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Retrofitting Technique Used for Restoration of the Old Hostel in Surguja Chhattisgarh

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Abstract:- The research work is based upon the Restoration of old concrete masonry structure by the use of various retrofitting methods applicable now-a-days. The Structure undergoes degradation due to various adverse environmental effects such as Rain and sun exposure etc and seismic effects. So the determination of the causes behind the degradation and to adopt suitable retrofitting techniques to restore the structure for future use is main objective of this work. The construction of the renewed building is not possible for the backward state like Chhattisgarh and in the absence of hostel facility would be very challenging for the students those are willing for the higher studies in the selected town in the region.

Keywords: Old Hostel, Retrofitting, Repair, Rehabilitation, Restoration.

1. Introduction

This Hostel was built in 1984 under the Supervision of PWD by Madhya Pradesh Govt. There are total 3 floors and 48 rooms with Bed capacity of 100. The hostel consist of a activity area and Mess for the students. But after service life of about 38 years this building is abandoned because few of its structural component is not suitable for the future use.

In IAP Districts like surguja is not Possible to rebuilt new govt. structures in such a quick passage of time. So the restoration of the old structure must be adopted for increasing the service life of the structure in such places.

Retrofitting

1.1 Introduction

Old concrete buildings face challenges such as deterioration due to environmental influences, outdated building regulations and changing usage requirements. Retrofitting addresses these issues by improving structural integrity, increasing resistance to seismic events and enabling adaptability for new functions.

1.2 Reasons Behind retrofitting

Retrofitting is necessary for various reasons:

Structural deterioration: concrete and masonry can degrade over time due to moisture affecting its strength and durability.

Functional adaptation: The use of structure changes over time, requiring Additions to meet new loads for operational requirements.

Safety standards: Changes in building codes need retrofits to ensure structures meet safety and performance.

1.3 Retrofitting techniques

There are various retrofitting techniques used now-a-days but we are using basically four five techniques for restoration in this work.

1. Stitching used for cracking in wall.
2. Plastering used for the patching and covering the masonry surface.

3. Epoxy sealing for the cracking in concrete slab.
4. Bracing in the concrete column.
5. Water proofing in the concrete slab to counter seepage.

2. Various Defects Observed in the Building

A) Cracks in Vertical and Digonal Direction

B) Growth of Vegetation

C) Cracks in Horizontal Direction

d) Cracks In Slab & Spalling of Concrete

E) Cracks in Beams & Lintel

F) Cracks in Columns

3. Determination of in-situ strength of structure.

The methods of determination of strength of structure are of following types.

1. Non- destructive testing.

2. Destructive testing.

The destructive testing is not used in determination of in-situ strength of old building, Hence non- destructive testing is used in the process of determination of in- situ strength of concrete members. And it is done by **Schmidt Rebound Hammer.**

4. Observed Strength

A) WALL (FOR PLASTERING)

B) SLAB (FOR WATERPROOFING)

C) WALL (FOR STITCHING)

D) SLAB (FOR EPOXY SEALING)

S No.	Location	Avg. Compressive Strength	Rebound No.
1	A	12.5 mpa	26.2 R
2	B	13.6 mpa	26.7 R
3	C	12.4 mpa	26.1 R
4	D	15.1 mpa	27 R

5. Materials and Methods.

1. Reinforced bars used for Stitching.
2. Cement Mortar for Plastering.
3. Epoxy Sealant for Cracks sealing.
4. Steel Angles for Bracing.
5. Polymer Raisins for water Proofing.

1. Stitching- The reinforcing bars of diameter 8mm to 12mm with varying length of about 50mm to 90mm and tensile strength of about 650 N/mm^2. Is used for this purpose. The reinforcing bars are hammered in the bore holes in the walls for stitching which ultimately stops the propagation of cracks and also increases the strength of the wall.

i. Tensile strength- 650 N/mm^2.

ii. Length- 50mm- 90mm

iii. Diameter- 8mm- 12mm

Before Stitching

After Stitching

2. Plastering- Plastering is the process of applying the mortar over the masonry surface to protect it from the adverse environmental effects. The main ingredients of cement mortar is cement, sand and water. We use these materials of the following property.

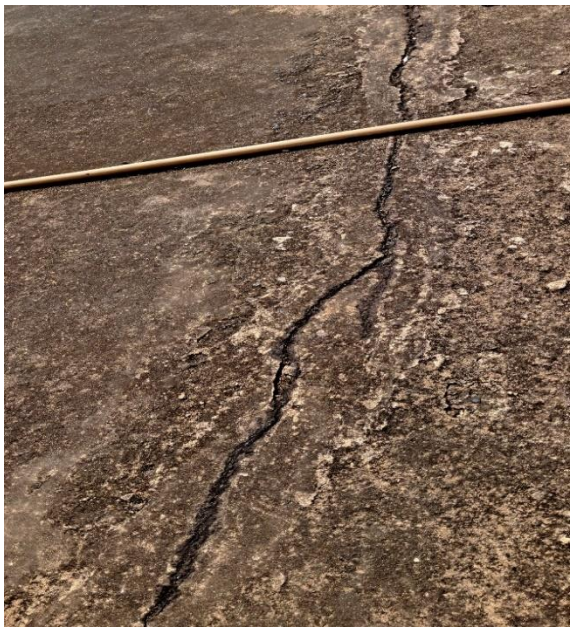
a) CEMENT- Cement is the material which provides binding properties in the mortar. The following property of the cement is observed.

i. Normal Consistency- 0.33.
ii. Fineness of cement- 8.84%
iii. Initial setting time- 47 min.
iv. Final setting time- 567 min.

Before Plastering **After Plastering**


3. Epoxy Sealing- Epoxy resins is advance sealing material which is liquid in form and after successful placement it settles completely in 72 Hours. The epoxy used in this method is used to place in the slab cracks which increases the strength and performance of the slab impressively.

Before Application **After Application**




4. Bracing- Bracing is the process of providing members between Beams and columns to transfer the loads accurately without any failure. In this method we provide wooden and steel bracing to increase the stability and strength of the column.

5. Water Proofing- It is a process to apply special coating of chemicals to prevent the seepage of water from any structural member. We used SBR based multipurpose polymer for water proofing. This method is very effective as we observed reduction of about 90% of seepage and also increases in strength of slab.

Before Waterproofing **After waterproofing**

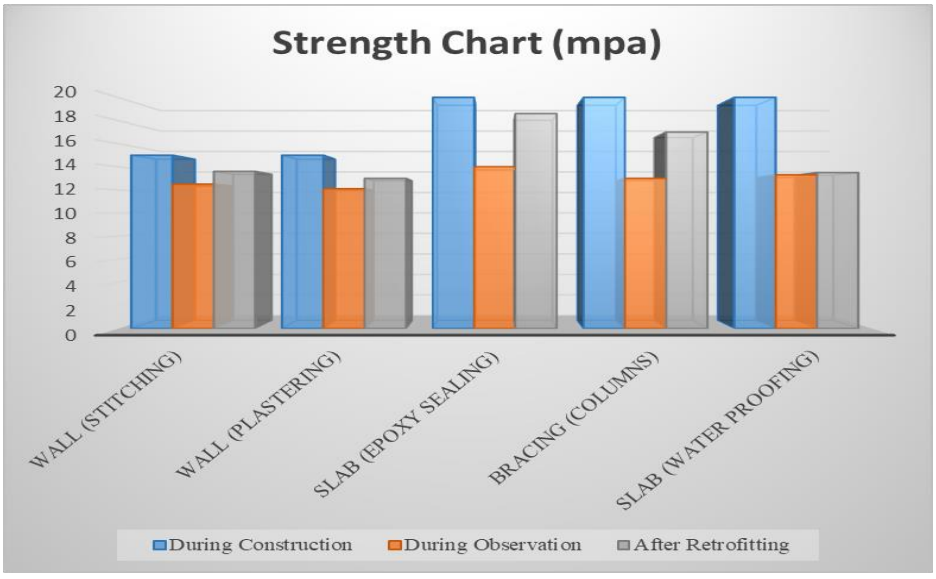
6. Discussion

All the five methods of the retrofitting is suited for the restoration of various structural member and it also increases the in-situ strength of the structure. The stitching of the wall helps in the reduction of the propagation of the cracks in the walls but also increases its strength. Waterproofing help in the reduction of the seepage which helps in the prevention of the structure from the further degradation.

7. Conclusion

Seepage control is the best method for the prevention of the structure from the degradation and deterioration of the structure. If the seepage control is done in the early stage of the service life of the structure then there is no need of the retrofitting of the structure to the service life of the structure.

S No.	Location	Observed Strength		
		During Construction	During Observation	After Retrofitting
1	Wall (stitching)	15 mpa	12.5 mpa	13.6 mpa
2	Wall (plastering)	15 mpa	12.1 mpa	13 mpa
3	Slab (epoxy sealing)	20 mpa	14 mpa	18.6 mpa
4	Bracing (Columns)	20 mpa	13 mpa	17 mpa
5	Slab (water proofing)	20 mpa	13.3 mpa	13.5 mpa



We can clearly see that reinforcing helps strengthen the structural members and after the completion of our project we found that reinforcing processes such as plastering, stitching, Bracing, waterproofing and epoxy sealing are voluntary use to straighten and straighten the structure. This will restore the integrity of the system members and restore their performance.

8. Future Scope

As preventive measures, polymer raisin waterproofing can be used to protect the structure from the negative effects of environmental damage. While plastering can be used to cover themain structure, seaming and epoxy sealing help prevent cracks and strengthen the structure. This process can also be applied to other old structures to extend the life of damaged structure

References

[1] Mohammed Ahmed Ismaeil (2013), Seismic Retrofitting of a RC Building by Adding Steel Plate Shear Walls, IOSR Journal of Mechanical and Civil Engineering.
[2] Asst. Prof. Anumol Raju (2013), Retrofitting of RC Beams Using FRP, International Journal of Engineering Research & Technology (IJERT).
[3] Minakshi V. Vaghani, Sandip A. Vasanwala and Atul K. Desai (2014), Advanced Retrofitting Techniques for RC Building: A State of an Art Review, International Journal of Current Engineering and Technology,
[4] Muhammad Jamaluddin Thaheem and Alberto De Marco (2014), Sustainable Repair & Maintenance of Buildings in the Developing Countries, J. Civil Eng. Architect. Res Vol. 1, No. 1,
[5] Ahmed Abdelraheem Farghaly (2014), Evaluation of Seismic Retrofitting Techniques Used in Old Reinforced Concrete Buildings, IOSR Journal of Engineering.
[6] H. M. C. C. Somarathna, S. N. Raman, A. A. Mutaliba, K. H. Badri (2015), ELASTOMERIC POLYMERS FOR BLAST AND BALLISTIC RETROFITTING OF STRUCTURES, Jurnal Teknologi.
[7] J. Bhattacharjee (2016), REHABILITATION/RETROFITING OF CONCRETE STRUCTURES ALONG WITH CASE STUDY, Civil Engineering and Urban Planning: An International Journal(CiVEJ).
[8] Abhishek Jodawat, Arihant Parekh (2016), Retrofitting Of Reinforced Concrete Column by Steel Jacketing, Int. Journal of Engineering Research and Application.
[9] Kirtika Gupta, Abhishek Kumar (2017), REVIEW PAPER ON SEISMIC RETROFITTING OF STRUCTURES, International Research Journal of Engineering and Technology (IRJET).
[10] Jinkoo Kim, Minjung Kim and Mohamed Nour Eldin (2017), Optimal distribution of steel plate slit dampers for seismic retrofit of structures, International Journal of Steel and Composite Structures.