

# Structural Audit and Rehabilitation Of Building

**Prof. R. M Desai, Akshay Pawar, Mahendra Mate, Lakshadeep Gade, Shivam Badekar,  
Veer Kumar Patil.**

*Dept. of Civil Engineering*

*Sanjay Ghodawat Institute, Atigre.*

-----\*\*\*-----

**Abstract** - Civil engineering is a sector which provides infrastructure to all human beings. Structural audit is preliminary survey of buildings to find its strength, defects etc. These all structures may be residential, commercial and industrial building. These all structures should provide safe and efficient service throughout the life. So structural audit should be done regularly to determining the condition of the structure. NDT tests are conducted for determining the strength and other parameters. Then to give any rehabilitation suggestions for better service and safety of the building. Then structural audit report is prepared.

## 1. INTRODUCTION

As the structures gets older it needs regular repair and maintenance to avoid any risk. Therefore, structure audit is done to assess the general health of building. Health and performance of building depends on its quality of maintains also to prevent the structure from environmental effect one should monitor it time to time by taking professional opinion. Building causes external and internal damages due to the faulty construction or age of building and also various actions like fire damage, temperature effect, wing effect, frost action or chemical attack slowly deteriorate the structure. So audit is very much needful to make the building serviceability and safe for human beings.

## 2. PROBLEM STATEMENT

In Maharashtra over thousands of old buildings are present in every city with no structural audit; most of those buildings are a major tragedy just waiting to happen. But housing societies and Municipal Corporation have not taken any steps for auditing building or for stabilities of building. In 2007 accident took place in borivili in which more than 20 lives had claimed to be death. Then government took decision for auditing old buildings. So to avoid this casualties structural should be done.

## 3. OBJECTIVE

1. To save lives.
2. To find condition of structure and predict future life.
3. To identify areas to be repair.
4. To increase the life of the building by doing rehabilitation work.

## 4. WHAT IS STRUCTURAL AUDIT

Structural Audit is an overall health and performance checkup 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 rehabilitation measures

required for the buildings to perform better in its service life. This can be done government agency or by any experienced auditors.

## **5. METHEDOLOGY**

### **5.1. Non-destructive testing (NDT)-**

NDT is a wide group of analysis techniques used in science and technology industry to evaluate the properties of a material, component or system without causing damage. The terms nondestructive examination (NDE), nondestructive inspection (NDI), and nondestructive evaluation (NDE) are also commonly used to describe this technology. Because NDT does not permanently alter the article being inspected, it is a highly valuable technique that can save both money and time in product evaluation, troubleshooting, and research. Commonly used NDT are ultrasonic pulse velocity, rebound hammer test, and rebar tec.

### **5.2. NDT Tests**

Mostly we used

1. Rebound hammer test.
2. Ultrasonic pulse velocity.
3. Rebar

#### **5.2.1. Rebound hammer test-**

1. Schmidt Rebound Hammer Test is a most common non- destructive test (NDT) performed on hardened concrete.
2. Schmidt Rebound Hammer Test method is most useful in checking the uniformity of concrete in laboratory.
3. It works on the principle that the rebound of an elastic mass depends on the hardness of the Surface against which the mass impinges
4. Theoretical relationship between the strength of concrete and the rebound number of the hammer.
5. The rebound value indicated by the hammer is related empirically to the compressive strength of concrete.
6. It is able to provide a quick estimate of the quality of concrete.
7. The Plunger is held perpendicular to the concrete surface and the body pushed towards the concrete.
8. This movement extends the spring holding the mass to the body. When the maximum extension of the spring is reached, the latch releases and the mass are pulled towards the surface by the spring.
9. The mass hits the shoulder of the plunger rod and rebounds because the rod is pushed hard against the concrete,
10. During rebound the slide indicator travels with the hammer mass and stops at the maximum distance the mass reaches after rebounding. The distance travelled by the mass. Expressed as a percentage of the extension of the spring is called rebound number.
11. The button on the side of the body is pushed to lock the plunger into the retracted position and the rebound number is read from a graduated scale is fitted on the body.

#### **5.2.2. Ultrasonic pulse velocity**

1. An ultrasonic pulse velocity test is an in cast in situ, non-destructive test to check the quality of concrete and natural rocks.

- In this test, the strength and quality of concrete or rock is assessed by measuring the velocity of an ultrasonic pulse passing through a concrete structure or natural rock formation.
- This test is conducted by passing a pulse of ultrasonic wave through concrete to be tested and measuring the time taken by pulse to get through the structure.
- Higher velocities indicate good quality and continuity of the material, while slower velocities may indicate concrete with many cracks or voids.
- Ultrasonic testing equipment includes a pulse generation circuit, consisting of electronic circuit for generating pulses and a transducer for transforming electronic pulse into mechanical pulse having an oscillation frequency in range of 40 kHz to 50 kHz, and a pulse reception circuit that receives the signal.
- The transducer, clock, oscillation circuit, and power source are assembled for use. After calibration to a standard sample of material with known properties, the transducers are placed on opposite sides of the material.
- Pulse velocity is measured by a simple formula:

Pulse Velocity=width of structure / Time taken by pulse to go through

**Table -2 Pulse velocity result comparison with grade**

Pulse velocity	Concrete quality
>4.0 km/s	Very good to excellent
3.5 – 4.0 km/s	Good to very good, slight porosity may exist
3.0 – 3.5 km/s	Satisfactory but loss of integrity is suspected
<3.0 km/s	Poor and lots of integrity exist.

### 5.2.3. Rebar

- To determine the size and depth of steel bar in concrete.
- Built for the professional this is the most Advanced System for finding the location, depth, and size of steel reinforcement bar, post tension cables, copper and conduit in concrete brick, masonry or other non-metallic construction materials.
- Certain type of reinforcement such as glass fiber rebars, post tension or pretension strand will require a Ground Penetrating Radar systems to locate correctly.

## 6. STRUCTURAL AUDIT REPORT FORMAT

- Name of owner-
- Address & cont no-

3. Year of construction-

4. Engineer for audit-

### 7. STRUCTURAL AUDIT REPORT FORMAT

Sr no	Description	comment
1	Type of building	
2	Year of constr.	
3	No of floors	
4	Architectural plan available	
5	Structural plan available	
6	Date of repair	
7	Details of repair	

### 8. STRUCTURAL OBSERVATION

Sr no	Structural part	Comment
1	Beam	
2	Column	
3	Slab	
4	Plaster	
5	External wall	
6	Internal wall	
7	Cracks	
8	leakages	

## 9. RESULTS

In structural audit the results are given in grade and colours.

Sr no	Grade	Color code	Discription
1	0 to 3	Red	Major Distress
2	2 3 to 5	yellow	Considerable Distress and Repairable
3	3 5 to 7	Green	Moderate Distress and Repairable
4	4 7 to 10	Blue	Sound Structure

## 10. 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.

### 11. CONCLUSION

By conducting structural audit may avoid any structural accidents. Depending on the results and analyzing rehabilitation work can be carried. So audit of old structures from the cities should be carried out regularly by government authorities from experts to avoid casualties.

### 12. FUTURE SCOPE

By structural audit of structure its life span and strength can be calculated. This is the initial stage of structural audit of buildings. Non Destructive Tests (NDT) is necessary. By these test results the strength of different components can be calculated.

### 13. REFERENCE

1. Aleksander Milenkovic, Chris Otto, Emil Jovanov, "Wireless Sensor Networks for Personal Health Monitoring: Issue and Implementation", Elsevier Publication 2006.
2. A.B. Mahadik and M.H. Jaiswal "International Journal of Civil Engineering Research. ISSN 2278-3652 Volume 5, Number 4 (2014), pp. 411-416.
3. Bhavar Dadasaheb "Retrofitting of Existing RCC Buildings by Method of Jacketing" Vol. 1, Issue: 5, June: 2013 (IJRMEET) ISSN: 2320-6586.
4. Dong Hyup Kim "An Information System Audit Model for Project Quality Improvement by the Agile Methodology" International Journal of Information and Education Technology, Vol. 3, No. 3, June 2013.
5. Guney Ozcebe "Rehabilitation of Existing Reinforced Concrete Structures Using Cfrp Fabrics" 13th World Conference on Earthquake Engineering Vancouver, B.C., Canada August 1-6, 2004 Paper No. 1393.
6. J. Bhattacharjee "Repair, Rehabilitation & Retrofitting Of RCC for Sustainable Development with Case Studies" Civil Engineering and Urban Planning: An International Journal (CIVIL) Vol.3, No.2, and June 2016.