BEHAVIOUR OF REINFORCED CONCRETE BEAM COLUMN JOINT AT ELEVATED TEMPERATURE

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Abstract

To explore the behaviour of RC BCJ subjected to fire, a FEA was done. The study's goal was to look at fire resistance and fire danger after the fire had been extinguished. The maximum danger time, defined as the period between fire extinguishment and collapse of beam column junction was found. In this investigation the main objective is to check the behaviour of the BCJ when model is subjected to 50%- 70% of design load under elevated temperature in accordance to fire curve (ISO 834). The conclusion made in this work shows that the deformation is increases when design shear is applied in beam.

Introduction

The general goals of fire protection are to reduce the hazards to life, society, property, and surrounding property in the event of a fire. Exposure to fire or high temperatures is a severe circumstance that causes changes in material qualities and, as a result, changes in overall behaviour. After the incident of WTC on 11 September 2001 (USA) and TAJ HOTEL on November 2011 an important aim is to prevent building from fire hazards. When a longitudinal member in structure subjected to elevated temperature is tends to elongate and distribution of temperature in adjacent column is studied by previous researchers.

Normal fire has an impact on RC members by raising the temperature of the concrete mass. The mechanical properties of steel and concrete deteriorate as temperatures rise. They may also cause concrete member surface particles to explode. Concrete, on the other hand, can sustain significant damage when exposed to prolonged fire or extremely high temperatures.

The goal of this paper is to check behaviour of RC BCJ under elevated temperature subjected to 40% -70% load of ultimate load.

FINITE ELEMENT MODELING OF RC BEAM COLUMN JOINT

Finite Element Analysis (FEA) is a numerical approach for solving issues that would otherwise be difficult to solve. The numerical analytical studies were carried out using the commercial programme ANSYS. This software is a strong engineering simulation software package based on the finite element method that can address issues ranging from relatively easy linear analyses to the most difficult non-linear simulations. An ANSYS structural analysis is done in three steps

- Pre-processing P – Defining the finite element model
- Analysis solver – solution of finite element model
- Post processing of results.

Over the last two decades, advances in computer-aided engineering have been enormous, resulting in considerable benefits to various engineering organisations. The application of current finite element techniques in the building industry has permitted not only the introduction of unique and efficient building products, but also the creation of accurate design procedures. Here SOLID186 and SOLID187 elements are used to model RC column beam junction.

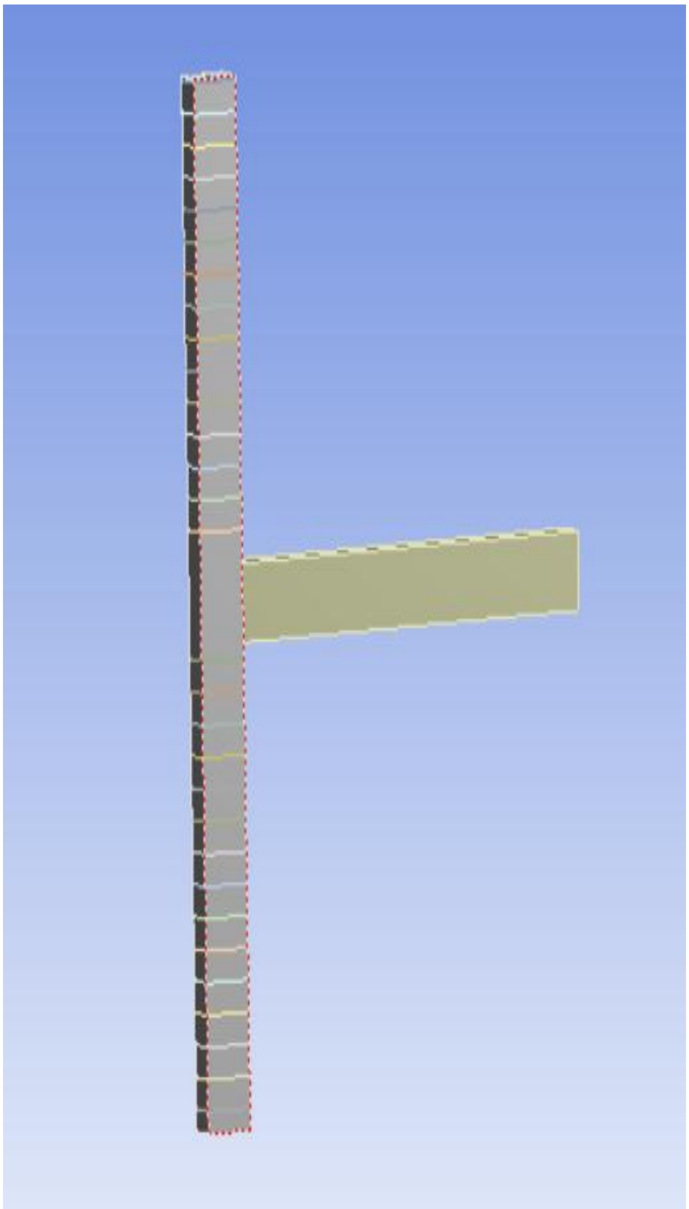

Fig 1: RC beam column joint model

MTETHOD OF ANALYSIS

ANSYS Finite element Software is used to carry out the analytical procedure. The model is investigated in order to learn about the structural behaviour of an RC beam column joint at high temperature in a real-world scenario. The prototype model is created and tested. The prototype model employs transient state analysis for analysis. The column will deliver 40%-70% of its ultimate load in the transitory condition, and the temperature will steadily rise until it collapses.

RESULTS AND DISCUSSION

Deformation in beam:

ANSYS Finite element Software is used to carry out the analytical procedure. The model is investigated in order to learn about the structural behaviour of an RC beam column joint at high temperature in a real-world scenario. The prototype model is created and tested. The prototype model employs transient state analysis for analysis. The column will deliver 40%-70% of its ultimate load in the transitory condition, after the temperature load applied.

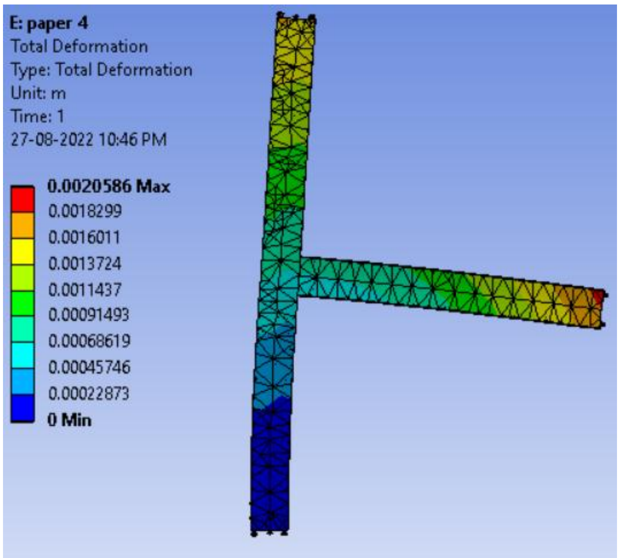

Fig 2: deflection at 40% of ultimate load

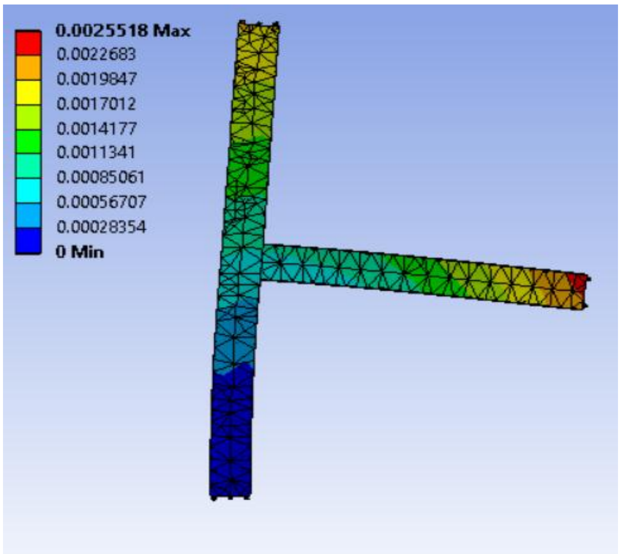

Fig 3: deflection at 50% of ultimate load

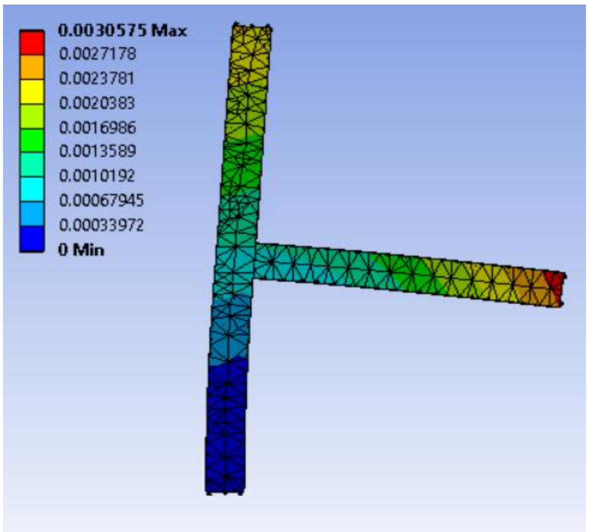

Fig 4: deflection at 60% of ultimate load

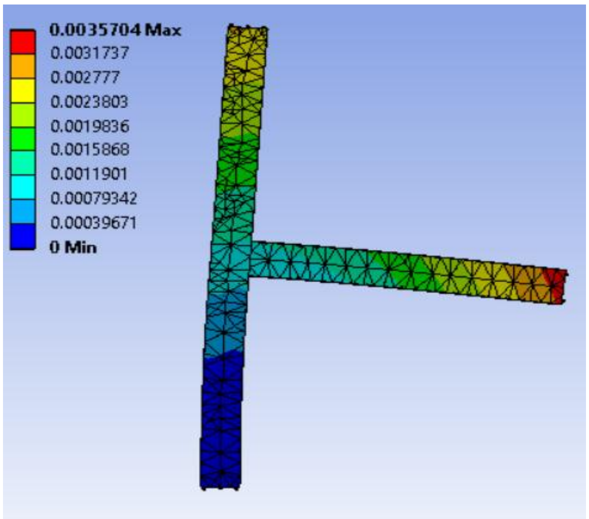

Fig 5: deflection at 70% of ultimate load

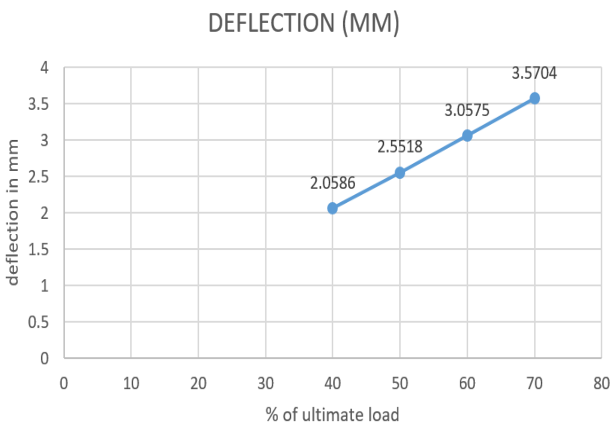

Fig 6: deflection v/s ultimate load

The results reveal that when the proportion of maximum load and temperature conditions grow over time, the column deformation and rotation increase, and the column fails promptly.

CONCLUSION

The RC beam column junction is studied at high temperatures in transient states. The RC finite element model is exposed to varied loadings such as forty, fifty, sixty and 70% of ultimate load at high temperatures over time. At high temperatures, the steel and concrete attempt to expand, resulting in the creation of fracture at the beam and column junction and these cracks leads to failure. As the load is increasing the deformation is also increasing (fig 6).

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