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Structural Audit, Repair & Rehabilitation of Building

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Abstract - *In case of Construction Industry the life cycle of a structure can be divided by in to four important phases those are as Architectural planning ,Structural planning, Construction and Maintenance. Every structure has its own Service life it should stand firmly on its position. But because of giving less importance to the maintenance collapsed mechanism has increased day by day and structure are getting collapsed before its service life is completed which leads to the lose of properties and life of human beings. There for it is suggested that to overcome the failure of structure it is necessary to do the structural audit and find the lacunas in the structure also find out the root causes of faulty mechanisms to avoid future problems.*

Key Words: Structural audit, Structural Engineering, NDT method, Structural Evaluation Program, Rehabilitation, Retrofitting, Sustainable Development, Polymers, Admixtures

1. INTRODUCTION

The structural audit must be carried out following auditing norms, methods of non-destructive testing and code provisions. The structural auditing will help to implement maintenance and repair work timely which leads to prolonged life of the building and safety of the occupants. In India there are many old buildings which have reduced strength in due course of time. If further use of such deteriorated structure is continued it may endanger the lives of the occupants and surrounding habitation. Appropriate actions should then be implemented to improve the performance of structures and restore the desired function of structures. Thus, it is utmost important to perform structural audit of existing buildings and to implement maintenance/ repair work timely which will lead to prolonged life of the building and safety of the occupant. Structural Audit is an overall health and performance check-up of a building like a doctor examines a patient. It ensures that the building and its premises are safe and have no risk. It analyses and suggests appropriate repairs and retrofitting measures required for the buildings to perform better in its service life. This paper deals with study of different parameter of structural audit including visual inspection, non-destructive testing, core sampling and testing. It also emphasizes on different repairs and retrofitting measures to be used for buildings after structural audit. Structural audit is done by an experienced and licensed structural consultant.

1.1 Structural Audit of Building

Structural Audit is nothing but the overall Health Performance, Checking up of Building like a Doctor examines the Patient. It ensures that the building and its premises are safe and have no risk. It gives analysis of structure and provides necessary suggestion for appropriate repairs and retrofitting measures for the building to provide better service life .This Audit should done by experienced and Licensed Structural Consultants.

1.2 Rehabilitation Work-

When the structure is distressed or damaged the normal visual signs are: cracks different patterns and sizes; rust stains or rust spots; peeling of plasters etc.; spalling of concrete; and, rusted reinforcement if exposed. It is the primary task to determine whether the damage is structural or non-structural. Structural repairs are undertaken to restore the structural stability of the structure to carry the present stresses under the service conditions. Non-structural repairs are undertaken to restore the long term durability but do not increase the load bearing capacity of the structure in question. A nonstructural repair or cosmetic repair if not conducted at appropriate time can lead to structural distress.

A. Techniques for Repairs and Rehabilitation of Concrete Structure.

1. Depending upon the requirement, the repairing technique may be of a superficial (cosmetic) nature or, in some cases, may involve the replacement of part or whole of the structure.

2. The technique to be adopted for repair or restoration of the structure depends on the cause, extent and nature of damage, the function and importance of the structure, availability of suitable materials and facilities for carrying out repair, and a thorough knowledge of the long- term behavior of the materials used for the repair work.

B. The repairing techniques can be classified into three major groups:

1. Removal and replacing of defective and damaged area.

2. Surface treatment.

3. Injection into cracks, voids or honey-combed structures.

1.3 Retrofitting Techniques

1 Adding New Shear Walls

2 Adding Steel Bracings

3 Jacketing (Local Retrofitting Technique)

4 Base Isolation (or Seismic Isolation)

5 Mass Reduction Technique of Retrofitting

6 Wall Thickening Technique of Retrofitting

2. OBJECTIVES AND METHODOLOGY

OBJECTIVES

1. To identify areas to be repair.

2. To increase the life of the building by doing retrofitting work.

3. Awareness of residents to under the seriousness of the problems and to suggest the remedial measures for strengthen or repairs, rehabilitation of the structure.

METHODOLOGY

1-Study of plan, all Structural drawings, details, if not available the plan should be prepared.

2-Visual Inspection

The building was investigated by Floor by Floor for observation and external area of the building some of the column, beam and slab within the structure were observed for a range of defects such as spalls, seepage cracks and crazing….etc. All the defects were marked on the observation sheets with approximate repairs which formed the total data of the structure.

3-Tapping Observation

Some of the column and beams inside the flats were subjected to Tapping by hammer. The hollow sound was recorded. This was evaluated for remedial measures.

4- Non Destructive Testing [NDT]

In addition to Visual Inspection and Tapping Observation the quality and strength of structural components can be determined by the use of various Non-Destructive Test. There are various NDT instrument used in concrete members which determines the present Strength and quality of concrete. The result of these is useful in finding out the treatment to be given to the structural members and various types of the test available in the market those are as below.

A] Rebound Hammer Test

To measure the surface Hardness of Concrete.

B] Repairs

The repairs should be as per Standard Procedure given in respective code. The maintenance work should carried out as per mentioned.

C] Identification of distress area of structure Based on the above inspection analysis and test results the report concluded the critical areas that need immediate repairs and maintenance, retrofitting, rehabilitation. The report is prepared on the maintenance required.

Photo -1: Visual Inspection of Cracks and Damages of Plaster in Building.

Photo -2: Visual Inspection of Leakage in Building.

4. After all auditing completed now we start the retrofitting work.

Fig. Retrofitting

RESULTS & DISCUSSION

Repair/Rehabilitation of G+1 building at Buldana, India

Structural Audit Report:

Name of the Building: Rushikesh Niwas

Description: House

Address: Buldana. 443201

MH, INDIA.

Type of Structure - RCC Building of G+1 floors

Type of Structure – RCC

No of wings & stories - 2

Description of Building

Year of construction-Aug 1987

Age- 33 years

Effects of monsoon – Yes.

The damages observed were excessive spalling of concrete, formation of wide cracks, excessive corrosion, falling of fenders and shearing off of piles etc. In general, it was observed that various structural

Elements after these have been exposed/chipped off showed much more deterioration than was observed at the time of the site survey. The repair methodology adopted for different types of defects are as follows:-

1. Square cutting the boundary of damaged concrete.

2. Chipping the spalled surface by pneumatic chipper.

3. Removing rust from existing reinforcement by wire brushing.

4. Welding of additional reinforcement after carrying out anti-corrosive treatment and an epoxy coating.

5. Removing dust from surface of concrete and reinforcement by compressed air, drying of the surface before applying coating of epoxy.

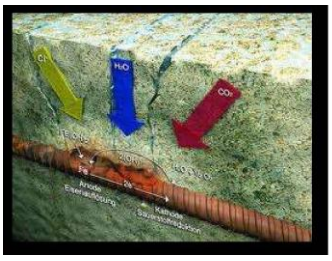


Fig No3 -Corrosion of Reinforcement

Fig.No-4 Spalledcover concrete

Also owner wants to increase the one floor. For that we need to strengthening the structure. We use retrofitting technique to increase durability & strength of existing structure without demolishing .For that we done following steps

1. First prepare the surface of existing structural member.

2. In retrofitting we provide shear key & reinforcement around existing column & beam.

Existing Column size – 0.23x0.30m

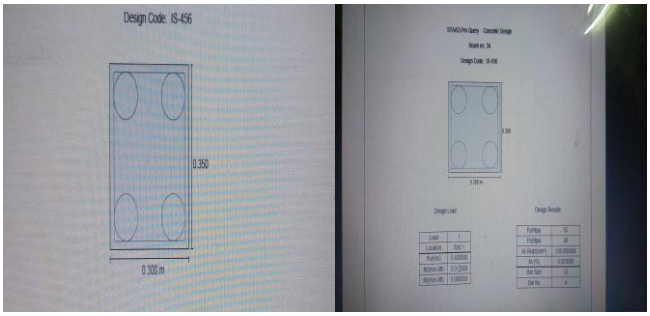
Existing Beam size _ 0.23x0.23m

After retrofitting increase sizes

Size of column after retrofitting – 0.30x0.35m

Size of beam after retrofitting – 0.30x0.30m

3. Bonding agent is applied over prepared surface of existing column & Concrete is casted.



Stadd Results

CONCLUSIONS

From the consideration of all the above points we conclude that the defects of structural members are due to combined effects of carbonation, corrosion & effect of continuous drying and wetting. The result of visual survey prompt us to conclude the distress is wide spread and is an ongoing process and so needs to be stopped at this stage so as to avoid complete collapse of the structure. Therefore Rehabilitation of the RCC members and will constitute the following steps

1. Propping the structure wherever necessary

2. Removing loose/disintegrated concrete

3. Cleaning the affected steel

4. Adding steel wherever necessary

5. Applying Passivator coat to the steel

6. Applying Bond Coat and doing Polymer /Micro

7. Concrete treatment depending on the requirements

8. Finishing with new plaster.

Retrofitting is best method of modification of existing structure to make them more resistant. Due to that strength & ductility of structure also increases. We can use this techniques in taluka places & villages.

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