STRENGTH OF CONCRETE

The strength is usually specified as characteristic strength which is the strength determined by testing at a fixed age samples of concrete.

1.Compressive Strength:

Three types of test specimen

Cube:150mm X 150mm or 100mm X 100mm

Cylinder: 150mm dia and 300mm ht

Prism: 100mmX100mmX500mm

Test specimen are cast, cured & tested as per standards.

Compressive strengths given by different specimens for the same concrete mix are different

$(fck)cy = 0.8(fck)cube$

$ft = t/(a+bt) * f28$

a=4.7,b=0.833

2. Flexural Strength

- Determination of this test is essential to estimate the load at which the concrete member may crack.

- Specimen size:150X150X700mm over 600mm span
  100X100X500mm over 400mm span

  Flexural Strength=$0.7(fck)^{1/2}$

Results are affected by

- Size of the specimen
- Casting
- Curing
- Moisture conditions
- Rate of loading
- Manner of loading

3. Tensile strength:

- **Splitting tensile strength:**

Direct compressive force is applied to a concrete specimen in such a way that the specimen fails due to tensile stresses induced in the specimen.

$$\sigma sp = 2P/(\Pi*d*l)$$

Factors affecting strength of concrete

- Size of the test specimen
- Size of aggregate & type of aggregate
- Support conditions of the specimen
- Moisture conditions
- Types of testing machine
- Type of cement
- Degree of compaction
- Type of curing & temp of curing
- Nature of loading

Permeability of Concrete

Permeability is the property that governs the rate of flow of a fluid through the concrete. The rate of flow is higher when the permeability is higher.

Permeability of Concrete affects its Durability:

- The durability of concrete has proven to be a formidable obstacle in the service life of new and existing structures.
- The durability of concrete is a function of permeability. Permeability is governed by the capillary pores in the cement paste. Pores that are too large will result in a high permeability, while pores that are small will result in a low permeability.
- The objective of this research is to study the permeability of concrete as the water-to-cement ratio is changed. For this investigation, the AutoClam device will be used to explore the permeability of different water-to-cement ratios respectively.
- Results presented in this investigation will provide valuable knowledge of the durability of concrete. Current research and or tests will study any relationships between water permeability and the water-cement ratio of the concrete mix.
- Our ultimate goal will be to show/prove an inverse relationship between water permeability and concrete water-to-cement ratio. The test results show that by increasing or decreasing of water-to-cement ratio and curing time, the permeability of concrete changes.
- The AutoClam was successful in measuring the permeability of concrete used for this research. In the future the AutoClam can be tested side by side with a 16' head of water and or the Rapid Chloride.

CONCRETE PERMEABILITY:

Concrete durability depends largely on the ease (or difficulty) with which fluids (water, carbon dioxide, oxygen) in the form of liquid or gas can migrate through the hardened concrete mass. Concrete is a porous material. Therefore, moisture movement can occur by flow, diffusion, or sorption. We are concerned with all three, but generally the overall potential for moisture and ion ingress in concrete by these three modes is referred to as its permeability.

CONCRETE POROSITY

- Found on several ways, the water is the most important fluid on nature. Among its properties, is noticeable the capacity to penetrate in small pores or cracks, and the capacity of dissolve a large amount of substances.
- Several researches refer and attest the great importance of the water molecule on the concrete structure, especially on the first ages, caused by the cement hydration and consequent hardness of the concrete.
- However, the presence of water after the hardness of the concrete and after the reduction, or the ceasing of the hydration reactions, may cause the deterioration of the concrete or of the steel bar present on the structure.
- The water take action as a direct agent (lixiviation) or transporting noxious substances, such as chloride ions, sulfate ions and acid, or components that can activate and propel many chemical reactions that speed up the degradation process of the matrix, proportioning this way a substantial reduction of the durability and the use life of the concrete and reinforced concrete structures.
- The permeability of the water is the most important factor to esteem the durability under the most diverse conditions of service of a structure. The permeability regulates the speed of aggressive water penetration for inside of the concrete besides controlling the movement of the water during the ice-thaw process.
- Therefore concrete must be projected and manufactured for the environment to which it goes to be displayed, because the permeability is related to the porosity that varies in accordance to the composition of the concrete, its factor water cement, its age and even though with its form of launching.
- In this paper, will be evaluated permeability and the compressive strength of the concrete with different compositions, water cement factor and ages, making possible to generate correlation curves, suggesting a standard of reference and analysis of the permeability in function of some variable of the concrete.