

# STRUCTURAL AUDIT FOR AN EDUCATION BUILDING

Abhinandan Kale<sup>1</sup>, Mahesh Gond<sup>2</sup>, Pallavi Kharat<sup>3</sup>.

<sup>1,2</sup> student, Department of civil engineering ,D Y Patil school of Engg & tech. pune Maharashtra India

<sup>2</sup> Prof. Pallavi V Kharat. Asst Professor at D Y Patil school of Engg & tech.pune Maharashtra ,India  
[abhinadankale@gmail.com](mailto:abhinadankale@gmail.com) [mgond3729@gmail.com](mailto:mgond3729@gmail.com) [pallavi.kharat@dypic.in](mailto:pallavi.kharat@dypic.in)

## ABSTRACT

*The life cycle of a building can be broadly divided into four phases i.e. architectural planning, structural design, construction and maintenance in most of the building almost care is taken in first three cases but the maintenance is forgotten. Ignoring to maintenance causes severe structural distress in building over period of time. This paper deals to create awareness amongst the resident, owner of building, civil engineers towards the health examination of existing concrete building and current status of the building. Every structure has its own service life and it should stand firmly on its position during its complete service life. But now a days due to lack in the quality in construction process and the low quality material used in the construction has decreases the life of the structure and it also has increased the rate of failure of structure which leads to lose the life of the people.*

*There are the various demand from the society and from the government for appropriate action and measure to be taken to prevent it from the collapse of structure, to save the life of the occupant and to improve the life of the structure.*

*The reinforced cement concrete is used as a construction material all over the world because of its high-strength and cost ratio, its application, it is easy to use. As the time passes the strength of the rcc members get decreased. This decrease in strength increases the risk of the structural to collapse. So as to prevent this type of the collapse necessary precaution should be carried out and this type of the procedure is known as Structural Audit.*

**Keyword :** - Structural audit, Non-destructive testing, suggestion and repairs.

---

## 1. INTRODUCTION

The life cycle of a building can be broadly divided into four phases i.e. architectural planning, structural design, construction and maintenance in most of the building. The life of the building plays an important role the architectural planning, structural planning and construction are the stages which are primary stages and all possible care is taken during the execution. The secondary stage that is maintenance of the structure is least considered. Maintenance of the structure increases the healthy life of the building. The first structural audit was presented by the Indian Structural Engineers. From the year 1975 the construction industry has been set up and the growth of the infrastructural has been increased. Due to the increase in the population and the people migrating from the village to the cities has increased the population in metropolitan cities and with the limited space available therefore the height of the building has to be increased and the number of people living in this building is more than its actual design consideration. Due to this the load on structural is increased and the settlement of the building takes place. Due low quality of construction material, improper construction technique the failure of building is increased.

Structural audit is the technical process in which the health of the building is checked completely and the necessary maintenance can be suggested regarding to the health of the structure.

This paper deals with study of different parameter of structural audit including visual inspection, non-destructive testing. It also emphasizes on different repairs and retrofitting measures to be used for buildings after structural audit.

The structural audit is done by the qualified structural engineer registered with the respective municipal corporation.

### 1.1 STRUCTURAL AUDIT

Structural audit is the process in which the overall health of the building is completely checked up by the using of various instrument, visual inspection, various test so that the current condition of the building can be found out and the necessary measures are to be taken so that the life of the structure can be increased. Structural Audit also deals with the preventative measures to be taken and the type of the maintenance and repair.

### 1.2 PURPOSE OF THE AUDIT

1. To save life and building.
2. To know the health of your building and to project the expected future life.
3. To find critical areas to repair immediately.
4. To guide the residents to understand the seriousness of the problem and to suggest the solution .
5. To comply with municipal or any other statutory requirement.

### LAWS FOR CARRYING AUDIT

As per clause No.77 of revised Bye-Laws of Cooperative Housing Societies: The Society shall cause the 'Structural Audit' of the building as follows:

- For building aging between 15 to 30 years once in 5 years.
- For building aging above 30 years once in 3 years.

Such structural audit by the society which is in Municipal Corporation limits shall be conducted by the approved engineers from the corporation panel. In case of other society such structural audit shall be carried out by the government Approved structural engineers / architect, and maintain record.

## 2. METHODOLOGY AND INVESTIGATION

1. Study of plan, if not available the plan should be prepared.

2. Visual inspection

The various points should be checked on inspection

- Any settlement in the foundation.
- Detect dampness in wall.
- Visual cracks in columns, beams, slab and walls.
- Any sign of material deterioration.
- The various addition and alteration made.
- Status of balconies – sagging, deflection, crack.
- Electrical wiring from main connection to all rooms. Any explosion in the meter room.
- Leakages from terrace and toilet block.

3. Non destructive testing.

In addition to the visual inspection the quality of the member can be determined by the use of various non destructive test. There are various instrument (NDT) used in the concrete members to determine the present strength and quality of the concrete. The result of these is useful in finding out the treatment to be given to the structural members. There are various types of the test available in the market. The instrument used depends upon the type of the audit carried out, age of the building, type of the structure, surrounding condition, atmospheric condition etc. some of the instrument are listed below.

- Core Cutter Test:- To measure strength, permeability, density of concrete.
- Rebound Hammer Test:- To measure surface hardness of concrete.
- Half Cell Method:- To assess probability of corrosion in the embedded steel.
- Ultrasonic Pulse Velocity Test:- To assess homogeneity of concrete, to assess Strength of concrete qualitatively, to determine structural integrity

4. Identification of critical areas in building

Based on the above inspection, analysis and test results, the report should conclude the critical areas that need immediate repairs and retrofitting. The report is prepared on the maintenance required

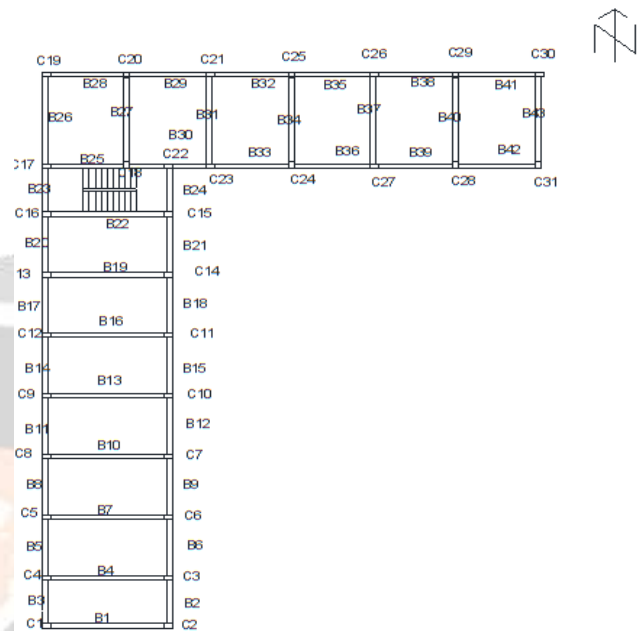
5. Repairs

The repair should be carried out as per the standard procedure mentioned in their respective code. The maintenance work should be carefully carried out as per mentioned

### 3. CASE STUDIES

Table 1: Information about Building  
Basic information

Name of building	Sant. Tukaram Maharaj Vidyalay
Address	Lohegaon bus stop, Pune 411047
Mode of use	School building
Type of structure	RCC framed structure
No. of storey	Two
Previous structural audit	None
-----	
Floor Height (m)	3
External walls	Brick
Internal walls	Brick
Balconies	None
Survey	
Mode of survey	Visual inspection, NDT
Area inspected	External building faces, terrace, internal walls etc.
Units locked	None
Survey disallowed in units	None



### 3.1 VISUAL INSPECTION

The building was investigated room by room for observation and external areas of the building. Some of the column, beams, walls and slab were observed for a range of defects such as cracks, spalls, seepage etc. All the defects were marked in the below table.

**Chart -2:** Visual inspection

Sr.no.	Description	VB	B	F	G	VG
<b>A</b>	<b>External building faces</b>					
1	Columns & Beams Cracks,Bulging,Corrosion in RCC				✓	
2	Walls, Plaster and Cracks		✓			
3	Chajjas cracks and reinforcement open to atmosphere		✓			
4	Corrosion in water supply pipes and leakages	✓				
5	Paint, Weathering, Fading, Absence	✓				
<b>B</b>	<b>Staircase, Lobby &amp; Passage</b>					
6	Cracks in walls, Railings		✓			
7	Flooring Unevenness, Loose			✓		
8	Slope for removal of rainwater	✓				
9	Dampness	✓				
<b>C</b>	<b>Terrace</b>					
10	Seepage into classroom	✓				
11	Waterproofing	✓				
12	RCC Water Tank Cracks, Bulging, corrosion in RCC			✓		
13	Parapet wall Cracks, dampness			✓		
14	Slab vegetation	✓				
<b>D</b>	<b>Rooms</b>					
15	Walls & Plaster Cracks	✓				
16	Leakage and Dampness	✓				

17	Flooring loose			✓		
18	Ceiling reinforcement corrosion		✓			
<b>E</b>	<b>Other</b>					
19	Water logging during monsoon	✓				
20	Cracks in compound wall		✓			
21	Cracks in paving				✓	

A R.C.C. Framed structure as visually inspected and giving the ratings as Very Bad (VB), Bad (B), Fair (F), Good (G), Very Good (VG). Inspected building giving ratings on the visual inspection



Fig 1- spalling of paint



Fig 2- seepage of water through walls

### 3.2 Limitation of case study

Present study is done on the basis visual inspection and rebound hammer. The rough idea can From the result of the visual inspection and rebound hammer it can be said that the building need repairs

## 4. CONCLUSIONS

The present status of the building is satisfactory. The restoration work for the building will require major repairs for the structural members which could prove dangerous as well as very costly. In spite of this remaining member of the building needs major up-gradation. Under these condition it is my firm opinion that the complete repair will be practicable and advisable. However the final decision may be taken by the corresponding authority in the good interest of the users of the building

## 5. REFERENCES

- [1] Structural Audit of Buildings BY A.B. Mahadik& M.H. Jaiswal International Journal of Civil Engineering Research. ISSN 2278-3652 Volume 5, Number 4 (2014), pp. 411-416
- [2] Structural Audit of Existing Buildings By I. H. Shah , Consult Eng.
- [3] Indian Standard: 13311:1992 (Part 2) NDT methods of Test- Rebound Hammer.

[4]Structural Audit ByB.H Chafekar1, O.S Kadam, K.B Kale, S.R Mohit, P.A Shinde, V.P Koyle, International Journal Of Civil And Structural Engineering Research (IJCSE) Vol. 1, Issue 1, pp: (42-46), Month: October 2013-March 2014

[5]Indian Standard: 456: 2000- Plain and Reinforced Concrete

[6] J. J. Shah (2008), Article in The Indian Concrete Journal, pp. 17- 26.

[7]Indian Standard: 516: 1959- Method of test for strength of concrete.

[8]Jayakumar.J.Shah 1, “*Can Structural Audit Alone stop collapses of building?*” , The Indian Concrete Journal, July 2008, pp 17-26.

[9] Building and Construction Authority, “PeriodicStructural Inspection of Existing Buildings”, January2012Central PWD,”Handbook on repair andrehabilitation of RCC Buildings”, July 2010

