

Concrete Technology



Final Paper

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Q1: (a) What is re-tempering of concrete? In which case is re-tempering of concrete done?

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 "re-tempering of concrete".

In which case is Re-tempering of Concrete Done

Re-tempering is done on the mortar board by the mason, usually by dribbling water into the mortar pile, then reworking with a trowel or shovel. This replaces water lost by evaporation. It keeps the mortar plastic so that units can be laid and positioned in it.

(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?

RPM of the Agitator

While loading the concrete, use the appropriate rotations per minute according to the function that is being carried out. For agitating, a range from 2 to 6 rpm is sufficient. For mixing, the concrete drum must turn faster, with a maximum of 12 to 18 rpm.

Minimum Limitation of total Revolutions of Agitator in A Transit Mixer

Concrete is remixed for a minimum of 30 revolutions at mixing speed or until the uniformity of the concrete is within the limits described in ASTM.

Q2: (a) What will be the expected loss in strength of 3000psi concrete if it curing has not been performed at all?

Ans: Losses of up to 40% were experienced when the concrete curing has not been performed at all.

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

Using membrane curing compounds, an efficiency of 80-90% can be achieved as compared to Conventional water Curing.

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

Retrogression of strength

Strength retrogression is defined as a change in the hydration products that are formed when cement is exposed to high temperatures ($>110^{\circ}\text{C}$ / 230°F). It can be described as a decline of cement strength at elevated temperatures where decreased strength is observed with increasing time. When strength retrogression occurs, not only is there a reduction in the strength of cement, but also an increase in permeability which compromise zonal isolation.

Method of curing promotes Retrogression in Concrete Strength

Retrogression is the reduction in strength of concrete with elevated/high temperature

The method which we use of curing to promote retrogression in concrete strength is due to Steam Curing. Concrete can attain 28days strength in 3 days by application of heat.

Q3: (a) What do you mean by endurance level? What is the endurance level of concrete and steel?

Endurance Level

Endurance level is the ability of any material to resist and stand against fatigue.

Endurance Level of Concrete

The endurance level of concrete is 2 million loading cycle.

Endurance Level of Steel

The endurance level of steel depends upon the tensile strength of steel. Higher the tensile strength concrete higher will be the endurance level. Normally it range 0.36-0.58 of the tensile strength.

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

Attrition

Attrition may be defines as “it is mechanical wear and tear through contact”

Erosion

Erosion may be defined as “it is detoriation of concrete by chemical mean”

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

The bond strength between steel and concrete can be increased by using admixture (Methylcellulose) increase shear bond strength between steel and concrete.

Q4: What is creep? What are the factors affecting creep? What difference is between creep and strain relaxation?

Creep

It is a tendency of material to deform under static load. It is slow and long term process.

Factors Affecting Creep

1. The magnitude of sustained loading, higher the magnitude of load more and rapid creep will occur.
2. The age and strength of concrete when stress is applied. If concrete are fresh, its strength will be less, by applying load on it more creep/formation will occur.
3. The total amount of time that concrete are stressed. It is slow and long term process. Its deformation depends /increase with age.

Difference is between creep and strain relaxation

Creep	strain
Creep is increased in plastic strain under constant load.	Strain relaxation is the reduction in strain under constant stress.

Q5: What is the difference between drying shrinkage and plastic shrinkage?

Is drying and plastic shrinkage reversible?

drying shrinkage	plastic shrinkage
Drying shrinkage is the contracting of hardened concrete due to loss of water.	Plastic shrinkage occur in freshly made /mixed concrete due to loss of water by evaporation from its surface.

Is drying and plastic shrinkage reversible?

Both drying and plastic shrinkage are irreversible.

Q6: (a) What are risks to concrete structure exposed to sea water? How do you increase resistance of concrete to sea water?

Concrete structure exposed to Sea Water

The constituents of sea water reacts chemically with the constituents of cement concrete which results damage to the concrete structure in several way.

The magnesium sulphate present in sea water react with calcium hydroxide of cement and form calcium sulphate as well as magnesium hydroxide. Magnesium sulphate also react with hydrated calcium aluminate and form sulpho-aluminate. These are the primary reason for chemical attack on concrete structure.

The lime present in concrete also lost due to leaching. The calcium hydroxide and calcium sulphate are soluble in sea water this will result in leaching action.

How do you increase resistance of concrete to sea water?

- Good proper compaction in well-made construction joints in structure help the concrete structure to with stand against sea action.
- Cement with low content of C_3A with stand against sea action.
- Low water cement ratio make concrete improperness. Since there are no pores but many loss result in prevention of expansion by freezing of water and crystalized of salt in pores.

(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

$$f_m = f_{min} + 7 \quad \text{for } f_{min} < 21 \text{ MPa}$$

$$f_m = f_{min} + 8.5 \quad \text{OR} \quad f_{min} = 1.1 * f_m + 5 \quad \text{for } 21 \text{ MPa} < f_{min} < 35 \text{ MPa}$$

. 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.

Solution

Q: 6 (part b). Pg. # ①

GIVEN DATA:

Slump = 50mm
 agg max. 25mm
 F.M. = 2.60
 G_f = 2.6
 G_c = 2.7
 W.A. = 2 %
 W.A. = 1 %
 S.C.A. = 1600 kg/m³

Water Required = 275 lb/yd³
 W/C Ratio = 0.68
 Cement Content = $\frac{275}{0.68} = 404.41 \text{ lb/yd}^3$

Coarse Aggregate Content
 $0.72 \times 27 \text{ ft}^3/\text{yd}^3 = 19.44 \text{ ft}^3/\text{yd}^3$
 Dry net weight of aggregate.
 $19.44 \times 1600 = 31104 \text{ lb/yd}^3$

F.A. Content. Pg. # ②

Volume of Cement = 2.05 ft³
 " " water = 4.40 ft³
 " " C.A = 11.5 ft³
 " " air = $1.5\% \times 27 = 0.405 \text{ ft}^3$

Total = 18.395 ft³

Volume of Fine Aggregate = $27 - 18.395 = 8.605 \text{ ft}^3$

Saturated Surface Dry weight of F.A.
 $8.605 \times 2.6 \times 62.4 = 1396 \text{ lb}$

Adjustment of for moisture

F.A. = $1396 (1 + 0.02) = 1424 \text{ lb/yd}^3$
 C.A = $1944 (1 + 0.01) = 1963 \text{ lb/yd}^3$

REQUIRED WATER:

Pg # (3)

$$274.5 - 1396(0.02) - 1944(0.01) \\ = 227.2 \text{ lb/yd}^3$$

The estimated batch weight.

$$\text{Water} = 227.2$$

$$\text{Cement} = 404.41$$

$$\text{F.A} = 1424$$

$$\text{C.A} = \underline{1963}$$

$$\text{Total} = 4018.61 \text{ lb/yd}^3$$

$$= 148.84 \text{ lb/ft}^3$$

The End.