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# **Review on Comparative Static Analysis of Beam-Column Junction**

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Abstract: In a multi-storey building, the beam-column joint is one of the most important regions. Usually the beam-column hinge was considered as a rigid frame. Various researchers have pointed out in recent years that the joint is not stiff. It is now also noted that instead of failure in the beam and column, failure can occur in the joint; therefore, the joint should be considered as a structural member. Indian standards define a joint as part of a column in the depth of the deepest beam that frames the column. In framed structures, the bending moment and shear force are maximum at the joint area. Therefore, the connection of the beam column is one of the failure zones. Among the joints of the beam column, the outer joint is more critical. In this shared working beam column, you should model with ANSYS software for different types of concrete. Voltage and deformation results must be obtained and the optimal model.

Keywords: Exterior beam column joint, lateral loads, ANSYS

### **I. INTRODUCTION**

The behavior of the reinforced concrete moment, which resists frame structures in recent earthquakes around the world, has highlighted the consequences of poor performance of the beam column joints. Protein connections are critical regions in the reinforced concrete frame, and it is designed to withstand strong earthquakes. According to the philosophy of design capacity, loops should be formed only on the beam. Extensive research has been conducted over the past three decades to study the performance of the beam joint under seismic forces through analytical and experimental studies. It is generally accepted that it is uneconomical to design reinforced concrete structures for strong ground movement without damage.

Earthquakes are one of the most feared natural phenomena, which are relatively unexpected and the impact of which is sudden due to the almost instantaneous destruction that can cause a large earthquake. The severity of ground jitter in a given place during an earthquake can be negligible, moderate and severe, which are relatively common, periodically and rarely, respectively. Thus, the main intention is to make the construction resistant to earthquakes that resist the effects of ground shivering, although it can be severely damaged, but will not collapse even during a strong earthquake.

### **II. LITERATURE REVIEW**

Murty, C.V.R., Rai, D.C., Bajpai, K.K. and Jane, S.K. (2003) [5] tested the connection of the column of the outer beam subject to static cyclic load, changing the details of the beam reinforcement and shear reinforcement. It was reported that practical joint detail using pin type reinforcement is a competitive alternative to closer ties in the common region.

Scott, R. H. (1992) [6] conducted research, changing the reinforcement pattern using curved, curved and U-bars. It has been observed that U-bars show the highest load capacity, while curved and curved bars fail due to traction.

Hegger Josef, Sheriff Alaa and Roser Wolfgang [8] in this document investigate the behavior of external and internal beam-column connections using nonlinear finite element analysis using ATENA software for nonlinear analysis of reinforced concrete structures. The model was calibrated according to the results of tests of the third author. The behavior of the outer and inner column beams was different .The parameters that affect the shear strength are not the same for both types of connections.

### **III. METHODOLOGY**

The following models are prepared using ANSYS software:

1. Model-I: Beam Column Joint for M40 grade of concrete Copyright to IJARSCT DOI: 10.48175/568 www.ijarsct.co.in



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- 2. Model-II: Beam Column Joint for M50 grade of cocnrete
- 3. Model-III: Beam Column Joint for M60 grade of cocnrete

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Figure 2:Properties of the Steel



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Figure 3:Geometry of the model

Details of Geometry of the model-I Object Name: Geometry State Fully Defined

### Definition

Type: SpaceClaim Length Unit: Meters Element Control: Program Controlled Display Style: Body Color

### **IV. RESULTS**

Model I(M40 grade of concrete) The results of model I are as follows



### Figure 4: Total Deformation of model-I

The above figure gives the details about the Total Deformation of model-I as obtained in the ANSYS software. The different colors indicates the details about the deformation in different area of the model.



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Figure 5:Equivalent plastic strain for rebar of model-I

The above figure gives the details about the Equivalent plastic strain for rebar of model-I as obtained in the ANSYS software. The different colors indicates the details about the Equivalent plastic strain for rebar in different area of the model.



Figure 6:Equivalent stress for rebar of model-I

The above figure gives the details about the Equivalent stress for rebar of model-I as obtained in the ANSYS software. The different colors indicates the details about the Equivalent stress for rebar in different area of the model.



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Model-II (M50 grade of concrete)

The following results gives the details of model-II i.e. M-50 grade of concrete used in the beam column junction.



Figure 7: Total Deformation of model-II

The above figure gives the details about the Total Deformation of model-II as obtained in the ANSYS software. The different colors indicates the details about the deformation in different area of the model.



Figure 8:Equivalent Plastic Strain of Rebar for model-II

The above figure gives the details about the Equivalent plastic strain for rebar of model-II as obtained in the ANSYS software. The different colors indicates the details about the Equivalent plastic strain for rebar in different area of the model.

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The above figure gives the details about the Equivalent stress for rebar of model-II as obtained in the ANSYS software. The different colors indicates the details about the Equivalent stress for rebar in different area of the model.

### Model-III (M60 grade of concrete)

The following results are obtained for the case of the model-III i.e. M60 grade of concrete as used in the beam column junction.



Figure 10:Total Deformation for model-III

The above figure gives the details about the Total Deformation of model-III as obtained in the ANSYS software. The different colors indicates the details about the deformation in different area of the model.



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Figure 11: Equivalent Plastic Strain of rebar for model-III

The above figure gives the details about the Equivalent plastic strain for rebar of model-III as obtained in the ANSYS software. The different colors indicates the details about the Equivalent plastic strain for rebar in different area of the model.



Figure 12: Equivalent Stress of rebar for model-III

The above figure gives the details about the Equivalent stress for rebar of model-III as obtained in the ANSYS software. The different colors indicates the details about the Equivalent stress for rebar in different area of the model. The following results shows the details of the combined results for Model-I, Model-II and Model-III and the graphical representation gives as follows.



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Figure 13:Total Deformation (m) for all the models

From the above results it is observed that the total deformation of all the models is mentioned in the graph. The model-1 gives the maximum deformation of 2.06E-02 while the minimum results are for the model-3 and the obtained value is 1.96E-02.



Figure 14:Equivalent stress (Pa) of rebar for all the models

From the above results it is observed that Equivalent stress of rebar of all the models is mentioned in the graph. The model-3 gives the maximum Equivalent stress of rebar of 1.89E+08 Pa while the minimum Equivalent stress of rebar results are for the model-1 and the obtained value is 1.84 E+08 Pa.

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### V. CONCLUSION

From the above models related to beam column junction following conclusions are obtained:

- 1. The model-1 gives the maximum deformation of 2.06E-02 while the minimum results are for the model-3 and the obtained value is 1.96E-02.
- 2. The model-3 gives the maximum Equivalent stress of rebar of 1.89E+08 Pa while the minimum Equivalent stress of rebar results are for the model-1 and the obtained value is 1.84 E+08 Pa.
- 3. The model-1 gives the Maximum Principal stress of 6.92E+07 Pa.
- 4. The model-3 gives the Maximum Strain Energy of 4.125 E+04 J.
- 5. It is observed that as the grade of concrete is increased then the beam column junction behaves in significant manner.

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