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Structural health assessment of RCC building: Case study

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ABSTRACT: *Structural health assessment is anhealth and serviceability checkups of a building, like a doctor examining a patient. It ensures that the building and its premises are safe for human beings and have no risks. It analyses and suggests appropriate repairs which are required for the buildings to perform better in its service life. Today the development of a country and the development of economy is decided on the basis of its infrastructure, therefore a major and huge part of country's revenue is invested in this sector as our priceless lives relay on them. For the proper infrastructure management,condition and serviceability of structure should be regularly checked. Structural health assessment is technique used to determinedeteriorationof the membes, stress strain development in members, etc. by using NDT methods. Hence structural audit is important to make the serviceability and scope for future development aspects better. In this paper case study of an RCCBuilding is given with its test results. This test results gives strength of that building. This study is important for checking the existing condition of building.*

KEYWORDS-*NDT methods, repairs, structural health assessment*

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I. INTRODUCTION

Structural health assessment (SHA) is defined as the process of a damage identificationfor aerospace, civil, and mechanical engineering infrastructure as well as non engineering structures.Here, damage is defined as changes to the material, geometric properties,including changes to the boundary conditions and system connectivity, which affects adversely on theperformanceof structure.Avariety of mosteffectivenon-destructive testing equipment's and methodsare available for such type of assessment. However, the majority of structural health assessmentrelatedresearch conducted over the last 30 years has attempted to identify damage in structures.The past 10 years have seen a rapid increase in the amount of research related to structural health assessmentas quantified by the papers published on these subjects. Most of the Reinforced Concrete (RC) structures which are in service,are facing aging and deterioratingof various members due to harsh environmental exposure conditions and are damaged by natural causes like earthquakes, hydrologic forces, etc. or man-made collisions, fire, road, etc. Due to this, the structural capacity of an existing structure is typically less than the structural capacity of just-built structure.The Non-Destructive Test (NDT) of concrete in today's scenario has received a great importance and popularity. Commonly used NDE methods are Rebound Hammer Test, Ultra Sonic Pulse Velocity (UPV) Test, chloride test and carbonation test.The NDT adopted in this paper for the assessment of strength of structure are Schmidt's Hammer test. The Schmidt Rebound Hammer (SRH) is useful non-destructive test, which are so familiar Now-a-days and effective for determining the strength.

II. AIM AND OBJECTIVES

It is mandatory for allbuildings are more than15 years old to have compulsory structural audit carried outto determine the existing life of building's structures and its balanced life.According tobylawstructural audit is necessary and binding requirement. Itstates 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. You can go even earlier for it if structural conditions get bad for safety purpose.According to the study objective of this paper is to identify structural damages area using NDT techniques and to suggest maintenance for it, for saving human life.

III. LITERATURE REVIEW

Er. Nilesh B. Deshmukh, Er. Manesh B. Satpute, Er. Rahul B. Abhale, Er. Akshay B. Varpewritten thatin case of Construction Industry, the life cycle of a structure can be divided by in to four important phases those are as Architectural planning, Structural planning, Construction and Maintenance. Every structure has its own Service life it should stand firmly on its position. But because of giving less importance to the maintenance collapsed mechanism has increased day by day and structure are getting collapsed before its service life is completed which leads to the loss of properties and life of human beings. There for it is suggested that to overcome the failure of structure it is necessary to do the structural audit and find the lacunas in the structure also find out the root causes of faulty mechanisms to avoid future problems.

Sachin RambhauShelke, Prof.DarshanaAinchwar briefed that structures are assemblies of load carrying members capable of safely transferring the superimposed loads to the foundations. Their main and most looked after property is the strength of the material that they are made of. Concrete, as we all know, is an integral material used for construction purposes. Thus, strength of concrete used, is required to be 'known' before starting with any kind of analysis. Apart from requiring regular maintenance, many structures require extensive Repair, Rehabilitation &Retrofitting. Over a period of time, as these structures become older, we find in them certain degradation or deterioration with resultant distress manifested in the form of cracking, splitting, delaminating, corrosion etc. Such deteriorated structures can be rehabilitated and retrofitted by using various types of admixtures & modern repair materials. The paper brings out the present state of concrete structures & the major areas where improvement is needed during its service life stage for sustainable development & also the method of carrying out Repair, Rehabilitation &Retrofitting. This has been brought in details in the paper along with Case studies, where the Author of the paper was directly involved in planning and execution of the jobs.

Sanket Sanjay Suryawanshi, Vaibhav Vishnu Vishe, Deepak , ReetikaSharan.stated that 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 present structures can't be seen anywhere. Structures are getting older or weak before their design period. This project is about trying to root out faulty mechanism in structure so as to overcome the failure of structure.

IV. METHODOLOGY AND OBSERVATIONS

In the present study, one RCC building is considered. Structureaway from the coastal environment. Following are some important factors of this study:

1. Identifying various Non-Destructive Test Methods to be carried out on the building.
2. Assessing the amount of damage occurred.
3. Identification of the possible causes leading to the damage of the structure.

Following NDT Test conducted to assess the structure

Rebound Hammer Test:

This test is conducted using Schmidt hammers for concrete as per IS 13311 part II. The interpretation of rebound hammer results is carried out based on the guide lines given in BS: 188-6089 since IS 13311 part II remains silent in this aspect.

Table 1: Information about Building

Name of the building	Ashirwad Housing Society
Address	Behind Sant Tukaram police station, Sant Tukaram Nagar, Pimpri, Pune, Maharashtra.
Name	Ashirwad Housing Society
Mode of use	Residential
Type of structure	RCC Frame structure
No. of stories	Two
No. of staircase	Zero
No. of lifts	Zero
Previous structural audit	This is first Structural Audit
Shape in plan	Symmetrical
Floor height	3.2 m
External walls	Brick
Internal walls	Brick
Balconies	Zero
Lofts	Above toilet bath
Mode of survey	Visual inspection using scale, tape.

Area inspected	External building faces, terrace etc.
Building inspection	Internal observations are subject to following constraints: due to storage of goods some cracks were not visible
Unit locked	None
Survey disallowed in units	None
Additional information	None

Table 2: Rebound number &compressive strength of structural member

Sr. no.	Area	Cracks in	Rebound hammer no.	Compressive Strength N/mm^2
1	Living room	Beam B_1	23	16
		B_2	19	10
		Column C_1	24	18
2	Kitchen	Column C_2	20	<10
		C_3	18	13
3	Bedroom1	Column C_4	22	<10
4	Bedroom	Beam B_{11}	19	10
		Column C_6	21	10

Table 3: Rebound number &compressive strength of structural member for internal faces:

Sr. no.	Area	Cracks in	Rebound hammer no.	Compressive strength N/mm^2
1	Living room	Beam b_1	25	15
		B_2	15	<10
		B_3	18	<10
		Column C_1	24	19
		C_2	23	19
2	Kitchen	Beam B_2	21	<10
		B_3	17	<10
		B_4	18	12
		B_5	20	<10
		Column C_2	17	<10
		C_3	17	<10
3	Bedroom1	Beam B_5	26	10
		B_6	26	10
		B_7	16	<10
		B_8	21	12
		Column C_4	18	<10
		C_9	19	<10
4	Bedroom 2	Beam B_3	17	<10
		B_9	11	<10
		B_{10}	24	10
		B_{11}	12	<10
		Column C_8	16	<10
		C_9	15	<10

Table 4: Result and observation

Sr. no.	Observation	Description
1	Distress in RCC	Corrosion of reinforcement in chajja and column
2	Leakage of water	Leakage of water due to lack of chajja at hall was observed.
3	Plaster	Due to environmental effect, spalling of concrete has occurred at allwalls.
4	Miscellaneous	Lack of regular maintenance of building was observed in building
5	Structural repair and RCC	For beams, columns bond coat and polymer modified mortar for RCC memberare required.

V. CONCLUSION

A case study gives the effective knowledge about any study. Above mentioned case study is very useful for checking the area of damage and deteriorated parts of building. Hence structural health assessment highlights following points,

1. The behavior of concrete at high temperatures is influenced by variousfactors including the rate of temperature rise or fall and the type of aggregate.
2. For any structure it is necessary to carry out structural audit at least once in five year.
3. For structure older than 15 years structural audit should be carried out once in fiveyears.
4. Reinforcement provided is in very bad condition and lost its strength due to corrosion and there is reduction in the area of the reinforcement resulting on deflection due to their own weight therefore unsafe to carry intended load.
5. From above observation we conclude that even though heavy reinforcement is provided for the structural memberfor all structural members the structure may fail without any prior indication.

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