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COMPARATIVE STUDY ON RC BEAM COLUMN JOINT USING BOTH ANALYTICAL AND EXPERIMENTAL METHOD

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Abstract –

In the case of reinforced concrete structures beam to column joints are the most crucial zones. The behaviour of beam - column joints are based on the strength, stiffness and ductility of the reinforced concrete structure. Beam to column joints are one of the members in reinforced concrete structures and these joint locations are always at risk fpr failures.

The main aim for choosing this topic is generally failures are formed at the location of beam - column joint. If these beam - column joints are not designed properly, different types of failures may happen. A building beam - column joint connects other several joints they can work together and resist against failures. Most of failures frequently occurs at the exterior beam to column joints compared to interior joints.

In the present work as per IS 456 - 2000 beam - column joint is manually designed and casted. After 28 days of curing this joint tested in the laboratary. The same design specifications of beam - column is modelled in Ansys software on the basis of finite element method and results are carried out. After getting the results, compared to both experimental and analytical results.

Key Words: Beam - column joint, Ansys, Loading frame, Reinforcement detailing.

1. INTRODUCTION

Beam - column joints are the foremost crucial elements in reinforced concrete structure. The main function of providing the beam - column joint in concrete building structures is to transfer the load to remaining members effectively and to continue the structural action between the members. In reinforced concrete structure, the segment of column that is common to the depth of beam at its intersection is called beam to column joint.

During ground movements beam-column joints overcome the large forces or lateral forces.Its behaviour plays an important role in the response of reinforced concrete structure.Because of lateral forces,high shear forces are developed at the beam - column joint,if its fails to resist the forces then failure may happen. In the case of reinforced concrete moment resisting structure, beam to column joints are foremost weakend elements. The main importance of beam - column joint is that they can stabilize the structure, if failure occurs at a joint, complete collapse will starts. Beam - column joint is one of the important tie up part to convey loads to next column and beam. Most of the failures are formed at joint due to poor detailing of shear reinforcement.

1.1. TYPES OF JOINTS:

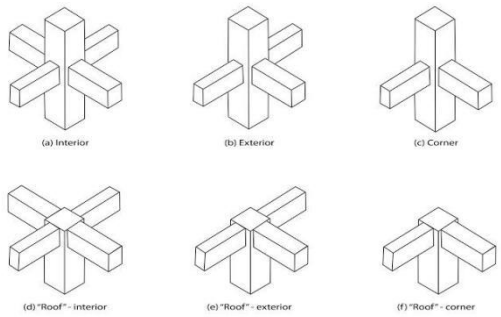


Fig 1

There are seven types of joints,

1. Roof interior joint
2. Roof exterior joint
3. Roof corner joint
4. Interior joint
5. Exterior joint
6. Corner joint
7. Planner joint

Interior joint : When four beam frames are in contact with the portion of column, it is called as an interior joint.

Exterior joint : When one beam is in contact with the column and the other two beams joins the joint in perpendicular direction, that type of joint called as exterior joint.

Corner joint : When two beam faces frame into portion of two side faces of column is called as corner joint.

Planner joint : When one face of the beam frame into portion of any side of the column is called as planner joint.

2. OBJECTIVES OF THE STUDY

To find out shear force,bending moment and deflections of beam - column joint in experimental method.

Analyse the beam - column joint in Ansys software and find out the shear force,bending moment and deflections.

Compare the results of beam - column joint in both experimental and analytical methods

3. METHODOLOGY

In the present work as per IS 456 - 2000,beam - column joint is manually designed and casted. After 28 days of curing this joint tested in the laboratary. The same design specifications of beam - column joint is modelled in Ansys software and results are carried out on the basis of finite element method. After getting the results, compared the both manual results and ansys results.

Table 1.Properties of beam - column joint

Beam size	200 x 250 mm
Beam length	450 mm
Column size	200 x 200 mm
Column length	1150 mm
Materials	Concrete,steel
Grade of concrete	M_{30}
Grade of steel	Fe 415

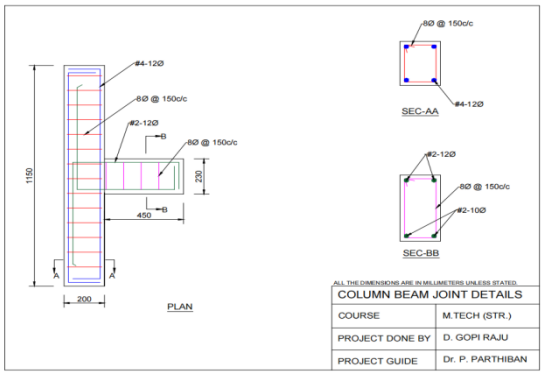


Fig 1.Reinforcement detailing

Fig 2.Beam - column joint steel design

Fig 3. Rcc beam - column joint

Graph 1.Experimental results

Deflection = 0.51 mm

Manual calculations

Dead load = 0.2 x 0.23 x 0.45 x 25

= 0.5175 kN

Live load = 10 kN

Total load = 10.5175 kN

Factored load = W_u = 1.5 x 10.5175 = 15.776 kN

Bending moment $M_u = WL_{eff}$

L_{eff} = 0.45 + (0.2/2) = 0.55 m

M_u = 15.776 x 0.55 = 8.6 Kn - m

$V_u = W_u$ =15.76 kN

4. ANALYSIS OF BEAM - COLUMN JOINT USING ANSYS SOFTWARE :

4.1 . Modelling of beam - column joint in ansys

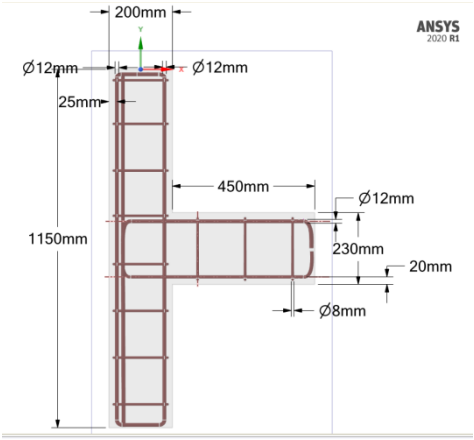


Fig 4. Modelling details of beam - column joint

4.2. Deflection of beam - column joint in ansys

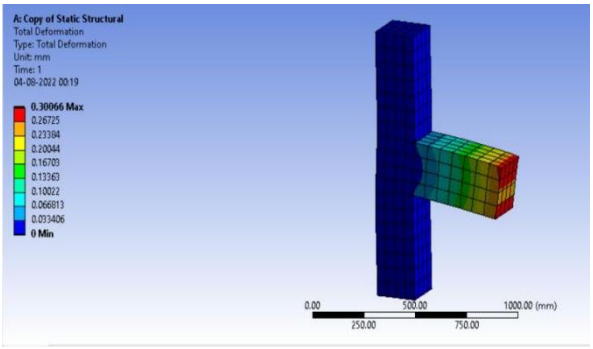
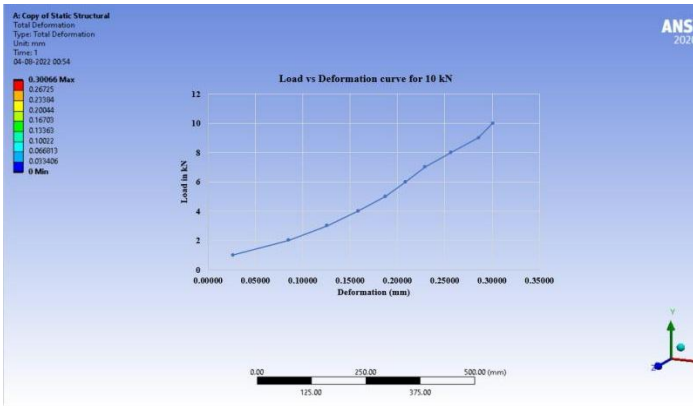


Fig 5.Deflection of beam - column joint in ansys



Graph 2.Analytical results in Ansys software

4.3. Shear force

Fig 6.Shear force diagram of beam - column joint

4.4. Bending moment

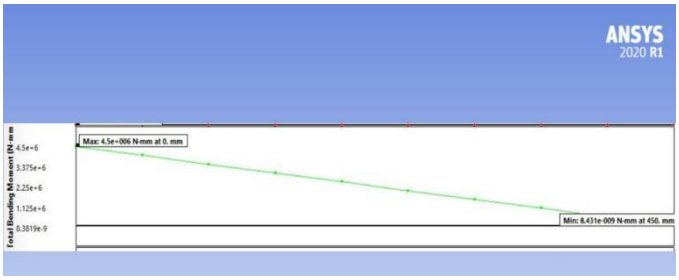
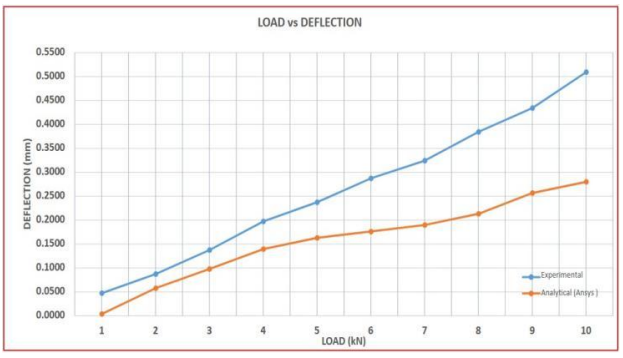


Fig 7.Bending moment diagram of beam - column joint

RESULTS AND DISCUSSION

Comparison of results in both experimental and analytical methods are done.

Sl. no	Type of method	Bending moment	Shear force	Deflections
1.	Experimental method	8.6 Kn - m	15.76 kN	0.51 mm
2.	Analytical method	4.5 kN - m	10 kN	0.30 mm



Graph 3. Load vs deflection results of analytica and experimental results

CONCLUSION:

The experimental study demonstrates based on the results that are obtained from manual analysis and ansys software analysis, it is clearly notifying that the ansys software results are more accurate as compare to manual analysis which may cause to the reduce of structural elements cross sectional area, therefore it is possible to make the sections economical and safety as well

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