JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Condition Assessment of Existing Concrete Building Using Non-Destructive Testing Methods for Effective Repair and Restoration- A Case Study

Ashutosh Chouhan [1], Gaurav Awasthi[2]
[1]M Tech Civil, Department of Civil Engineering, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore, India
[2]Professor, Department of Civil Engineering, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore, India

ABSTRACT: - Buildings built in the early 70s & late 80s in India are found to be in a state of disrepair due to inadequate clarity and poor construction procedures. Continuous monitoring of concrete structures using appropriate NDT (Non-Destructive Inspection) methods and the use of possible restoration methods helps significantly reduce the deterioration of concrete structures thereby extending the lifespan of buildings. NDT methods are very useful in assessing consistency, homogeneity, approximate pressure strength, durability, degree of corrosion of metals in concrete etc. of damaged buildings. The purpose of this study is to improve the health of a 50-year-old hospital building (Part of the RC and Brick masonry) in Kurnool, Andhra Pradesh. The condition test was performed by visual, field and laboratory testing of samples collected from the structure and the results are presented in this paper. This paper also highlights the strength and durability of concrete to assess the degree of stress and damage to a building. In addition to visual inspections, Non-Destructive Tests covering the values of UPV & Rebound Hammer and Half Cell Potential in relation to corrosion of reinforced bars and chemical testing in non-compressive RC columns, beams, and slabs are also presented and discussed. Corrective and reinforcing methods using the latest materials and possible restoration activities such as column jackets, shotcreting, anticorrosive coatings, etc. proposed to improve the life of the building..

Keywords: Distressed Condition; NDT Methods; Condition Assessment; Restoration Works.

INTRODUCTION

Reinforced cement concrete is one of the most popular construction materials used for decades. Due to its high strength, economy, and durability, it is the first choice as a construction material. Premature failure of the structure due to chemical penetration due to processes such as chloride penetration and carbonation, sulphate attack, or deterioration of the reinforcement due to chemical processes such as surface degradation due to temperature/humidity fluctuations are often observed. Therefore, monitoring of concrete structures such as buildings, bridges, etc. is essential to ensure safety, stability, and service. The safety of the infrastructure system largely depends on the proper maintenance of each component. The need for repair, rehabilitation, and maintenance has now become a major problem in India. The goal of every construction system is to increase the level of reliability, public safety, and better service level. This can be achieved through proper maintenance of the system. Position assessment component of the decision-making process of infrastructural asset management. It provides quantitative ways to estimate material degradation for the entire construction system. Various methods have been proposed for the conditional evaluation of structures. A few decades ago, repairs to an

existing reinforced concrete building were prioritized by combining visual inspection techniques, knowledge, and experience. Later, in the fuzzy logic, visual review data of most studies, but the visual review data alone is not the parameter for decision making. Condition ratings are always subjective and judgments vary from person to person, but the inclusion of NDT test data increases the stage of repair priority.

It is necessary to use various Non Destructive Data parameters such as rebound hammer value, USPV, etc. Visual inspection to confirm the structural conduct of the RC building. As larger the parameter, the easier it will be to decided on repairs. Weight distribution between parameters is required to estimate the final status rating according to their importance.

RCC is most reliable and extensively used for this decade. Because it has high strength, economy, and durability, it is the first choice made as a construction material. SHM "Health Monitoring of structure" is the damage detection strategies to ensure service efficiency and sustainability for civil, aerospace, and mechanical structures etc.

The main goal of every construction system is to the betterment of public safety, and better service level. This can implement by proper maintenance. Position assessment is a component of the decision-making process of infrastructural asset management. It provides quantitative ways to estimate material degradation for the entire construction system. Condition assessment can be described as "measuring and evaluating state assets of built facilities and related to performance standards". Condition assessment includes identification of DDDs, i.e., losses, depreciation, and errors.

Estimation of structural features, viz. The residual endurance of concrete, corrosion, etc. is used to determine the current condition of the building and future durability problems and is a basic requirement of the maintenance plan. The current state of stability of the building helps in estimating its residual life. This assessment also helps in estimating the life cycle cost of the building which includes construction cost, maintenance cost, maintenance cost, etc. The need of the repairing work can be determined. The main purpose of assessing the status of a building is to knowing about need, nature, and cost of repairs.

Condition Assessment of Buildings

The main purpose of a situational assessment is to place the structure in the following three categories:-

- The building did not show any signs of distress and Satisfied with all safety and operational requirements in accordance with the applicable Rules of Procedure, so no action is required regarding rehabilitation.
- The structure appears to be defective (or compressed) but can be modified and reinforced to meet the Codal security requirements or operating system set by the user.
- The building is badly damaged. It will be demolished and a new building will be built, better rebuilt.

The key steps for the status quo will be: -

- Record the damage if you have it, and find the causes of the stress
- Assessing the level of stress and measuring the residual strength of components of the structure and system including the foundation.
- Planning for renovation and renovation / strengthening of the building

How to Assess the Situation

Status tests are usually done at two levels:

1. Precursors once
2. Detailed.

If we obtain sufficient information to assess the safety of the building at the initial stage of investigation, a detailed investigation, involving significant costs and time, will not be recommended.

Quick (Visible) Investigation.

There are basically three parts and steps:

1. Collection of information and details about building structure, construction, use, and maintenance in the past
2. Visual assessment of the situation in the area and recorded details of grief
3. Safety testing against specific building code provisions or operating system

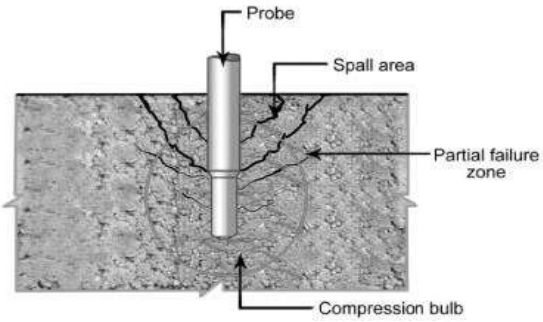
Detailed Investigation

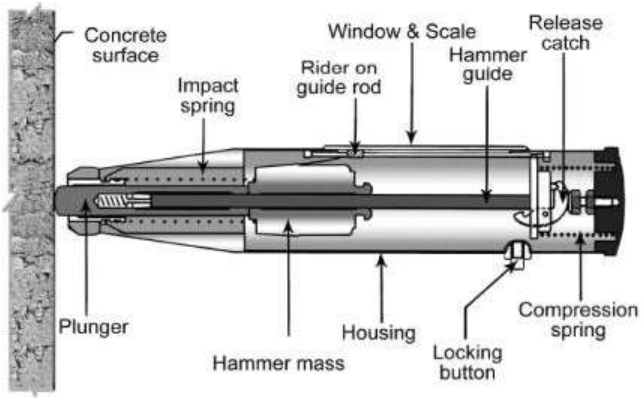
When building drawings regarding the structure that provides the structure and details of the structure of the system (including equipment details) and its foundation are not available, a detailed investigation should be conducted regarding the structure of the building system without specific details. , location, and magnitude of damage or stress to various organs and systems.

It may be necessary to make measurements in an existing building to determine the size of the building elements. Building materials, namely, concrete, steel reinforcement and stone construction, for representative building structures, will be required by conducting Non-Destructive Testing (NDT) in the field and by conducting laboratory.

Different Methods of NDT of concrete

Penetration resistance test





Rebound Hammer

UPV Testing equipment

Literature Review: -

2.1 Sasmal S, Ramanjaneyulu K, Gopalakrishnan S and Lakshmanan N (2006): A measure of the unpredictability of existing concrete bridges. He proposed appropriate test method from the various measures using the class analysis process. Test techniques such as reverse hammer, main test, UPV test, etc. are compared based on estimated cost, structural damage, view speed, and reliability.

2.2 - Grigg N (2006): "Testing the satatus of a water supply pipe."

The author describes and describes the situation assessment, pipeline restoration schedules, and procedures for applying existing methods and techniques. The author used various materials that alter

the destruction of the pipe. Physical integrity, water loss, flow and pressure, water level, and complaint time.

2.3 Bhadauria S and Gupta M (2006): Graphical degradation model for water tanks was also taken in this paper. The pressure level of the 204-water tank was also reported the material. Upper dome, cylinder wall, lowers dome, column, bracing, stairs, shaft, and foundation. A lot of the tanks were severely damaged and their CR was founded higher than 10 5.

2.4 Kaner A, Yanmaz A., Yakut A, Opportunity O and Yilmaz T (2008): "The service life of existing highway bridge bridges is without standard inspection by a test editor".

A visual inspection was taken out on the bridge position measurement on a scale of 1 to 9. After inspection, measure bridge system (3 pot large body distributed for ground protection and service convenience). The final conditional rate was developed age graph. A link between conditional measurement and age is established and service time is measured with an extension to the rest of the work site.

2.5 Seman N and Zayed T (2009): "Underground Station Discovery Model" data collected from questionnaires and interviews with experts. STM sub-channel network was also conducted. Data analysis shows that construction and safety conditions are very important. Error detected on STM channels with an SDI rating of 4.4 of 10.

2.6 Yokota H., Kato E. And Ivanmi M. (2010):

"Simplified testing for damaged concrete operational structures. All 30 RC slabs removed from 30- to 44-year-old openings operation are tested for corrosion after load capacity. Visual testing and load-endurance.

2.7 Mitra G, Jain K and Bhattacharjee B (2010): "State of Fuzzy Logic". Constructed using abstract concepts and combines visual exploration with local research. The data obtained were utilized to improve comprehensive registration operations during critical repairs. The problem D-fuzzy-fiction refers to the integrated structure of BCI from basic membership activities using a centralized approach. Requirements for purchased BCI condition and structural adjustment.

2.8 Li Hua, O Jinping (2011): "Structural Health Monitoring: A General Diagnostic Technology Review"

SHM technology is to monitor the long-term performance of buildings, Behavior of buildings natural disasters like earthquakes, landslides, flood etc. However, current sensitivity technologies may in some cases not meet the SHM requirement for public buildings, which may require further research and advancement.

2.9 Fernando Moru, Jiameng Li, Shunlong Li, and Dongyu Zhang (2018): "Occupational Health Care Techniques on Highway Bridges: New China Building Health Monitor Code" The new SHM code will based on similarities and differences in Chinese code. Future SHM codes may contain lessons learned from the development and publication of SHM law from the Chinese Department of Transportation, resulting in a safer description of SHM bridge operations. Technical integration by bridge owners.

2.11 S. Sen, N. Galvao, M. Kusser (2019): "Using Data Correction Testing for Common Security Check Bridges"

All NDTs utilized to measure corrosion have the same properties, resulting values of corrosion consumption are the same. They are considered less suitable for standard bridge tests and their use should be with high corrosion.

.CONCLUSION

In the above papers, measurements of different dimensions are proposed. A few decades ago, the reconstruction building was undertaken by combining observed inspection, information, and information. Research is always needed. In the paper above, some papers on rational analysis of observational inspection data, but visual inspection data alone should not be the

decisive parameter. Various NDT like rebound hammer value, USPV, carbonation depth, etc. should be mixed with so that the functionality of the structure is also guaranteed. Furthermore, an RC element, which is an important factor, somehow does not exist. many parameters making adjustment decisions. The eight-year distribution between final status measures of their required values. Position estimation logic and judgments vary from person to person, but the addition of NDT test data improves priority correction. It's impossible to reach a clear relationship between conditional data and related instantiation and difficult to improve on ambiguous functions. The logical summation of adjustment is therefore a useful and complementary tool. Many factors are displayed such as observational inspection, reverse hammer, ultra-sonic heart rate, and carbonation rate. All set to status indicators 0-5 each parameter as a conditional indicator.

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