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Structural Audit of a Residential Building

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***Abstract*— Civil Engineering Industry is one of the oldest diligence which gives an introductory structure to all mortal beings.Every structure has its own service life and it should stand forcefully on its position during its complete service life. Over a period of time, as these structures come aged, we find in them certain declination or deterioration with attendant torture manifested in the form of cracking, disjoining, delaminating, corrosion etc. Similar deteriorated structures can be rehabilitated and retrofitted by using varied types of compounds & modernistic repair accouterments. The paper brings out the current state of concrete structures & the considerable areas where enhancement is demanded during its service life stage for sustainable expansion & so the approach of carrying out Repair, Rehabilitation & Retrofitting.**

Keywords—Structural Audit; Visual Inspection; NDT Methods; Maintenance; suggestion & Repairs.

I.INTRODUCTION

A. Structural Audit

The general health and performance of a structure depends on its quality of conservation. As a structure grows old and aging, use and exposure to the climate can affect the health of buildings significantly. Thus it's judicious to Cover it periodically by taking professional advice. Structural Audit is the primary specialized check of structure to assess its general health as a civil engineering structure. It's generally initiated as the first step to form this is analogous to periodic health checkup recommended for aged people. Structural inspection is based on visual check by a competent adviser who lists his compliances and recommendations in the form of Structural Audit Report. The purpose of Structural Inspection is to ensure regular assessment of structures that the owners (managing committee of Cooperative Housing Society) become conscious of the structural deterioration of their structures and they can make timely measures to repair or strengthen them.

B. Need of Structural Audit

- To increase life of property
- To know the health of structure and its anticipated life.
- To check effective dependability of the structure.
- In order to recommend rehabilitation methods
- In order to point to the critical regions and repair them instantly.
- For structural inspection certificate needed by municipality and other administrations.

C. Objectives of Structural Audit

- To recognize the types of structural deformities.
- To perform preliminary inspection of the structure.
- To conduct visual examination to emphasize critical areas.
- To conduct NDT tests.
- To identify any signs of material deterioration.
- To identify any signs of structural distress and distortion.
- To identify any alteration and addition in the structure, misuse which may affect in overburdening.

II. LITERATURE REVIEW

ShahI. H: has stated structural inspection is an important tool for knowing the real status of the old structures. The inspection should punctuate and probe all the threat areas, critical areas and whether the structure needs immediate attention. If the bldg. has changed the stoner, from domestic to marketable or artificial, this should bring out the impact of such a change.This Publication gives step by step guidelines for carrying out structural inspection of old structures.

Investigation of Structural Defects and Renovation of a RC Residential Building by Dr. Akil Ahmed, Prof. Mehtab Alam, and Dr. Asif Husain [1]: The focus of this work was to sketch and research, about detecting the causes of some structural defects in a multistoried reinforced concrete domestic structure and its cures for renovation. For this purpose,non-destructive testing for worried columns, physical tests for buttressing bars, chemical tests for concrete and water were carried out. In addition, the structural sketches were checked with a thorough design calculation. Based on the analysis of the test outcomes, visual audit and design calculation, some cures are recommended for repairing, and strengthening the Worried and damaged factors of the structure.

Villain Geraldine Sbartai, Zoubir Mehdihave: Applied non-destructive techniques (NDTs) for surveying concrete structures in marine surroundings, nondestructive dimension results must be identified with concrete continuity pointers similar to porosity and water and chloride contents. For this purpose, tests introducing two electromagnetic techniques (GPR and the capacitive method), as well as the impact-echo system, were run on six different concrete composites containing varied porosities, with five water content values and three chloride attention.

Monteria. J., Pathak,N. J.: have estimated the soundness of being buildings whose life has crossed the time of thirty

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times. Concrete constructions are usually anticipated to give trouble free service throughout its aimed plan life. The deterioration of structures can be an effect of various aspects containing fire damage, frost action, chemical aggression, erosion of steel, etc. during the life span of the structure. The examination of soundness is therefore necessary for changing the present service of the structure and its compass for coming progressions or for the change in its operation.

III.METHODOLOGY

As we know concrete is extensively used as a construction material because of its good strength- expenditure rate in numerous operations. Concrete structures are usually anticipated to give trouble free service throughout its intended design life. Still, these prospects aren't realized in numerous constructions because of structural insufficiency, material deterioration, unexpected over ladings or physical damage and therefore Civil structures like structures, heads, islands subordinated to nonstop deterioration over the times. For structural auditing we have chosen a residential building situated at Worli and an investigation can be carried out us in the following methods:
i) Visual Inspection
ii) Non-Destructive Testing

A. Visual Inspection

In this system examination is done manually like if there are defects present on external and internal walls. Defects like crack in beam and column, spalling of concrete, deterioration of building leakage if and get the deep knowledge about agreement in foundation and soil, strata, etc.

B. Non- Destructive Testing

Non-destructive Testing systems are the method of testing in which properties of material or condition of the material is determined without harming or making changes in the object. This way of testing allows us to test the material or member without losing its utility.
Common NDT methods include:

- Ultrasonic pulse velocity: To assess homogeneity of concrete, to assess strength and quality of concrete qualitatively, to determine structural integrity.
- Half cell potential: To check corrosion or the possibility of it in the steel.
- Core Cutter Tests: To measure strength, permeability, density of concrete.
- Rebound Hammer Tests: To measure surface hardness of concrete.
- Carbonation Tests: To assess depth of carbonation and pH of concrete.
- Chemical Tests: To check pH of water/acid soluble chloride and sulphate contents of the concrete.

IV. CASE STUDY OF R.C.C. BUILDING

Name of Building: 358, Municipal Tenements, K.A.G Khan Road, Worli, Mumbai- 400018.
Number of Storey: G+4
Age of building: 43 Years (As Reported)
Type of building: Residential building
Date of Inspection: 26 January 2022
History of Repairs Done: Before 5 years

A. Visual Inspection

Condition of	**Remark**
Internal Plaster	Found damaged at many locations
External Plaster	Found damaged at many locations
Plumbings	Found damaged at many locations
Drain line	In working Condition
Observations	
Columns & Steel exposing	Corrosion Cracks are observed
Foundation Settlements	Not observed
Deflections	Lintel beam found sagged
Major cracks in beam/ Column	Wide corrosion cracks and Spalling observed
Seepage/ Leakages	At many locations
Vegetation	At many locations
Terrace/ Waterproofing	Found damaged
Staircase area	Found Corrosion cracks
Chhajjas	Spalling, Leakage marks
Common areas	Water seepage from External Walls
Parapet at terraces	Plaster cracks, Peeling of Paint, Moss growth
Lift walls	NA

B. NDT Tests

Ultrasonic Pulse Velocity Test:
The UPV tests were conducted at 30 locations in the building. The test results show that all locations have the UPV reading of less than 3.0 km/sec, which makes the concrete quality as “Doubtful” for these locations.
Half cell potential Test:
The HCP tests were conducted at 17 locations in the building. Half-cell potential results show that the probability of corrosion in reinforcement is 50% at 14 tested locations & 90% at 03 tested locations.
Chemical Tests:
The samples were collected from 04 locations in the building for chemical analysis. Chemical test results show that all chemical aspects such as PH, chloride content & sulfur content are within permissible limits of Indian Standards.

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Cover Meter Test & Carbonation Test:

Cover meter test was done at 02 locations on columns, 02 locations on beams & 01 locations on slab in the building. Test results show that the average thickness of cover provided to RCC columns, beams and slab is 31 mm, 27 mm & 25 mm respectively.

Carbonation test was carried out at 13 locations on columns, 03 locations on beams, 01 locations on slab in the building. The average depth of carbonation was obtained as 25.8 mm for columns, 28.33 mm for beams & 28 mm for slabs.It can be observed that carbonation has reached a depth which is more than reinforcement cover provided to RCC beams and slab.

Rebound Hammer Test:

Rebound Hammer test was carried out at 30 locations in the building. The test results show that the strength of surface concrete obtained is 15.27 MPa (Average). Surface strength found out to be less than 9 MPa at 08 locations in the building.

Core Cutting Tests:

Core cutting test was carried out at 04 locations in the building. The results obtained from core testing gives the average concrete strength value as 23.14 Mpa (Average).

IV. SUGGESTIONS AND REPAIRS

Following are the suggested Repairs for the structures

Repairs in Masonry work

- Wrong jointing work.
- Remove all loose and weak masonry work which is visible.
- Make proper voids in the adjoining wall for locking purposes.
- Take care to minimize damages to before completed masonry.
- Execute repairing work precisely. If demanded re-do the affected portion also observe curing on all repaired work.

Repairs in Waterproofing

- Repairs in waterproofing should be done by the approved agencies only.
- External and internal Proper finishing after fixing the rainwater pipe, should be done by the waterproofing contractor precisely with waterproofing chemicals.
- If the water-proofing agency has done redundant waterproofing treatment on walls of WC get remedied by the same agency, before fixing glaze penstocks.
- Insure necessary preventives for the required water miserliness.
- All form workshop should be duly cured.

Repairs in Tiling/Flooring

- Broken mosaic penstocks during polishing of the flooring should be repaired before farther polishing as specified below.
- Remove the broken pipe piece, by breaking it from the center.
- Insure that the conterminous penstocks aren't disturbed.
- Remove any similar perturbed penstocks.
- Prepare a rich cement slurry and re-fix the pipe with proper finish at the joints.
- Cure this work duly.
- If possible use a polish to bring a repaired portion and conterminous polished pipe in one position and line.
- Balance fleeces of polishing should be carried out on the entire area.

V. CONCLUSION

The structural opinion is a vast, important and much responsible job which is chained with the lives of mortal beings. It's obligatory and judicious to carry out the journal structural inspection of the structures by professional experts and act instantly through recommendations handed in the inspection report. The success of repairs and restoration is always grounded on thorough knowledge, correct opinion and in- depth studies of problems in structure, proper form practices and eventually socio-profitable considerations.

From the results of visual inspection and NDT tests , we conclude that the periodical structural auditing and analysis for health of existing buildings is very important for finding the present status of structure. And the defects of structural members are due to combined effects of carbonation, corrosion & effect of continuous drying and wetting.

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Based on the foregoing compliances, we may conclude that, despite considerable reinforcing, the demand-to- capacity proportion for all structural rudiments is less than one. Because of erosion, the given reinforcement is in poor condition and has lost its strength. The cross section of the reinforcement is degraded due to erosion, performing in deviation under their own weight, making them unfit to support any farther cargo.

REFERENCES

[1] I.SHAH:"Structural audit of RCC Building"2008
[2] The Constructor Civil Engineering, "Concrete Cracks".
[3] Abhinav Kale, Mahesh Gond, Pallavi Kharat, "Structural Audit For An Educational Building", Vol-3, Issue-3, ISSN (O) 2395-4396,2017
[4] Ravi Ranade, "Structural Diagnosis, Repair & Retrofitting of RCC Structure".
[5] ACI 562-12 - Code Requirements for Evaluation, Repair, and Rehabilitation of Concrete Buildings.
[6] A.B. Mahadik, M.H. Jaiswal,"Structural Audit Of Building", International Journal of Civil Engineering Research. ISSN 2278- 3652 Volume 5, No4 (2014), pp.411-416.