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NUMERICAL STUDY ON FLEXURAL BEHAVIOR OF ENCASED BEAM

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Abstract – *In recent years composite construction dominates the non-residential multi storey building sectors. In this study the steel channel section was encased inside a reinforced concrete beam. The flexural behavior of ordinary beam and encased beam are evaluated using ANSYS software by considering the beam as simply supported with a point load acting at centre. The finite element model has proved to be effective in terms of evaluating load carrying capacity and deflection behavior. It has been found that the encased beam has high load carrying capacity and low deflection.*

Key Words: **channel section, encased, Flexural behavior, ANSYS, finite element model.**

1. INTRODUCTION

Encased beam is a composite construction which employs structural members that are composed of two materials: structural steel (rolled or built-up) and reinforced concrete. When a steel beam is encased in cement concrete throughout the entire length, it is called an encased beam.

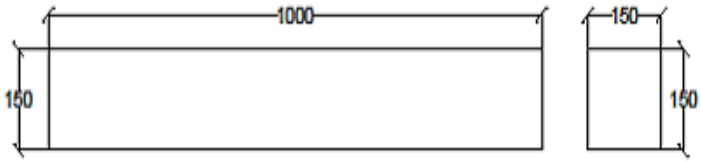
Composite beams are generally shallower (for any given span and loading) than non-composite beams and they are used commonly in long span applications. In composite beam the structural steel and concrete act together to resist bending under loading.

Neelima Khare [1] studied the performance of composite beams under shear and flexure with and without shear reinforcement. The results indicated that the crack width observed was more in beams without shear reinforcement as compared to beams with shear reinforcement. Ductility of beams was increased by providing shear reinforcement beams without shear reinforcement fail due to crushing of concrete in diagonal tension. Ammar. A [2] conducted experiments on strength and ductility of concrete encased composite beam. Their study indicated that the ductility of the encased beam was very high because of the high percentage of steel area and this was one of the favorable features for seismic construction.

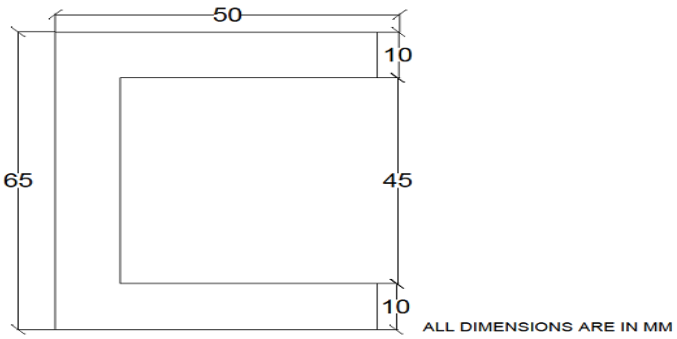
2. MATERIALS AND METHODS

Current work is on encased beam which is a reinforced concrete beam in which steel channel section is encased and is analyzed using ANSYS. For this purpose M30 grade of concrete and Fe415 steel are used.

Dimension of beam: 150mmx150mmx1000mm. The top reinforcement is 2 bars of 12mm dia and main reinforcement is 2 bars of 16mm dia and shear reinforcement of 2 legged 6mm dia bar at 80mm spacing.



Dimension of steel channel section is taken as:



2.1 SPECIFICATIONS IN ANSYS

The value of Young's modulus, Poisson's ratio and density are to be given separately for steel and concrete in ANSYS. For concrete SOLID65 is used as element type for 3D modelling of solids which is capable to crack in tension and crush in compression. Beam188 is used for steel section and reinforcement because this element type is suitable for analysing slender to moderately stubby/ thick beam structures. Fine mesh of hexahedron mapping is used to mesh the elements and the boundary condition is set as Ux, Uy = 0 and Uz is set free.

2.2 MODELING AND ANALYSIS USING ANSYS

1. CONVENTIONAL RC BEAM

The ordinary reinforced concrete beam with support and loading is shown in figure 1 and total deformation under loading is shown in figure 2 as:

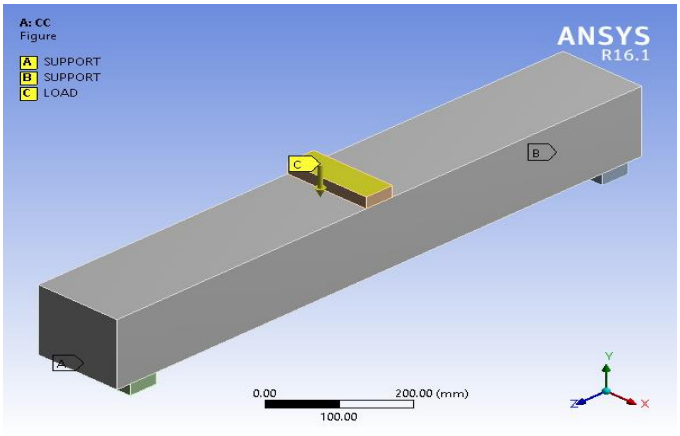


Figure-1: Model with support and loading

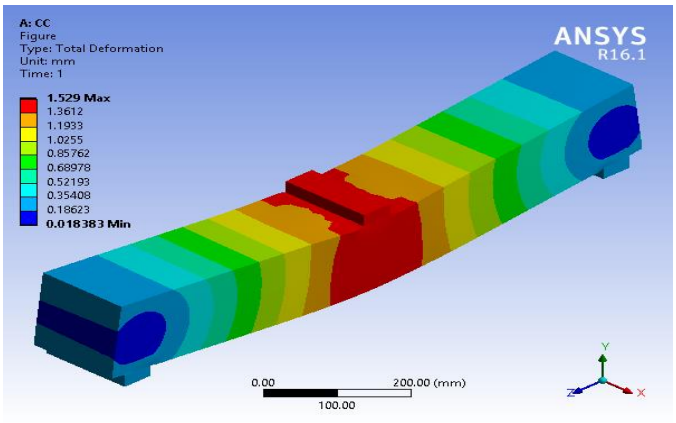


Figure-2: Total Deformation

2. ENCASED BEAM

The encased beam with support and loading is shown in figure 3 and total deformation under loading is shown in figure 4 as:

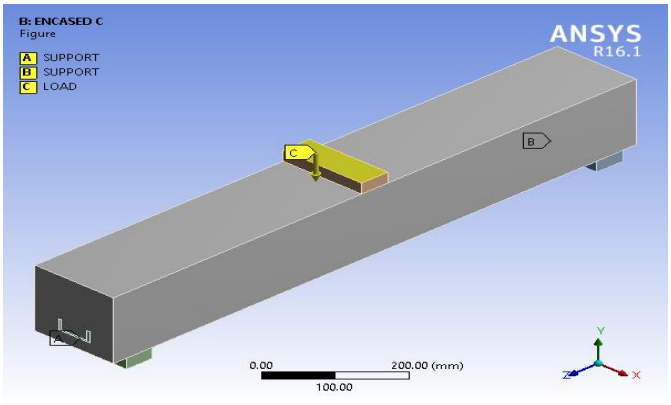


Figure-3: Encased beam model with support and loading

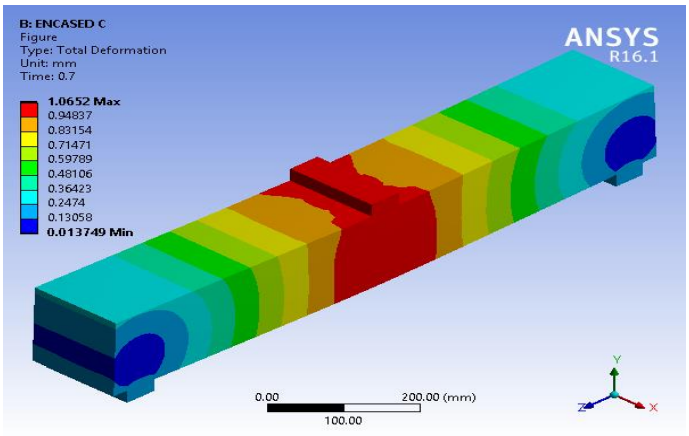


Figure-4: Total Deformation

3. COMPARISON CHART

The load versus deflection value for both ordinary reinforced concrete beam and encased beam is plotted in ANSYS as:

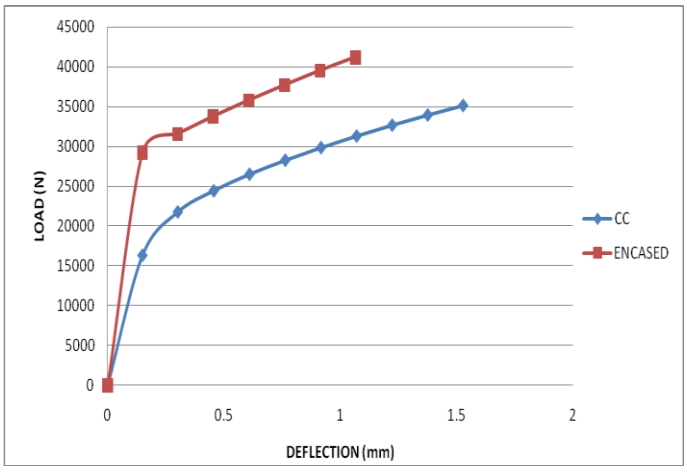


Chart-1: Comparison chart

Table -1: Comparison of analytical result of beam

TYPE OF BEAM	MAXIMUM LOAD CARRYING CAPACITY (KN)	DEFORMATION (mm)
Ordinary RC beam	35	1.529
Encased beam	41	1.06

3. CONCLUSIONS

The numerical study on flexural behavior of encased beam leads to the following conclusions.

1. The encased beam has significant increase in load carrying capacity.

2. The deflection value of encased beam is less and hence the ductility will be high.

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