STRUCTURAL HEALTH MONITERING BY NON-DISTRACTIVE TEST-A REVIEW

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Abstract: **There is a phenomenal rise in construction activities in the field of civil engineering in the recent years. Major structures like buildings, bridges, dams are subjected to severe loading and their performance is likely to change with time. It is, therefore, necessary to check the performance of a structure through continuous monitoring. If performance deviates from the design parameters, appropriate maintenance is required. The life of a structure depends on initial strength and the post construction maintenance. It is for this reason that the necessity of structural health monitoring (SHM) is emphasized worldwide. There are several techniques to monitor the health of structures. These can be divided broadly into two types, global and local. The local and global techniques independently cannot monitor the health of a structure continuously in an autonomous manner. For example, the global technique, cannot determine incipient damage. The local techniques, being localized in nature, can identify damage only within a limited zone. Hence, a technique is required for structural health monitoring (SHM), which should carry out continuous monitoring of structure both locally and globally, should be sensitive and at the same time cost effective. The primary objective of this research work is to develop a new technique by integrating the global and local techniques based on piezoceramic sensors.**

***Keyword*:-Non-Distractive test, Rebound hammer, Ultrasonic pulse velocity test, Compressive strength, Research review**

I. INTRODUCTION

Concrete is widely used for the construction of infrastructures such as bridges, power stations, dams, etc. In the hardened state concrete may contain defects such as voids/honeycombs, cracks etc. The presence of voids particularly in the cover zone of a reinforced concrete structure leads to early corrosion of the reinforcement. Non-destructive testing in reinforced concrete structure plays a very important role for the condition assessment of reinforced concrete structures. This includes identification of defects such as honeycombs, voids, cracks, etc., and, thickness measurement, location of reinforcements, ducts, etc., The Ground Penetrating Radar (GPR) technique is a very effective method for investigating the integrity of concrete, thickness measurement, reinforcement identification in concrete structures. The Ultrasonic Pulse Echo is a one-sided technique which can be used effectively for the thickness measurement, localization of reinforcement and ducts, and the characteristics of surface cracks. The Impact-Echo (IE) method is used to detect thickness, voids, honeycombing etc. of concrete and masonry structures. Software packages used for NDT data acquisition and analysis are dependent on the technique and manufacturer. Fusion algorithms based on the technique whether they are pixel level or feature level will come after pre-processing stage. Visualization of fused data and merging of input from different NDT devices is done in order to create user friendly visual output that can be directly used for on-site evaluation of building components condition. The overall objective of data fusion is to improve the information quality over that obtained from individual sources. Fusion techniques allow reinforcing redundant evidence and integrating complementary information to achieve a higher degree of certainty. Research work is done at CSIR-SERC to study the effectiveness of various advanced NDT methods in evaluating different features in RCC and PSC structures and also on the data fusion techniques.

II. LITERATURE REVIEW

Literature survey is carried out by study of various Research paper related on Structural health monitoring as follow:

[1]Mr. Ayaz mahmood : He has been study on Non-Destructive evaluation (NDE) method and it is used for (a) Concrete strength determination and (b) Concrete damage detection. **Rebound hammer test** and **Ultra-sonic pulse velocity test** have be done on specimens and the column, beams and slabs of two double storied buildings in NIT Rourkela. 6 Cubes were cast, targeting at different mean strengths, and then tested by rebound hammer and UPV and get Predicted compressive strength by help of Rebound numbers and Velocity. Also plot the graph between rebound number vs. compressive strength and velocity vs compressive strength. Then after M-20 and M- 25 concrete grade beam were casted. Again Rebound hammer and UPV tested on beams for comparative analysis to know the effect of reinforcement on the test Then after compare the without reinforcement and with reinforcement results, the maximum variation for Rebound value is **3.6%** where in case of Ultrasonic Pulse Velocity the maximum variation is **16.1%** .Therefore the variations are well within the tolerable limits. Then after rebound hammer and UPV were tested on actual structure and got existing condition of the structure.

The result of ultra-sonic pulsevelocity test&Rebound hammer test as shown in graphs:

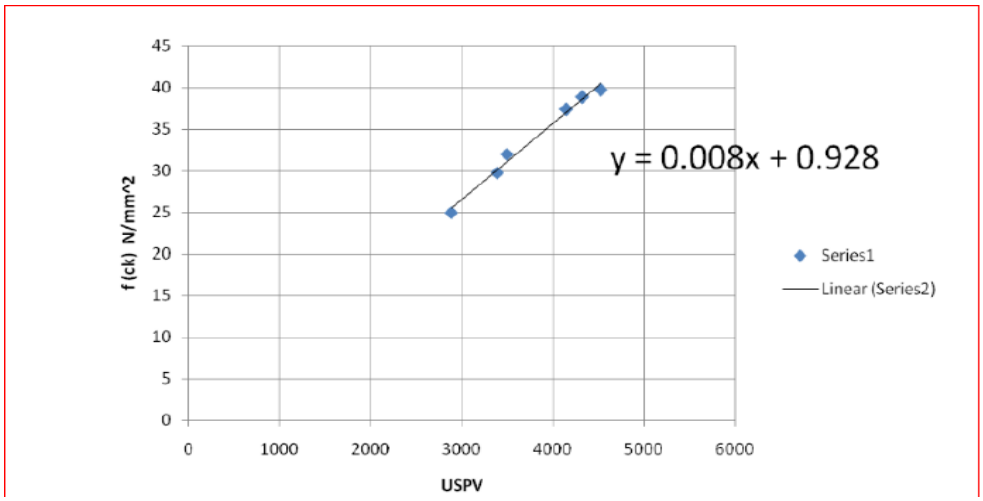

Fig (a) Graph obtained for USPV Testing

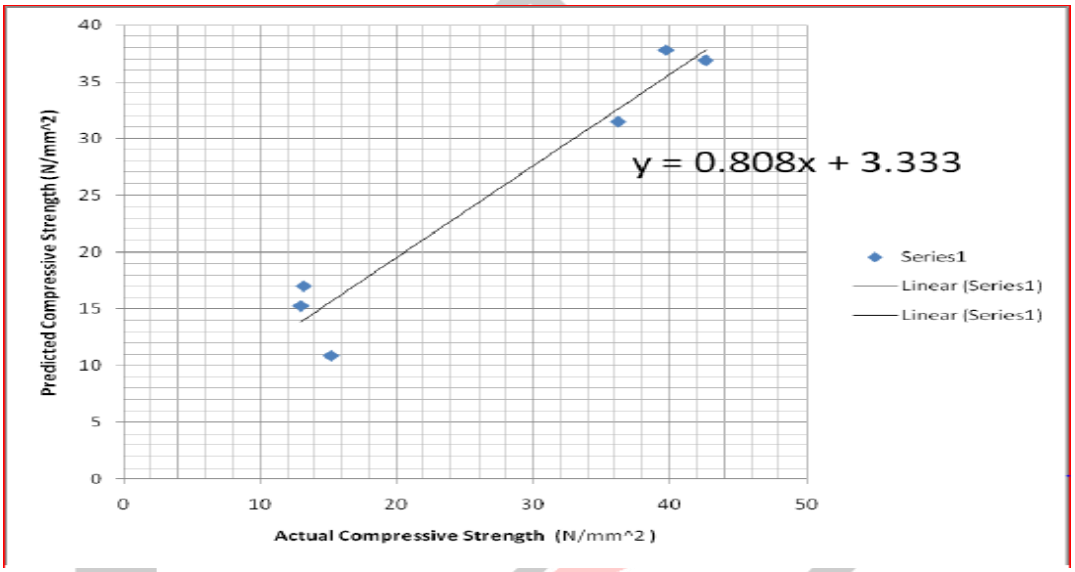

Fig (b) Calibration Graph for Rebound Hammer with its equation

[2] KONDAPALLI HARSHADA 1, K. SUNDARA KUMAR 2 : They has been study on Non-Destructive Testing (NDT) by Rebound Hammer test. The rebound values obtained from the experimental work are used to estimate the compressive strength. The resulting compressive strength values for all the 725 columns are studied for analysis. It was observed that compressive strength values measured on large columns are bigger than the compressive strength values measured on small columns. This peculiar difference may be due to the less importance given to the columns at the construction time. The range of compressive strength values measured on small columns vary from 20 to 45 N / mm2 where as the range of compressive strength values measured on large columns vary from 20 to 50 N / mm2.

[3]Jen-Chei Liu, Mou-Lin Sue and Chang-Huan Kou: in this paper authors carried out structural monitoring. The study estimates the strength of concrete, an attempt is also made to increase the accuracy of Calculating the strength, using the nondestructive test (NDT) surface hardness rebound value, material design parameters and regression analysis.
Regression analysis was performed to establish a mathematical formula. Study results indicate that the correlation coefficient may reach 0.9622, indicating that the proposed method has referential value. Therefore, engineers may use this comprehensive approach to develop NDTs to determine concrete strength.
Study results show that, regarding surface hardness rebound value (an NDT) and design parameters of materials for estimating concrete strength, the accuracy of Calculating concrete strength is based on input design parameters of materials involved, such as water-binder ratio, fly ash, slag, chemical admixture, age, and moisture content.

[4] Ehiorobo J.O: in this paper authors carried out structural monitoring, periodic measurement of displacements, strains, stresses and damage evaluation (e.g. crack width) and vibration characteristics and mainly visual inspection of the structure. To detect the various crakes and also measuring the width of cracks, to show the layout of that structures. In this papers also using various non-destructive test to detect the cracks and to evaluate the existing condition of the structure. From the investigation carried out, it has been established that inadequate foundation consideration has resulted in differential settlement which is

responsible for the various cracks noticeable in building. The foundation footing is found to be inducing high bearing pressure on the soil, thus resulting in substantial differential settlement. The cracks within the building vary in width from 0.75mm to 31.50mm. As some of the cracks along the wall are more than 25mm, it means that the stability of the building is already being impaired.

[5] MR.Meltem Vatan; In this research paper to identify the potential seismic risk in existing historic buildings for hazard mitigation, disaster preparedness and prior knowledge of potential hazards. Seismic risk evaluation is based on safety assessment which requires qualitative and quantitative data. This data is necessary before making any intervention decision. The qualitative data is visual inspection of decays, structural damages and deteriorations; and the quantitative data requires laboratory tests, structural analysis etc. Obtaining the quantitative data is detailed method, which necessitates specialists and takes more time and money. The fact that there are so many historic buildings and a few specialists on this field it is very important to make condition survey based on visual inspection as a first step of safety assessment procedure.

III. Major Finding

From the above literature it is clear that many researchers have put their efforts to study the various Non-Destructive tests on structures for concrete strength determination, concrete damage detection, to detect the corrosion in steel and also find the deflection of structure.

IV. Conclusion

From literature the researchers have been done lots of work to detect distress, deterioration and existing condition of any structures like buildings, bridges, any hydraulic structure etc. by Various NDT, using sensors and Visual inspection. NDT tests such as rebound hammer, UPV and combine of Rebound hammer and UPV are most commonly used for Health monitoring of RC Structure from the literature. Structural health monitoring is an important aspect in ensuring successful performance of a structure in its given life span. The method of conducting structural health monitoring varies highly with the type and usage of structures which needs to be investigated. Hence it is imperative that the structure which needs to be investigated must be studied thoroughly before adopting a proper strategy to conduct structural health monitoring.

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