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Study on RC Jacketed Rectangular Column under Axial load

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Abstract: ***One strategy for the jacketing of reinforced concrete column is to target the improvement of local vulnerabilities in columns related to inadequate strength (compressive & Flexural) or poor ductility. Theoretical analysis have been carried out in the present study for different column sections of jacket thickness of 75mm and 100mm for jacketed RC columns subjected to axial compressive loading for rectangular column. The axial load carrying capacity along the major axes has been carried out under balanced section condition. Linear static finite element analysis has been carried out for the jacketed RC columns to compare the confined concrete strength (fcc) of finite element analysis with that of theoretical analysis, to plot the variation of stresses at the central core concrete and at the interface of old and new concrete. The displacements at core with respect to both major and minor axis are also plotted. Considerations have been given for variations in the properties of different types concretes used in the jacket and the original column. In order to find out the increase in the confined capacity of jacketed columns due to strengthening with respect to original column, theoretical analysis has been carried out.***
Keywords: axial load, NISA Display IV, Jacketing, confined compressive strength.

I. INTRODUCTION

Reinforced concrete is a composite in which steel reinforcement bars ("rebar's"), reinforcement grids, plates or fibers have been incorporated to strengthen the concrete. It was invented by French Joseph Monier in 1849 and patented in 1867. The term Ferro Concrete refers to concrete that is reinforced with iron or steel. Other materials used to reinforce concrete are organic and inorganic fibers as well as composites in different forms. Concrete is strong in compression, but weak in tension, thus adding reinforcement increases its strength in tension. In addition, the failure strain of concrete in tension is so low that the reinforcement has to hold the cracked sections together.

II. OBJECTIVES OF THE PRESENT STUDY

A. The Primary Objectives of the Present Study are

1) To find the confined and unconfined capacity of the jacketed RC columns subjected to axial load using the method based on Sheikh and Usurer's model.

2) To obtain the strength gain factor K using the confined and unconfined capacity for Axial loaded columns for rectangular columns.

III. METHODOLOGY

To study the variation of stresses at the central core concrete, at the interface of old and new concrete and at the column surface and lateral displacement along the length of the column, first theoretically calculate the axial compression convert it to the pressure and apply that load on the FEM model and execute it. Then plot the variation of stresses and displacement. Then also compare the increases in the confined capacity of jacketed columns with respect to the original column

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Table 1: Dimensions of rectangular columns for Axial load (Both Theoretical and F E M Analysis)

Type of column	Column Dimension	Spacing	Percentage of steel		Longitudinal Steel Provided	
			Original Column	Jacketed Column	Original column (number and diameter of main bars)	Jacketed column (number and diameter of main bars)
Rectangular Columns	230x230	100	2% gross area of original column	1% gross jacketed area	8#20	8#16
	230x300	150				4#16+8#12
	300x450	200				12#12
	300x600	250				16#25
	450x600	300				12#25

A. Theoretical Analysis of Jacketed RC Axial Rectangular Columns

The method based on Sheikh and Usurer's has been used for the theoretical analysis of jacketed RC column subjected to axial load. The grade of the original column concrete considered is 25MPa and that of jacket concrete are 30MPa. From below table it can be noticed that in case of rectangular columns of different dimensions the confined capacity of jacketed column, strength gain factor(k) and confined concrete strength (fcc) decreased considerably as the spacing of bars increased. In turn the unconfined capacity of jacket column remains constant irrespective of varied spacing and thickness of jacket.

Table 2: Comparison of axial compression component of original and jacketed column

Column Dimension (mm)	Spacing (mm)	100mm jacket, 16#25, fci=25, fco=30Mpa			Confined concrete Strength (fcc) in MPa
		Confined capacity of Jacketed column (KN)	Unconfined capacity of Jacketed column(KN)	Strength gain factor (K)	
230x300	100	10433.82	5806.55	1.79	39.98
230x300	150	10397.93	5806.55	1.79	38.98
230x300	200	10347.88	5806.55	1.78	37.59
230x300	250	10280.91	5806.55	1.77	35.73
230x300	300	10204.47	5806.55	1.75	33.61
230x450	100	12488.99	7569.05	1.65	40.36
230x450	150	12445.62	7569.05	1.64	39.63
230x450	200	12383.89	7569.05	1.63	38.58
230x450	250	12285.38	7569.05	1.63	36.95
230x450	300	12123.08	7569.05	1.60	34.23
300x450	100	14103.90	8776.55	1.60	40.83
300x450	150	14070.35	8776.55	1.60	40.44
300x450	200	14027.65	8776.55	1.59	39.95
300x450	250	13970.96	8776.55	1.59	39.29

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300x450	300	13893.71	8776.55	1.58	38.39
300x600	100	16599.18	10801.55	1.53	40.95
300x600	150	16560.77	10801.55	1.53	40.63
300x600	200	16512.67	10801.55	1.52	40.23
300x600	250	16448.98	10801.55	1.52	39.70
300x600	300	16360.53	10801.55	1.51	38.96

B. Finite Element Modeling

Finite element modelling is described as the representative of the geometrical model in terms of a finite number of elements and nodes, which are the building blocks of the numerical representation of the model. In addition to information about elements and nodes, model also contains information about material and other properties, loading and boundary conditions. The most important step in the finite element method of structural analysis is to generate, using finite number of discrete elements, a mathematical model which should be as near as possible equivalent to the actual continuum. Such a formation of a model is referred to as structural idealization or discretization.The geometrical and material properties of the jacketed RC columns considered for analysis are given in below table.

Table 3: Geometrical and material properties

Original column dimensions (mm)	230x230, 230x300, 230x450, 230x600, 300x300, 300x450, 300x600
Column height (m)	3
Jacket thickness (mm)	50, 75 and 100
Original column concrete	
Modulus of Elasticity(MPa)	22360, 25000 and 27386
Poisson's ratio	0.15
Jacketing concrete	
Modulus of Elasticity(MPa)	27386 and 31623
Poisson's ratio	0.15
Longitudinal Reinforcement	
Modulus of Elasticity(MPa)	200000
Poisson's ratio	0.3
Stirrups	
Modulus of Elasticity(MPa)	200000
Poisson's ratio	0.3

C. 3-d Models for Square and Rectangular column of Axial Loaded Column

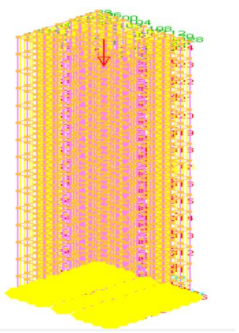

Fig 1: Modelling of jacketed RC column

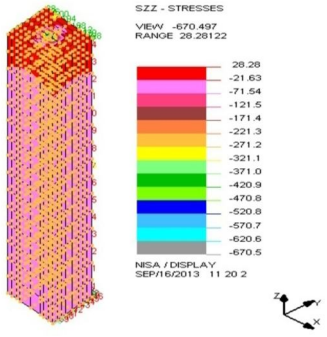

Fig 2: Isometric view of normal stress distribution in the jacketed RC column

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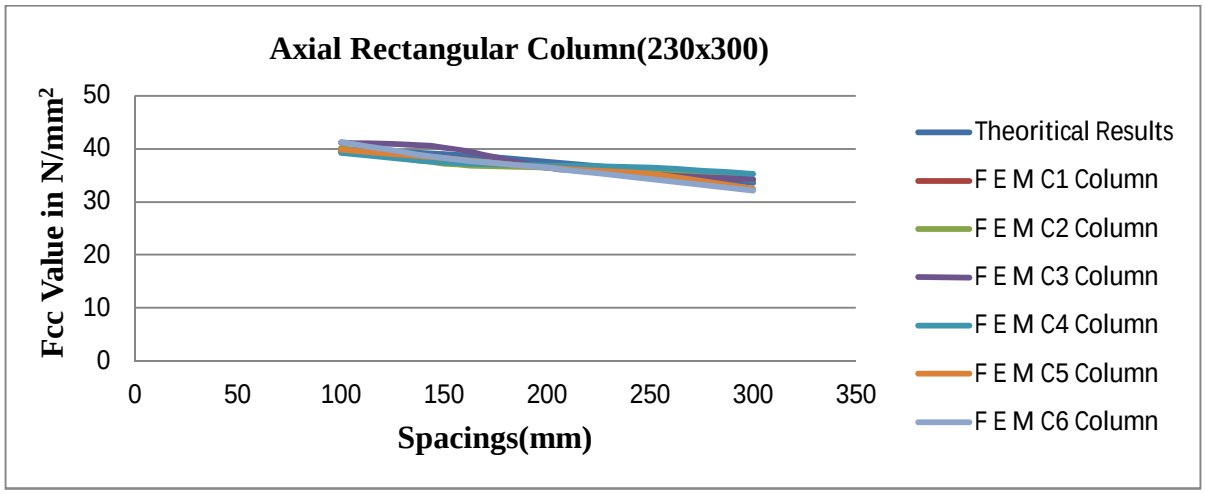
Table 4: FCC Results of Axial Loaded Rectangular Column

Column Section	Spacing	Confined concrete strength (fcc) in MPa values
		100mm jacket, 16#25, fci=25, fco=30Mpa
230x300	100	39.38
230x300	150	37.98
230x300	200	36.49
230x300	250	34.85
230x300	300	34.23
230x450	100	39.13
230x450	150	37.24
230x450	200	36.45
230x450	250	35.13
230x450	300	33.18
300x450	100	39.45
300x450	150	39.13
300x450	200	37.13
300x450	250	36.43
300x450	300	36.20
300x600	100	39.24
300x600	150	39.13
300x600	200	38.43
300x600	250	38.14
300x600	300	36.25

IV. RESULTS AND DISCUSSION

Due to confinement of core concrete by both inner and outer sets of stirrups, its original strength gets increased. In order to validate the theoretical results, the same has been compared with that of the finite element analysis results. The theoretical and finite element results obtained for the different column sections having different spacing of outer stirrups has been taken up for the comparison. The theoretical results obtained from the analysis of jacketed column of different thickness and varying concrete strength have been considered. That the results of theoretical and finite element analysis are approximately matching with some percentage of errors. Comparative errors are as shown in below graphs for with respect to theoretical analysis.

Graph 1: Comparison of Theoretical FCC Value to F E M FCC Value



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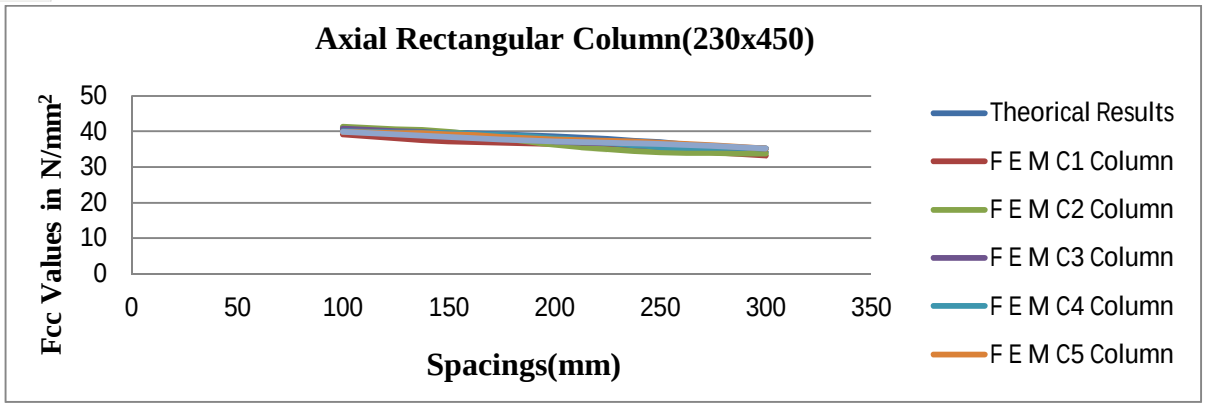

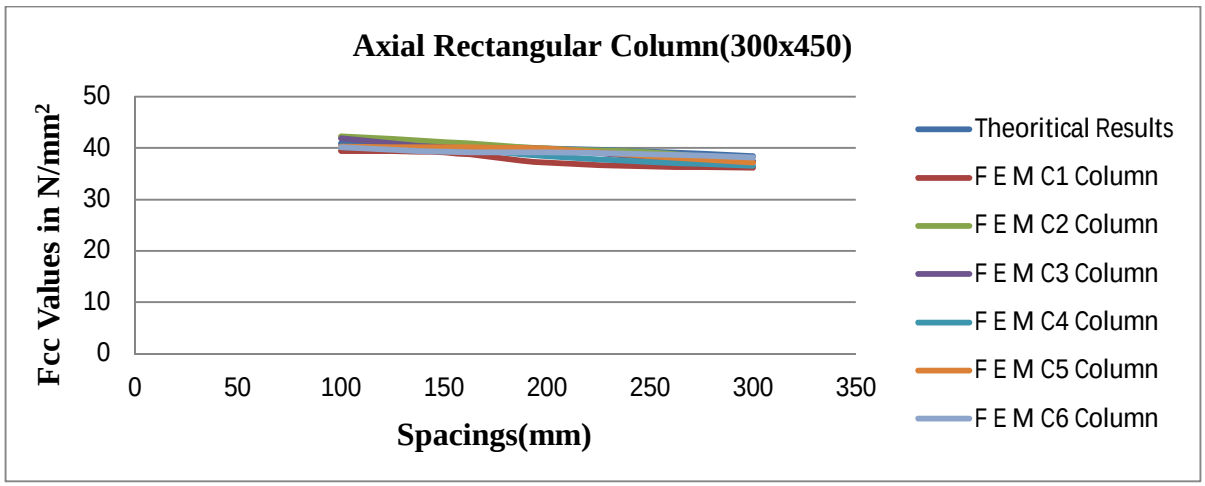

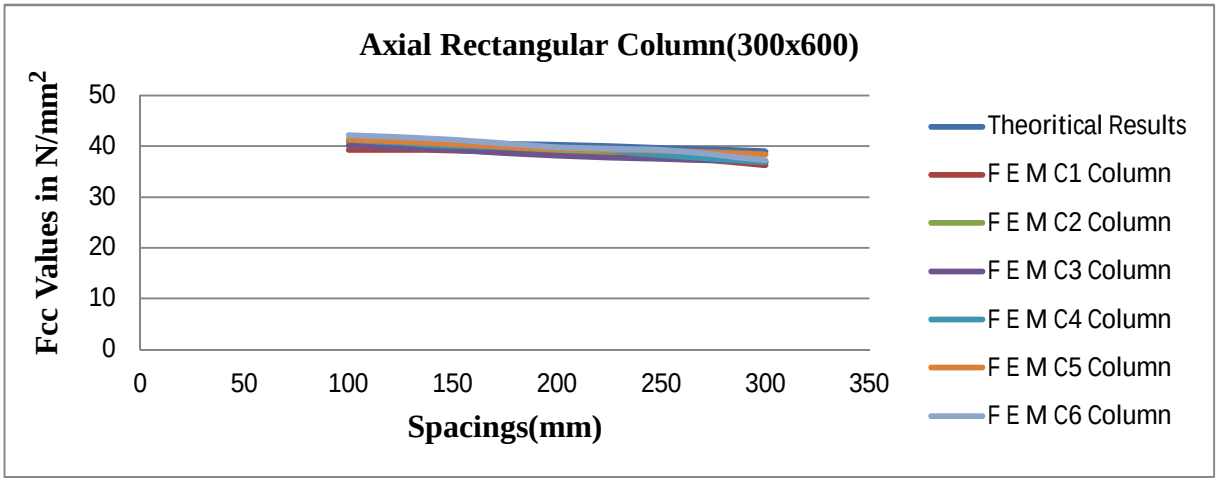

From the Above graph results of theoretical and finite element analysis are approximately matching with some percentage of errors. The percentage of errors is mentioned in the conclusion.

V. CONCLUSIONS

The object of investigation is to study the confined and unconfined capacity of jacketed R.C column. In turn to compare confined concrete strength by theoretical and F E M analysis. The conclusions are discussed in the respective chapters with results for all the aspects considered for study.

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A. R. C Jacketing can be considered for rehabilitation of column member. In which special design and construction techniques are not essential.

B. The K and fcc of axial loaded square and rectangle column will considerably decrease with increase in spacing of bars.

C. The theoretical and FEM analysis reveals that axial rectangular column the maximum error varied from positive 3.26 to negative 8.17.

REFERENCES

[1] Sheikh,S.A., and Uzumeri,S.M.(1982)."Analytical model for concrete confinement in tied columns". Journal of the Structural Division.ASCE, 108(12), PP. 2703-2722

[2] J. B. Mander, M. J. N. Priestley, and R. Park: stress-strain model for concrete subjected to uniaxial compressive loading and confined by transverse reinforcement. ASCE, Journal of structural Engineering, Vol.114, No. 8, August, 1988

[3] Bett et al (1988) "the effectiveness of three different repair and / or strengthening techniques in enhancing the lateral load and response of reinforced concrete short columns"

[4] M.Frangou et al (1995) "Structural repair of RC columns construction and building materials,Vol.9 Jan 1995,PP.259-265.

[5] Husnii et al [1995] partially jacketed (Two, Three, Four sides) Reinforced Concrete Column Behaviour under Uni-Axial

[6] Indian standard Code of practice for plain and reinforced concrete (fourth revision), IS 456-2000, Bureau of Indian standard, July 2000, New Delh

[7] K.C.G. Ong, Y. C. Kog, C. H. Yu and A. P. V. Sreekanth,[2002] "Jacketing of reinforced concrete columns subjected to axial load". National University of Singapore; CPG Consultants.

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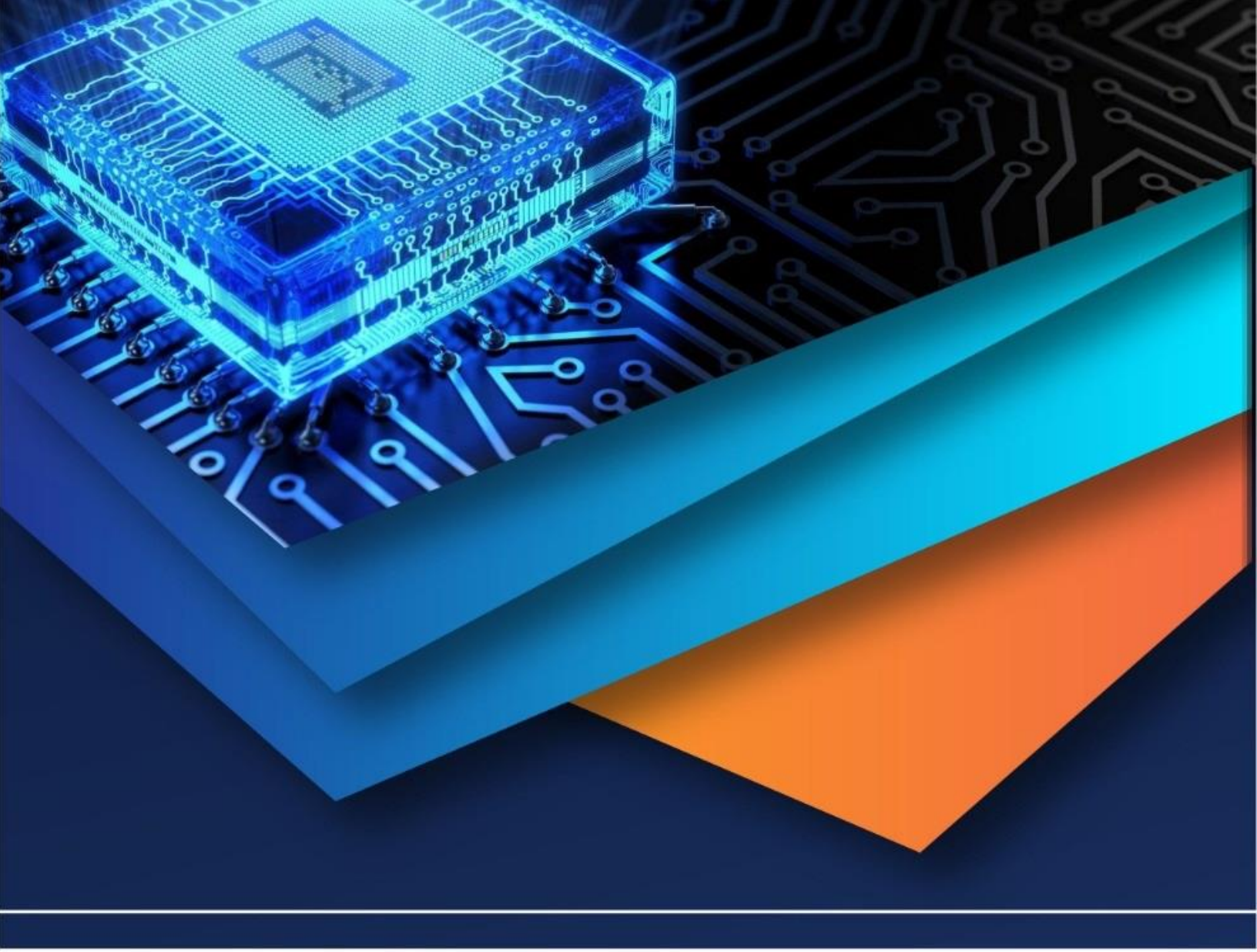

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