

STUDY ON REPAIR AND MAINTENANCE OF EXISTING BUILDING STRUCTURES

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ABSTRACT:

Now days it has become a major challenge to select right techniques, materials, and procedures for the repair of a building structure. For the maintenance of reinforced concrete structures and buildings, it requires periodic inspection; therefore it is essential that there should be little awareness regarding the periodic inspection and repair of various structures. As we know that Civil Engineering is one of the oldest engineering. The first duty of every Civil engineer is to give emphasis on the durability aspect during construction as well as maintenance. If we consider old monuments they still stand on its position very efficiently. But this is not the condition of today's structure. A collapse mechanism is increasing and today's structures are getting collapsed before their serviced life is completed. Over a period of time, as these structures become older, we find in them certain degradation or deterioration with resultant distress manifested in the form of splitting, cracking, corrosion, delaminating, carbonation etc. Therefore, it is advisable to monitor it periodically by taking professional opinion.

KEYWORDS: repairs, maintenance, life cycle cost, cracks, new materials and techniques, rehabilitation, restoration, inspection, visual inspection, testing, rebound hammer, core cutting, SPT

I. INTRODUCTION

For the maintenance of reinforced concrete structures and buildings, it requires periodic inspection and preventive maintenance. In that case there is very little awareness in civil engineers and other discipline. As a result, many of the times due importance is not given to the repair and maintenance of the building. But now a day it has become necessary to give more attention towards the repair and maintenance of old and damaged building structure. Hence, in depth requirement has been generated for structural repair, restoration and strengthening of RCC structures. New and innovative techniques have been developed in the repairs of concrete structures. In India there are large numbers of old existing buildings which are deteriorated because of their use, their age and may be due to fully consumption of their design life. For such a deteriorated structures it requires repair with proper material and proper technique. The cost of repair for any

deteriorated building structures could be in lakhs of rupees. To avoid any kind of accident of such deteriorated buildings, repair works should be carried out at regular time so that the building will be serviceable up to its full serviceable life. For any recreational activity of structure it required strengthening of structural elements

II. METHODOLOGY

2.1 Visit to Site:

1. Telrandhe House, Diamond Nagar, Nagpur
2. Mahatma Fule Market, Cotton Market, Nagpur
3. RSS Bhawan, Reshimbag, Nagpur
4. LIG Quarter, Nandanwan, Nagpur
5. Ganeshpeth Bus Stop, Nagpur

2.2. Visual Inspection:

In visual inspection, we visit the above mention sites and to know about the types of problem (cracks, corrosion of reinforcement, drainage, efflorescence, peeling off,etc.) occurred on site in actual practice. We take photographs of each and every problem on site. Some of the photographs of problems are as follows.



Fig 1. settlement of column and crack



Fig 2. crack on road surface



Fig 3. settlement of building



Fig 4. small hair cracks

2.3. Problems onSite:

2.3.1. Cracks:

There are two types of cracks are as follows. According to its variation of occurrence, it can be defined separately.

- a. Structural crack
- b. Non-structural crack

a) Structural Cracks: These cracks occur due to incorrect design, faulty construction or overloading and these may

endanger the safety of a building. Structural cracks that are formed in Beam, Column and slabs are-

III. Wide - more than 2mm in width.

Beam	Columns	Slabs
Flexural Cracks	Horizontal Cracks	Flexural Cracks
Shear Flexural Cracks	Diagonal Cracks	Top Flexural Cracks
Torsional Cracks	Corrosion Bond Cracks	Shrinkage Cracks
Bond Slip Cracks		
Disturbance Cracks		
Tension Cracks		

2.3.2. Corrosion of reinforcement:

The mechanism of corrosion in aqueous media is of electrochemical nature. This means that the oxidation of the metal is counterbalanced by the reduction of another substance in another region of the metallic surface. Therefore, zones (anodes and cathodes) with different electrochemical potential develop.



Fig 5: - Corrosion of reinforcement

b) Non-Structural Cracks : They are due to internal forces developed in materials due to moisture variations, temperature variation, crazing, effects of gases, liquids etc.

2.3.3. Drainage:

The majority of drainage problems are usually caused by an inadequate pitch or slope in your yard which prevents water runoff from being diverted away from the house. And the issue is often complicated by downspouts on the residence that do not pipe away the rain gutter water from the Property.

Non-Structural Cracks are occurred due to:

1. Plastic Settlement
2. Plastic Shrinkage
3. Early Thermal Expansion and Contraction
4. Long Term Drying Shrinkage
5. Crazing
6. Due to corrosion of concrete
7. Due to Alkali-Aggregate Reaction
8. Sulphate Attack
9. Due to corrosion of Steel

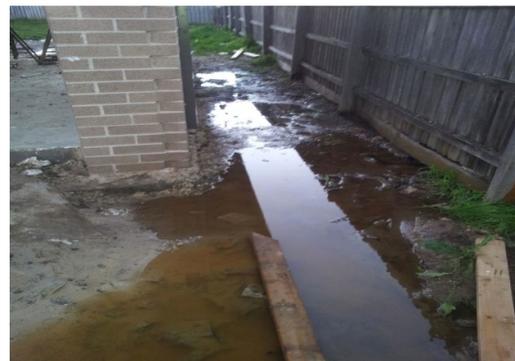


Fig 6. Drainage

c) A commonly known classification of cracks on the basis of their width is:

- I. Thin - less than 1mm in width.
- II. Medium - 1 to 2mm in width.

2.3.4. Peeling off:

It is generally occurred defect in all the building structure. It is such type of defect in which surface of paint is get removed from its surface. It is occur due to various reasons such as moisture present, dampness, low quality of paint is used, improper surface, etc.



Fig 7. peeling off

2.3.5. Efflorescence:

Efflorescence is the migration of salt to the surface of a porous material, where it forms a coating. The essential process involves the dissolving of an internally held salt in water, or occasionally in another solvent. The water, with the salt now held in solution, migrates to the surface, and then evaporates, leaving the coating of the salt.



Fig 8. efflorescence

2.3.6. Settlement of building:

When soil consolidation occurs, your foundation experiences a downward movement at an uneven rate which result in cracks and structural damage. It could take week to years to see the results of settlement cause by consolidation of foundation soil.



Fig 9. settlement of building

III. DETAIL STUDY ON STRUCTURE

3.1. Types of building:

While study it is essential to study about the type of building. According to its type such type of precaution and proper method we decide for prevention of such building. Generally two types of building are present in practice. Load bearing and frame structure. But load bearing building is used before 15-20 years commonly. But todays framed structures are most commonly used structures in actual practice.

3.2. Types of foundation:

Study of types of foundation is also very important, because it is the main part of the building. It has great importance in compare other components. It is the basement of building on which building rest. According to types of building (single storey, multi-storey, etc.) type of foundation is selected.

3.3. Types of soil:

Building project requires careful and through planning because they can have a major impact on their surroundings, whether you're building a house or commercial,

it all starts with the foundation. Since the foundation holds the entire structure, it's of the almost importance that it's rock solid. There is where soil investigation plays vital role that will enable to plan your foundation work properly and preciously. However, before undertaking your building project, you should learn more about soil investigation and its importance for construction project.

3.4. Construction year of building:

How many years completed for construction of building is important while we take maintenance of such building. When the building is very old then such test are conducted to know the strength of the structure and then according to result value of each case such precaution and remedial measures adopted which is economically.

3.5. Previous Repair, painting of building:

Whenever maintenance is conduct in previous year then impact of problems on building get minimised up to some extent. It is very important to take a periodic maintenance of building to increase its durability and of safety point of view. Because no one know about the perfect time danger occurance.so be prepare of all problems.

3.6. Name of contractor and architecture:

They are the persons who constructed this building, so we collect the data from such contractor or architect about the building, such as method of construction, type of material,etc. because owner not give full technical information about the construction. So we can easy to adopt the method of maintenance from collected data.

3.7. Structural drawings :

It is very important parameter for maintenance and construction. Because without diagram we cannot decide the

positions of column and beam. Its gives orientation detail of building .it is very helpful in maintenance.

IV. DETAIL ANALYSIS ON PROBLEMS:

In detail analysis, we study on causes of problems occurrence and their remedial measures. Them after studying the all causes and remedial measure we finalised the best remedial measures for building problems with considering the detail information about building and their problems. So we enlisted causes and their remedial measures of each problem occur in building as follows.

4.1. Cracks:

4.1.1. Causes & Its Preventive Measures:

- A. Elastic Deformation
- B. Thermal Movement
- C. Chemical Reaction
- D. Shrinkage
- E. Foundation Movement and Settlement of Soil
- F. Earthquake
- G. Vegetation
- H. Poor Construction practices

4.1.2. Techniques to Cure Crack

- A. Epoxy injection
- B. Routing and sealing
- C. Stitching
- D. Drilling and plugging
- E. Gravity Filling
- F. Dry packing
- G. Polymer impregnation

4.2. Corrosion of Reinforcement:

4.2.1 Causes:

- a) Corrosion mechanism
- b) Carbonation
- c) Chloride attack
- d) Stress corrosion cracking

4.2.2. Preventive Measures:

- a) Galvanisation
- b) Cathodic protection
- c) Electrochemical chloride migration (Desalination)
- d) Re-alkalisation

4.3. Efflorescence's:

4.3.1. Causes:

- a) Soluble salts must be present within or in contact with the brickwork. These salts may be present in brick, backing materials, mortar ingredients, trim, adjacent soil, etc.
- b) There must be a source of water in contact with the salts for a period of time sufficient to dissolve them.
- c) The masonry must have a pore structure that allows the migration of salt solutions to the surface or other locations where evaporation of water can occur.

4.3.2. Preventive measures:

- a) Provide effective damp-proof course.
- b) Take adequate measures to stop leakage/seepage through chajjas.
- c) Prevent water percolating into brick work from roof and gutters.
- d) Avoid use of bricks and sand with high soluble salt content.
- e) Protect the bricks and sand against contamination.

4.4. Drainage:

4.4.1. Causes:

- a) Used of low quality materials
- b) Improper workmanship
- c) Used of poor construction technique
- d) Improper water supply line

4.4.2. Preventive measures:

- a) Use of good quality materials
- b) Use of waterproofing materials
- c) Use of moderate construction technique.

- d) Proper workmanship

4.5. Settlement of building foundation:

4.5.1. Causes:

- a) Settlement due to Static Loads on Soil
- b) Settlement due to Dynamic Forces from Vibrations
- c) Settlement due to Excavation of Soil
- d) Settlement due to Lowering of Water table
- e) Settlement due to Deterioration of Foundation Concrete.
- f) Settlement due to Increasing Load on Surrounding of Soil.

4.5.2. Preventive Measures:

- a) Increasing the depth of the foundation except when the material grows wetter as the depth increases.
- b) Compacting the soil by ramming.
- c) Ramming in sand, gravel, moorum, broken stone or brick bats in-situ between the foundation concrete and soil. This is useful for silt or black cotton soils and clayey soils.
- d) Cement grouting of the rammed materials will make the foundations much harder.
- e) Draining out water from wet foundations.
- f) Driving piles, either of wood or concrete, or driving and withdrawing piles and filling the holes with sand or concrete. This will increase the density of the soil.
- g) Artificial stabilization can be used to seal off permeable strata for deep foundations, or to give soft soils additional strength if they are likely to flow.

V. CONCLUSION

If proper construction material and technique is used during construction and in case of periodic maintenance, the major causes that affect the building can be minimised. Therefore it is very essential for the people to know the exact condition of the structure. So that they can take a proper safety measures with the help of expertise.

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