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Repair and Rehabilitation Techniques Using in School of Engineering Building

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Abstract
In today's time there is shown presence of defects in building because of poor quality control during the construction, lack of maintenance and unfavourable or abrupt change in the weather condition. It is essential to maintain quality in terms of material quality, mixture with their desire specification, workmanship etc. During the construction stage and after the construction suitable maintenance system should be there to reduce tendency of occurring defects in the building for durable and reliable future usage of the building. Cracks are common and major defects are shown in the building occurring mainly because of uneven distribution of shear stresses at poor structural sections so that an engineer should have sufficient knowledge about suitable repairing techniques for particular type of damage in the structure like, which type of defects is there, its reason, its adverse effects and other characteristics of constitution material by that there will be suitable final decision of evaluate the repairing technique to get desired reliable output. It is very tropical process to estimation of materials because of so many irregularities in distress. There is no accurate measurement for depth and width which is same throughout the length of cracks and dimensions of efflorescence. This report includes a case study having estimation and costing as reference to other case studies with their remedial measures and some repair.
Keywords: *Rebound Hammer Test, Dial Caliper, Measurement Tap.*

Introduction

To improve the ability of an existing building to withstand seismic forces arise usually from the evidence of damage and poor behaviour during a recent earthquake. It can arise also from calculations or by comparisons with similar buildings that have been damaged in other places. While in the first case the owner can be rather easily convinced to take measures to improve the strength of his building, in the second case dwellers that have much more stringent day-to-day needs are usually reluctant to invest money in the improvement of seismic safety.

Sustainable development has become the challenge for humanity particularly with rapid growth of urbanization. Critical issue is to provide food, shelter and other basic needs to rapidly growing world population and save natural resources on which the very existence of population depends. We have got wide variation in the Perception of responsibility to future generations and ethical issue. There is an urgent need of us the professional to understand and implement cleaner production and sustainable development and maintenance objectives at all level of responsibility.

The buildings in which we live, work, and play protect us from Nature's extremes. Yet they also affect our health and environment in countless ways. As the environmental impact of buildings becomes more apparent, a concept called green building is gaining momentum.

The maintenance of building is a lifelong continuous process. It has been observed that the

minimum maintenance of concrete structures require an integral approach which need the introduction of as much preventive measures as possible in accordance with the basic established concept –"Prevention is always better than cure". Repair/rehabilitation/retrofitting is the fastest growing segment of the concrete industry. Across the globe, billions of dollars are spent annually in repair and restoration of distressed concrete structures.

Thus selection and evaluation of repair materials and protective coatings is receiving more and more attention among Civil Engineers in the recent past. The new technologies and new repair materials, which have been extensively being used by the advanced countries, are also being tried in developed country like India.

Objective

- Improve better Quality of Stability to Structures.
- Improve the usage efficiency and serviceability of the building.
- Improve the strength of damaged structure.
- Improve the durability of the building with help of suitable modification.
- In the joints between old and new concrete, epoxy based bonding material to be applied on old concrete structures.

Scope

There is major problems of damaging of structure in India due to tropical earthquakes zones, poor material quality, poor workmanship, unsuitable method of construction and heterogeneous weather condition of a year. There is always seen that major or minor deterioration present in a structure at particular time interval because of that necessity of repair and rehabilitation occurs. To minimize the cost of new construction we should apply suitable repair and rehabilitation techniques rather than adopting new construction after complete demolition of existing structure. There is also benefit of time, because suitable repair and rehabilitation technical consumes less time in front of new construction of existing damaged structure.

Literature Review

Bassam A. Tayeh, and B H Abu Bakar 2013, paper reports under normal circumstances, reinforced concrete structures (RCS) show excellent performance in terms of durability and structural behaviour except for the zones that are subjected to severe mechanical or cyclic loading and aggressive environmental conditions. Therefore the methods of rehabilitation or strengthening of these zones should be reliable, effective and economical. Today, many scientists, academics and engineers understood the extremely low porosity and low permeability characteristics of ultrahigh performance fibre concrete (UHPFC) giving its enhanced durability over high performance concrete (HPC), thus making it potentially suitable for rehabilitation and retrofitting problematic RCS. The advantages of utilizing the technology of UHPFC in repairing works includes:-

1. Decrease the working time needed for the rehabilitation works

2. Increase the serviceability and durability to an extent where the repaired structures can meet the expected design life of the structures, with minor preventative measure. This paper discusses and reviewing some of the most recent issues and findings using UHPFC as a repair material. The results of the findings will also be presented to prove that the UHPFC displays excellent repair and retrofit potentials in compressive and flexure strengthening and possesses high bonding strength and bond durability as compared with other types concrete.

Bassam A. Tayeh and B H Abu Bakar 2013 report in recent year's premature deterioration of concrete structures due to salt damage has become a serious social problem. Repair and strengthening in order to improve the durability of these structures has become critical. Therefore ultra-high performance concrete properties in terms of durability and strength are fully exploited in rehabilitation and strengthening.

As so in figure J.H bunger describe the damage of this study was performed to evaluate the bond strength between UHPFC and Normal Concrete substrate; Slant shear tests were performed to quantify the bond strength in shear, split tests conducted to evaluate the bond strength in indirect tension. The results showed that UHPFC has excellent interlocking with the surface of NC substrate, and then gives bond strength greater than the strength of NC substrate.

Figure 1.1 .J.H. Bunger, 1989, The Testing of Concrete in Structures, Surrey University Press.

Methodology

A.Epoxy injection

Epoxy injection is an economical method of repairing non-moving cracks in concrete walls, slabs, columns and piers as it is capable of restoring the concrete to its pre-cracked strength. The technique generally consists of establishing entry and venting ports at close intervals along the cracks, sealing the crack on exposed surfaces, and injecting the epoxy under pressure.

B. Routing and sealing

This method, the crack is made wider at the surface with a saw or grinder, and then the groove is filled with a flexible sealant. This is a common technique for crack treatment and it is relatively simple in comparison to the procedures and the training required for epoxy injection. It can be done on vertical surfaces and curved surface.

C. Stitching

This method is done to provide a permanent structural repairs solution for masonry repairs and cracked wall reinforcement. It is done by drilling holes on both sides of the crack, cleaning the holes and anchoring the legs of the staples in the holes with a non-shrink grout.

D. Drilling and plugging

This technique is only applicable when cracks run in reasonable straight lines and are accessible at one end. This method is mostly used to repair vertical cracks in retaining walls.

E. Gravity Filling

Low viscosity monomers and resins can be used to seal cracks with surface widths of 0.001 to 0.08 in. by gravity filling. High molecular weight methacrylates, urethanes, and some low viscosity epoxies have been used successfully.

F. Dry packing

It is the hand placement of a low water content mortar followed by tamping or ramming of the mortar into place and also helps in producing intimate contact between the mortar and the existing concrete.

G. Polymer impregnation

Monomer systems can be used for effective repair of some cracks. A monomer system is a liquid consisting of monomers which will polymerize into a solid. The most common monomer used for this purpose is methyl methacrylate.

Location of sight

Location of sight: - School of engineering building (R. K. University, Rajkot).

Place of work

Site 1 outlet window in drawing hall, near drinking water, first floor (horizontal crack).

Site 2 stair, opp., and computer lab, near drawing hall first floor (vertical crack).

Site 3 surveying lab, first floor (diagonal crack).

Site 4 Porch near room no.110 (expansion joint).

Layout of Cracks & Measurement

Damaged Expansion Joint

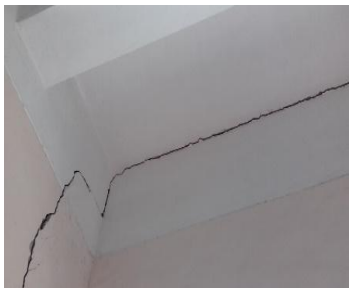
W= 62mm
D = 1.4 cm, L = 11 m

Vertical crack

W= 35mm, D = 60mm
L = 6m

Horizontal crack

W= 68mm, D = 64mm,
L = 1.5m



Diagonal crack

W= 4.10mm,
D = 4.9mm, L = 12m

Measurement

Sr. No	Location	Description	Measurement
1.	Porch near dean office	Expansion joint problem	W= 3mm, D = 20mm L = 0.5m
2.	Passage near principal office and near the doors	Expansion joint problem, corner crack and non-structural	W= 4mm, D = 70mm L = 8m
3.	Outlet window, Drawing hall first floor	non-structural	W= 68mm, D = 64mm L = 1.5m
4.	Porch near room no.110	Expansion joint problem	W= 62mm, D = 1.4 cm L = 11 m
5.	Room no.118	Cracks	W= 3mm, D = 10mm L = 2.5m
6.	Room no.120	Cracks	W= 30mm, D = 10 mm L = 2.5m
7.	MOS lab, first floor	Expansion joint problem, corner crack and non-structural	W= 30mm, D = 50mm L = 12m
8.	Surveying lab, first floor	corner crack and non-structural	W= 4.10mm D = 4.9mm, L = 12m
9.	Computer department near stair case first floor	Cracked plaster, efflorescence.	W= 35mm, D = 60mm L = 6m
10.	Room no.216	Diagonal, non-structural crack near beam and column	W= 40mm, D = 10mm L = 9m
11.	Room no. 205 at outer periphery	Expansion joint	W= 45mm, D = 60mm L = 2.1m
12.	Second floor, Porch near room no. 220	Expansion joint	W= 3mm, D = 5mm L = 0.4mm
13.	Porch near room no.222	Expansion joint problem, water leakage.	Refill needed

Figure 7.1 measurement

Testing

Damaged Expansion Joint

Vertical crack

Horizontal crack

Diagonal crack

Rebound Hammer Test

30.73
good layer

35.05
good layer

29.08
Fair

26.33
Fair

Repairing work and test result

Damaged Expansion Joint

Vertical crack

Horizontal crack

Diagonal crack

Rebound Hammer Test

41.75
Very good hard layer

46.08
Very good hard layer

38.75
Good layer

34.53
Good layer

Material used in crack

- Cement 8kg
- Sand 12 kg
- Dr. fixit(chemical) 500g
- Bricks no 4 (wt. 8.90Kg)
- Cement : sand (1 : 1.5)

Conclusion

- ❖ After completing this case study we have found that most of distresses-cracks
- ❖ Cracks formed because of shrinkage and overload of the structure.
- ❖ They are not affecting the structural stability of the structure.
- ❖ Distress present in the buildings can be easily repaired.
- ❖ Dr.fixit pidicrete is used water-proofing ratio of 1:1.5 and repair 1:1

Coasting

We had also calculates the quantity of different materials required and overall cost project work as below

Sr. No.	Description	No.	Cost (RS)	Total(RS)
1	Dr. Fixit	500g	140	140
2	Ordinary Portland Cement	8.00kg	325	52
3	Brick	4 no	8	32
4	Sand	12.00kg	3	36
			Total	260
		Labour cost (Day)	1 * 500	500
		Water charge	1.50%	39
		Lump sum amount	2%	5.2
			Total Rs.(four site)	804.2=804

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