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FINAL TERM EXAM

QUESTION 1

Part (1) Frost Action:

- Mechanical weathering process caused by repeated cycles of freezing and thawing of water in pores, cracks and other openings usually at the surface -
- Frost action occurs when water freezes and expands in open spaces in rocks, pushing fragments apart -
- Frost action divides into two phases, freezing the soil water and thawing the soil water -
- For pavements, Frost action becomes critical when either (1) freezing phase is accompanied by noticeable heaving of the road surface or (2) thawing phase is accompanied by noticeable softening of the roadbed -

Part (2) Effect of fire

- Fire are considered as one of the physical cause of concrete deterioration -
- When concrete is subjected to fire the cement paste start to shrink due to water evaporation and dehydration
- The particles of the aggregates expand because of high thermal exposure -

Part (3) Sulphate attack

- Sulphate attack is one of the most damaging causes of concrete deterioration causing either softening and decay of concrete matrix -

Part (B)

(1) Slump test

- Slump test is means of assessing the consistency of fresh concrete -
- It is used indirectly as means of checking amount of water has been added to the mix

(2) Compaction factor test

- It is workability test for concrete conducted in laboratory -
- Compaction factor is the ratio of weights of partially compacted to fully compacted concrete -

3) Flow test

- A test to determine the consistency of freshly mixed concrete by measuring its spread on flat surface under jarring -

4) Kelly ball test

- It is a simple test and inexpensive that is performed on concrete -
- It provides an indication of yield stress and result of the test can be successfully used for special concrete mixes -

5) Vee bre test

- This test allow the evaluation of freshly mixed concrete measuring its workability by determining the characteristics of mobility and compactibility -

QUESTION 2

Part (A)

Admixture :-

- These are natural or manufactured chemicals which are added to concrete before or during mixing-
- The most often used admixture are air-entraining agents, water reducers etc-

Uses of concrete admixture

- 1- Protect against freeze thaw cycles improve durability-
- 2- High strength concrete
- 3- Set acceleration
- 4- Water reduction in mixture
- 5- Mid Range water reducers
- 6- Corrosion protection

Types of Admixture

There are 5 types of admixtures which are

- 1- air-entraining
- 2- water reducing
- 3- Retarding
- 4- Accelerating
- 5- Plasticizers

- or expansive cracking and other
disruption associated with formation
of ettringite and other reaction products -
- To prevent sulphate attack is to have
the quality of concrete at a low
permeability -

Part (4) Alkali-Aggregate Reaction

- Aggregate react with alkali hydroxides
in concrete, causing expansion and
cracking over a period of many
years -
- It has two forms alkali-silica reaction
and alkali-carbonate reaction -

Question (1) Part (B)

- Heat of hydration effect
- Heat of hydration is the heat generated
due to hydration of cement i.e. due to
reaction between cement pastilles and
water -
- It is critical to measure heat of
hydration in mass concrete work -
- To reduce heat of hydration, water
reducers or high range water reducers
are used to minimize both cement
and water contents -
- Heat of hydration is most influenced
by proportion of C₃S and C₃A in the
cement -
- This thermal gradient causes cracking in
concrete due to non uniform expansion
of concrete with the body

Effect of Strength

- Concrete strength is effected by many factors such as quality of raw materials, water/cement ratio, compaction of concrete etc-
- It is the strength the set cement has obtained- This usually refers to compressive strength-
- Cement having a compressive strength of 500 psi (35 bar) is adequate for most applications-
- Concrete is stronger with less water in the mix, but water makes the concrete workable-

QUESTION 3

Part (A)

(1) Batching

- This is a process in which the quantity or proportion of materials like cement, aggregates, water etc are measured on the basis of either weight or volume to prepare concrete mix.
- Batching is used to mix and blend cement, water, sand and aggregates to form quality concrete without which building any construction project is not possible.

2) Mixing

- In industrial process engineering, mixing is a unit operation that involves manipulation of a heterogeneous mixture. Mixing is performed to allow heat or mass transfer to occur between one or more streams, components or phases.

3) Transporting

- Transporting of concrete from the mixing plant to construction site.
- The main objective of this is to ensure that water-cement ratio, slump or consistency, air content and homogeneity are not modified from their intended states.

4) Placing

Deposition, distribution and consolidation of freshly mixed concrete in place.

5) Compacting

- Process which expels entrapped air from placed concrete and pack the aggregate particles together so as to increase the density of concrete

6) Curing

- Process of maintaining the moisture and temperature conditions of concrete for hydration reaction to normally so that concrete develops hardened properties over time -

Part (b)

- Segregation in concrete is a case of particles segregation in concrete applications in which particulate solids tend to segregate by virtue of differences in the size, density and shape.

Factors

- Factors are concrete that is not proportioned properly and not mixed adequately
- It also can result from external factors such as too much vibration, improper transportation, placement, adverse weather-condition.