

Repair, Rehabilitation and Retrofitting of Building

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Abstract

In present era, there are so many buildings which collapse fully or partially due to lack of maintenance, improper construction method and material or even due to earthquake. They need repairing to make them safe. Repair are always neglected or delayed by many people in most of building owing to lack of awareness and financial ability and so it leads to major hazards. Hence, it is needed proper repair and reconstruction application. In this project we have more focus on repairing on building which have required maintenance, because most of problem occurs after certain life of building. In addition, we have also focus on repairing of that sort of structure which have more than of their certain life and which has affected by some disaster like earthquake, flood, etc. At last, we will suggest some useful innovative materials and its application, how to apply on damage part, which would ultimately improve the strength of the structure.

Keywords: Repair, Retrofitting, Rehabilitation, Innovative material (Glass fiber wrap, Carbon Laminate)

I. INTRODUCTION

Earthquake can pose one of the greatest challenges to the designer of buildings and other civil engineering structure. The potential for violent ground motion lasting not more than few minutes to cause great destruction has been amply demonstrated by recent events. Experience from past earthquakes and results of structural analysis indicate that a large proportion of the existing reinforcement concrete building in Gujarat (or anywhere) is vulnerable to damage or even collapse during a strong earthquake. These structures are possessing neither sufficient strength nor ductility to perform satisfactorily during future past, and not just which have been those damaged during earthquake. However, the redesigning of all damaged or non-damaged (conceptual error design) structure are very difficult. Replacement of damaged building or existing unsafe building by reconstruction is generally, avoided due to a number of reasons, the main ones among them is Higher cost of Repair and retrofitting. The retrofitting work carried out in various regions, although on a small scale, offers a number of lessons that could be valuable for the further development of retrofitting as well as for its promotion as the most attractive option for reducing vulnerability.

- Repair: The main purpose of repair is to bring back the architectural shape of the building so that all services start working and the functioning of building is resumed quickly.
- Retrofitting: Retrofitting is the seismic strengthening carried out to upgrade the seismic resistance of a damaged building.
- Rehabilitation; It is the act of restoring something to its original state.

II. PROCEDURE

A. Using Innovative Materials:

Current research on advance material in civil engineering is mainly concentrated on high performance concrete and steel, and some of the other materials are also used to regain structural strength. Like Glass fibre wrap, Carbon fibre wrap and Carbon laminates. By using this material, we can improve strength of structural member which have been damaged. High specific stiffness and specific weight combined with superior environmental durability of these materials have made them a competing alternative to the conventional strengthening methods. It was shown through experimental and analytical studies that this

material can be applied to various structural members including columns, beams, slabs, and walls to improve their structural performance such as stiffness, load carrying capacity, and ductility. Here, we are used two different material Glass fibre wrap and Carbon laminates on precast concrete beam (M25 Grade) and calculate its new strength.

1) Procedure of Glass Fibre Wrap:

1) Step-1:

Grind the corner of the beam at 1 inch, which is covered by the glass fibre wrap.



Fig. 1: Grind the surface

2) Step-2:

The next step was applying an adhesive-compatible (epoxy) primer. The primer that comes in two components was mixed thoroughly with a drill equipped with an agitator until a smooth homogeneous mass was obtained.



Fig. 2: Applied primer

3) Step-3:

When the primer will be in sticky form then applied the saturate on the primer. The saturate will be in two parts, so mix properly and applied on the beam.



Fig. 3: Applied saturate

4) Step-4:

Then, after the 5 minutes wrapped the glass fibre on the surface and press with the rollers.



Fig. 4: Applied glass fibre wrap on beam

The glass fibre will be take the 45 minutes for the bonding with the saturate.

5) *Step-5:*

After the wrapped of glass fibre, applied the 1 layer of saturate on the glass fibre for proper bonding.

2) *Procedure of Carbon Laminates:*

1) *Step-1:*

Before bonding the laminates on the concrete, the surface were ground to remove all contamination and weak surface layers and to expose the aggregates. Surface preparation generally has a much greater influence on long term bond durability than it does on initial bond strength, so that a high standard of surface preparation is essential for promoting long term bond performance. After this the dust and debris were removed by air blast.

2) *Step-2:*

The next step was applying an adhesive-compatible (epoxy) primer. The primer that comes in two components was mixed thoroughly with a drill equipped with an agitator until a smooth homogeneous mass was obtained.

3) *Step-3:*

The epoxy adhesive is prepared the same way as the primer, by mixing the two components. The mixture was then applied evenly with a trowel ensuring that on the rough surface all gaps are covered. The epoxy adhesive's thickness was maintained constant at 2mm throughout the length, for all of the beams.



Fig. 5: Epoxy materials applied on beam

4) *Step-4:*

After uncoiling, the laminates to be installed were cut to the proper length. Surface preparation of the composite plates was accomplished by stripping off a clean, scrubbed, nylon peel-ply layer molded into one surface during composite fabrication. The laminates were placed in their final position by using light finger pressure. After checking the location and the alignment with the help of a rubber roller and a trowel the excess adhesive was removed.



Fig. 6: Install the laminates on beam

B. Advantages:

- Upgrade load bearing capacities of concrete and masonry structures
- Increase bending strength of concrete beams, slabs, and walls
- Increase shear strength of concrete beams and walls
- Restore capacity of concrete structure loss due to deterioration
- Replace reinforcing steel lost to corrosion
- Correct design/construction errors
- Substitute missing reinforcing steel
- Prevent brittle shear failures of concrete beams and walls

Table-1
Flexural strength of beam (28 days)

Sr. no.	Materials	Maximum load(KN)	Strength(N/mm ²)	Average strength (N/mm ²)
1	BEAM WITHOUT WRAPING	19	3.94	3.73
2		17	3.52	
3		18	3.73	
4	GLASS FIBRE	53	10.99	10.09
5		52	10.78	
6		41	8.50	
7	CARBEN LAMINETS	81	16.8	15.07
8		72	14.93	
9		65	13.48	

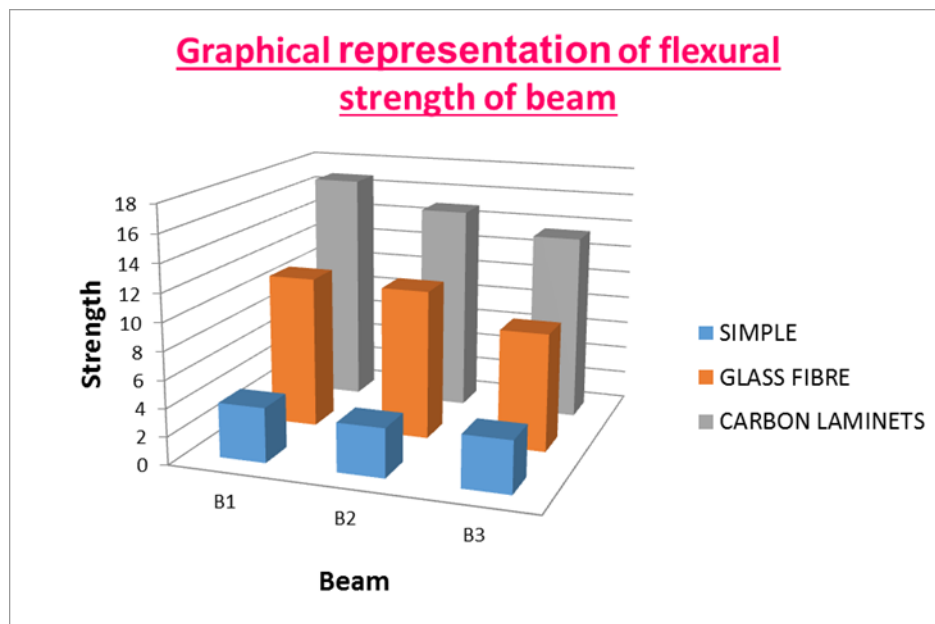


Fig. 7: Graph-1: Graphical representation of flexural strength of beam

Table - 2
Compression test of cylinder

SR NO	MATERIALS	MAXIMUM LOAD(KN)	STRENGTH(N/MM ²)	AVERAGE STRENGTH(N/mm ²)
1	CYLINDER WITHOUT WRAPING	591.3	16.73	15.85
2		524.9	14.85	
3		565	15.98	
4	GLASS FIBRE	752.80	21.29	22.45
5		836.56	23.66	
6		792.38	22.41	

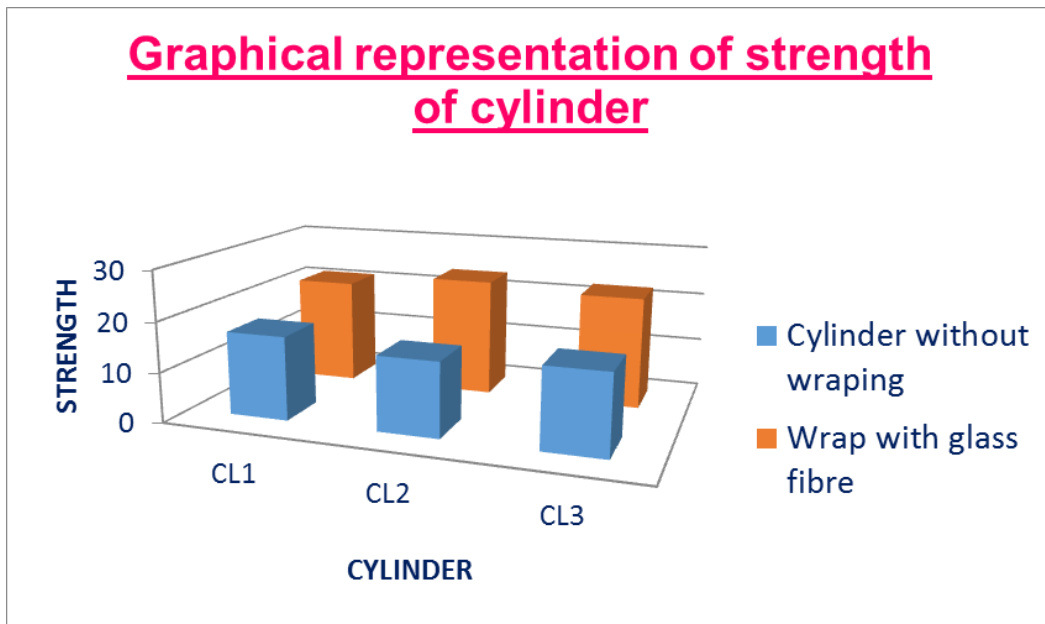


Fig. 8: Graph-2: Graphical representation of strength of cylinder

III. CONCLUSIONS

Reviewing the literature & from visit of different buildings which requires repair or retrofitting. We will suggest the methods of repair or retrofitting for such buildings.

From the visit of already retrofitted building, we take that case as a case study of our project and study all the aspects considered while retrofitting carried out.

- Based on comprehensive experimental study carried out on concrete by using glass fibre and carbon laminates; the following measured conclusions are flexural strength and compressive strength: -
 - 1) Result of flexural strength of wrapped glass fibre beam is 2.7 times and wrapped carbon laminates beam is 4 times more than normal beam without wrapped.
 - 2) The compressive strength of wrapped glass fibre cylinder is 4.3 more than normal cylinder.
- By result of test, we conclude that the strength of beam with wrapping by glass fibre and carbon laminates are increase as compare to the normal beam.

REFERENCES

- [1] CPWD handbook of repair and rehabilitation
- [2] Arya, A.S. et. al. (1986), Guidelines for Earthquake Resistant Non-Engineered Construction, IAEE Committee, The International Association for Earthquake Engineering, Tokyo.
- [3] Brühwiler, E., Fehling, E., Bunje, K. & Pelke, E. 2007. Design of an innovative composite road bridge combining reinforced concrete with Ultra-High Performance Fibre Reinforced Concrete. Proceedings, IABSE Symposium "Improving Infrastructure Worldwide" Weimar, September 2007.
- [4] G.R. Reddy, Akanshu Sharma, P.N. Dubey, Y.M. Parulekar, "SEISMIC RETROFITTING OF LIFELINE STRUCTURES AND SYSTEMS", Proceedings for WSRR 09, IIT Bombay, ASTR, (2010)
- [5] Dr. B.N. Pandya, Dr. M. M. Murudi, Dr. A. A. Bage, "SEISMIC RETROFITTING OF REINFORCED CONCRETE BUILDINGS", Proceedings for WSRR 09, IIT Bombay, ASTR, (2010)
- [6] G.R. Reddy, Y.M. Parulekar, A. Sharma, K.N. Vaity, A. Ravi Kiran, M.K. Agrawal, K.K. Vaze,
- [7] A.K.Ghosh and H.S Kushwaha, "Studies on response of structures, Equipment and piping
- [8] Material Testing laboratory (SNPIT & RC Umargh)
- [9] Dr. Krupesh Chauhan(Proff. Of S.V.N.I.T surat)
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