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Analysis of Damage to the Existing Structure under Distress

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Abstract:- Recent advances have taken place in the area of structural damage detection and localization using several approaches. Accessibility of cost-effective computing memory and speed, advancement in sensor technology including remotely monitored sensors, headways within the limited component strategy, adjustment of modular testing and advancement of non-linear framework distinguishing proof strategies bring out monstrous specialized headways that have contributed to the progression of modal-based harm discovery strategies. Propels in modal-based harm location strategies over the final 20-30 a long time have created unused methods for looking at vibration information for distinguishing proof of auxiliary harm. Harm characteristics and energetic push reaction of maturing stone work structures for blast-induced ground movement were performed utilizing high-order nearby modular examination strategy. A total examination of harm sorts and areas of maturing stone work buildings due to burrow impacting vibration were performed by on-site study. A commonplace 2-storey maturing stone work building found over a burrow was chosen for energetic reaction investigation. With propels in estimation advances and investigation apparatuses, the utilize of damping to distinguish damage is getting to be a center of expanding consideration within the harm location community.

Keywords:- *Structural Damage, RCC Structures.*

I. INTRODUCTION

A. General

Concrete is the second most commodityafter water main used by mankind All Concrete that is currently in use will undergo chemical changes. RCC Structures are known to degrade over time and become obsolete after a given amount of time. of time RCC Structures Buildings surrounding tunnel blasting projects have undergone several damage analyses. The growing emphasis on buildings being environmentally friendly brings up the value of upkeep. It is necessary to carry out maintenance work as soon as a structure is finished and placed into use in order to guarantee that it operates at a satisfactory level. Frequent vibration brought on by tunnel blasting exacerbates structure damage and may result with major system failure. Buildings surrounding tunnel blasting projects have undergone several damage analyses. The findings demonstrated that various local non-load-bearing structural components, such as stress concentration corners, brick and concrete contact regions, precast floor seams, and infilled walls, were susceptible to cracking.

A audit is a thorough examination of the building's general health and function, much like how a doctor examines a patient. A structural audit can assist you understand the condition of a historic structure. The audit assists in highlighting and analysing all risk essential sections, and whether the facility need emergency maintenance. It examines the structural analysis of the current frame and emphasises the weak structural components for static, wind, and seismic loads. and earthquake loads. If the building's user has shifted from home to commercial and industrial, this should highlight the value of the transformation. The general health and effectiveness of a building depend on how well it is maintained. As a structure ages, its usage (misuse) and exposure to the environment.

B. Problem statement

There are numerous antique buildings in India that have lost strength. The lives of the residents and those living nearby may be at danger if further usage of this dilapidated building is undertaken. The right steps should next be taken in order to improve structfural 3392ntended3392ce and bring ack the 3392ntended function of structures. Therefore, it is crucial to conduct a structural audit of buildings currently in use and carry out maintenance and repair work on a timely basis in order to extend the life of the structure and ensure the safety of its residents.

C. Aim

To investigate and evaluate the harm done to the distressed existing structures and recommend corrective actions for strengthening, repairs, and rehabilitation.

D. Objective

- To study the type of structural defects.
- To identify any signs of material detoriation.
- To identify any signs of structural distress and deformation.
- To identify any alteration and addition in the structure.
- The remedies for the restoration of the structure.

E. Scope of Study

The first responsibility is to increase life of the building thus by saving the work indirectly saving the man power,raw materials , time and capital. To find damage area of the building and to repair it immediately. Which can lead to the proper maintainace of the building as the damages are repaired time to time and taken well care of . Another important task of the analysisof damage to the esisting structure under distress is to know the real condition of the building whether it is safe for dwelling as safety is the major priority of the fresidents and the localities thus safety is an important aspect kept in mind while undertaking the analysis of the existing structure under distress.

II. LITERATURE REVIEW

A. " Analysis on Health Superve of Structure of Building"

(Assistant Professor Khanjunaid, Shaikhs M.D. Shakib and M.D. Kasheef, Adeel Ahmed, and Humeraanjum) This study aims to raise awareness among civil engineers on the health examination of buildings made of concrete, which is nothing more than a structural audit, among residents, the owners, bridges, and buildings. The building is being examined for overall health and function, much like a doctor would a patient. The building needs to guarantee that all occupants are safe and at no risk. A structural audit is a useful tool for determining the real state of historic buildings, but it should only be used to maintain and repair existing structures whose lifespan has exceeded 30 years in order to avert harm and save priceless lives of people. Now a days life of the building is being examined for overall health and function, much like a doctor would a patient. The building needs to guarantee that all occupants are safe and at no risk. A structural audit is a good tool for assessing the true status of a historic structure that is 60 years old rather than 100 years old. For these reasons, we need to undertake a structural audit of the building every 15 years to see if it is safe or not, and if not, what corrective steps should be taken.

B. "A Case Report of a Residential Structure in Maharashtra, India" (Dr.A.W.Dhawale)

The building's life cycle can be divided into four phases: architectural planning, structural design, construction, and maintenance. Most buildings take the most care in the first three instances, but maintenance is often overlooked. Over time, neglect of maintaining produces severe structural deterioration in a building. A large percentage of structures developed in the previous 23 to 30 years are in serious structural distress and require repair; hence, these structures require an annual structural analysis to check their health. In light of the findings of this survey, inferences regarding the building's structural condition and required repairs can be drawn. This article explores audit cost estimation methodologies. existent constructions whose life has exceeded the age of 30 years.

C. "Structure Audit of Buildings' Perspective and Challenges inKenya"

This article intends to raise awareness among construction stakeholders (governments, architects, civil engineers, citizens, and owners) about the Structural Audit, which is a health check of existing concrete buildings. The need over structural audit typically occurs for the maintenance and repair of existing buildings that have surpassed the age of 30 years to try to avoid errors and save useful human life; however, structural audit becomes essential in cases of continuous building collapse, as was the case in Kenya. The material is a common building material due to its low cost, ease of shaping in a plastic form, and high strength-to-cost ratio. The building sector is more concerned than ever with improving the social, economic, and environmental criteria of sustainability.

D. "Structural Analysis for Buildings" (A.B. Mahadik and Mr. H. Jaiswal)

This document aims to raise awareness among civil engineers, inhabitants, and building owners about the Structural Audit, which is a health check of existing concrete buildings. The purpose for structural audit is to avoid mishaps and save valuable human life years. Concrete is frequently utilised as a construction material due to its low cost, ease of construction, and good strength-to-cost ratio. The building sector is more concerned than ever with improving the social, economic, and environmental criteria of sustainability. In India, from 1980 to the present, the infrastructure business has seen an increase in public investment and expansion, resulting in the construction material due to its low cost, ease of construction, and good strength-to-cost ratio. The building sector is more concerned than ever with improving the social, economic, and environmental sustainability. In India, from 1980 to the present, the infrastructureconstruction of new multistory concrete apartmentswhich are already more than thirty years old. Many structures throughout this century and earlier have lost strength over time owing to structural deficiencies, material deterioration, unforeseen over loadings, or physical damage. If such a deteriorating structure is used for an extended period of time, it may endanger the lives of the people and the surrounding community. All such building structures require appropriate actions and processes to enhance their efficiency and recover the intended functions for the buildings, which can result in an increase in their useful life. Periodic structural audits and health diagnostics of existing buildings are therefore essential for assessing structural viability.

E. "The Building Structure Audit" (Patil S.R, Prof G.A)

Construction Engineering Industry is one of the oldest sectors, supplying a basic infrastructure for all humans. Structures can be of any type, including historical, heritage, residential, commercial, and industrial structures. Any structure has a service life, and within that service life, it should remain firmly in place. For example, the Taj Mahal in India's Agra city is one of the oldest structures and one of the

Seven Wonders of the World, and it still stands extremely well. However, this is not required of today's Structures. The number of collapsed mechanisms is rising and today's structures are collapsing while their service life is fulfilled. As a result, it is advisable to monitor it on a regular basis and seek professional advice. Structural preliminary technical survey of a building to assess its overall health as a civil engineering structure is known as an audit. It is usually the initial stage in the repair process. In this project, the root cause of a faulty structure mechanism and preventive strategies to overcome the failure of this structure are investigated.

F. "Summary of Literature on Structural Analysis of Several Structures"

In recent years, there have been events involving the collapse of numerous bridges and structures. This study discusses the many factors associated with structural auditing of constructions. Civil engineers have been witnessed carrying out structural audits of numerous big buildings. However, the audit includes a variety of elements that are unique to each organisation.The auditing process and the reconstruction of the superstructure differ slightly.

III. METHODOLOGY

A. General

Existing structural damage assessment methods provide varying magnitudes of SDI (or GDI) since they use different reaction parameters, resulting in a contradictory scenario to choose the most appropriate one (Hait et al., 2020). In this study, structural DI was calculated for an eight-story RC frame building using 14 distinct accessible methods for seven pairs of ground motions.

B. Methodology

- Carrying out a preliminary inspection of the residential building.
- Architectural and residential building preparation.
- Visual assessment to identify crucial areas.
- The effectiveness of NDT testing.
- Determine the building's strength.
- Suggestions for corrective action.

C. Tests :

- Ultrasonic pulse velocity (UPV) test.
- Concrete core evaluation
- The carbonation test.
- Hammer rebound test.

➢ *Rebound Hammer Test*

Rebound Hammer test is a Non-destructive testing method of concrete which provide a convenient and rapid indication of The rebound hammer, also known as the Schmidt hammer, is made out of a spring-controlled mass that slides on a plunger inside a tubular chassis. Figure 1 depicts the functioning of a rebound hammer. When the plunger of a rebound hammer crashes against the surface of concrete, a spring-controlled force with constant energy impacts of a spring-controlled mass that slides bounces back. The extent of rebound, which is a measure of surface hardness, is measured on a graduated scale. This measured value is designated as Rebound Number (rebound index). A concrete with low strength and low stiffness will absorb more energy to yield in a lower rebound value.

When the rebound hammer is driven on the surface of the concrete, the spring-controlled mass and the extent of this rebound is determined of the concrete. The surface hardness, and hence the rebound, are thought to be connected to the concrete's compressive strength.objectives is to Determine the concrete's compressive strength by connecting the rebound index and the compressive strength,To determine the consistency of the concrete, Determine the quality of the concrete using established specifications.

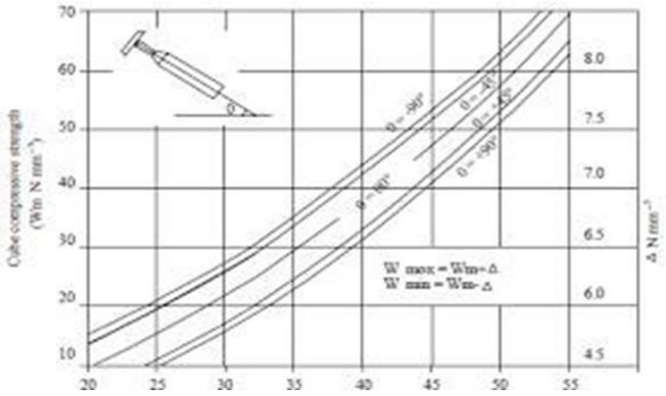

Fig 1- Rebound Hammer Test Graph

Rebound hammer test method can be used to differentiate the acceptable and questionable parts of a spring-loaded mass striking the surface of a sample. The test hammer strikes the concrete with an established quantity of force. The structure or a rebound hammer or concrete hammer test,is a device to measure the elastic properties or strength of concrete or rock, mainly surface hardness and penetration resistance. It was invented by Ernst Schmidt, a Swiss engineer.A measures the rebound of a spring-loaded mass striking the surface of a sample. The test hammer strikes the concrete with an established quantity of force. Its rebound is affected by the hardness of the concrete and examined by test equipment.

The rebound value can be used to calculate the compressive strength of concrete using a conversion chart. The rebound reading will be modified by the hammer's orientation: when applied upward (for example, on the bottom of a hung slab), gravity will increase the mass's rebound distance, and vice versa for a test performed on a floor slab. (ii) type n-2.207 nm impact energy, and (iii) type n-2.207 nm impact energy.

- *Manufacturer*

Take twelve readings, removing the highest and lowest, and then calculating the average of the 10 remaining. This type of testing is classified as indirect since it does not provide a direct measurement of the material's strength. It just provides an indicator based on surface traits and is thus only useful for evaluating samples. Astm C805 governs this concrete testing procedure. The process for testing rock is laid out in ASTM D5873.

➢ *UPV (Ultrasonic pulse velocity) test*

The ultrasonic pulse velocity method is used to examine the quality of concrete in accordance with IS: 13311 (Part 1) - 1992. When the concrete quality is good in terms of density, uniformity, homogeneity, and so on, the velocity is relatively higher.

Pulse velocity=(Path length)

Separation of transducer leads: When measuring transit times, it is best to keep the two transducer wires from coming into correspondence with each other. If this is not done, the receiver lead may pick up unnecessary signals from the transmitting lead, resulting in an erroneous delay in the transit readout.

➢ *Concrete Core Test:*

The width of core samples used to assess concrete's compressive strength shall be at least three times the nominal maximum size of fine aggregate used in the building material and at least double the nominal limit size of coarse material used in the concrete. in the core sample:

Table 1: Correction factor

Ratio of cylinder to diameter (L/D)	Strength correction factor
1.75	0.98
1.50	0.96
1.25	0.93
1.00	0.87

Keep the specimens moist between removal from water storage and testing by covering with a wet blanket of hessian or other suitable absorbent fabric." If the length to diameter ratio of the specimen is less than 1.94, use the adjustment factors given in Fig. 1.

IV. RESULT AND DISCUSSION

Rebounding hammer test and Ultrasonic pulse velocity test were carried out on various RCC Members. The rebound hammer test results include the following components that are floor, Average of selected limit and the strength in Mpa .similarly the ultra sonic pulse velocity result Include the component distance in mm, time in µ S and the type of test

A. Rebound Hammer Test

The rebound hammer test was performed on 15 points. The The tensile strength of every specimen remained more than **10 MPa**. The surface strength of these columns is determined to be within a range of **21.60 MPa** and not more than **36.30 MPa,** with an average value **27.58MPa.**

Table 2 Rebound Hammer And Upv Strength Column

REBOUND HAMMER		**UPV**	
Maximum	**36.30**	***Maximum***	**2.73**
Minimum	**21.60**	***Minimum***	**0.50**
Average=	**27.58**	**Average=**	**1.29**

A. Ultrasonic Pulse Velocity Test

Ultrasonic Pulse Velocity Test - 15 samples were subjected to this test. The surface of two of the samples was determined to be unsatisfactory. The ultrasonic pulse velocity of these columns is determined to be between **0.50Km/S** and **2.73Km/S**, with an average ultrasonic pulse velocity of **1.29Km/S.** Due to site conditions, all samples had to be tested using the Indirect Method.

B. CONCLUSIONS

The following conclusions are formed in this chapter based on the preceding results and discussion. The building is suffering from category four damage.The principle fixes are required at several levels.The visual inspection and appearance of concrete structure ,combination with The advanced instrumental control and different physical and chemical methods of the analysis of the material(concrete and constituents- cement matrix and aggregates. And also Reinforcement),as well as the environment, provides valuable information about the types and history of loading, resulted in the damage , and helps in investigation of structure failure. Different types of source of damage in concrete structure are reviewed. The simple and convenient classification of damge by source, which includes chemical attack, higher, overloading by static and dynamic(inpact and earthquakes),loads and malicious damage(which covers faulty maintaiance, human mistakes and wrecking),is suggested for practicing engineering . the two case studies are reported , which helps the practicing engineer in making damage investigation and development recommendation

To minimise further degradation of the structure, the repair work should begin as soon as possible. All plants should be removed as soon as possible.Any delay in structural repair work might result in additional degradation and an increase in labour costs. Slabs with fine latent cracks should be mended using an overlay such as chemically altered hydraulic cement concrete or mortar or oxide fume concretei.unsound material should be replaced;, it should be cleaned to reduce oxidation, and extra reinforcement must be given. Minor cracks should

be repaired with epoxy injection or grouting procedures. The infrastructures in question include all sorts of buildings, communication facilities, energy generating and distribution facilities, factories, roadways, water resource places of work, and urban water systems. They are supposed to be useful, durable, and safe for extended periods of time, often 50 to more than 100 yearsi. They are potentially vulnerable to the effects and extremes of climate and weather such as droughts, flooding, heat waves, high winds, stromsurges, wildfire, and accumulated ice and snow, and for rehabilitation of structure and preventing damage in future. infrastructure systems and facilities.

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