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EXPERIMENTAL AND NUMERICAL ANALYSIS OF RCC BEAM WITH SURFACE REINFORCEMENT

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Abstract - In RCC structures design criterias of different countries are given through different codes of procedure. For reinforced concrete structures concrete takes the compression and steel takes the tension. There are different types of reinforcement used in RCC structures for shear, torsion, seismic loadings etc. In Eurocode, another type of reinforcement named as surface reinforcement, which is not given in IS 456:2000. Surface reinforcement is a type of reinforcement should consist of wire mesh or small diameter bars, and be placed outside the links and it is provided when the cover of reinforcement of structural members exceeds 75mm, and it may be appropriate to provide a surface reinforcement. This research work deals with the application of surface reinforcement in beams in all conditions by without considering the provisions given in Eurocode for surface reinforcement. Thermal resisting capacities of an RCC beam specimen with and without surface reinforcement calculated Models were developed by considering these criteria and that were analysed by using ANSYS 2022 software

Key Words*: *ANSYS, Surface reinforcement

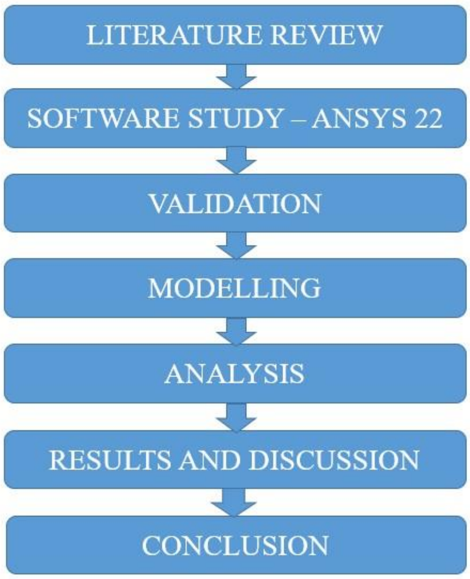
1.INTRODUCTION

In reinforced concrete structures concrete takes the compression and steel takes the tension. There are different types of reinforcement used in RCC structures for shear, torsion, seismic loadings etc. Surface reinforcement is a type of reinforcement should consist of wire mesh or small diameter bars, and be placed outside the links. It is used to resist spalling should be used where the main reinforcement is made up of bars with diameter greater than 32 mm or bundled bars with equivalent diameter greater than 32 mm. The area of surface reinforcement should be not less than in the two directions parallel and orthogonal to the tension reinforcement in the beam. Where the cover to reinforcement is greater than 70 mm, for enhanced durability similar surface reinforcement should be used, with an area of 0.005 times area of concrete external to the links in each direction. The longitudinal bars of the surface reinforcement may be taken into account as longitudinal bending reinforcement and the transverse bars as shear reinforcement provided that they meet the requirements for the arrangement and anchorage of these types of reinforcement.

2. OBJECTIVE

- To identify properties of structural components by comparing properties of a beam with and without surface reinforcement
- To calculate Thermal resistance of the beam with and without surface reinforcement

3. METHODOLOGY



4. MODELLING

In the present study, a reinforced concrete beam of 200x600mm and 3000mm long is taken. Reinforcement for the beam Two numbers of 10mm diameter HYSD bars are used at the bottom and two numbers of 8mm diameter HYSD bar at the top were used as main reinforcement. Two legged of 6mm diameter bar are provided as stirrups. Surface reinforcement consist of wire mesh or small diameter bars, and be placed outside the links or stirrups. Steel mesh of 4mm diameter longitudinal and transverse bars spacing of 25mm of (19x115) cm section is used.The model will then import to ANSYS and the external wall to be analyzed will be optimized by further analysis using ANSYS.

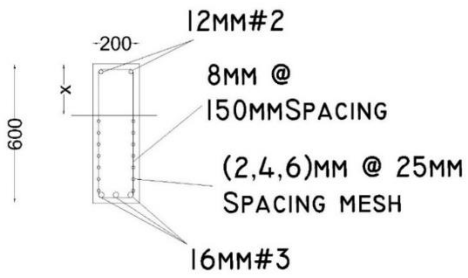


Fig. 4.1 Beam section with surface reinforcement

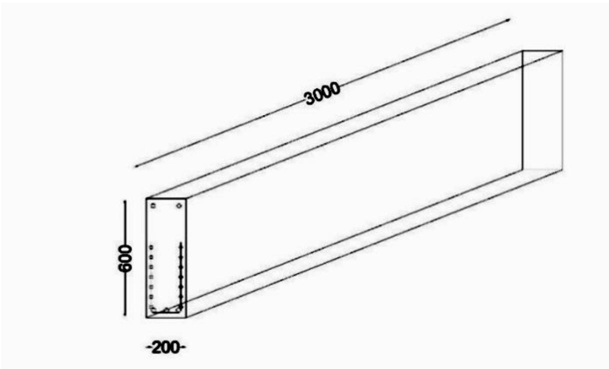


Fig. 4.2 Beam with surface reinforcement

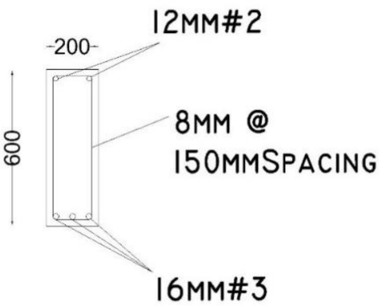


Fig. 4.3 Beam section without surface reinforcement

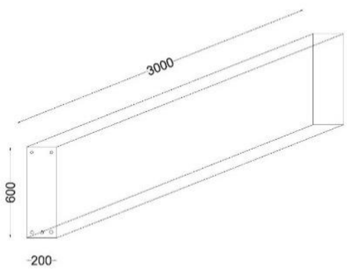


Fig. 4.4 Beam without surface reinforcement

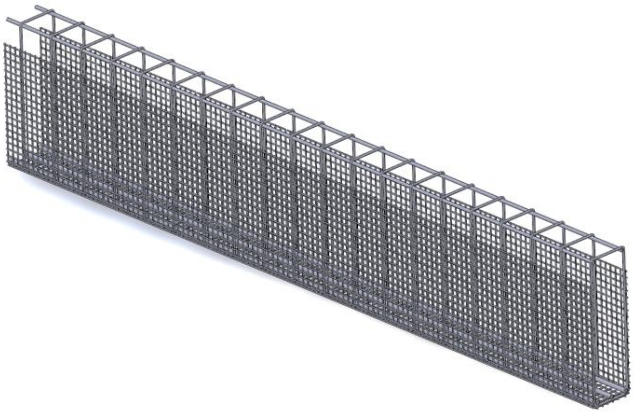


Fig. 4.5 Surface reinforcement

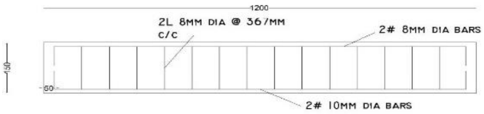


Fig. 4.6 Longitudinal section

5. TYPES OF MODELS

On the basis of provision of surface reinforcement in beams as with surface reinforcement and without surface reinforcement and distance between top of reinforcement and top of the beam, there are 5 models are created.

Table No 5.1Model types

Types	Surface reinforcement
T1	Not provided
T2	Provided

Table No 5.2 Classification

X Value (mm)	Name
100	T2M1
200	T2M2
300	T2M3
400	T2M4

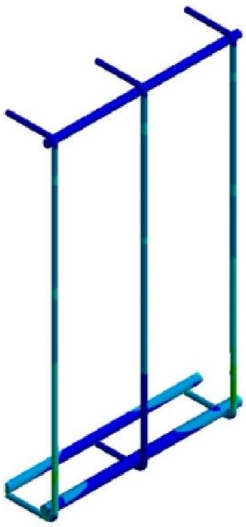


Fig 5.1 Reinforcement section in T1

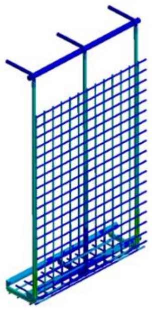


Fig 5.2 T2M1

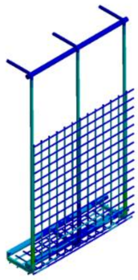


Fig 5.3 T2M2

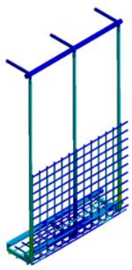


Fig 5.4 T2M3

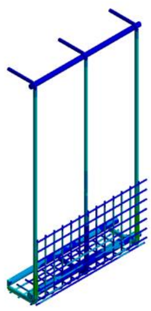


Fig 5.5 T2M4

`6. NUMERICAL ANALYSIS

Thermal analysis is a branch of materials science where the properties of materials are studied as they change with temperature. Thermal analysis calculates the temperature and heat transfer within and between components in your design and its environment. This is an important consideration of design, as many products and material have temperature dependent properties. Engineers commonly use temperatures that a transient thermal analysis calculates as input to structural analyses for thermal stress evaluations. A transient thermal analysis follows basically the same procedures as a steady-state thermal analysis. The main difference is that most applied loads in a transient analysis are functions of time. A Steady state thermal analysis may be either linear with constant material properties or nonlinear with material properties that depend on temperature. The thermal properties of most material do vary with temperature, so analysis is usually nonlinear.

7. RESULTS

For the analysis of thermal load, Finite element tool ANSYS 2022 was used. Temperature of 1300°C is used as thermal load in one face of specimen. Heat transfer by convection from one face to another in all models are evaluated by using the software. After analysis of models in ANSYS 2022 thermal resistance of all models are computed and sorted out.

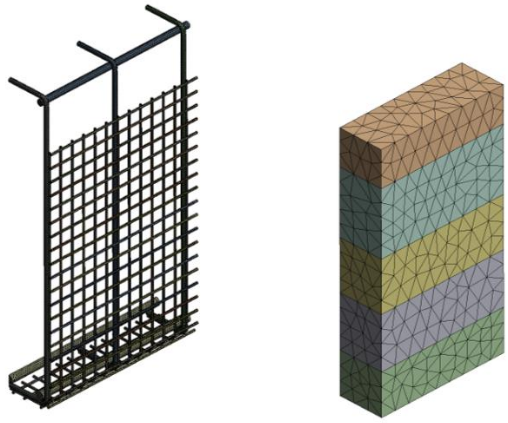


Fig. 7.1 Tetrahedron meshing

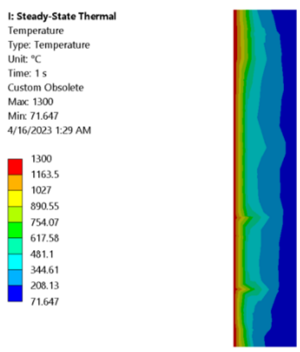


Fig. 7.2 Thermal loading in T2M1

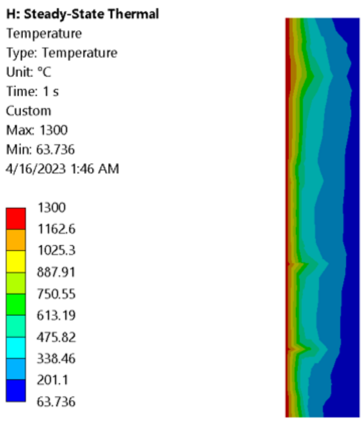


Fig. 7.3 Thermal loading in T2M2

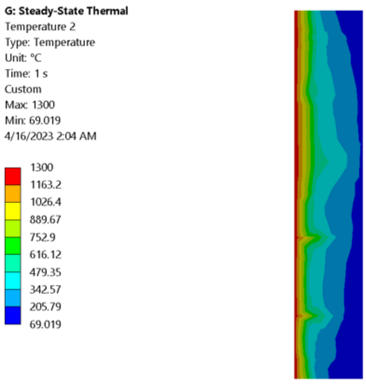


Fig. 7.4 Thermal loading in T2M3

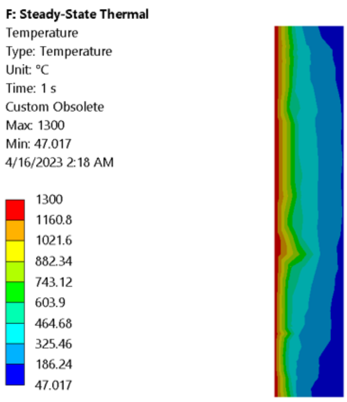


Fig. 7.5 Thermal loading in T2M4

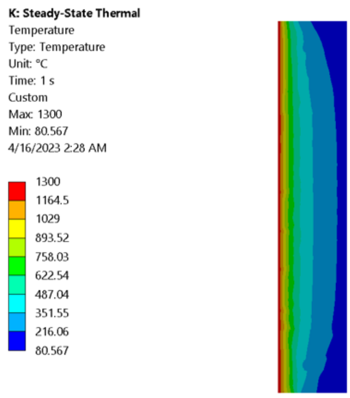


Fig. 7.6 Thermal loading in T1

Table 7.1 Heat transfer in percentage

Model name	Percentage heat passing (%)
T1	6.19
T2M1	3.61
T2M2	4.90
T2M3	5.30
T2M4	5.51

3. CONCLUSIONS

- Surface reinforced specimen conducts half of the heat compared to beam specimen without surface reinforcement. Max percentage of heat conducted in model T1 and minimum is in T2M1.T1represents the specimen without surface reinforcement. T2M1 represents the specimen with reinforcement with an X value of 100mm.Providing surface reinforcement improves heat resistance capacity in concrete beams. There is an increase of 42% thermal resistance in surface reinforced beam compared to beam conventional RCC beam.

ACKNOWLEDGEMENT

The heading should be treated as a 3rd level heading and should not be assigned a number.

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