

STUDY OF RC JACKETED COLUMN

Varchas Koushik^{1*}, N.C. Balaji²

¹ Undergraduate, Department of Civil Engineering, The National Institute of Engineering, Mysuru

² Assistant Professor, Department of Civil Engineering, The National Institute of Engineering, Mysuru

* e-mail: varchaskoushik1@gmail.com

Introduction

This study focus on the planning and designing of a multistory building. Further, understanding the structural system of the designed building and its performance with respect to structural design. While designing building certain materials characteristics have been assumed. Experimentally, obtained the characteristics of the materials assumed in the design, and verified its suitability in the design. A retrofitting scheme have been suggested for the failed column member, and also performed related tests regarding the process of retrofitting by RC jacketing of short columns, developing a formwork system for jacketing and a prototype has been prepared for the same as an outcome of this study.

Design of a multistory building, suiting the requirements of the site selected and study of RC jacketed column and developing a formwork for the same, forms the foundation of this paper. Necessity and methods of retrofitting were studied in 'Guidelines for retrofit of concrete structures'^[1] published by Japan Society of Civil Engineers journal in 1999.

Materials and Methods

Started with the preparation of an architectural plan suiting the requirements using AutoCAD and the structural layout were prepared using the same. The plan was then imported to the ETABS software and a model was prepared. The model was analyzed for the given loading conditions as per the Indian standard codes and the design of RCC structural components was carried out with the software.

During our survey on the failures leading to retrofitting of the member, we noticed that the failure of compression member, the column (short column), was due to the fact that the desired compressive strength of concrete for column was not achieved. Hence, we chose the retrofitting of the column with the help of RC Jacketing and have made a prototype to replicate the same and validated the increase in strength of column achieved after retrofitting. A formwork mould has also been developed by us.

A reconnaissance survey was first conducted to form an architectural plan suiting the requirements needed. Conceptual design of the building is then framed and the architectural plan is prepared and imported to ETABS. Loads values as per IS codes are input and the analysis is carried out. Assuming workmanship failure, strength of a column is decreased and a suitable retrofitting scheme is provided and validated through retrofitting works.

Formwork is prepared by using locally available materials such as plywood and PVC pipe for casting cylinders.



Figure 1. Part of a formwork arrangement.

Results and Concluding Remarks

Table 1. Compressive strength of concrete at different time periods.

Sl. No.	Moulds casted	Age of the Cubes	Avg. Compressive Strength in N/mm ²	Standard Deviation (SD) N/mm ²	Coefficient of Variations (CoV)
1.	Cube 150 x 150 x 150mm	7 Days	16.74	0.42	0.025
2.		28 Days	22.44	0.26	0.011
3.	Cylinder 150 mm diameter	28 Days	17.65	0.13	0.007
4.	Cylinder 300 mm diameter (Retrofitted)	28 Days	27.65	0.02	0.001

Since the strength of concrete achieved is less than the specified strength (target mean strength), core sample had to be taken to find out the actual strength of concrete. Since, we are only simulating the field conditions, we have casted three 150 mm diameter cylinders with same grade of concrete casted for cubes and we have tested the cylinder in a Compression Testing Machine as per IS 516:2018[5] and result of this test is compared as per IS 456:2000.

Specified grade of Concrete is M25, 75% of M25=18.75N/mm². Achieved strength of the cylinder is less than 75% of grade of concrete specified as per IS 456:2000 Clause 17.4.3, the result is not acceptable; hence, retrofit of the column is to be done.

Retrofit is done by the method of RC Jacketing. Shear connectors are put in place. Epoxy is used as a bonding agent between concrete used for retrofitting and original concrete. M30 grade concrete is used for retrofitting. 75mm jacketing is provided all around, i.e., 300mm diameter cylinder is casted and we have tested the cylinder in a Compression Testing Machine and result of this test is compared as per IS 456:2000^[2].

The strength achieved is more than that desired (75% of M30=22.5N/mm²). From these observations, we can say that the retrofitted scheme provided by us is satisfactory.

Acknowledgments: The author thanks Karnataka State Council for Science and Technology, IISc Campus, Bengaluru for funding this project. The author also thanks Mr. Shreekumar, Ms. Undaru Gauthami, and Mr. Vishwambhara, Undergraduates, Department of Civil Engineering, The National Institute of Engineering, Mysuru, for their assistance in the conduction of laboratory experiments.

References

1. Tamon Ueda, Takumi Shimomura (1999) Guidelines for Retrofit of concrete structures, Japan Society of Civil Engineers.
2. IS 456-2000, Plain and reinforced concrete- code of practice (fourth revision), Bureau of Indian Standards.