

Simplifying and Managing the Process of Structural Audit

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Abstract— With the study of current process of Structural Audit there is need to find the lacunas in the current process and modify the process for efficient implementation of Structural Audit. This research aims at finding out the lacunas if any in the current procedure and applying management principals to modify the structural auditing process and suggest some improvement measures to the governing body.

Keywords— *Structural audit, current process, lacunas, management principals, improvement*

1. Introduction

In India, from 1980 onwards the infrastructure industry witnessed stepping up of public investment and growth in infrastructure industry which results in construction of new multistorey concrete apartments which are now in the age of thirty plus years. There are many buildings during this period and earlier have reduced strength in due course of time because of structural deficiency, material deterioration, unexpected over loadings or physical damage. If, further use of such deteriorated structure is continued it may endanger the lives of occupants and surrounding habitation. 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 Structural Audit is an important tool for knowing the real status of the old buildings. The Audit should highlight & investigate all the risk areas, critical areas and whether the bldg. needs immediate attention. It also covers the structural analysis of the existing frame and pinpoints the weak structural areas for static, wind & earthquake loads. The need of structural audit is for maintenance and repairs of existing structures whose life has exceeded the age of 30 years to avoid any mishaps and save valuable human life. There is demand of appropriate actions and measures for all such building structures to improve its performance and restore the desired functions of structures which may leads to increase its functional life. The periodical structural auditing and

diagnosis for health of existing buildings is thus utmost important for finding the present serviceability and structural viability of structures.

2. Methodology

The process of structural audit is studied with the data available with various auditing firm. To find the lacunas in the procedure if any by the method of Questionnaires to the Owners of various Existing Structures. The using management skills to carry out Structural Audit of a building using minimum resources framing some suggestions to local Governing bodies for Smooth conduction of Structural Audit.

2.1 Process of Structural Audit

The detailed Architectural and Structural plans of the buildings must be available. If the Architectural plans and Structural plans are not available, the same can be prepared by any Engineer by measuring the size of the bldg. & locating the position of the columns, beams and size of all such structural elements.

Visual Inspection of the Bldg.:

A detailed inspection of the bldg. can reveal the following:

1. Settlements in the foundations.
2. Visual cracks in columns, beams and slabs
3. Concrete disintegration and exposed steel reinforcements
4. Deterioration in concrete.
5. Extent of corrosion in reinforcement.
6. Status of Balconies – sagging, deflection, cracks?
7. Status of chhajjas, fins, canopies etc.
8. Leakages
9. Status of lift and lift machine room
10. Status of electrical wiring from meter room to all the flats.
11. Status of overhead & underground water tank capacity.
12. Last Structural Audit prepared.

If all the data required for structural audit is not sufficient by Visual Inspection then Various Non-Destructive Test are conducted. Highlight the critical areas and decide the method for repairs. Implementation of suggested repairs and improvements in Structural Audit is useful.



Fig.1(a,b,c): cracks identified by Visual Inspection

2.2 Suggested Format for Structural Audit Report

Name _____ of _____ the _____ Building:

Description: _____

Address: _____

Society Name: _____

Age of the Building: _____

Contact Person:- _____ Tel. No: _____

Inspection Report Date: / /

INSPECTED BY: _____

S N O	DESCRIPTION	LOCATIO N OF COMPON ENT	EXTEN D OF DAMA GE	MEAS URES FOR REPAI R
1	FOUNDATION STRATA			
	VISUAL INSPECTION			
	SETTLEMENT OF COLUMNS			
	SETTLEMENT OF WALLS			
	CRACKS IN COLUMNS., WALLS, JOINT AT PLINTH			
2	SUPER STRUCTURE INSPECTION			
	CRACKS IN COLUMNS/ RUSTING OF STEEL , / EXPOSED STEEL			
	CRACKS IN BEAMS / RUSTING OF STEEL , / EXPOSED STEEL			
	CRACKS IN SLABS / RUSTING OF STEEL , / EXPOSED STEEL			
	CRACKS IN EXTERNAL WALLS			
	CRACKS IN INTERNAL WALLS			
3	LEAKAGES & DAMPNES IN EXTERNAL WALLS			
4	TOILET LEAKAGES,CRACKS			
5	TERRACE WATER PROOFING INSPECTION			
6	LEAKAGE & DAMPNES ON THE TOP FLOOR SLAB			
7	INSPECTION OF WATER TANK ABOVE TERRACE			
8	INSPECTION OF UNDERGROUND WATER TANK			
9	LEAKAGES & DAMAGES:- PLUMBING LINES/WATERLINES, DRAINAGE LINES			
10	ELECTRICAL LINE			
11	BUILDING LAST REPAIED DETAILS			
	DATE			
	COST OF REPAIR WORK			
	WHAT WAS REPAIED?			
1	DATE OF CONSTRUCTION OF BUILDING			
2				

1 3	R.C.C./ LOAD BEARING STRUCTURE			
1 4	DETAILS ABOUT FOUNDATION STRATA FROM SURROUNDING AREAS & ENQUIRY			
1 5	HIGH FLOOD LEVEL			
	HFL DURING THIS MONSOON			
	HFL DURING LAST FIVE YEARS			
1 6	ANY CRACKS OBSERVED DURING EARTHQUAKE			
1 7	ARCHITECTURAL PLANS AVAILABLE			
1 8	STRUCTURAL PLANS AVAILABLE			
1 9	BUILDING PLAN APPROVAL DATE			
2 0	OCCUPATION CERTIFICATE DATE			
2 1	BUILDING IS DESIGNED FOR EARTHQUAKE CODE -1893-1984			
	TESTS RECOMMENDED			
	CONCLUSION:			
	REVIEW OF REPAIRS CARRIED OUT:			

5	Ultrasonic pulse velocity	IS 13311 (Part 1): 1992
6	Rebound hammer	IS 13311 (Part 2): 1992
7	Abrasion resistance	IS 9284: 1979, ASTM C779-76, ASTM C944-80
8	Permeability	IS 3085: 1965
9	Testing drilled cores	ASTM C 42-87
10	Infrared thermograph	ASTM D4788-88
11	Ground penetrating radar	ASTM D6087-97
12	Density by nuclear methods	ASTM D2950-91, ASTM C1040-93
13	Impact echo method	ASTM C1383-98a
14	Half-cell potential	ASTM C876-91
15	Penetration resistance	ASTM C 803-82
16	Radiography	BS 1881: Part 205: 1970, BS 4408: pt. 3, NDIS 1401-1992
17	Water absorption	BS 1881: Part 122: 1983, AS 1012.21-1999
18	Electromagnetic covermeter	BS 1881: Part 204: 1986, BS 4408: pt. 1
19	Concrete strength by near to surface methods	BS 1881: part 207: 1992
20	Strain gauges for concrete investigation	British Standard Institution, London, 1969, (83)
21	Determination of chloride and sulfate in hardened concrete	AS 1012.20-1992
22	Visual inspection	NDIS 3418-1993
23	In situ monitoring of concrete	NDIS 2421-2000
24	Surface hardness method	BS 4408: pt. 4

2.3 Non-Destructive Test

The various NDT carried out in Structural Audit are:

S. NO	TEST	CODE
1	Alkali aggregate reactivity	IS 2386 (Part 7): 1963
2	Petrographic examination	IS 2386 (Part 8): 1963, ASTM C856-77
3	Pull out test	IS 2770: 1967, ASTM C900-94
4	Water soluble chlorides in concrete admixtures	IS 6925: 1973

3. Conclusion

After studying the detailed procedure of Structural Auditing and Various Non-Destructive Tests it is been

concluded that carrying out Structural Audit of Old Buildings has become very necessary. It is necessary to make the Auditing Procedure simpler so as to make it familiar the common man. The lacunas in the existing procedure will be evaluated and the process will be simplified by use of management Principles.

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