embedded reinforcing steel. These include structures subjected to wind-born salt spray. Engineers often must evaluate existing structures that exhibit corrosion-induced damage. Finite element analysis is a good tool; however, application to corrosion-damaged structures requires modeling assumptions.

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2. PROBLEM FORMULATION AND OBJECTIVE

Problem Identification

Finite element analysis is to be performed to analyze the linear behaviour of the beams. The FEM package SolidWorks is planned to use for the analysis. Model is created in SolidWorks. The dimension of the beam is planned to taken as b= 150mm, h= 220mm, and l= 6100mm.

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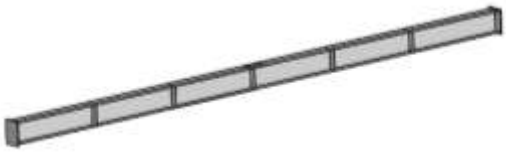
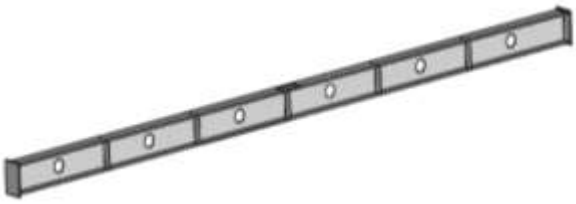


Plain I Beam without Web opening



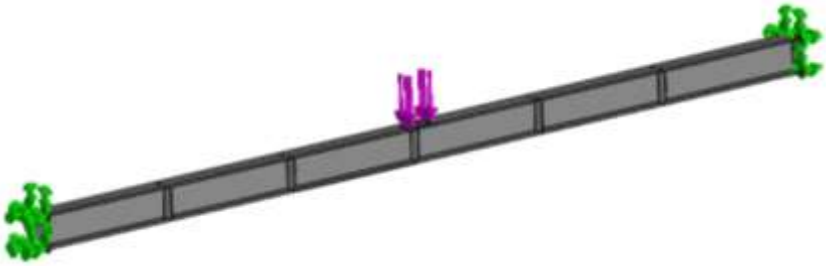
Circular Web Opening Beam (Circle Dia – 100mm)

Slot Shape Web opening Beam (Slot size – 100 x 200)

Rectangular Shape Web Opening Beam (Rectangle Size – 100 x 150)

Voided Beam with simply supported boundary condition is planned to be analyzed under different loading conditions such as:

1. Point load at the center of the beam.
2. Fixed from both ends.
3. Duct shapes may be varied to compare results.
4. Duct material can be tested varying material data for analysis.



Boundary Conditions (Center Load: 30000 N, Fix at both sides)

Method and Objective of the Research

1. To find the ANSYS analysis result outcomes for Voided RCC beams considered.
2. To compare the Stress, Deflection and Strain result outcomes with varying material and web opening shapes.
3. Four materials are selected for all shapes of voided beams. (Epoxy Carbon Fiber, Fiber Reinforced Aluminum, Plain Carbon Steel, SS304).

3. ANALYSIS AND DATA COLLECTION

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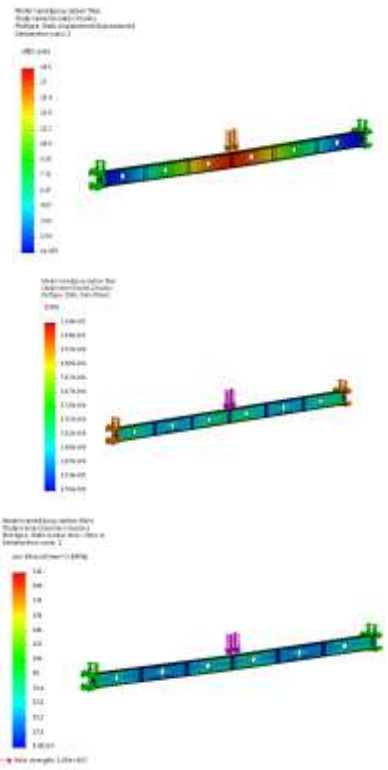
The analysis is performed for each shape and all materials decided and results were tabulated and compared for conclusion.



Displacement Stress Strain

4. RESULTS

Circular Web Opening Results

	Epoxy carbon fiber	Fiber Reinforced Aluminum	Plain Carbon Steel	SS 304
Deformation (mm)	18.5	9.39	9.33	10.3
Strain	1.14E-03	5.80E-04	6.22E-04	6.90E-04
Stress (N/mm^2)	211	211	192	191

Simple I Beam

	Epoxy carbon fiber	Fiber Reinforced Aluminum	Plain Carbon Steel	SS 304
Deformation (mm)	18	9.3	9.2	10
Strain	1.10E-03	5.80E-04	6.20E-04	6.90E-04
Stress (N/mm^2)	210	210	191	190

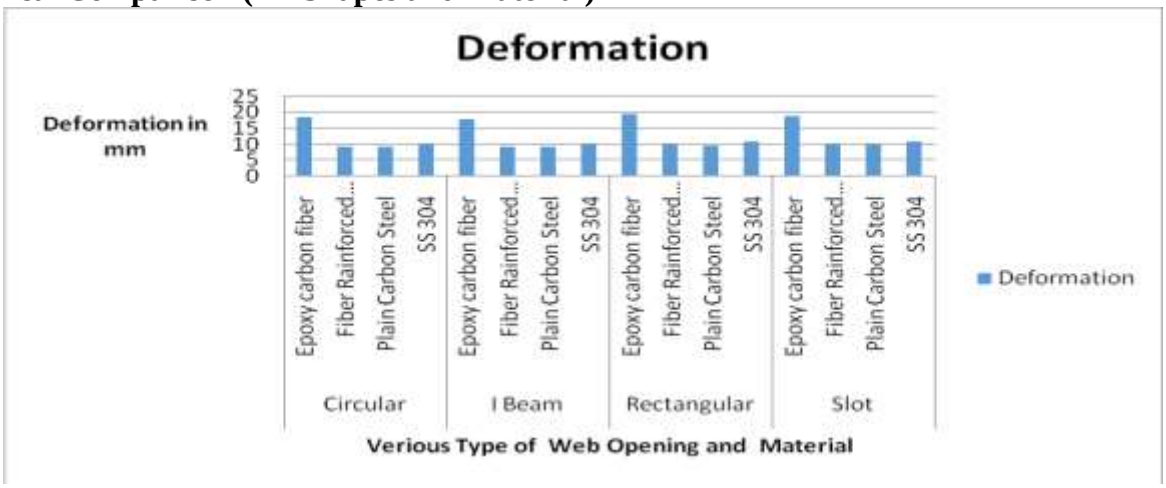
Regular Web Opening

	Epoxy carbon fiber	Fiber Reinforced Aluminum	Plain Carbon Steel	SS 304
Deformation (mm)	19.4	9.82	9.76	10.8
Strain	1.51E-03	7.64E-04	8.61E-04	9.58E-04
Stress (N/mm^2)	228	228	225	225

Slot Shape Web Opening

	Epoxy carbon fiber	Fiber Reinforced Aluminum	Plain Carbon Steel	SS 304
Deformation (mm)	19	9.8	9.8	11
Strain	1.48E-03	7.16E-04	8.60E-04	9.58E-04
Stress (N/mm^2)	237	237	237	237

Graphical Comparison (All Shapes and Material)



Deformation Comparison Graph

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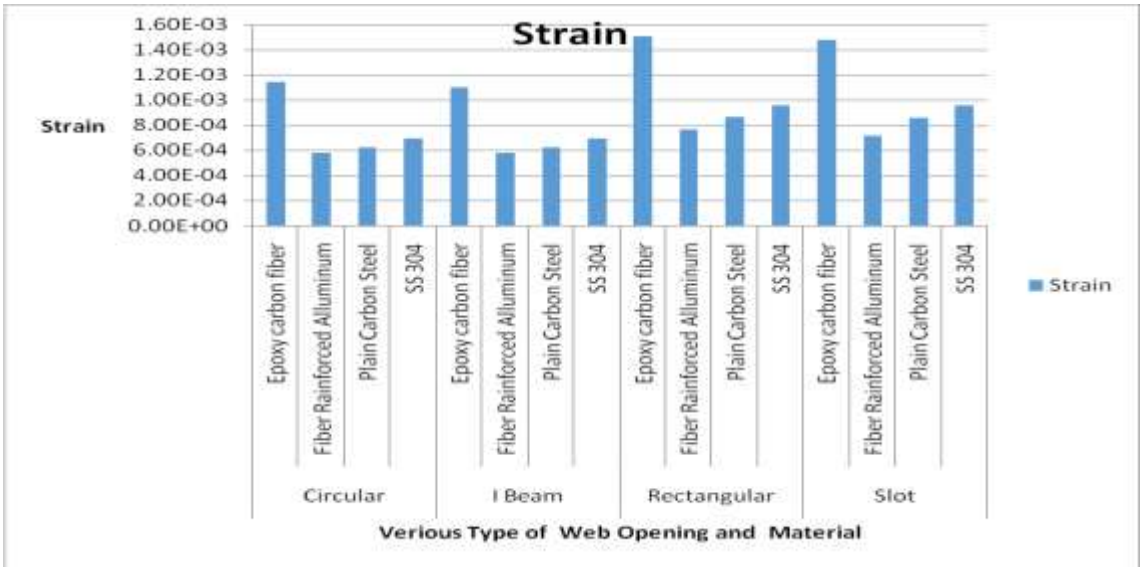
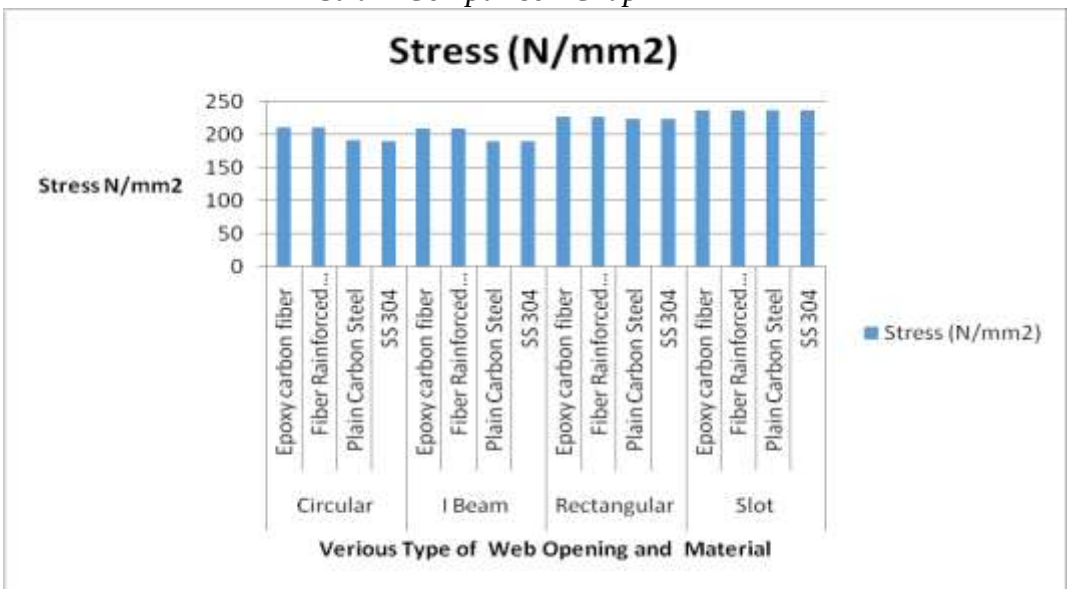


Strain Comparison Graph



5. CONCLUSION

Simple I Beam and Web Opened I Beam are analyzed with different materials and shape variations in SolidWorks.The results are compared graphically for Deformation, Stress and strain. The shape variation for web opening is considered as rectangular, circular and slot shaped. The material tested against each shape are epoxy carbon fiber, fiber reinforced, plain carbon steel and SS 304.

It is found from results that simple I beam possess minimum deformation , stress , strain and considering web opening beams circular web opening beam possess lowest deformation,

stress and strain for all materials considered.

Material is also tested against all shapes considered, It is found that plain carbon steel and fiber reinforced aluminum is best among all four materials for all shapes analysis outcomes because deformation , stress , strain are minimum in this material.

6. REFERENCES

[1]. Pradeep Singh et al., Finite Element Analysis of Reinforced Concrete Beam Using ANSYS, Technical Research Organization India, VOLUME-3, ISSUE-1, 2016, 122 – 126.

[2]. TanaratPotisuk et al., 2011, Finite Element Analysis of Reinforced Concrete Beams with Corrosion Subjected to Shear, Hindawi Publishing Corporation Advances in Civil Engineering Volume 2011.

[3]. Syed Sohailuddin S S and M G Shaikh, 2013, Finite Element Modeling of Reinforced Concrete Beam Column Joint Using ANSYS, International Journal Structural & Civil Engineering Research, 2013, Vol. 2, No. 3, August 2013.

[4]. Nimiya Rose Joshuva et al., 2014, Finite Element Analysis of Reinforced and Pre – Tensioned Concrete Beams, International Journal of Emerging Technology and Advanced Engineering, Volume 4, Issue 10, October 2014, PP 449 – 457.

[5]. Amer M. Ibrahim and Wissam D. Salman, Finite Element Analysis Of Reinforced Concrete Beams Strengthened With CFRP In Flexural, Diyala Journal of Engineering Sciences, Vol. 02 ,pp. 88-104 , December 2009.

[6]. T. Tejaswini and M.V.RamaRaju, Analysis of RCC Beams using ABAQUS, International Journal of Innovations in Engineering and Technology (IJIET), Volume 5 Issue 3 June 2015, PP 248 – 255.

[7]. KarthigaShenbagam.N and Preetha.V, Finite Element Analysis of Reinforced Concrete Beams, International Journal of Innovative Research in Advanced Engineering (IJIRAE), Volume 1 Issue 8 (September 2014)

[8]. T. Subramani et al., Analysis of Retrofitting Non-Linear Finite Element of RCC Beam And Column Using ANSYS, International Journal of Engineering Research and Applications, Vol. 4, Issue 12(Part 5), December 2014, pp.77-87.

[9]. Umer Farooq and Mir Aijaz Ahmad, Finite Element Approach to Reinforced Concrete Using ANSYS, Research Gate, https://www.researchgate.net/publication/277712994, DOI: 10.13140/RG.2.1.4721.9365, 2014.

[10]. S. S. Patil and S. S. Manekari, Analysis of Reinforced Beam-Column Joint Subjected to Monotonic Loading, International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 10, April 2013, PP 149 – 158.

[11]. Mustafa BasheerMahmood and V. C. Agarwal, Non-Linear Finite Element Analysis of RC Slabs Strengthened with CFRP Laminates, International Journal of Engineering Trends and Technology (IJETT) – volume 5 number 3- Nov 2013.

[12]. T.Subramani and K.Balamurugan, Finite Element Analysis of Composite Element For FRP Reinforced Concrete Slab By Using ANSYS, International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 5, Issue 5, May 2016.

[13]. Ghernouti Y et al., Strengthening of concrete beams by CFRP: Experimental study and finite element analysis, J. Build. Mater. Struct. (2014) 1: pp 47-57, http://journals.oasis-pubs.com.

[14]. Tara Sen and H. N. Jagannatha Reddy, A Numerical Study of Strengthening of RCC Beam Using Natural Bamboo Fibre, International Journal of Computer Theory and Engineering, Vol. 3, No. 5, October 2011

[15]. Sudheer Reddy et al., Finite Element Analysis of High Strength Concrete Beams In Shear - Without Web Reinforcement and With Fiber in Shear Predominant Regions, International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4, Issue 4, April 2015

[16]. SelcukSaatci and Frank J. Vecchio, Nonlinear Finite Element Modeling of Reinforced Concrete Structures under Impact Loads, ACI Structural Journal/September-October 2009, pp 717-725.