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Section	"B"
Paper	Concrete Technology
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Q No 1 Which step is taken to prevent flash setting of cement? Also write steps to prevent false setting of concrete?

Ans → Flash set is an early loss of workability in paste, mortar, usually accompanied by the evolution of considerable heat resulting primarily from the rapid aluminates. If the proper amount or form of calcium sulfate is not available to control the ca hydration, rapid stiffening takes place.

→ False set is the rapid development of rigidity in freshly mixed paste, mortar, or concrete without the evolution of much heat. Plasticity can be regained by further mixing. Flash is also the rapid development of rigidity, but with the evolution of considerable heat.

When cement is mixed with water it becomes hard over a period of time. This is called setting of cement. Gypsum is often added to portland cement to prevent early

hardening or "dash setting", allowing a longer working time. Gypsum slows down the setting of cement so that cement is adequately hardened admixtures containing weak electrolytes or organic molecules with retarding effect, interfere with the nucleation of gypsum crystals and so reduce the tendency towards false set.

QNo 9 What steps can be taken during transportation and placement of concrete to avoid segregation of concrete?

Ans: Segregation in concrete is commonly thought as separation of some size groups of aggregates from cement mortar in isolated locations with corresponding deficiencies of these material in other locations. Segregation results in proportions of the laid concrete being in variation to those as designed. Segregation could result from internal factors such as concrete that is not proportioned properly and not mixed adequately, or too workable a mix. It also could result from external factors such as too much vibration improper transportation, placement, or adverse weather conditions. The corresponding increase in proportion of cement paste in upper areas would tend to make them susceptible to increased shrinkage and formation of cracks. We can avoid happening

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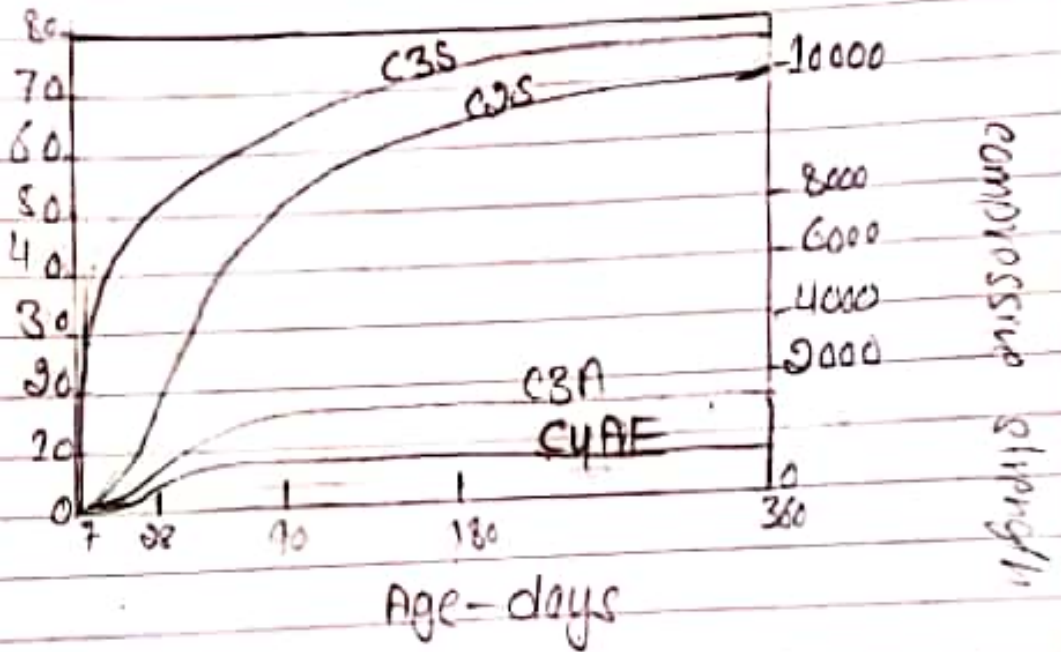
of segregation by:

- 1) The concrete mix should be properly designed with optimum quantity of water to make a cohesive mix. Such concrete will not exhibit any tendency for segregation.
- 2) Field quality control must be maintained while handling, transporting, placing and compacting and finishing concrete.
- 3) If at any stage segregation is observed then remixing should be done to make the concrete again homogeneous.
- 4) Admixtures such as pozzolanic material or air entraining agent should be used to avoid segregation. Air entrainment permits a reduction of the mixing water with no loss of slump which increase workability and decreases segregation and bleeding.
- 5) Concrete should not be allowed to fall from greater heights, it should be placed as near its final position as possible.

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QNo2

Draw a graph showing the strength development of pure compounds of cement?



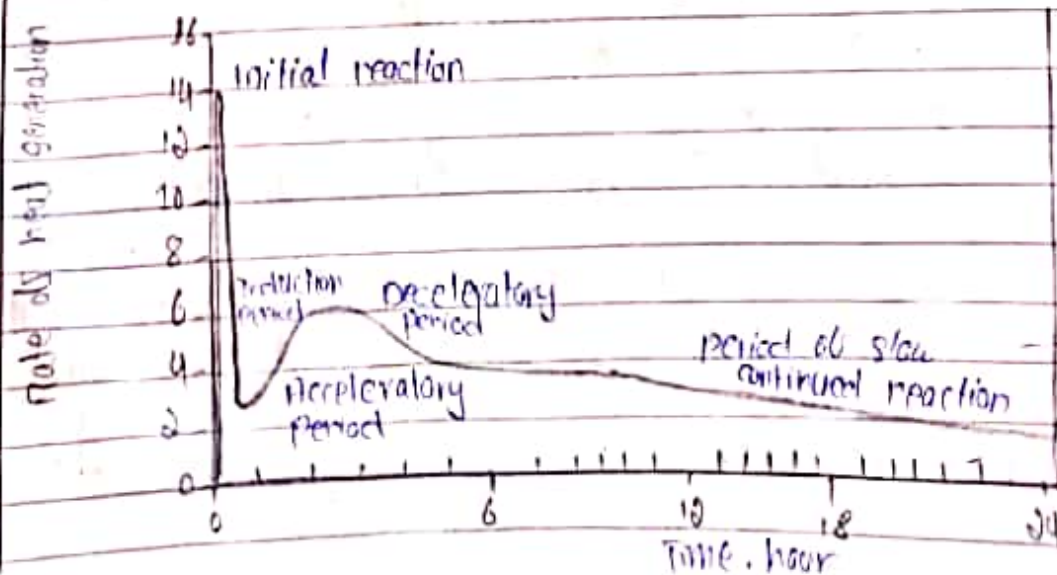
Q No 3 Why type III cement is Rapid Hardening and type IV low Heat producing? Draw a graph showing the development of heat of hydration of different cement types

Ans Rapid Hardening portland cement (Type III):-

→ This type develops strength more rapidly than ordinary portland cement. The initial strength is higher, but they equalize at 2-3 months.

- Setting time for this type is similar to that of ordinary portland cement.
- The rate of strength gain occurs due to increase of C3S compound and due to finer grinding of the cement clinker (the minimum value of fineness is 330 m²/kg according to IS 8115).

Low Heat Portland Cement:- It contains less C3S and C3A percentage and higher percentage of C2S in comparison with ordinary portland cement.



QNo5 Why is the percentage of gypsum added to cement limited only to 5%?

Ans: Gypsum is added to control the "setting of cement" it is not added the cement will set immediately after mixing of water leaving no time for concrete placing. If Gypsum percentage is exceeded from 5% it should delay the setting time more than usual time after adding gypsum in excess it accelerates the setting time b/c gypsum generates its own clotting agent resulting in quick setting of cement. it also results in weaker strength and inevitable expansion.

QNo6 What is the effect of following on the bond strength of concrete?

- i) Shape of aggregate
- ii) Size of aggregate
- iii) Texture of aggregate
- iv) Bleeding

Ans: Bond Strength of concrete:-

The force that resists to separation of mortar and concrete from reinforcing steel (or other materials with which it is in contact). Such as adhesion (friction due to shrinkage

1) Shape of Aggregate: and longitudinal shear in the concrete engaged by bar deformation.

The shape and texture of aggregate affect the property of fresh concrete more than hardened concrete. The aggregate have smooth surface are improve workability and a rougher surface generates a stronger bond the paste and the aggregate creating a higher strength.

2) Size of Aggregate:

The required amount of cement paste is depended upon the amount of void space that must be filled and the total surface area that must be covered. When the particles are of uniform size the spacing is the greatest but when a range of sizes is used the void spaces are filled and the paste requirement is lowered. Therefore maximum aggregate size is critical for bond strength when smaller size aggregate are used.

3) Texture of aggregate:

The surface texture of aggregate can be either smooth or rough. A smooth surface

can improve workability, yet a rougher surface generates a stronger bond b/w the paste and the aggregate creating a higher strength. Texture of aggregate also effect the properties of fresh concrete.

4) Bleeding:-

Bleeding is responsible for causing permeability in concrete. Due to bleeding bond b/w aggregates and cement paste reduces, thus bond strength and wear resistance of concrete decreases.

Q7: What is the effect of following on workability of concrete?

- i) Porosity and absorption
- ii) Air entraining agent.
- iii) Coarse aggregate to fine aggregate ratio

Q8: Workability of Concrete:-

Grading of aggregates have the maximum effect on the workability of concrete. This helps in reducing the voids in a given volume of aggregate. The less volume of voids makes the cement paste available for aggregate surface to provide better lubrication to the concrete.

1) Porosity and absorption:-

The porosity of an aggregate may be also affect workability of concrete. If the aggregate can absorb a great deal of water less will be available to provide workability. Porosity also significantly affects fatigue behaviour. The lower fraction of porosity can cause pore size, pore shape and pore spacing are all important factors.

2) Air Entraining Agent:-

The presence of entrained air caused a slight reduction in the water requirement. The flexural strength and the dynamic modulus of elasticity of concrete and increased the durability from 5 to 50 times, depending upon the quantity of entrained air and the concrete. It increase the workability of concrete without much increase in water-cement ratio.

3) Coarse aggregate to fine aggregate ratio:-

it increases the workability of concrete without much increase in water-cement ratio. The effect of coarse to fine aggregate ratio on the fresh and hardened properties of Roller Compacted concrete pavement. The test result

demonstrate that increasing the C/F ratio from 0.6 to 1.8 increased the work time threshold while increasing the cement from 9% to 13% decreased the work time by 13%.

4) Grading of Aggregate:

Well graded aggregates tend to fill up voids and easily get workability less amount of water can make it workable. Its grading is better there will be fewer voids and excess paste will be available to give better lubricating effect.

Q1008 What is the effect of fineness of cement on the following?

Ans: Fineness of cement:

The fineness of cement affects hydration state and in turn the strength. Fineness causes an increased state of hydration high strength and high heat generation. Bleeding can be reduced by increasing fineness.

1) Strength of concrete:

The compressive strength of concrete with or without entrained air, increases with an increase in cement fineness, therefore for a given workability

an increase in the cement content results in an increase in strength of concrete.

ii) Rate of Heat evolution during hydration:

The hydration heat of blended cement has been investigated by several authors (17-37). It has been observed in these tests that the evolved heat decreases as slag content increases but at the same time the heat evolved increases with the fineness of the slag or clinker in the blended cement.

iii) Total Heat of hydration:

Increasing the fineness increases the rate of hydration of cement, which increases the rate of gain in strength and also the rate at which heat is liberated.

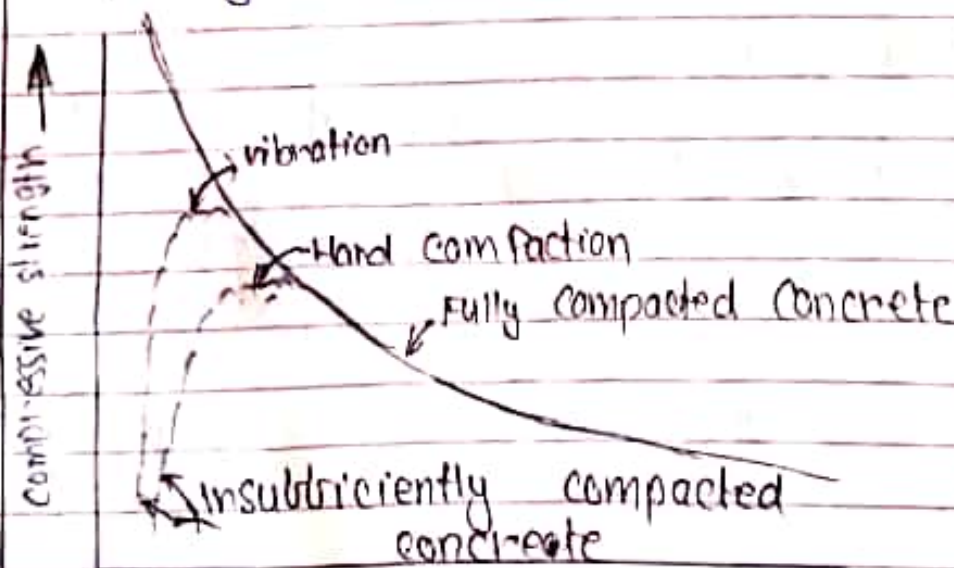
iv) Workability:

The workability of non air-entrained concrete is increased by increasing the cement fineness. In air-entrained concrete the effect of fineness of cement on workability is very less.

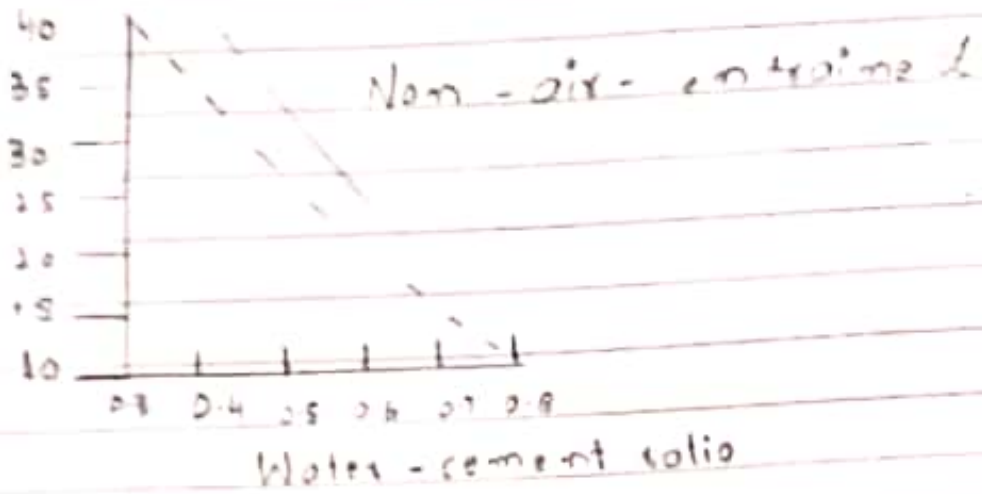
Q104 What is the effect of compaction on entrapped air of concrete? What will be the effect on strength if concrete is not compacted sufficiently? Explain with graph.

Ans: Compaction is the process which expels entrapped air from freshly placed concrete and packs the aggregate particles together so as to increase the density of concrete. It increases significantly the ultimate strength of concrete and enhances the bond with reinforcement.

There are various problems that might arise if compaction of concrete is not carried out properly such as honeycomb and trapped air inside concrete paste. Moreover, poor compaction of concrete could lead to permeability problems and therefore steel corrosion and decreasing ultimate capacity of hardened concrete.

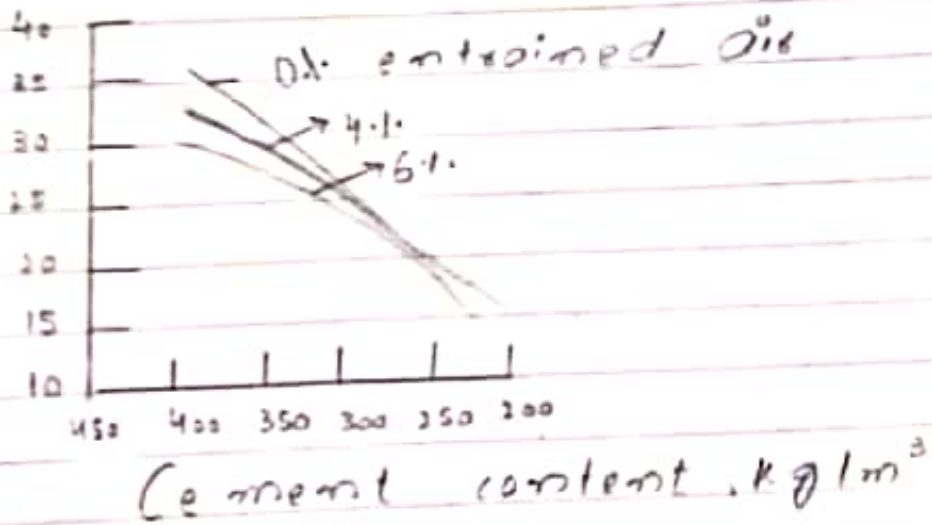


Compressive strength MPa



(a)

Compressive strength MPa



(b)