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Non Distractive Testing Of Concrete Structures

[1]G. Kavitha , [2]K. Anjaneyulu, [3]MR.K. Prathap reddy

[1,2] M. Tech [3] Assistant Professor [1, 2, 3] Department of Civil Engineering, Samskruti College of Engineering and Technology, Hyderabad Email -kavithagunti93@gmail.com

ABSTRACT

Nondestructive testing plays an important role in identifying and detection of internal defects and cracks in many industrial applications such as concrete structures, pavements, and metal testing. Nondestructive testing of concrete allows the inspection of larger areas of concrete members at lesser cost than coring and provides more information than visual inspection. Main problem of today world is to ensure the quality of structures within given requirements. To ensure safe durable service and selecting the most appropriate repair strategy it is essential to perform in situ inspection for a distressed concrete structure. The ranking assessment for elevated structure has been carried by using different Non-destructive test methods like surface hardness, ultrasonic pulse velocity test, half- cell potential methods and cover depth measure. NDT is wide group of analysis techniques used in science and industry to evaluate the property of material, component or system without causing damage to the structures or components of structure .NDT does not permanently alter the article being inspected ,it is highly-valuable technique that can save both the money and time in product evaluation ,troubleshooting, and research. Non- destructive test is a method of testing existing concrete structures to assess the strength and durability of concrete structures. In the non- destructive method of testing, without loading the specimen to failure (i.e. without destructing the concrete) we can measure strength of concrete. Presently this method has become a part of quality control process. This method of testing also helps us to investigate crack depth, micro cracks and deterioration of concrete.

KEYWORDS

Non- destructive testing, ultrasonic pulse velocity test

1. INTRODUCTION

Testing of concrete is done in two ways one is in hardened state and other is done before hardening.
.Non- destructive test is done in hardened state by using various methods of non-destructive testing methods.

1.2 NON -DESTRUCTIVE TEST

Nondestructive testing (NDT) is the process of inspecting, testing, or evaluating materials, components or assemblies for discontinuities, or differences in characteristics without destroying the serviceability of the part or system. In other words, when the inspection or test is completed the part can still be used. In contrast to NDT, other tests are destructive in nature and are therefore done on a limited number of samples ("lot sampling"), rather than on the materials, components or assemblies actually being put into service.These destructive tests are often used to determine the physical properties of materials such as impact resistance, ductility, yield and ultimate tensile strength, fracture toughness and fatigue strength, but discontinuities and differences in material characteristics are more effectively found by NDT**.** Today modern nondestructive tests are used in manufacturing, fabrication and in-service inspections to ensure product integrity and reliability, to control manufacturing processes, lower production costs and to maintain a uniformquality level. During construction, NDT is used to ensure the quality of materials and joining processes during the fabrication and erection phases, and in-service NDT inspections are used to ensure that the structures in use continue to have the integrity necessary to ensure their usefulness and the safety of the public.

Non -destructive test for concrete

Hardness test -rebound hammer test
Ultrasonic pulse velocity test

Partially Destructive Tests for Concrete
- Core Cutting
- Pull-out test
- Pull-off test
- Break-off test

Above specified methods are used in partially destructive testing of concrete. Selection of tests to be conducted is based on some parameters i.e strength, honeycombing, voids etc. suitability of methods based on properties to be tested are mentioned below.

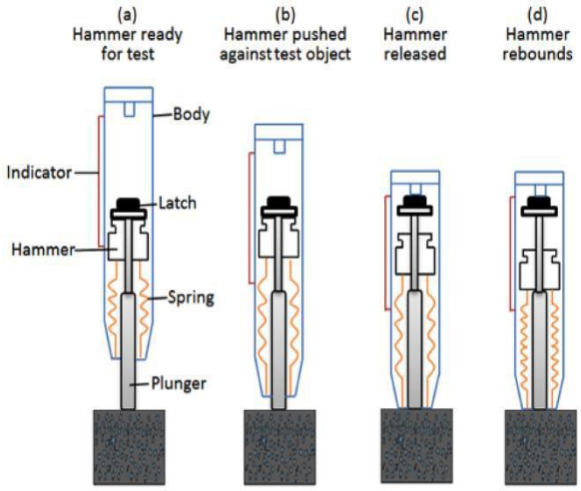
Fig 1 the testing procedure of rebound hammer

Parameter	Test/Method
Concrete structures	Rebound hammer
Compressive strength	Rebound Hammer, Ultrasonic Pulse Velocity, Core Cutting, Pull Out, Combined Methods
Flexural Strength	Break-off

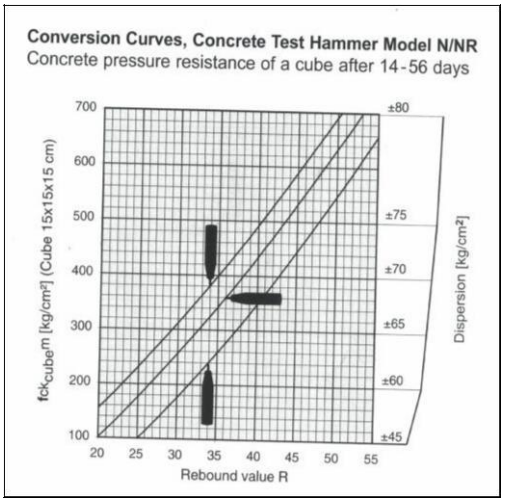
2.0 description

2.1Rebound hammer test

Rebound hammer test is conducted to find the compressive strength of concrete by using rebound hammer equipment as per Is -13311(part 2).principle of rebound hammer test is that rebound of an elastic mass is depends on the hardness of the surface .when the plunger of rebound hammer pressed against the surface of concrete, spring -controlled mass rebounds and the extent of such a rebound depends upon the surface of hardness of the concrete. The surface hardness and therefore the rebound is taken to be related to the compressive strength of the concrete.



It is necessary that the rebound hammer is checked against the testing anvil before commencement of a test results .the testing anvil should be of steel having brine 11 hardness of about 5000n/mms .the supplier of rebound hammer should indicate the range of the anvil suitable for deferent type of rebound hammers .



Hardness measurement of surface layer of 25 to 30 mm. influenced by type of cement ,type of aggregate surface conditions &moisture content ,curing &age of concrete ,carbonation of concrete surface .

3. Ultrasonic pluse velocity test

It is the test to check the quality of concrete and natural rock .this test the strength and quality of concrete or rock is assessed by measuring the velocity of an ultrasonic pulse passing through the concrete structure or rock formation. The test is conducted by passing ultrasonic wave through concrete to be tested and measuring the time taken by pulse to get through the structure .higher velocity indicates the good quality and continuity of the material, while slower velocities may indicate concrete with cracks or voids inside it .

3.1Advantages by using upv test

to test the homogeneity of concrete

to test the presence of cracks ,voids and other imperfections

changes in structure of concrete which may occur with time

the quality of the concrete in relation to the standard requirements

to check the quality of one elements of concrete in relation to another

3.2 Why we use upv

its helps in testing of structure without destruction .the inside cracks and voids are detected without collapsing structure .quality to quantity assurance prior to purchase uniformity of built structure .to know the post damage of structure.

3.3 Working principle of ultrasonic pulse velocity test

Equipment consisting of transmitter and receiver probe and time measuring device

transmitter and receiver probes are pressed against concrete structure surface

physical distance between probes are measured

the time required to transverse ultrasonic pulse from transmitter to receiver is recorder

3.3.1 Principle

If concrete quality is good homogeneity, velocity will be high .if damage present in transverse path pulse transverse around the damage velocity will be low.

Velocity computed v=L/T KM/SEC

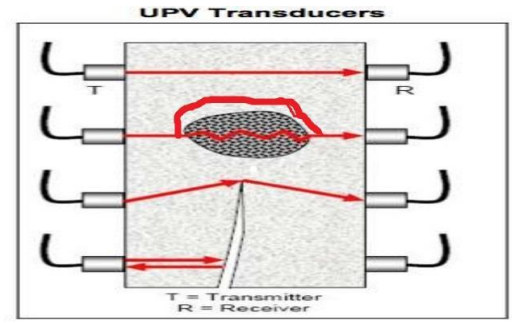
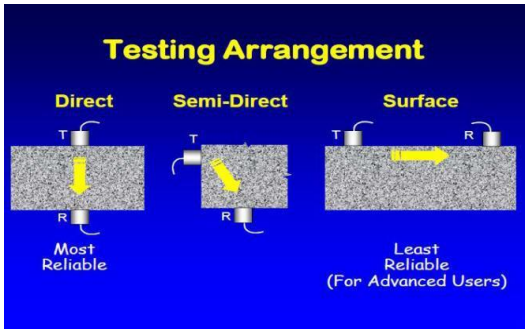


Fig.04



Quality of concrete grade as defined in Is 13311(part 1)-1992

Pulse velocity in km/sec

Above 4.5 - excellent

3.5 to 4.5 - good

3.0 to 3.5 - medium

Below 3.0 -doubtful

3.4 evolution of compressive strength of cores

Concrete represented by the cores are considered structurally adequate if

1. avg strength of 3 at least 85%of fck (Specified 28 days compressive strength)
2. no single core less than 75 %of fck

Rebar locator, bar sizer

Rebar location is a central activity for anyone involved in on-site testing of reinforced structures. Locating rebar is in fact a common need when drilling, cutting coring as well as a preliminary operation required for most other non-destructive investigations. Other typical applications include conformity check of new buildings, investigations on unknown structures and corrosion analysis. The eddy current pulse induction principle is the only imaging technology not influenced by concrete composition and humidity, which leads to a high cover accuracy under every scenario.

Fig rebor locator

Conclusions

Non -destructive testing is testing is a technique for checking structural integrity after concrete hardening without damaging it.Upv , rebound hammer applied to newly constructed structures to check quality of adequacy of cover before applying live load to the structures . NDT economical because we can find the strength of concrete structures without destruction of structures. We can check the voids and cracks inside the structures without collapsing of structures, there is no material wastage by using ultra pulse velocity test Various NDT methods plays an important role in condition assessment of existing structures and there has been an urgent need for developing standards for performing NDT methods and for interpretation of NDT results. It will provide useful information by revealing hidden or unknown defects inside the structures

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