



LECTURE # 3

In this lecture you will learn about:

Non - Destructive Testing

- Ultrasonic Pulse Velocity test.
- Rebound Hammer test.

Course Name:

“Material Testing, Repair & Maintenance”

Course Code: CT-245

Credit Hours: 3

Semester: Summer 2020



NON-DESTRUCTIVE TESTS

In case of non-destructive tests, the specimen are not loaded to failure. Non-destructive testing is considered to be a powerful method of evaluating existing concrete structures with regard to their strength and durability apart from assessment and control of quality of hardened concrete . These tests are also performed to determine then presence of internal cracks, micro cracks, and progressive deterioration in the concrete.



N.D.T METHODS

- Ultrasonic Testing (UT)
- Ultrasonic pulse velocity method
- Rebound hammer test
- Radiographic Testing (RT)
- Liquid penetrate Testing
- Magnetic particle Testing
- Electromagnetic Testing (ET)

N.D.T TESTS

- Ultrasonic Pulse Velocity test.
- Rebound Hammer test.





ULTRASONIC PULSE VELOCITY TEST

It measures the time of travel of an ultrasonic pulse passing through the concrete.

The apparatus for ultrasonic pulse velocity measurement consists of the following:

- (a) Electrical pulse generator
- (b) Transducer – one pair
- (c) Amplifier
- (d) Electronic timing device



ULTRASONIC PULSE VELOCITY METER



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HOW IT WORKS?

In ultrasonic testing, an ultrasound transducer connected to a diagnostic machine is passed over the object being inspected.

There are two methods of receiving the ultrasound waveform

- Reflection
- Attenuation.





ULTRASONIC PULSE VELOCITY TEST

REFLECTION MODE

The transducer performs both the sending and the receiving of the pulsed waves as the "sound" is reflected back to the device.

ATTENUATION MODE

In attenuation mode, a transmitter sends ultrasound through one surface, and a separate receiver detects the amount that has reached it on another surface after traveling through the medium.



APPLICATIONS AND LIMITATIONS

The pulse velocity method is an ideal tool for establishing whether concrete is uniform.

Applied to both existing structures and those under construction.

High pulse velocity readings are generally indicative of good quality concrete.



INTERPRETATION

To determine the quality & homogeneity of the concrete structures.

To determine the existence of the flaws ,cracks & voids in concrete structures.

Table: Velocity Criterion for concrete Quality Grading (IS :13311 Part I).

S.No	Pulse Velocity in Cross Probing (km/sec)	Concrete Quality Grading
1.	Above 4.5	Excellent
2.	3.5 to 4.5	Good
3.	3.0 to 3.5	Medium
4.	Below 3.0	Doubtful



ULTRASONIC PULSE VELOCITY TEST

ADVANTAGES

- High penetrating power.
- High sensitivity.
- Greater accuracy
- Some capability in estimating the size , shape , nature of the flaws.
- Portability

DISADVANTAGES

- Manual operation requires careful attention by experienced technicians
- Difficulty in inspecting the parts which are irregular.
- Requirement of the couplants.
- Test objects should be water resistant.



REBOUND HAMMER TEST

This is a simple, handy tool, which can be used to provide a convenient and rapid indication of the compressive strength of concrete.



REBOUND HAMMER TEST

The schematic diagram showing various parts of a rebound hammer were

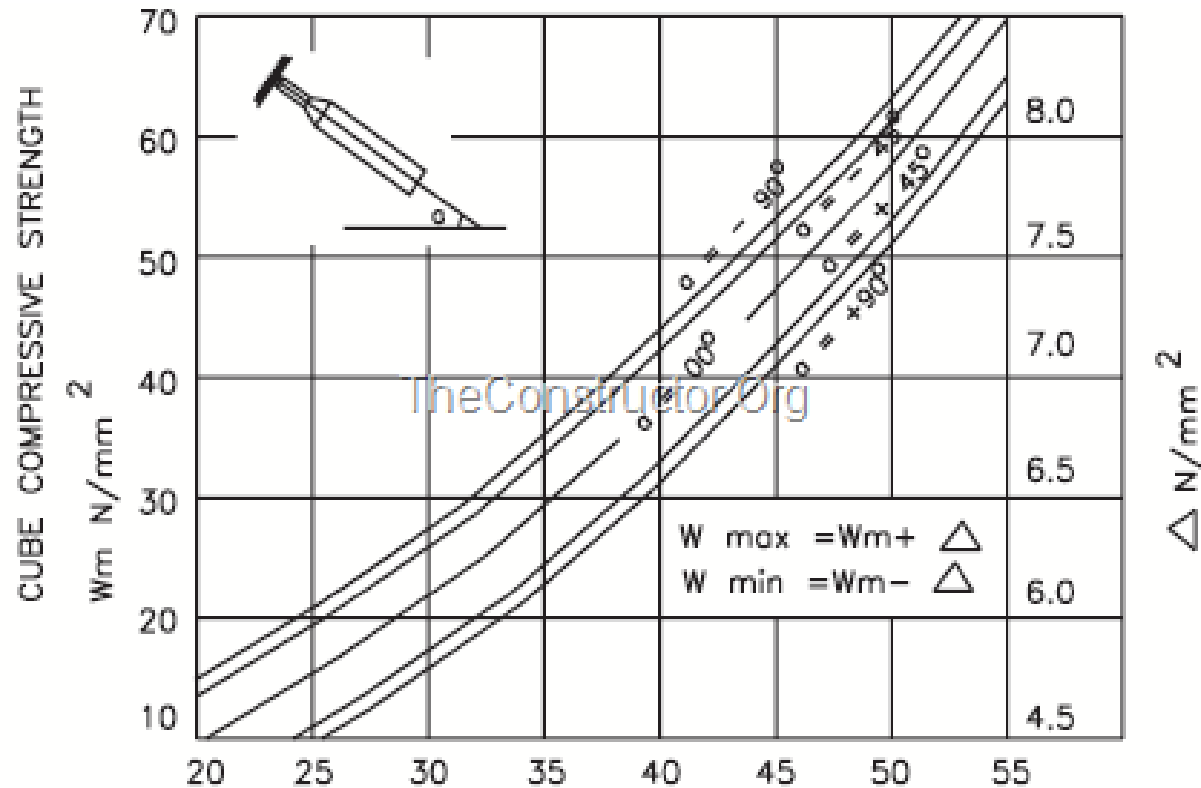
- Concrete surface
- Impact spring
- Rider on guide rod
- Window and scale
- Hammer guide
- Release catch
- Compressive spring
- Locking button
- Housing
- Hammer mass



PRINCIPLE

- The elastic mass depends on the hardness of the surface.
- It is related to the compressive strength of the concrete.
- The rebound value is designated as the rebound number or rebound index.
- The results are significantly affected by :
 - A) Mix characteristics.**
 - B) Angle of inclination of direction of hammer.**
 - C) Member characteristics.**

REBOUND HAMMER TEST



Cube compressive strength is N/sq.mm plotted against rebound number



STRENGTH ASSESSMENT

- To assess the relative strength of concrete based on the hardness.
- Casting cubes were tested under controlled conditions.
- This is due to hardening of concrete surface due to carbonation.
- It restricted to relatively new structures only.



SURVEY OF WEAK AND DELAMINATING CONCRETE

- It helps to identify relative surface weakness in cover concrete and to determine the relative compressive strength of concrete.
- This survey is carried by dividing the member into well-defined grid points.
- The grid matrix should have a spacing of approximately 300mm x 300mm.



PROCEDURE

- Should be tested against the test anvil.
- Apply light pressure on the plunger and allow it to extend to the ready position for the test.
- Apply a gradual increase in pressure until the hammer impacts.
- Take the average of about 15 readings.



ADVANTAGES

Assessing the likely compressive strength of concrete .

Assessing the quality of concrete in relation to standard requirements.



INTERPRETATION OF RESULTS

The rebound reading on the indicator scale has been calibrated by the manufacturer of the rebound hammer for horizontal impact.

Average Rebound Number	Quality of Concrete
>40	Very good hard layer
30 to 40	Good layer
20 to 30	Fair
< 20	Poor concrete
0	Delaminated

Thank You