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STUDY ON REINFORCED CONCRETE EXTERIOR BEAM COLUMN JOINT WITH PARTIAL REPLACEMENT OF CEMENT BY SIFCON

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ABSTRACT

In recent days, strengthening of structures has gained more importance. In earthquake prone zone, ductility is a desirable factor for increased life. Conventional reinforced concrete structures are brittle in nature with limited ductility. Hence to increase the life of the structures under the effect of earthquake force, lot of strengthening techniques have been developed and adopted over the years. From the past earthquakes, it was observed that the major collapse of structures has occurred due to the failure of beam-column joints. Repairing of damaged beam-column into is extremely difficult and least successful one. Hence the damage has to be prevented. Laboratory experiments have shown that SIFCON possess both high strength and large ductility. SIFCON (Slurry Infiltrated Fibrous Concrete) is one of the evolving techniques used for strengthening of structures. The behavior of SIFCON under cyclic loading is better than that of reinforced concrete. Hence it is proposed to study the behavior of beam-column joints strengthened with SIFCON.

1. INTRODUCTION

Multi-storied structures are the need of the hour due to low availability of construction area, attributed to increase in population density and increase in cost of land. Reinforced concrete framed structures, capable of carrying heavy loads with limited sectional area, is a wise choice for multi-storied buildings. In seismic design, reinforced concrete framed structures should perform satisfactorily under severe load conditions. To withstand large lateral loads without severe damage, structures need strength, ductility and energy dissipation capacity. It is commonly accepted that, it is uneconomical to design reinforced concrete structures for the greatest possible earthquake ground motion to avoid damage. Therefore, the need for strength and ductility has to be weighed against economic constraints. Ductility is an essential property of structures during severe earthquakes. Ductility is defined as the ability of sections, members and structures to deform in elastically without excessive degradation in strength or stiffness. The most common and desirable sources of inelastic structural deformations are rotations in potential plastic hinge regions. An energy dissipation mechanism should be chosen so that the desirable displacement ductility is achieved with smallest rotation. In normal design practice for gravity loads, the design check for joints is not critical and hence not warranted. But, the failure of reinforced concrete frames during many earthquakes has demonstrated heavy distress due to shear in the joints that end in the collapse of the structure. Detailed studies of joints for buildings in seismic regions have been undertaken only in the past three to four decades.

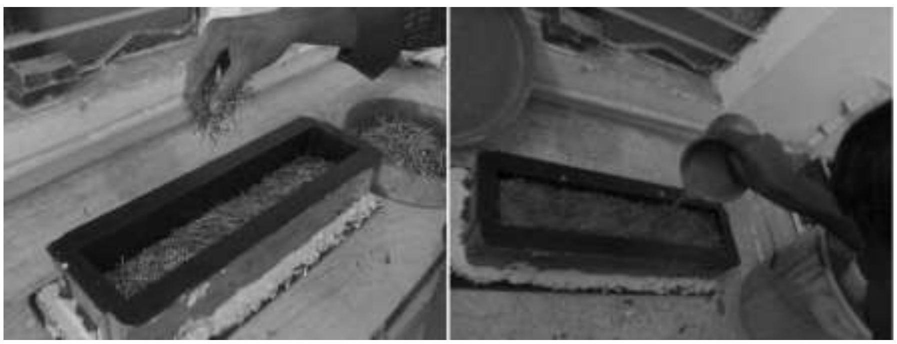

Figure 1. SIFCON specimens under casting

Based on the lessons learnt from past earthquakes, it is inferred that the structure should have high strength, high ductility, lateral stability and core confinement to resist earthquake forces. Strengthening of beam-column joints significantly improve the performance of the structures in seismic zones.

2. EXPRIMENTAL ANALYSIS

Three specimens were then strengthened with 20 mm thick SIFCON laminates using isophthalic resin. All the specimens were subjected to reverse cyclic loading to simulate earthquake loading conditions. From the experimental study, the load carrying capacity, ductility factor and energy absorption capacity of the beam-column joints were studied.

Material	**Mix Proportion**
Cement: Micro Silica: Fly Ash: Quartz Flour	1 : 0.1 : 0.5 : 0.5
Fiber Volume Fraction	9%
Water / binder ratio	0.45

Table.1. Mix proportion for SIFCON

The physical properties of aggregates stem from the inherent properties of the source rock; these include texture, structure, and mineral composition. Textural properties give rise to internal characteristics, of which the pore size is perhaps most important and it gives Unit Weight and Voids, Specific Gravity, Particle Shape and Surface Texture, Shrinkage of Aggregates, Absorption and Surface Moisture, Resistance to Freezing and Thawing and Freshly mixed concrete containing micro silica can be almost White, dark gray, or practically unchanged, depending on the dosage of micro silica and its carbon content. The more carbon and iron in the admixture, the darker the resulting concrete.

3. TESTING ANALYSIS

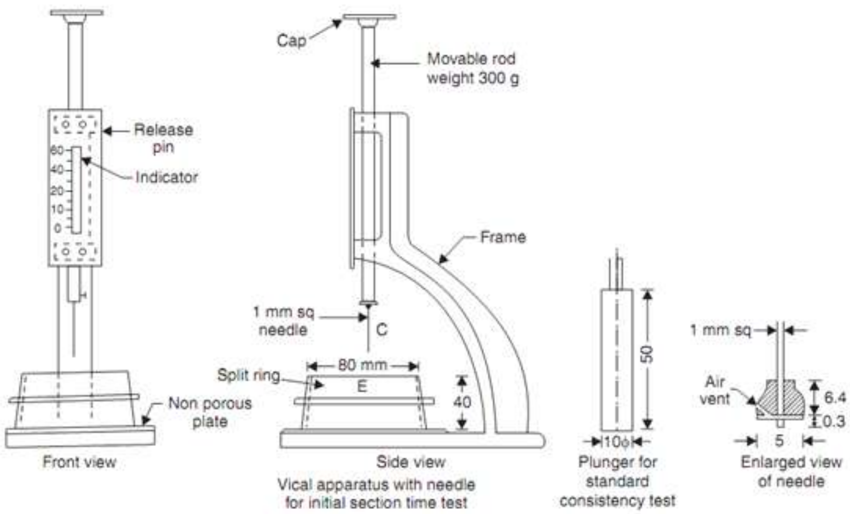

Fig.2. Vicat apparatus

SI. NO.	SAMPLE TAKEN IN Grams	% OF WATER	GAUGING TIME IN (MIN)	READING ON VICAT APPARATUS
1	400	25	3	38
2	400	28	3	19
3	400	29	3	05

Table.1. Reports of test results

Fill the vicat mould with the paste, the mould resting upon a non-porous plate. Smooth off the surface of the paste, making it level with the top of the mould. The mould shall be shaken to expel the air .Place the test block in the mould, together with the non-porous resting plate under the rod bearing the plunger. Lower the plunger gently to touch the surface of the test block and quickly release, allowing it to sink into the paste. Prepare the trial paste with varying percentages of water (starting from 25% and increasing by 1%) and test as described above until the amount of water necessary for making of the standard consistency.

4. TESTS ON FINE STRENGTH

Empty weight of pycnometer is to be taken (W_1).About 1/3 portion of the pycnometer is filled with an aggregate and it is weighed (W_2).Now the same pycnometer is to be filled with water and it is weighed (W_3).The pycnometer is to be cleaned and filled completely with only water and it is weight is to be taken (W_4).

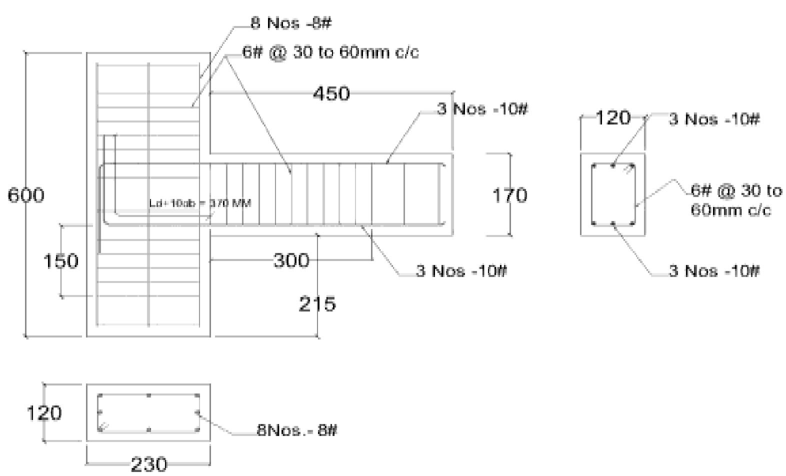

Figure .3. Reinforcement details of beam-column

The sizes of the beam and column sections were obtained from literature and they are 120 x 170 mm and 120 x 230 mm, respectively [9]. The length of column was 600 mm and length of beam was 450 mm, projecting from the face of the column. M20 grade concrete and Fe415 steel were used. The reinforcement detailing is shown in Figure 3.2. Eight numbers of 10 mm dia rods were used as main reinforcement for beam. Eight numbers of 8 mm dia rods were used as main reinforcement for column.6 mm dia ties were used for both beam and column.

5. RESULTS AND DISCUSSION

In this chapter, the results obtained from experimental analysis and numerical analysis are discussed. The load deflection behaviour, energy absorption and ductility obtained from the experimental investigation of the strengthened specimen are compared with that of the control specimen. The numerical analysis results of the specimen are compared with the experimental results. Load - deflection curve was plotted based on the experimental results. The load-deflection curve of control specimen (RC) and the strengthened specimen. There is a 60% increase in first crack load and 23%

increase in the ultimate load of the strengthened specimen over. Energy absorption capacity of each cycle is calculated from the area under the load-deflection curve of each cycle.

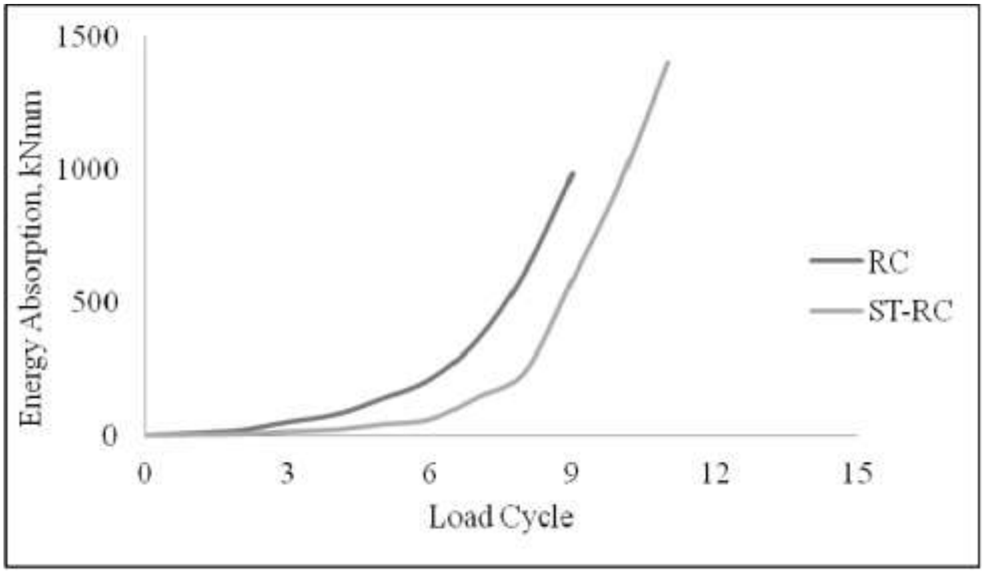

Figure.4. Variation of cumulative energy absorption capacity with load cycle

CONCLUSION

The load carrying capacity of strengthened beam-column joint was 23% more than that of control specimen and the first crack load of strengthened beam-column joint was 53% more than that of control specimen, the energy absorption capacity of strengthened beam-column joint was found to be 40% more than that of control specimen. SIFCON can be used for strengthening reinforced concrete beam-column joints.

REFERENCES

1. Alper Büyükkaragöz (2010), "Finite Element Analysis of the Beam Strengthened with Prefabricated Reinforced Concrete Plate", Scientific Research and Essays, Vol. 5, No. 6, pp. 533-544.

2. Amer M. Ibrahim and Mohammed Sh. Mahmood (2009), "Finite Element Modeling of Reinforced Concrete Beams Strengthened with FRP Laminates", European Journal of Scientific Research, Vol. 30, No. 4, pp. 526-541.

3. Amit Jindal (2012), "Finite Element Modelling of Reinforced Concrete Exterior Beam-Column Joint Retrofitted with Externally Bonded Fibre Reinforced Polymer (FRP)", M.E. Thesis, Thapar University, Punjab.

4. Anthony J. Wolanski (2004), “Flexural Behavior of Reinforced and Prestressed Concrete Beams using Finite Element Analysis”, M. S. Thesis, Marquette University, Wisconsin.

5. Antonio F. Barbosa and Gabriel O. Ribeiro (1998), “Analysis of Reinforced Concrete Structures using ANSYS Nonlinear Concrete Model”, Computational Mechanics: New Trends and Applications, CIMNE, Barcelona, Spain, pp. 1-7.

6. Antony Jeyasehar C. and Balamuralikrishnan R. (2012), “Strengthening of Structures by HPFRCC Laminates”, Asian Journal of Civil Engineering (Building and Housing), Vol. 13, No. 1, pp. 29-42.

7. Antony Jeyasehar C. and Ravichandran K. (2013), “Cyclic Behaviour of Beam Column Joint Retrofitted with SIMCON Laminates”, Asian Journal of Civil Engineering (BHRC), Vol. 14, No. 2, pp. 269-288.

8. Balaguru P. (1987), “Behaviour of Slurry Infiltrated Fibre Concrete (SIFCON)”, Proceedings of the International Symposium on Fibre Reinforced Concrete, Madras, India, pp. 7.25-7.36.

9. Balaji S. and Thirugnanam G.S. (2012), “Experimental study on behaviour of SIFCON beam column joints subjected to cyclic loading”, Journal of Structural Engineering, SERC, Chennai, In press

10. Balamuralikrishnan R. and Antony Jeyasehar C. (2009), “Retrofitting of RC Beams with Externally Bonded SIMCON Laminates”, The Open Civil Engineering Journal, Vol.3, pp. 34-40.