6/26/2020

Concrete Technology

Final Term Paper

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ANS 1:

a) Retempering of Concrete:

The process of remixing of water to concrete, in addition to required quantity of water is known as retempering of concrete. Sometimes, extra cement is also added while retempering.

When water is added to a stiffened concrete or partially set fresh concrete in order to bring it back to the desired consistency or workability, then it is called "*retempering of concrete*'.

Retempering is done owing to loss of workability or undue stiffness of concrete at actual side in case of long tunnels, road construction etc. where batching plant is few kilometers away.

The reason for retempering of concrete is to regain the lost workability of fresh concrete to make it usable. The reason behind the workability loss is the delay between mixing of concrete ingredients and placing of concrete on actual site. This type of delay may happen in the following situations.

- Due to traffic, delivery of concrete from central mixing plant to work site
- While constructing length tunnels or in road works
- While placing concrete manually by labor in hilly areas

b)

- Mixers generally run at speed of 15-20 revolutions per minute.
- Normally 25-30 revolutions are required for a well-designed mixer to mix ingredients properly.

ANS 2:

a)

The expected loss in strength of 3000psi concrete if its curing has not been performed at all will be about 40% of that of continuously moist concrete. If 3000psi is the strength from continuously moist then the loss in strength will be 1200psi.

b)

Membrane curing is 80% efficient as compared to water curing.

c)

Retrogression of strength: Curing at high temperature can cause 'Retrogression in strength' which refers to high strength in early age due to heating but loss in strength at later age. Steam Curing at Ordinary Pressure promotes retrogression in concrete strength.

ANS 3:

a)

Endurance level: The fatigue strength (S) decreases as the number of cycles (N) increases. The minimum value of S below which failure does not occur is known as endurance level. For steel S=0.5xstrength. Concrete does not have a minimum endurance level.

b)

Difference between erosion and attrition:

Erosion: It is a form of wearing of concrete that is observed in contact with flowing water. It is caused by the action of water in hydraulic structures.

while

Attrition: It is the wear on concrete floors, due to foot traffic, light trucking, and skidding, scraping, or sliding of objects on the surface.

c)

Strength of bond depends upon the friction between steel and concrete. The bond strength increase with increase in compressive strength of concrete. Deformed (ribbed) bars should be used to increase friction between reinforcement and concrete.

ANS 4:

Creep: The increase in strain of concrete with in passage of time under sustained stress is known as creep.

Factors affecting Creep:

- Stiffer the aggregate lower the creep. More the content of aggregate per unit volume of concrete, lower the creep.
- Decrease in W/C causes decrease in creep. In other words, strength and creep and inversely proportional.
- Creep is smaller when concrete is cured at high temperature because strength is higher than when cured and loaded at high temperature.
- Creep also depends upon the applied stress. The relationship is directly proportional.
- Creep also depends on the type of cement. High alumina cement experiences less creep as compared to Ordinary Portland Cement.

Difference between creep and strain relaxation

Creep: The deformation of material under design stress is termed elastic and the subsequent increase in deformation under sustained design stress is creep.

while

Strain Relaxation: If a loaded concrete specimen is retrained in such a way that strain over time remains constant, creep will manifest itself in the form of progressive decrease in stress over time. This is term as relaxation.

ANS 5:

Difference between drying shrinkage and plastic shrinkage:

Dry shrinkage: Withdrawal of water from hardened concrete causes drying shrinkage.

While

Plastic Shrinkage: The volumetric contraction of cement is called plastic shrinkage and results in 1% reduction per unit volume of cement paste. This results in tensile stress on surface of concrete, inducing cracks.

Reversibility of dry and plastic shrinkage:

A part of drying shrinkage is reversible through moisture movement (40 to 70%).

If the conditions are expected to be conducive to plastic shrinkage, protect the pour site. This can be done with windbreaks, tarps, and similar arrangements to prevent excessive evaporation. In the event the early cracks are discovered, revibration and refinishing can solve the immediate problem.

ANS 6:

a) Effect of Seawater on Concrete Structures:

The constituents of seawater react chemically with constituents of cement concrete which results damage to the concrete structure in several ways.

- The presences of chlorides in sea water prevents expansion of concrete unlike sulphate attack, but increase porosity of concrete over time, resulting decrease in strength.
- The magnesium sulfate present in seawater reacts with calcium hydroxide of cement and forms calcium sulfate as well as magnesium hydroxide precipitation. Magnesium sulfate also reacts with hydrated calcium aluminate and forms calcium sulpho aluminate. These final formations are the primary reasons for chemical attack on concrete structures.

- The deterioration of concrete structures by seawater is more due to leaching rather than expansion of concrete. Leaching more effects, the small concrete structures than expansion while large concrete structures are effected by leaching as well as expansion.
- Sulfates attack the concrete and cause expansion but due to the presence chlorides in seawater the swelling of concrete retards. Hence, erosion and loss of concrete takes place without showing much Expansion.
- Concrete is not 100% impervious. When seawater enters into the pores of concrete and reaches the reinforcement then corrosion will occur. It will affect the durability of structure
- Another case is that concrete damaged by abrasion. Seawater may carry sand and silt especially at the shallow end of the sea. When it forcibly contacts the concrete surface abrasion occurs. Abrasion also occurs due to mechanical force buy wave action.

Increasing resistance of concrete to sea water:

- To counter sulphate attack dense concrete of low permeability must be used. Moreover, Cement with low C3A content should be preferable to make concrete.
- Prepare rich concrete with low water cement ratio which makes the concrete impervious. Then the pores in concrete are very small and they cannot hold seawater results in the prevention of expansion by freezing of water and crystallization of salt in the pores.
- The concrete is of low water cement ratio. Concrete exposed to sea water should have W/C below 0.45
- Good compaction and well-made construction joints in the structure helps the concrete structure to withstand against expansion caused by seawater.

6) b **Given data:** $f_{min} = (x+y+15)$

Roll No = 16247 ⇒ $x = 4$ & $y = 7$ So $f_{min} = 26$ MPa

Slump = 50mm , Maximum aggregate size = 25mm

Specific gravity of fine aggregate = 2.65

Specific gravity of course aggregate = 2.7

Finness modulus of fine aggregate = 2.6

1% absorption for CA and 2% for F.A.

Bulk density of C.A = 1600 kg/m³.

Required: ~~Quanti~~ Quantities of Ingredients.

Sol:- ⇒ From Table 19.4, for 25mm aggregate and 50mm slump.

$W = 180$ kg/m³   Air content = 1.5%.

⇒ $f_m = f_{min} + 8.5$ ⇒ $f_m = 26 + 8.5$

$f_m = 34.5$ MPa

⇒ From table 19.1, for 34.5 MPa and Non-air entrained.

w/c ratio = 0.48

⇒ Cement Quantity $= C = W / (w/c)$

$$C = \frac{180}{0.48} \Rightarrow \boxed{C = 375\ kg/m^3}$$

⇒ From Table 19.9, C.A quantity

C.A = 0.69

weight of C.A = 0.69 × 1600

$$\boxed{= 1104\ kg/m^3}$$

⇒ weight of F.A $= \gamma_f \left[1000 - \left(W + \frac{C}{\gamma} + \frac{A_c}{\gamma_c} + 10A\right)\right]$

$$= 2.65\left[1000 - \left(\frac{375}{3.15} + \frac{180}{1} + \frac{1104}{2.7} + (10 \times 1.5)\right)\right]$$

~~weight of F.A = 773.57 kg/m³~~

$$\boxed{\text{weight of F.A} = 734.21\ kg/m^3}$$

⇒ For 1% of moisture in C.A, we have

$$\frac{1}{100} \times 1104 = \boxed{11.04\ kg}$$

⇒ For 2% of moisturew in FA, we have

$$\frac{2}{100} \times 734.21 = \boxed{14.68\ kg}$$

⇒ Net quantity of water

= 180 + 11.04 − 14.68

| Net water quantity = 176.36 kg |

Net quantity of C.A = 1104 + 11.04

| Net C.A quantity = 1115.04 kg |

Net F.A quantity = 734.21 + 14.68

| Net F.A quantity = 748.89 kg |

So

Cement = 375 kg.

water = 176.36 kg

F.A = 748.89 kg

C.A = 1115.04 kg