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Section: B

Paper: concrete technology

1.(a) What is re-tempering of concrete? In which case is re-tempering of concrete done?

(b) What is the normal RPM of the agitator of a transit mixer? What is the minimum limitation of total revolutions of agitator in a transit mixer set by ASTM before concrete placement?

Ans: **Re-tempering of concrete:**

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 kilometres away.

(b):

Transit mixers have capacity ranging from 4-7m^3. Speed of agitator varies from 2 to 5rpm. A limit of 300 revolutions has been set by ASTM before placing.

2.(a) What will be the expected loss in strength of 3000psi concrete if it curing has not been performed at all?

(b) What is the percentage efficiency of membrane curing as compared to water curing?

(c) What is meant by retrogression of strength in concrete? Which method of curing promotes retrogression in concrete strength?

Ans:(a). The expected loss in strength of 3000 psi concrete if curing has not been performed at all will be 60%.

(b). Membrane curing is 80% efficient as compared to water curing.

(c). Strength retrogression is defined as a change in the hydration products that are formed when **cement** is exposed to high temperatures (>110°C / 230°F). It can be described as a decline of **cement strength** at elevated temperatures where decreased **strength** is observed with increasing time.

Application of heat promotes retrogression in concrete strength.

3.(a) What do you mean by endurance level? What is the endurance level of concrete and steel?

(b) What is the difference between attrition and erosion of concrete?

(c) What steps should be taken to improve bond strength of reinforcement in concrete?

Ans: (a)Endurance level:

A fluctuating stress i.e. with positive and negative phase is the root cause of fatigue failure. ... Thus, there is existence of hypothesis that there exists stress amplitude below which it can take infinite number of load cycles; this limit is defined as endurance level or fatigue endurance limit.

(b) Attrition of concrete:

It increases the shear strength of structural concrete by providing a more homogeneous mix.

It reduces the water (and hence the cement) content in ready-mixed concrete for a given structural strength, thereby reducing the cost per cubic metre.

It increases the skid-resistance of asphalt wearing courses by presenting more angular faces to the tyre than a series of very flat particles.

It helps to reduce aquaplaning in wet weather when used for asphalt wearing courses because it reduces the amount of flat surfaces in contact with the tyre.

Erosion in concrete:

Erosion is the deterioration of **concrete** surface as a result of particles in moving water scrubbing the surface.

(c) steps to improve bond strength in reinforcement concrete:

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.

4.What is creep? What are the factors affecting creep? What difference is between creep and strain relaxation?

Ans. Creep:

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

Factors effecting creep:

. Stifer 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 b/w creep & strain relaxation:

two terms are sometimes used interchangeably, although they are really **different**. **Creep** is an increase in plastic strain under constant **stress**. **Strain relaxation** is a decrease in **stress** under constant strain. **Creep** is an increased tendency toward more strain and plastic deformation with no change in **stress**.

5.What is the difference between drying shrinkage and plastic shrinkage? Is drying and plastic shrinkage reversible?

Ans. Drying shrinkage:

Drying shrinkage results from the loss of capillary water from the hardened cement mixture, leading to contraction and crack formation within concrete. According to the previous studies, the addition of plant fibbers, such as sisal, to cement mortar increases its **drying shrinkage.**

Plastic shrinkage:

Plastic shrinkage is caused by the loss of water by evaporation from the surface of newly laid concrete or by suction of dry concrete underneath. At the surface, **plastic shrinkage** occurs when the rate of evaporation exceeds the rate of bleeding.

Reversible or not:

A part of drying shrinkage is reversible

through moisture movement (40 to 70%).

While plastic shrinkage is not reversible at all.

6.(a) What are risks to concrete structure exposed to sea water? How do you increase resistance of concrete to sea water? (b) Concrete is required for the internal columns of a building. The specified

28 days strength is (x+y+15) MPa (where x and y are the last two digits of your Roll no.) The following equations may be used to find average compressive strength The slump required is 50mm and a maximum size of 25mm is required. The fine aggregate has a Fineness modulus of 2.60. Preliminary tests indicate that FA and CA have a specific gravity of 2.65 and 2.7, with 1 percent absorption in C.A and 2% free moisture in F.A. The Bulk density of C.A is 1600 kg/m³. Find the required quantities of ingredients.

Ans: (a)Risks :

1. The constituents of seawater reacts chemically with constituents of cement concrete which results damage to the concrete structure in several ways. The magnesium sulfate present in seawater reacts with calcium hydroxide of cement and forms calcium sulfate as well as magnesium hydroxide precipitation.

2.Magnesium sulfate also reacts with hydrated calcium alumnat and forms calcium sulpho aluminate. These final formations are the primary reasons for chemical attak on concrete structures.

3.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.

Resistance of concrete to seasewater:

1. Cement with low C_3A content should be preferable to make concrete.
2. 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.

3. The concrete is of low water cement ratio. To make it workable for construction, Water reducing admixtures can be added to the concrete which is recommended by ACI 318 and ACI 357.
4. The admixtures should not contain chloride in any form otherwise corrosion of reinforcement takes place.
5. Adequate cover should be provided for reinforcement in concrete structure to enhance durability.

(b)

* Dry bulk volume of C.A for 50mm with 2.60 FM
  ⇒ 0.76
* Average compressive strength where my RoSF number is 07 ⇒ (3.2+1.5) 20 MPa

Where is
$f_m = 20 + 1.64 \times 4 \Rightarrow 4$ For M20 Concrete
$f_m = 26.56$
Now according to formulae if standard diviation not given
Now for 20 Mpa concrete
$f_m = f_{min} + 6.9$
$f_m = 20 + 6.9 = 26.9$ Mpa

* where is WK ratio
  for 20Mpa = 0.60

Now the Slump value is
50mm and maximum Size of aggregate is 25mm
So for non-air-entrained Concrete.
maximum water ration = 180
given in table
and maximum entraped air = 1.5

* So required concrete content $= \frac{180}{0.6} = 300$

Now maximum size of aggregate is 25mm and Finenes modules of 2.60 the dry bulle volume of the coarse aggregate is 0.76 per unit volume of concrete

there for the weight of C.A = 0.76 x 1600
⇒ 1.216 kg/m³

From table 11.9
25mm max size aggregate = 2375 kg/m³ for non air. for non air entrained Concrete if it is not mentioned that concrete is air entrained are are non air-entrained

Moral:-
weight of all known ingredients
W of water = 180
weight of cement content = 300
weight of C.A = 1216
Now
2375 - (180 + 300 + 1216)
= 679 kg/m³

So that absolute volume of F.A = (1000 - 679) x 10³
= 303 x 10³
wght of F.A = 303 x 2.65
= 803 Kg/m³
Adopt F.A = 803 kg/m³

(3)

Now estimate quantity for material per cubic matter of Concrete

Cemment = 300 kg/m3
F.A = 803 kg/m3
C.A = 1216 kg/m3
water = 180 kg/m3
2499 kg/m3

where 2375 for 25mm max size aggregate.

Now Cement	Fine aggregate	Coarse aggregate	Water
300	803/300 = 2.677	1216/300 = 4.05	180/300 = 0.6

So weight of material for one bag mix in kg = 50

Cement	Fine aggregate	Corsse aggreate	water
50	50 x 2.677 = 133.85 kg	50 x 4.05 = 202.5 kg	50 x 0.6 = 30 litre

★ F.A share 2% moisture

$P/A = 2/100 \times 803 = 16.06 \text{ kg/m}^3$

Weight of F.A Peild Contain = 803+16.06=819

★ Present absorption of C.A where is 1%

$= 1/100 \times 1216 = 12.16$

weight of C.A Peild Condition

$= 1216 - 12.16$

$= 1203.84 \text{ kg/m}^3$

now with regard to water 16.06 by F.A and 12.16 by C.A

There fore $16.06 - 12.16$

$= 3.9 \text{ kg}$

So 3.91 kg quantity of water will be deducted from to water

$180 - 3.91 = 176.11 \text{ kg/m}^3$

$176.11 \cong 176 \text{ kg/m}^3$

Quantity of material to be Used in Peild Condition

Cement = 300

F.A = 819

C.A = 1203.84

Water = 176

Feild density of each Concrete = 2468.04