

## Understanding the Structural Audit

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**Abstract** – Structural Audit of a building means everything connected to the conduct of a building, which includes strength of the columns, beams, pillars, iron bars, plasters, sewage discharge systems, water pipeline systems, etc. The need of structural audit is for maintenance and repairs of existing structures timely which leads to prolonged life of the building and safety of the occupants to avoid any mishaps and save valuable human life. The periodical structural auditing of existing buildings is thus of utmost importance in finding the present serviceability and structural viability of structure.

**Key Words:** Structural Audit, Repairs, Maintenance, NDT

### 1. INTRODUCTION

As time passes, buildings undergoes natural disruption and disturbance. In India, there are many buildings which are under serious structural risk. Leakages are a frequent sight throughout monsoon. If further usage of such deteriorated structure is carried on, it may put the lives of inhabitants and nearby occupants at risk. We continue to discover occasional building failure, which have resulted in irrecoverable destruction and losses of both men and material from time to time. Proper measures should then be executed to improve the performance and restore the appropriate desired function of the structures. Thus, it is of utmost importance to carry out structural auditing of existing structures and to execute maintenance or repair works time to time which will result in prolonged existence of the structure and safety of the inhabitants.

#### 1.1 What is Structural Audit ?

Structural Audit is an important approach to comprehend the distress level or state of any existing building/structure. It is an initial specialized technical inspection of a building to evaluate its general health as a civil engineering structure. It is usually initiated as the first step for repair. This is akin to the periodic health checkup recommended for older people. It ensures the safety of the building and its premises. Structural audit is important for knowing the real health status of the heritage buildings or structure. It is a process which suggests appropriate repairs

and retrofitting measures required for the better performance of the building.

Model bye-law no. 77 of the Maharashtra Co-operative Societies Act specifies that:

The Society shall cause the STRUCTURAL AUDIT of the Building of the society as follows:-

- 1) For the building ageing between 15 to 30 years- Once in 5 years.
- 2) For the building ageing above 30 years- Once in 3 years.

#### 1.2 Purpose of Structural Audit

- To understand the condition and health of the structure.
- To check actual reliability of the structure.
- To highlight the critical areas of the structure that needs immediate attention.
- To abide by the Municipal or any statutory requirements.

### 2. METHODOLOGY

#### 2.1 Stages in Structural Audit:

1. Study of architectural and structural drawings, design criteria, design calculations, structural stability certificate of existing structures.
2. If the Architectural plans and Structural plans are not available, the same can be prepared by any Engineer.
3. Inspection of the building.
4. Preparation of Audit report.

#### 2.2 Visual Inspection

The inspection report should reveal the following along with photographs and sketches:

- Settlement of columns or foundations
- Settlement of walls and floors
- Deflection and cracks in Retaining wall
- Materials used and framing system of structure

- Identification of the critical structural members like floating columns, transfer beams, slender members, rusting of exposed steel and its extent.
- Status of all building elements like beams, slabs, columns, balconies, canopy, false ceiling, chajja, parapet and railings with respect to parameters deflection, cracks, leakages and spalling of concrete.
- Status of water tank, staircase, lift and lift machine room.
- Dampness in walls
- Leakages in Terrace, toilets, plumbing lines, drainage lines and overhead tanks.
- Blistering of paints and paint peel off
- Inspection of drainage system



Fig -1: Exposed reinforcement in wall



Fig -2: Cracks in beams



Fig -3: Exposed brickwork in walls

### 2.3 Tapping observation

Tapping sound is noted by tapping hammer on some structural elements to find out whether it is hollow or dense. Defects like cracks and bulging are also identified by tapping with light hammer.

### 2.4 Destructive testing

It is feasible most of the times to make a stroke through the components and inspect the exposed surfaces to substantiate the robustness of a component. The building components can be stressed and pressurized until failure to ascertain their properties of strength and toughness. Materials can also be subjected to chemical testing. These are some forms of destructive testing. Unfortunately this approach of destructive testing renders the component useless for its intended use as against non-destructive testing which can be performed on the components and machines without affecting their service performance.

### 2.5 Non Destructive testing

Non-destructive testing (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. Common NDT methods include ultrasonic, magnetic particle, liquid penetrate, radiography, remote visual inspection (RVI), eddy current testing. These types of tests are of great importance in determining the damage to structures subjected to corrosion, chemical attack, fire attack, etc.

## 3. AUDIT REPORT

An Audit Report is prepared on the basis of the inspection carried out.

General Format of the Structural Audit Report:

- Name of the building
- Name of the owner
- Address
- Contact No.
- Year of Construction
- Name of Structural Engineer for Audits

**Table -1:** General Observations

Sr. No.	Description	Remark
1	Type of bldg. structure	
2	Age of building	
3	No. of wing	
4	Mode of use	
5	No. of stories	
6	No. of flats	
7	Architectural plan available	

**Table -2:** Structural Observations

Sr. No.	Description	Component	Grade
1	Cracks	Beam	
		Column	
		Slab	
		Plaster	
		Wall	
2	Settlement	Foundation	
		Joint at plinth	
		Column	
		Wall	
3	Leakage and Dampness	External wall	
		Toilet	
		Terrace	

		Slab	
		Water tank	
		Drainage line/Pumping line	
4	Deflection	Beam	
		Slab	
		Balcony	
5	Condition of staircase, balcony, flooring and ducts		

RCC framed structures are rated by grades as follows:

- Very Bad (VB)
- Bad (B)
- Fair (F)
- Good (G)
- Very Good (VG)

#### 4. CONCLUSIONS

Structural Audit is a highly responsible job and of utmost importance since it is connected with lives of people and socio-economic considerations. It is advisable to carry out structural audit of any building atleast once in five years; and for buildings aging more than 30 years, structural audit should be carried once in 3 years. The effective carrying out of structural audit prevents deterioration of building ensuing sustainability. The periodical structural auditing and analysis for health of existing buildings is very important for finding the present status of structures.

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