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COIMBATORE

DEPARTMENT OF CIVIL ENGINEERING

19CEB201 – CONSTRUCTION MATERIALS

II YEAR / III SEMESTER

Unit 3 : Concrete

Topic 8 : Tests on Hardened Concrete

Tests on Hardened Concrete

The test conducted on hardened concrete can be classified into two main categories:

1. Destructive Tests on Concrete
2. Non-destructive Tests on Concrete
3. Chemical Test on Concrete

Tests on Hardened Concrete

- The suitability of the hardened concrete structure is determined by conducting suitable tests.
- It is preferred to have such testing without any destruction or damage to the concrete structure.
- Non-destructive tests are tests that will undergo no damage to the structure and take the results.
- In Destructive tests, the results can be only taken by slightly damaging the concrete surface.
- Once the surface is tested, the surface has to be repaired.

Destructive Test

- The common destructive tests conducted on concrete are: The main destructive tests on hardened concrete are as follows.

1. Cube test
2. Tensile Strength Test
3. Concrete core test

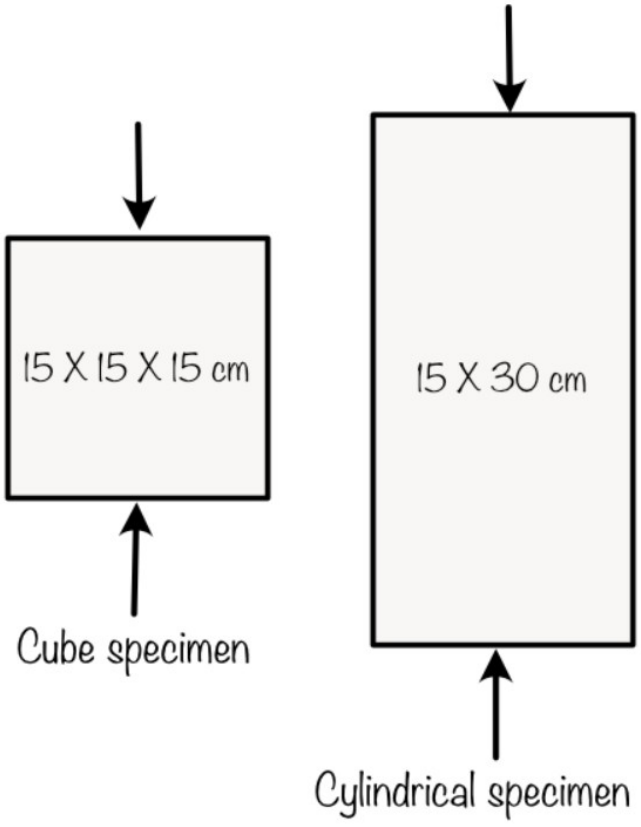
Cube Test

- Concrete Characteristics is determined by characteristics compressive cube strength test of concrete.
- For cube test two types of specimens either cubes of 15cm X 15cm X 15cm or 10cm X 10cm x 10cm depending upon the size of aggregate are used.
- For most of the works cubical moulds of size 15cm x 15cm x 15cm are commonly used.
- These specimens are tested by compression testing machine after 7 days curing or 28 days curing.
- Load should be applied gradually at the rate of 140 kg/cm2 per minute till the Specimens fails.

Cube Test

- It is the strength of concrete require to resist the compressive load.
- Measure the ability of concrete block to resist failure from cracks.
- In this test basically, we apply a compressive load and then note the maximum load a specimen can bear before failure which is equal to the compressive strength of concrete.

Cube Test



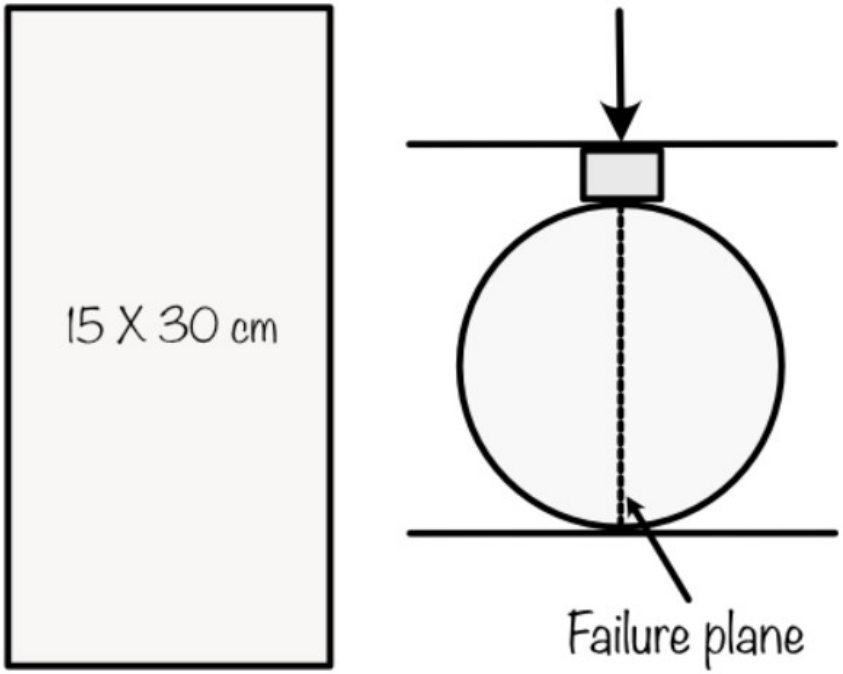
Compressive test specimen

Tensile Strength Test

Split Tensile Strength Test:

- It is a method to determine the tensile strength of concrete, though it is difficult to calculate the tensile strength directly so we test a cylindrical specimen which splits across the vertical diameter.
- In direct tensile strength test it is difficult to apply true axial load.
- The tensile strength calculated from this test is closer to the true tensile strength of concrete.

Tensile Strength Test



Cylindrical specimen

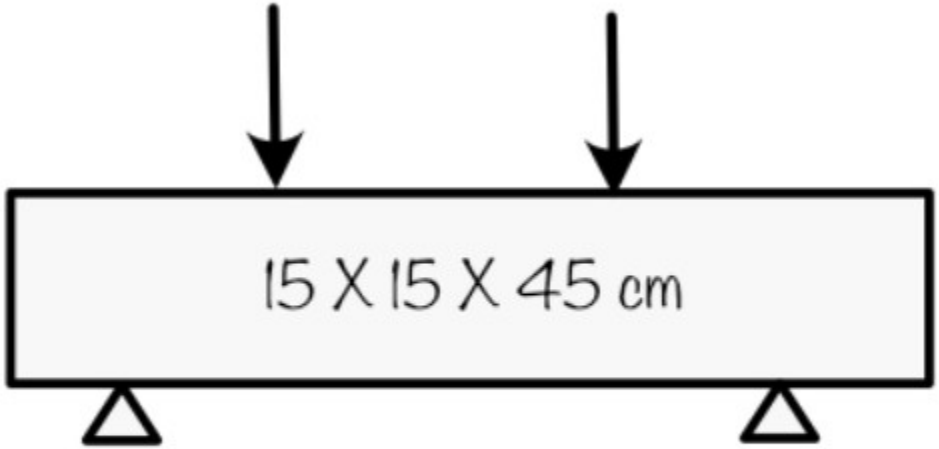
Split tensile strength test specimen

Tensile Strength Test

Flexure Strength Test:

- It is also an indirect method to determine the tensile strength of concrete.
- In this method, we note the maximum stress on the tension face of an un-reinforce concrete beam or slab at the point of failure in bending.
- A plain concrete specimen is examined to failure in bending.
- The theoretical maximum tensile stress at the bottom face at failure is measured. This is called the modulus of rupture.
- It is around 1.5 times the tensile stress obtained with the splitting test.

Tensile Strength Test



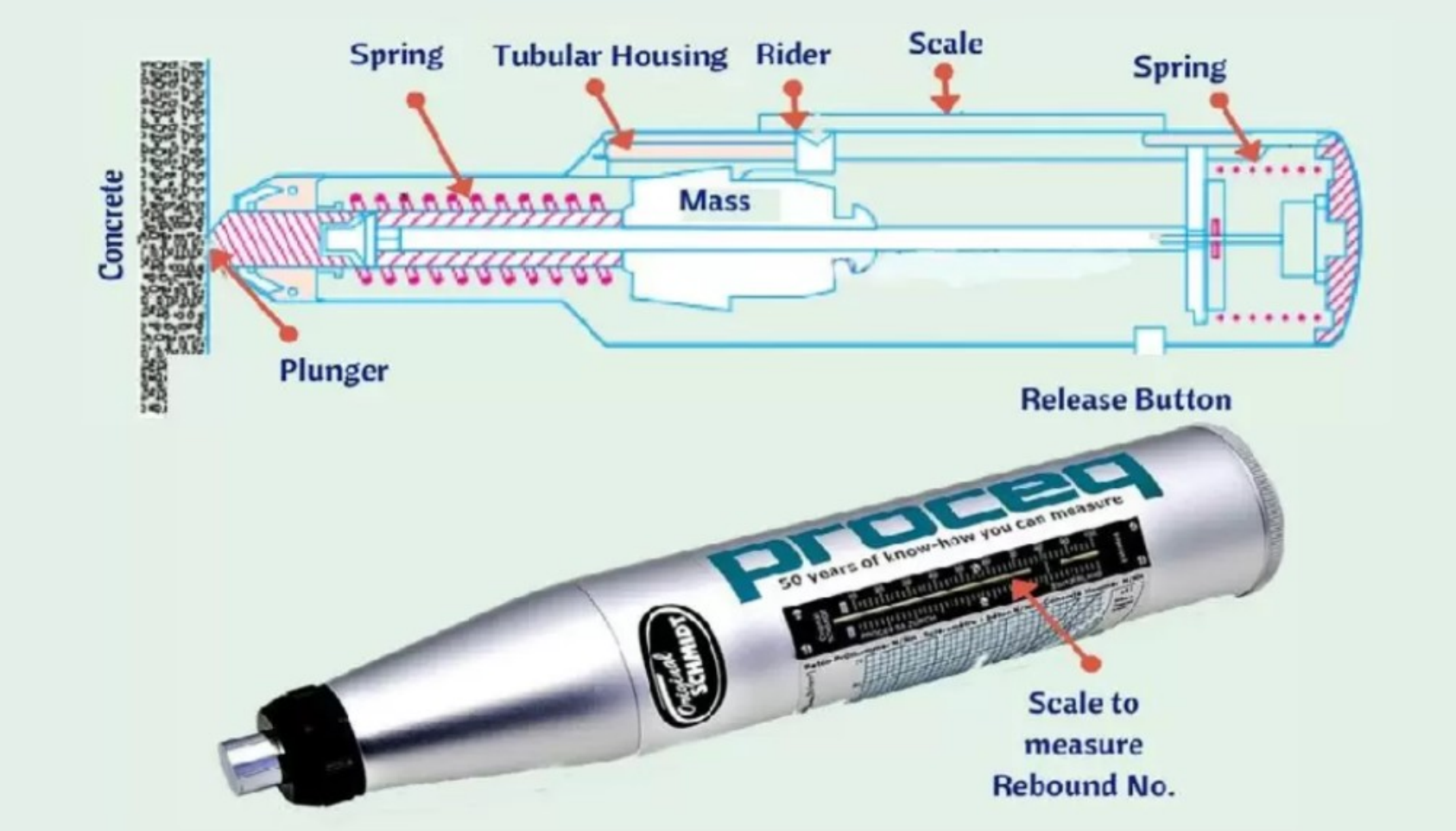
3 point loading method

Non-Destructive Tests

- The main non-destructive tests for strength on hardened concrete are as follows.

1. Rebound Hammer (Hardness Test)
2. Ultrasonic Pulse Velocity Test
3. Pull Out Test
4. Penetration Resistance
5. Other non-destructive tests

Rebound Hammer Test

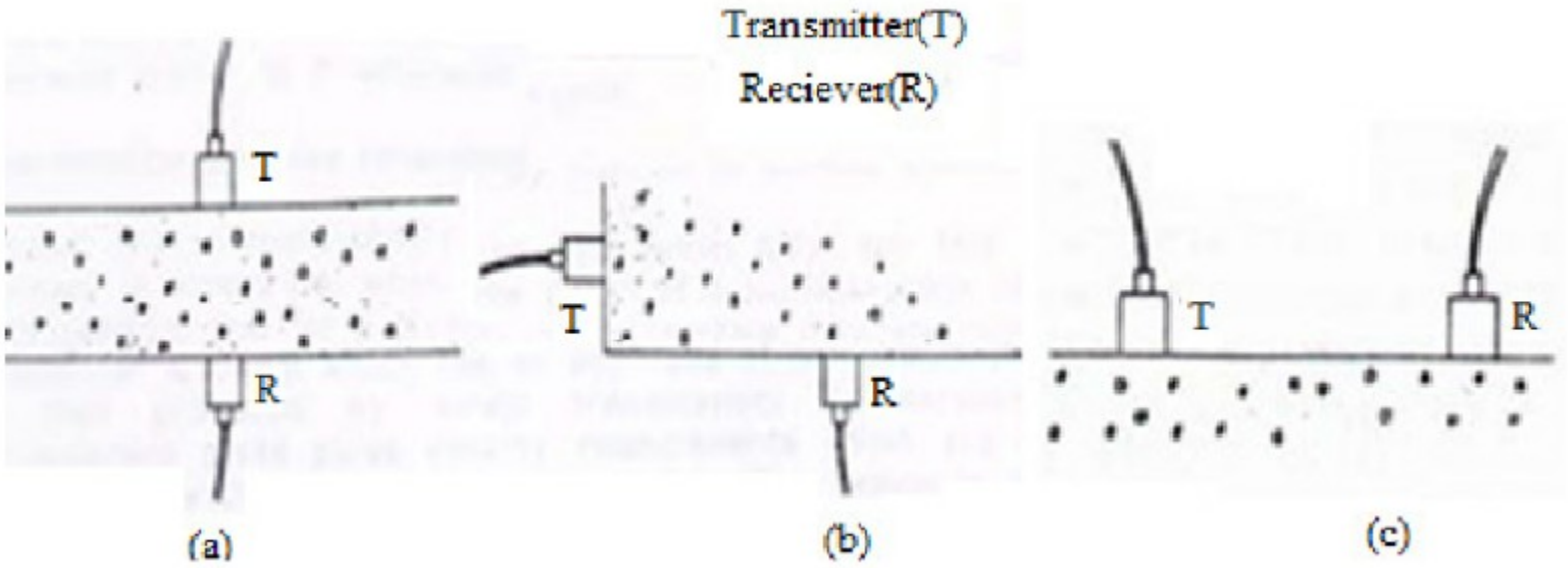


Rebound Hammer Test

- For the rebound hardness test, the schmidt hammer is utilized.
- Under this test, a metal hammer occupied against the concrete is sustained with another spring-driven metal mass and rebounds.
- The amount of rebound is documented on a scale and this highlights the strength of the concrete.
- As the rebound number is greater, the strength of the concrete will also increase.
- The Schmidt hammer is used in the rebound hardness test in which a metal hammer held against the concrete is struck by another spring-driven metal mass and rebounds.
- The amount of rebound is recorded on a scale and this gives an indication of the concrete strength.
- The larger the rebound number is, the higher is the concrete strength.

Ultrasonic Pulse Velocity Test

Ultrasonic Pulse Velocity Test



Ultrasonic Pulse Velocity Test

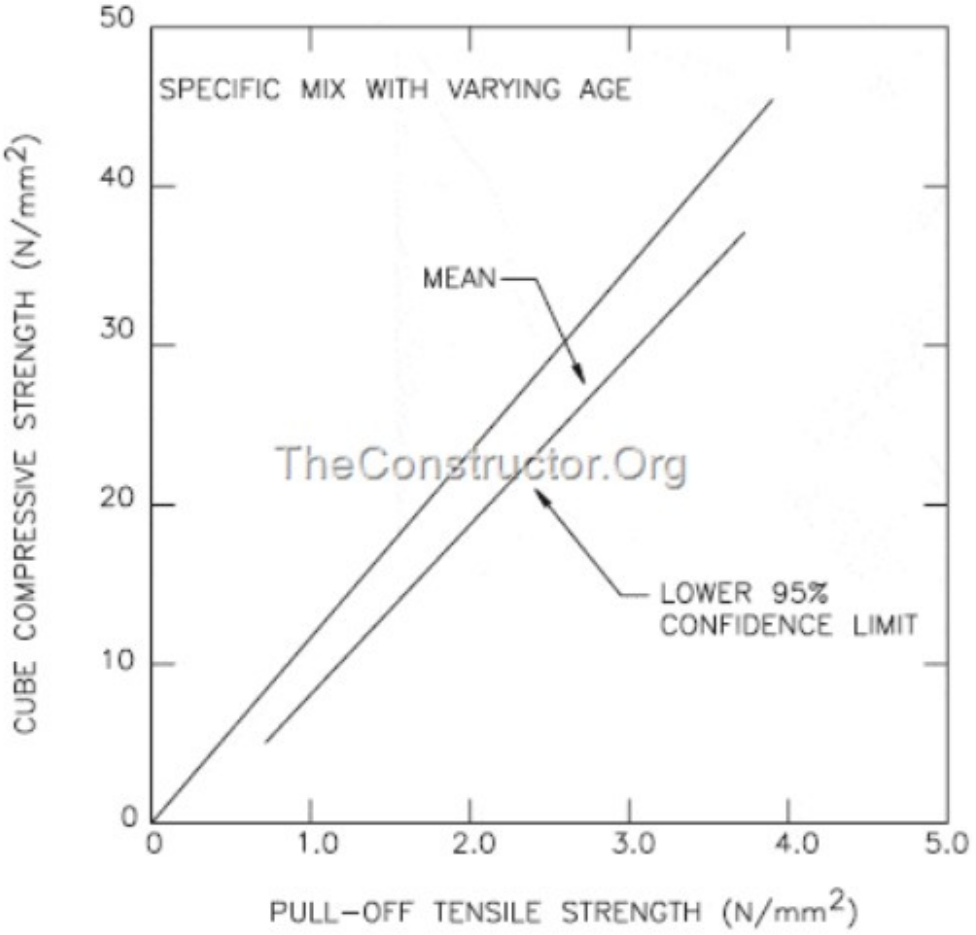
- In the ultrasonic pulse velocity test, the velocity of ultrasonic pulses that pass through a concrete section from a transmitter to a receiver is measured.
- The pulse velocity is correlated against strength. The higher the velocity is, the stronger is the concrete.
- Under the ultrasonic pulse velocity test, the velocity of ultrasonic pulses that transmit through a concrete section from a transmitter to a receiver is calculated.
- The pulse velocity is interrelated opposed to strength. If the velocity becomes higher, the strength of the concrete is increased.

Ultrasonic Pulse Velocity Test

- This test measures the velocity of an ultrasonic wave passing through the concrete.
- The length between transducers/the travel time = average velocity of wave propagation.
- It is used to detect discontinuities, cracks and internal deterioration in the structure of concrete.

Pull Out Test

Pull Out Test

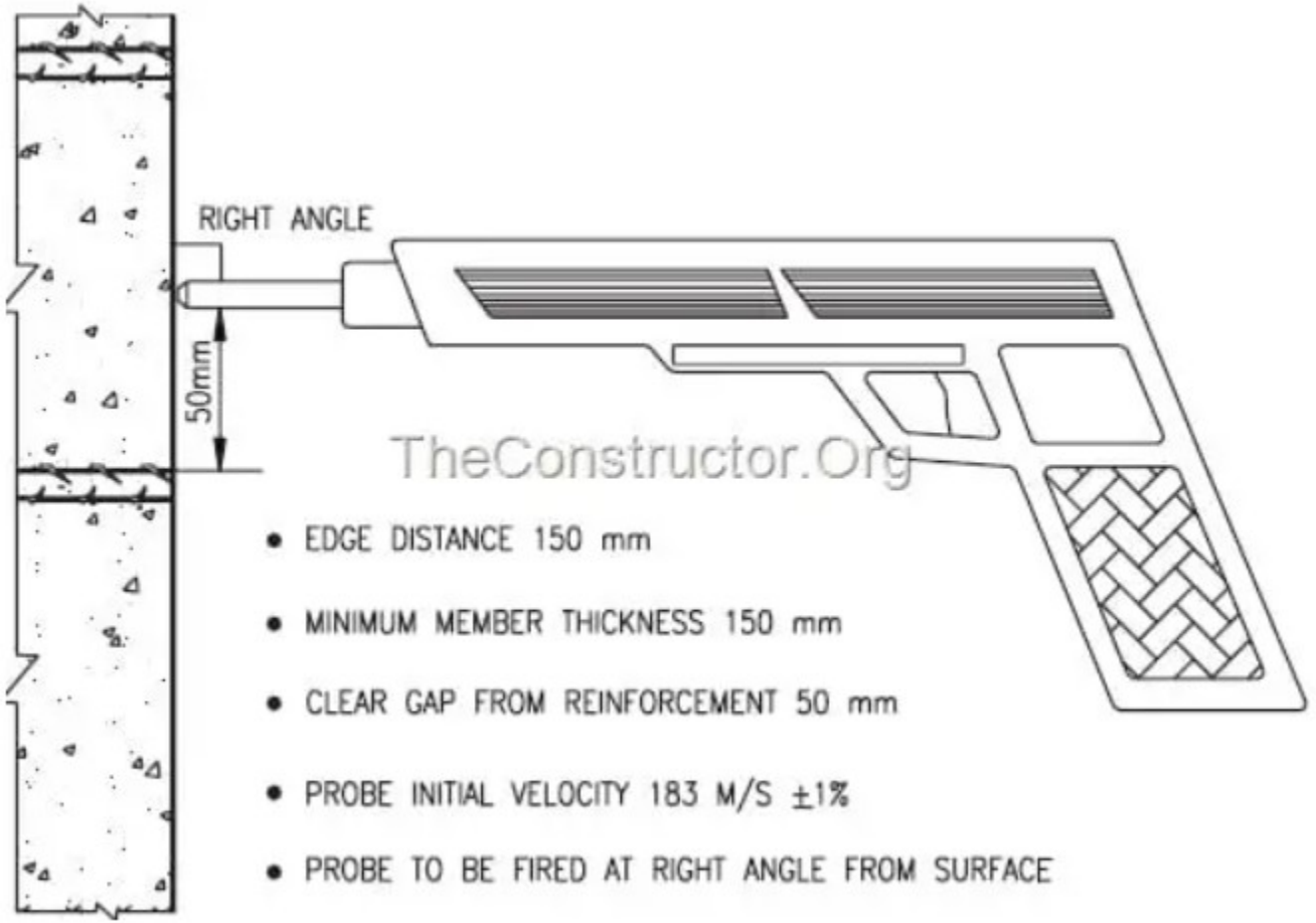


Pull Out Test

- The pull-out test will determine the force that is required to pull out a steel rod specially shaped from hardened concrete to which the steel was cast.
- Pulling out of steel is done with a cone of concrete that has a slope of 45 degrees.
- The force required to pull the concrete out is related with the compressive strength of the concrete.

Penetration Resistance Test

Penetration Resistance Test



Penetration Resistance Test

- Penetration resistance tests on concrete offer a means of determining relative strengths of concrete in the same structure or relative strength of different structures.
- Because of the nature of the equipment, it can not and should not be expected to yield absolute values of strength.
- ASTM C-803 gives this standard test method titled “Penetration Resistance of Hardened Concrete”

Other NDT Test

- These tests are done through Equipment to compute the following :-

1. Crack widths and depths
2. Water permeability and the surface dampness of concrete
3. Depth of cover and the location of reinforcing bars
4. The electrochemical potential of reinforcing bars and therefore the existence of corrosion

Chemical Tests

- A complete range of chemical tests is available to measure

1. Depth of carbonation
2. The cement content of the original mix
3. The content of salts such as chlorides and sulfates that may react and cause the concrete to disintegrate or cause corrosion of the reinforcement
4. Alkali Content

Thank You!!