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## Structural audit of RCC building

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### ABSTRACT

*Civil engineering is the foundations of all structure which made human life easy. Structure can be of any kind like residential building or non-commercial buildings or historical or ancient monuments had huge impact on human life because of their long life span which made them efficient structure, but this effectiveness of now-a-days structures can't be seen anywhere. Structure are getting older or weak before their design period. In this project where trying to root out faulty mechanism in structure to overcome the failure of structure.*

**Keywords:** Foundation, Ancient monument, Efficient, Effectiveness, Faulty mechanism, Design period, Failure.

### 1. INTRODUCTION

As the structure gets older and older as time goes it need periodical maintains and checkup to prevent future damages. 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. Therefore, structure audit is done to assess the general health of building. Structure audit is preliminary technical survey done on a structure to suggest remedies for repairs.

External and internal damage of structure mainly depends on the faulty construction technique. Also various action like fire damage, temperature effect, wing effect, frost action or chemical attack slowly deteriorate the structure. Hence audit is essential to make the serviceability and scope for future development aspects better.

#### 1.1 Need of structural audit of building

It is mandatory for all co-operative housing societies, whose buildings are more than 15 years old to have mandatory structural audit carried out every 5<sup>th</sup> year to determine the existing life of building's structure and its balanced life.

According to model bylaw no-77, structural audit is necessary and binding requirement. Its stipulates that if the age of building is 15 to 30 years structural audit must be carried out once in 5 years and for 3 years for building older than 30 years. U can go even earlier for it if structural conditions gets bad.

#### 1.2 Object of project

Structural audit of the building is done in following objectives.

- To assess the damage to the existing structures under distress and suggest the remedial measures for strengthening or repairs and rehabilitation.

- To establish reserve strength in elements of structures required upgradation in order to support higher capacity equipment. This was done to minimize modification and downtime.

## 2. METHODOLOGY

Structural audit is carry out by 2 method:-

- Visual Inspection
- NDT testing (Field and lab testing)

### A. Visual inspection

In this method inspection is done manually like if there are crack present on external and internal wall. Cracks in beam and column, spalling of concrete, deterioration of structure building leakage if and get the deep knowledge about settlement in foundation, strata, settlement in soil or etc.

### B. NDT TESTING

NDT stands for nondestructive testing mainly done is auditing process to assess the structure technically and with help of obtained data. Structural components can be classified into 4 category; very good, good, bad and very poor.

## 3. STRUCTURAL AUDIT REPORT

### A) Case Study of R.C.C. Building

Basic Information

Name of building:- Vidhata apartment

Type of Structure - RCC Building of G+4 floors

Address - thane

Age - 28

Weather effect - Yes

### B) Visual Inspection:-

Building was inspected by us as per flat and externally. Columns, beams, slabs, walls, and also some areas defects occurred, where observed, and conditions of the structural components were recorded on sheet. At the same time we have taken photographs elaborate the defects visually.

Sr. No.	DISCRITION	REMARKS
1	FOUNDATION STRATA	Hard strata observed on 1.70 m. and soft strata seen on 1.50 m. depth
•	Visual Inspection	Minor hair cracks are visible on external walls specially on corner of walls
•	Settlements of columns	Not properly identified on site
•	Cracks in column, walls, joint at plinth	Minor vertical cracks are developed on column and minor cracks are seen on joint of slab, beam, column
2	SUPERSTRUCTURE INSPECTION	
•	Cracks in columns/rusting of steel/exposed steel	Rusted ,broken Reinforcement is visible below underneath portion of slab
•	Cracks in beam/rusting of steel/exposed steel	Minor vertical crack are seen on wall surface whereas long wall and short wall are joint together
•	Cracks in slabs/rusting of steel/exposed steel	Rusted, broken Reinforcement is visible below underneath portion of slab
•	Cracks in external walls	Minor vertical and inclined cracks are developed
•	Cracks in internal walls	Minor vertical and inclined cracks are developed
3	Leakages and dampness in external walls	Not seen

4	Terrace waterproofing and inspection	seepage is notices on underneath portion of slab
5	Inspection of water tank above the terrace	Overhead water tank slab is leaking due to minor cracks are seen.
6	Leakages and damages ;plumbing lines/waterline; drainage line	Overhead water tanks slab reinforced is badly come from RCC padade.
7	Building last repair details	Before 5 years
•	Date	10 April 13
•	Cost of repair work	7 lakhs
•	What was repair	All walls and plumbing system and drainage system
8	Date of construction of building	In 1990
9	RCC/load bearing structure	R.C.C type
10	Idea about foundation strata from surrounding areas and enquiry	After enquiry it is understand by people living nearby area that hard strata is observed varying from 1.60 to 1.80 m
11	HFL during this monsoon	1.20 m
12	HFL during last 5 years	1.30m
13	Building plan is approved	Yes
14	Test recommended	
A	Rebound hammer test	10 readings required
B	UPV TEST	9 Reading
C	Carbonation test	5 Readings

**C) NDT observation**

Under NDT we have perform rebound hammer test, UPV test, and carbonation test to check performance of the structural components like beams, slabs, columns, internal and external walls.

**Rebound Hammer Test**

COMPONENTS		REBOUND NO	STRENGTH ,(KG/SQ.CM)	AVG. STRENGTH(KG/SQ.CM)	REMARK
Beam	1	29	265	244.17	Good layer
	2	27	205		
	3	29	265		
	4	26	200		
	5	30	270		
	6	28	260		
Column	1	32	290	300.83	Good layer
	2	33	300		
	3	32	290		
	4	35	320		
	5	31	280		
	6	36	325		
Slab	1	26	200	198.33	Fair
	2	25	175		
	3	25	175		
	4	27	205		
	5	28	260		
	6	25	175		

**UPV TEST**

COMPONENT		PULSE VELOCITY (KM/SEC)	AVG PULSE VELOCITY (KM/SEC)	REMARK
Beam	1	3.1		Satisfactory But loss of integrity Is suspected
	2	3.5	3.3	
	3	3.3		
Column	1	3.7		Good to very good, slight porosity may exist
	2	3.5	3.7	
	3	3.9		
Slab	1	3.1		Satisfactory but loss of integrity is suspected
	2	3.0	3.1	
	3	3.3		

**Carbonation Test**

MEMBER	DEPTH(MM.)	CARBONATION PRESENT
C1	35	NO
C2	25	NO
C3	10	NO
C4	30	NO
C5	30	NO

**4. RESULT**

By the above investigation survey we have come to result that the structure health condition is fair. With study of NDT test we have concluded that structural member or components are suffering from class 3 damage. According to CPWD (Central public works department) class 3 damage stands for observation like spalling of concrete cover, structural cracks etc., in which principal repairs required.

Principal repair works should be started early as possible and to avoid further deterioration of structure. The repair work should include strengthening of column, plastering works of defected areas and water proofing, etc. Also rectification of leakage should be in various location at top floors. Quality of RCC found was poor as per the result of rebound test and UPV test performed at various location. Delay in repair works will result in the increase of the quantity of works due to continuous deterioration project.

**5. LIMITATION OF PRESENT STUDY**

On the basis of present study of structural audit i.e. visual inspection and NDT test, only visual conditions of the building and structural members and also technical parameters can be study. But for detection of technical damage or defect at specific and particular component of building. Proximal remote sensing tools should be used.

**6. CONCLUSIONS**

- Building is suffering from class 3 damage.
- Principle repairs are required at various levels.
- The repair work should start earliest to avoid further deterioration of the structure.
- All the vegetation should be removed at earliest.
- Any delay in structural repair work will result in more deterioration and quantity of work will become more.
- Slabs containing fine dormant cracks must be repaired by applying and overlay such as polymer modified Portland cement mortar or concrete or by silica fume concrete.
- Corroded steel must be replaced where ever necessary, if steel cannot be removed then it should be clean for remove rusting and additional reinforcement is to be provided.
- Minor cracks should be repaired by injection of epoxy or by using grouting method.
- Deteriorated plaster surface must be removed and plastering should be done with mortar proportions 1:3

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