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Comparative Analysis of Straight Beam under Single Loading Conditions Using Different Materials by Use of ANSYS Software

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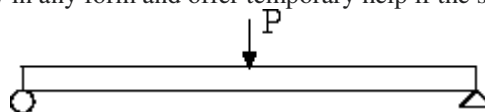
ABSTRACT:- As the population of the world keeps on increasing the motion of the vehicles have been increased which results in traffic. So the traffic have to be reduced which led to the construction of structural members (i.e., bridges). So it is necessary to study how much load that can be carried by these bridges. The main aim of our project is to study about the deflection of the beams on analysis of experimental value and the innovation of our project is to bring all types in a single apparatus. We can also find the deflection of both the rectangular sectional beams. The objective of our project is to provide a practical knowledge on how a beam gets deflected due to different types of loads acting transversely to the axis of the beam. Here we analysis the experiment by using ANSYS software. Beams belong to the basic structural members used in the modelling abstraction of mechanical systems. In this paper behaviour of beam and solid elements are discussed on the basis of Deflection occurred on beam due to various types of loads i.e., point load and uniformly distributed load applied on rectangular section beam. A member subjected to bending moment and shear force undergoes certain deformations. The material of the member will offer resistance or stresses against these deformations. It is possible to estimate these stresses with certain assumptions.

KEYWORDS:(Size 10 & Bold) Key word1, Key word2, Key word3, etc (Minimum 5 to 8 key words)...

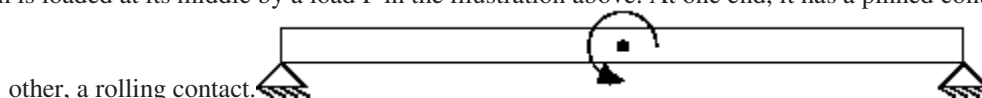
I. INTRODUCTION

Beams A series of external loads acting transverse to the axis act on a beam, a structural member. The beam can deflect under a variety of loads depending on how concentrated the load is. In most cases, beams support both horizontal loads and upward gravitational forces. Beams are categorised based on their profile, or the form of their cross-section, length, and material. Beam structures are used in smaller mechanical or structural systems, such as truck or vehicle frames, machine frames, and other mechanical or structural systems. The term "beams" is frequently used to refer to a building's structural components.

The response can only be perpendicular to the motion of the roller when the support is one. A support that is a pin cannot hold up a second. It can reply in any form and offer temporary help if the support is repaired.



A basic beam is loaded at its middle by a load P in the illustration above. At one end, it has a pinned contact, and at the



other, a rolling contact. An ideal moment acting in the centre of a beam is seen in the image above. An ideal moment is one that is unconnected to any external forces. Finding the loads, reactions, and moments, then calculating the values of the loads and moments

at each section, is the typical approach for evaluating beam problems. This, in general, will depend on the length of the beam piecewise. Axes are set up for loads, and this determines the direction of the force.

1.1 TYPES OF BEAMS

1.1.1 Straight Beam:

Curved beams must carry bending moment, shear force, and torsional moment in addition to the bending moment and shear force carried by straight beams. The geometry of the beam, whose centroid of geometry (C.G.) does not lie on its length, is what causes the torsional moment to appear. This torsional moment at the beam supports is caused by the force that follows acting on C.G. The lever arm between the C.G. and the supports and the resulting force will produce the torsional moment.

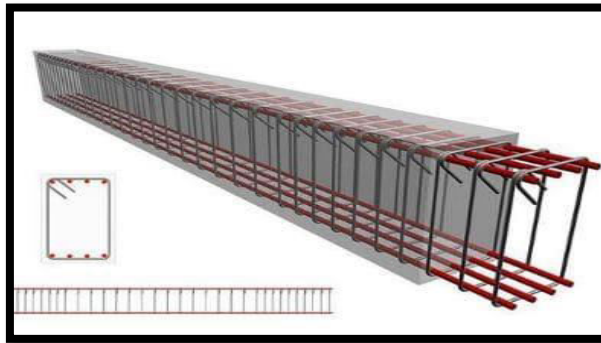


Fig.1.1: Straight beam

1.1.2 Curved Beam:

We have been researching initially straight members up until this point. In this chapter, we'll look at how originally curved beams can bend. To achieve this, we limit our analysis to situations in which bending occurs in the plane of curvature. This occurs when the bending force acts in the plane of the beam's curvature and the beam's cross section is symmetrical with respect to that plane. We first arrive at the answer, as we did for Straight Beams, assuming that originally planar parts stay that way after bending.

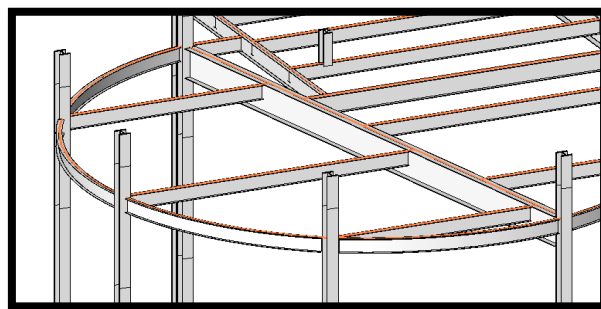


Fig.1.2: Curved beam

Beams face a wide range of static and dynamic loads and are one of the most often utilised structural elements in many technical applications (such as aeronautical structures, tankers, and rotors, etc.). The crack modelling process is crucial to understanding how damaged structures behave.

1.2 FINITE ELEMENT ANALYSIS

It was chosen for the modelling and analysis of the concrete beam with steel in the study due to its versatility in creating geometry and material models. The modelling and analysis of the steel utilised in the concrete beams for this investigation were done using ABAQUS due to its versatility in geometry and material modelling. Before starting to develop this or any other model, all input data must be provided in consistent units because ABAQUS software lacks a built-in system of units. For the numerical simulation of a reinforced concrete deep beam, a realistic model of the structural elements and its component members working as a made up of concrete and steel is required.



1.3 MATERIALS:

Cement, water, and aggregate, or a hard, chemically inert particle material, are the main components of the structural substance used in construction known as concrete (typically sand and gravel). Among the Assyrians and Babylonians of antiquity, clay was the most often utilised bonding material.

1.3.1 CONCRETE M35, M45, M65:

Concrete can be distinguished based on the kind of cement or aggregate used, its characteristics, or the processes used to make it. The behaviour of conventional structural concrete is significantly influenced by the cement to water ratio. When all other factors are maintained constant, concrete becomes stronger when its water content is lower. To ensure that the cement paste fully encloses each aggregate particle, fills any gaps between the aggregate, and makes the concrete liquid enough to be poured and distributed properly, the right amount of water must be added to the mixture.

1.3.2 Fe550 STEEL REINFORCEMENT:

The backbone of the contemporary construction industry, MT (Thermo-Mechanically Treated) bars are utilised in virtually every type of concrete structure, from residences to skyscrapers, bridges, dams, and underwater constructions. In terms of CIVIL ENGINEERING, TMT (Thermo Mechanically Treated) Bar, commonly known as Reinforcing Bar or Rebar, is a high-strength reinforcement bar with a hard outer core and soft inner core. It has repeatedly established itself as a high-quality building material for reinforcing concrete structures since its introduction to the market. TMT bars are a common tensioning tool used nowadays to reinforce concrete and assist it withstand compressive stresses.

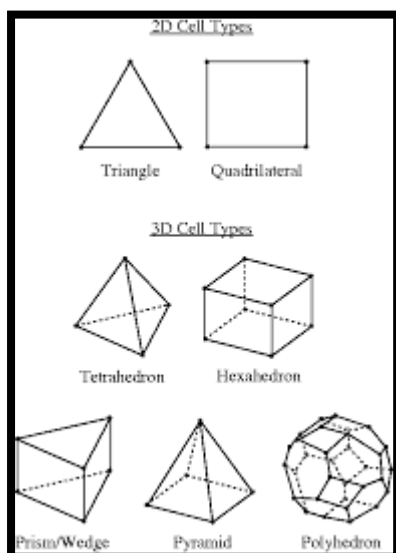
II. METHODOLOGY

2.1.1 CATIA V5



CTia V5 Dassault Systems, who currently maintains and develops the programme, released CATIA for the first time back in 1977. The Dassault Mirage fighter jet was the first project for which CATIA was created. CATIA has grown to be much more than just a CAD (Computer Aided Design) software suite over time. The following features—CAD and CAM—are now included in the software suite.

2.1.2 ANSYS 16.2



With the help of ANSYS 16.0, engineers will be able to validate full virtual prototypes throughout the company's entire portfolio, which includes solutions for structures, fluids, electronics, and systems engineering.



2.2 MESHING PROPERTIES CONSIDERED

ANSYS A high-performance, adaptable, intelligent, automated product is coming together. For accurate, efficient Multiphysics solutions, it produces the best mesh conceivable. With a single mouse click, the mesh that is most appropriate for certain research may be built for each component of a model.

Greater control over sizing functions is offered by the Size Function option. The following attributes are managed by size functions:

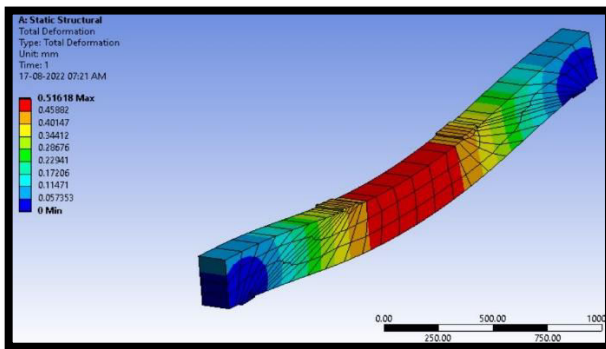
1. Angles between normals for adjacent mesh elements.
2. Number of mesh pieces used to fill up the spaces between two geometric objects (proximity-type size function)
3. Gradient between the smallest and largest sizes depends on a chosen growth rate.

You can choose from Adaptive, Proximity, Curvature, and Uniform for the Size Function. Unless the Physics Preference is set to CFD, in which case the default is Curvature, adaptive is the default. The refinement methods that are turned on in the Size Function, as explained in the following sections, depend on the choice you select.

2.3 ANALYSIS RESULTS

2.3.1 CONCRETE GRADE M35

TOTAL DEFORMATION:



STRESS:

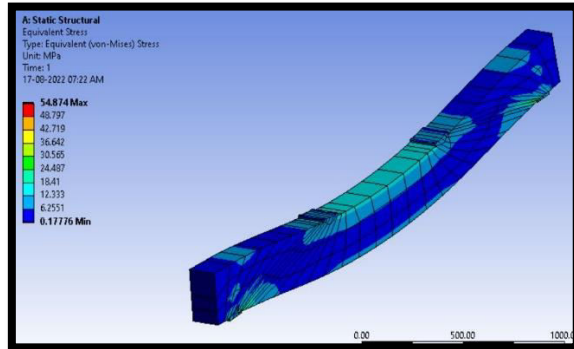


Fig.2.3.1.1 : Total deformation for M35 Fig.2.3.1.2: Stress for M35

STRAIN:

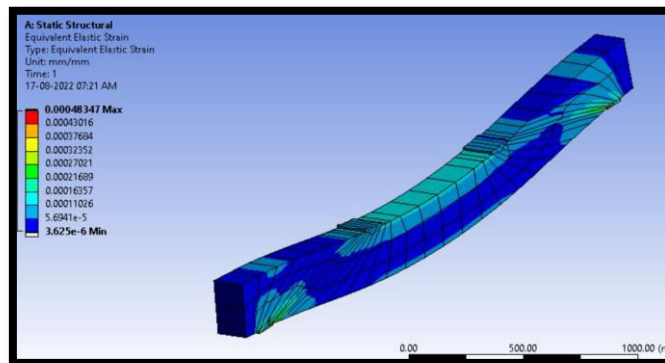


Fig.2.3.1.3: Strain for M35



**2.3.2 CONCRETE GRADE M45
TOTAL DEFORMATION:**

STRESS:

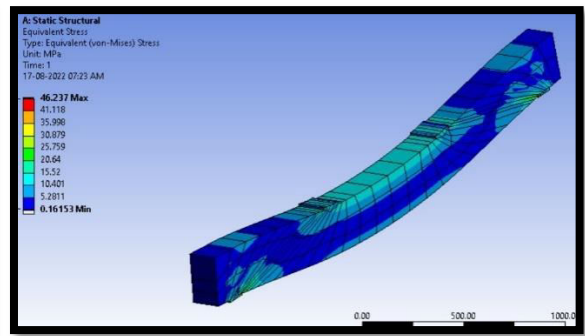
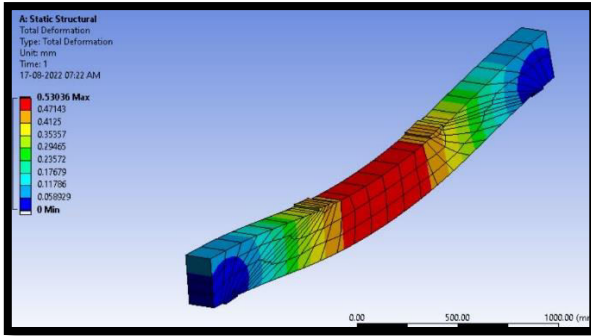


Fig.2.3.2.1: Total deformation for M45 Fig.2.3.2.2: Stress for M45

STRAIN:

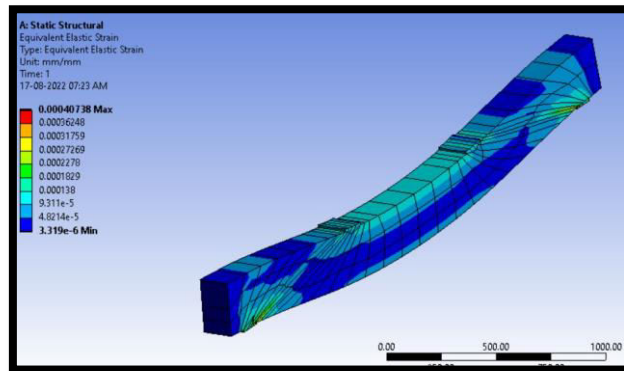


Fig 2.3.2.3: Strain for M45

**2.3.3 CONCRETE GRADE M65
TOTAL DEFORMATION:**

STRESS:

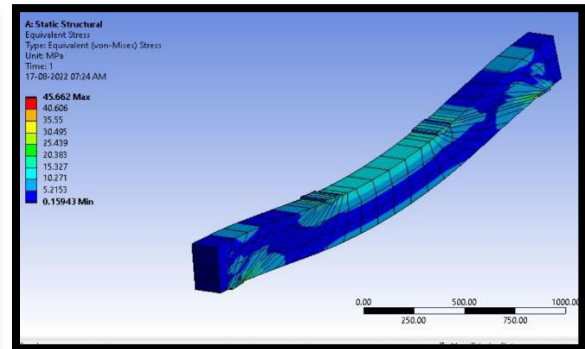
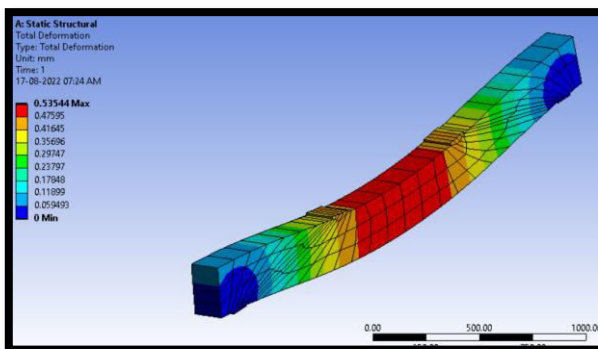


Fig.2.3.3.1: Total deformation for M65 Fig.2.3.3.1: Stress for M65

STRAIN:

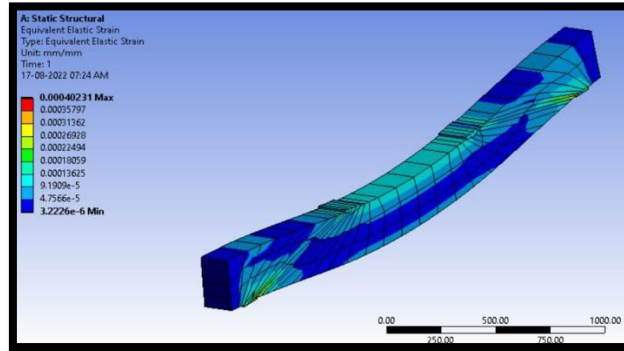


Fig.2.6.3.3: Strain for M65

III. EXPERIMENTAL RESULTS

3.1 TOTAL DEFORMATION

Grade of concrete	Deformation in mm
M35	0.51618
M45	0.53036
M65	0.53544

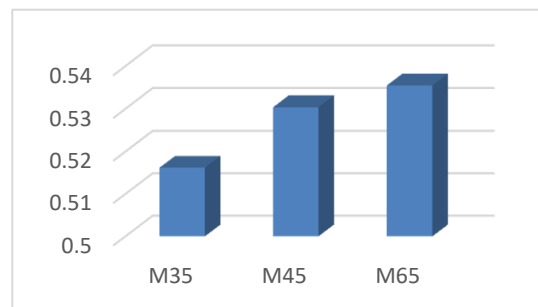


Table 3.1.1: Details of Deformation Fig.3.1.1: Graphical representation of Deformation values

From the results above, it is clear that during total deformation, the performance of the beam with M35 is superior to that of the beams with M45 and M65. The number for M35 indicates that it causes less deformation and extends the structure's life. The M45 Beams exhibit very little distortion, and the M65 beam exhibits very significant deformation—nearly twice as much as the other models.

3.2STRESS

Grade of concrete	Deformation in mm
M35	54.874
M45	46.237
M65	45.662

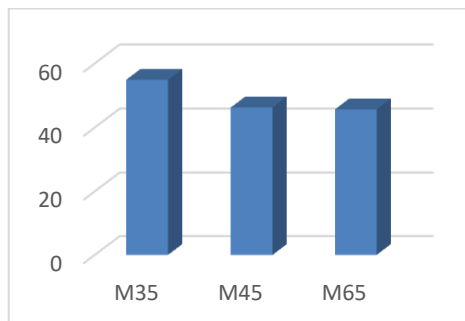


Table 3.1.2: Details of Stress Fig.3.1.2: Graphical representation of Stess values

From the results above, it is clear that the performance of the beam with M65 under stress is superior to that of the beam with M35 and M45. The value for M65 demonstrates that it causes less stress and promotes a long structural life. In contrast to the M35 model, which exhibits very high levels of stress, the M45 beams exhibit relatively low levels of stress.



3.3 STRAIN

Grade of concrete	Deformation in mm
M35	0.00048347
M45	0.00040738
M65	4.02E-04

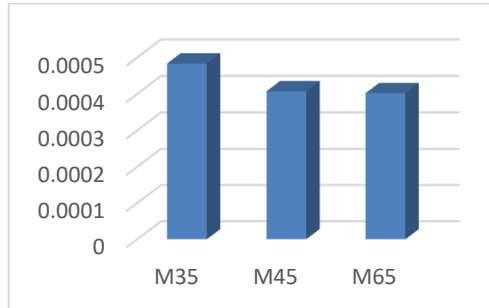


Table 3.1.3: Details of Stress Fig.3.1.3: Graphical representation of Stress values

From the results above, it is clear that the performance of the beam with M65 under strain is superior to that of the beam with M35 and M45. The value for M65 indicates that it results in less strains and a longer lifespan for the structure. According to a different viewpoint, the M35 model exhibits a significant degree of Strain while the M45 Beams exhibit relatively little Stress.

IV. CONCLUSION

1. When compared to M45 and M65, the performance of the beam for total deformation with M35 exhibits better performance. The number for M35 indicates that it causes less deformation and extends the structure's life.
2. From a different perspective, the M45 Beams exhibit very little distortion, whereas the M65 model exhibits extremely significant deformation—nearly twice as much as the other models.
3. Stress When compared to M35 and M45, the Performance for Beam with M65 exhibits better performance. The value for M65 demonstrates that it causes less stress and promotes a long structural life.
4. In contrast to the M35 model, which exhibits very high levels of stress, the M45 beams exhibit relatively low levels of stress.
5. The number for M65 indicates that it results in less strains and a longer lifespan for the structure. According to a different viewpoint, the M35 model exhibits a significant degree of Strain while the M45 Beams exhibit relatively little Stress.

REFERENCES

1. W. A. Nash, Schaum's Outlines of Theory and Problems of Strength of Materials (2nd edition), McGraw-Hill, New York (1987), ISBN 0-07-084366-X. International Journal of Applied Engineering Research, ISSN 0973-4562 Vol. 10 No.33 (2015) © Research India Publications; <http://www.ripublication.com/ijaer.htm> 2600113819
2. Wakchaure M.R. *, Sagade A.V.*, Auti V. A. International Journal of Scientific and Research Publications, Volume 2, Issue 8, August 2012 1 ISSN 2250-3153 www.ijsrp.org Parametric study of castellated beam with varying depth of web opening.
3. J. M. Gere and S. P. Timoshenko, Mechanics of Materials (4th edn), PWS Publishing Company, Boston, MA (1997), ISBN 0-534-93429-3.
4. Nikos D. Lagaros, Lemonis D. Psarras, Manolis Papadrakakis, Giannis Panagiotou “Optimum Design of Steel Structures with Web Openings” (Engineering Structures 30 (2008) 2528–2537).
5. International journal of mechanical engineering and computer application, vol 1, issue 5 special issue October 2013, ISSN 2320-6349 “Deflection and stress analysis simply supported beam and its validation using ANSYS” department of mechanical engineering , Birla Institute of Technology, Mesra, Ranchi, India.



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