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"Critical Study of Non-Destructive Testing on High Rise Reinforced Concrete Building Before Repair and After Repair"

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Abstract - *In this project, we carried out the condition assessment and structure audit on the high-rise structure by visual inspection and NDT (Non-destructive testing) due to poor quality of construction. Here we found out that the quality of concrete by UPV (Ultrasonic pulse velocity test) and compressive strength of concrete by rebound hammer. During the testing of building we found that the quality of concrete and the strength of concrete is poor due to poor quality of construction like heavy honeycombing and are not proper in line level. Afterwards the testing we suggest to repair the whole poor part of the building is by the epoxy grouting along with micro concrete/modified polymer plaster. After the grouting and plastering the structure we again test the building for surety to check the improvement in the structure and we found that the structure has improvement in strength and quality of concrete is also improved in the existing structure.*

Key Words*: *Structure audit, Visual inspection, Non-Destructive test, Rebound hammer, Epoxy Grouting.

1. INTRODUCTION

In the present time, even in new construction projects the quality of construction is poor due to unskilled labor, improper work and leniency. This affects the strength, durability and service life of the structure. The strength and the quality of construction is poor, it identifies the several defects in the various part of the structure. To overcome this problem, we conducted the NDT (Non-Destructive testing). The NDT process is done without disturbing the existing structure by visual inspection or by using various test apparatus and machine. In this project we carried out two type of test to identify the poor part of the building i.e. Schmidt rebound hammer test, UPV (Ultrasonic pulse velocity test), & Visual inspection is done in this case.

In general the NDT stands for Non-Destructive testing. It refers to the inspection method which is carried by inspector & evaluates and collects data of the structure and component of structure and materials, system of existing structure.

It can also be called

- NDE(Non-Destructive Examination)
- NDI (Non- Destructive Inspection)

The main objective of present work is to adopt Structural Auditing of Building which is situated at Nagpur (Maharashtra) with Schmidt's Hammer Test, Ultrasonic Pulse Velocity Test including Visual Inspection and assessing the stability and safety of the structure to withstand for its remaining life which is done by Diagnosis and root cause of the problems by recommending strengthening and then retesting after adopting strengthening is done to check the required strength which is expected

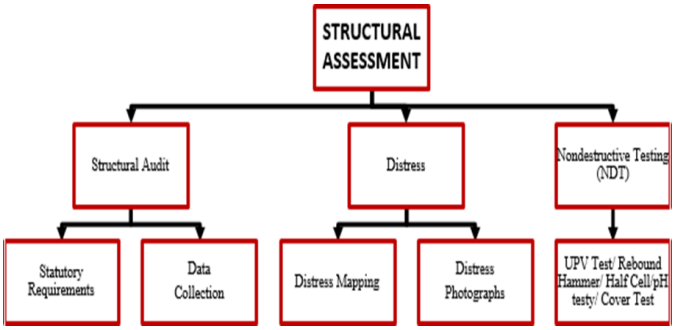

Figure-1: Structural Assessment

2. METHODOLOGY

2.1 Visual inspection

In the visual inspection we check the whole structure for cracks, spalling and for the seepage we observed and the poor part of the structure in the building and found the stability of the structure and suggested for the correct techniques to repair the damage of building.

2.2 Schmidt rebound hammer test

Rebound hammer is apparatus to find the compressive strength of the concrete of the existing structure without any disturbance, whereby the rebound of the spring driven mass is measured after its impact with concrete surface. The output of the rebound hammer is referred to as rebound number and is correlated with surface hardness of concrete. The internal mechanism of a typical Schmidt Hammer is illustrated in plunger is pushed against the concrete, perpendicular to the surface. In this test we find the rebound number using hammer and to finding the compressive strength using graph to find out the probable compressive strength of concrete as per IS13311 part II.

Figure -2: Rebound hammer & Rebound Graph

2.3 UPV (Ultrasonic pulse velocity)

An UPV is Nondestructive test in which we find quality of concrete. Cracks in concrete structure are determined in UPV test. UPV consists of transducer for transforming pulses, pulse generation circuit consisting of electronic circuit for generation of pulses.

In this test pulse of ultrasonic is passed through concrete structure and time taken by pulse is measured. Higher velocities indicate good quality concrete and continuity of the material and lower velocities indicate poor quality concrete and concrete with many cracks. There are three types of method to use Equipment to find the velocity i.e. Direct, Indirect & Semi direct method that has been shown in below figures.

Concrete quality can be classified into 4 categories Excellent, Good, Medium & Doubtful.

As per IS 13311 (Part I) 1992

U.P.V. (km/sec.)	Quality of Concrete for Direct Method
1. Above 4.5	Excellent
2. 3.5 to 4.5	Good
3. 3.0 to 3.5	Medium
4. Below 3km/sec.	Doubtful

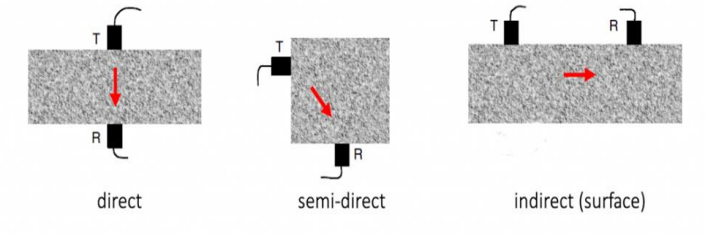

Fig-3: Method of UPV

3. OBSERVATION & RESULTS

3.1 BEFORE REPARING

- It is observed that the Ultrasonic Pulse velocity results with direct and indirect method indicate the maximum readings are between 2.04 Km/Sec to 5.56 Km/Sec and out of total number of UPV 533 point, 6.75% readings are Excellent, 41.83% readings are Good, 36.39% readings are Medium and 15% Doubtful. (Refer to IS 13311 (Part I) 1992 ''Non- Destructive Testing of concrete methods of test, Ultrasonic Pulse Velocity"). As per 13311 (Part 1) 1992 the Ultrasonic Pulse Velocity readings with indirect method gives less reading than direct methods generally by 1 km/sec and readings given in the report are factored.
- As per the rebound hammer test (refer IS 13311 part II 1992) all the readings are confirming M35 to M45 grade concrete

3.2 AFTER REPARING

- It is observed that the Ultrasonic Pulse velocity results with direct and indirect method indicate the maximum readings are between 2.64 Km/Sec to 5.08 Km/Sec and out of total number of UPV 80 point, 7.5% readings are Excellent, 61.75 % readings are Good, 23.75 % readings are Medium and 7.5% Doubtful. (Refer to IS 13311 (Part I) 1992 ''Non- Destructive Testing of concrete methods of test, Ultrasonic Pulse Velocity"). As per 13311 (Part 1) 1992
- As per the rebound hammer test (refer IS 13311 part II 1992) all the readings are confirming M35 to M45 grade concrete

3.3 COMPARISON OF RESULTS

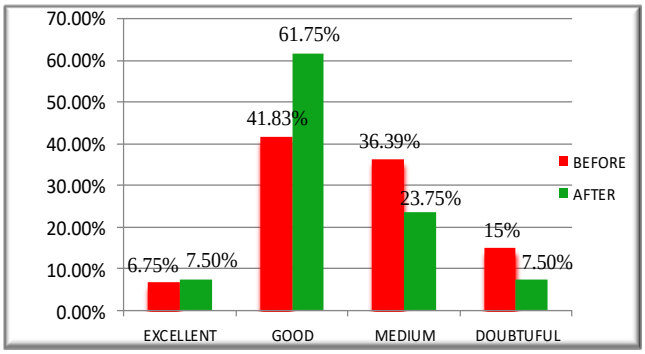

Figure -3: U.P.V. Test results Comparison Before and after repairing

4. CONCLUSION

Based upon Ultrasonic Pulse Velocity test and Rebound hammer test it is observed that quality of concrete and compressive strength of concrete is improved because of epoxy grouting micro concrete repair and various repair methods recommended in our pre strengthening test report. After repairs maximum readings are improved and confirming to relevant Indian standard specifications.

REFERENCES

[1] Malek Jedidi, Anis Abroug, Bedis Moalla and Omrane Benjeddou. "Non-destructive Testing for the Diagnosis and Repair of a Reinforced Concrete Building". International Journal of Architecture, Engineering and Construction Vol 6, No 1, March 2017, 20-28.

[2] Sandeep Kumar Dwivedi, Manish Vishwakarma, Prof.Akhilesh Soni. "Advances and Researches on Non Destructive Testing" Sandeep Kumar Dwivedi et al. / Materials Today: Proceedings 5 (2018) 3690–3698.

[3] Ayşe Tavukçuoğlu Middle East Technical University, Faculty of Architecture, Department of Architecture, Ankara, Turkey. "Non-Destructive Testing for Building Diagnostics and Monitoring: Experience Achieved with Case Studies" MATEC Web of Conferences 149, 01015 (2018) CMSS-2017.R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev. In press.

[4] Saiesh.L.Naik, Basavraj Saunshi. "STRUCTURAL AUDIT OF RCC BUILDING" International Research Journal of Engineering and Technology (IRJET) Volume: 04 Issue: 05 | May -2017

[5] Ahmad Zaki, Hwa Kian Chai, Dimitrios G. Aggelis and Ninel Alver. "Non-Destructive Evaluation for Corrosion Monitoring in Concrete: A Review and Capability of Acoustic Emission Technique" *Sensors* 2015, *15*, 19069-19101.

[6] Sanket Sanjay Suryawanshi "Structural audit of RCC building" ISSN: 2454-132X Impact factor: 4.295(Volume 4, Issue 2).

[7] Almir, P. and Protasio, F. (2000). "Application of ndt to concretestrength estimation." NDT. net, 5(2), 1–6.

[8] MR Jolly, A. Prabhakar, B. Sturzu, K. Hollstein, R.Singh, Thomas, P. Foote & A. Shaw. Review of Non-destructive Testing (NDT) Techniques and their Applicability to Thick Walled Composites. Procedia CIRP. 2015 Dec 31; 38:129-36.

[9] S.Gholizadeh. A review of "non-destructive testing methods of composite materials". Procedia Structural Integrity. 2016 Dec 31; 1:50-7.

[10] Jedidi Malek, Machta Kaouther, "Destructive and Non-destructive Testing of Concrete Structure", Jordan Journal of Civil Engineering, volume 5, Number 4 (2014), pp.411-416.

[11] A.B. Mahadik and M.H. Jaiswal. "Structural Audit of Buildings" India. International Journal of Civil Engineering Research. ISSN 2278-3652 Volume 5, Number 4 (2014), pp. 411-416.

[12] Gourav Sanjay Shinde, Dr.S.J.Arwikar. "Gourav Sanjay Shinde1, Dr.S.J.Arwikar", International Research Journal of Engineering and Technology (IRJET) Volume: 05 Issue: 07 | July 2018.

[13] Er. Nilesh B. Deshmukh, Er. Manesh B. Satpute, Er. Rahul B. Abhale, Er. Akshay B. Varpe, "STRUCTURAL AUDIT – A CASE STUDY OF EDUCATIONAL BUILDING", International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 06 Issue: 02 | Feb 2019 www.irjet.net p-ISSN: 2395-0072.

[14] Swapnil U Biraris, Aishwarya G Gujrathi, Abhishek D Pakhare Anjali N Satbhai, Pournima K Vispute, "Structural Audit of Old Structures", International Journal of Engineering Trends and Technology (IJETT) – Volume-43 Number-3 -January 2017.

[15] Rohit Newale , Yogesh Sartape , Ashish Ramane , Shreya Telrandhe , Sachin Vairal, Prof. Girish Joshi, "Structural Audit, Repair and Rehabilitation of Building", International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Website: www.ijirset.com Vol. 6, Issue 3, March 2017.

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