EXPERIMENTAL STUDY ON WORKABILITY OF CONCRETE BY USING VARIOUS TYPES OF WATER CEMENT RATIO

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Abstract

This experimental study on workability of concrete on different water-cement ratio concrete mixture. it is usually expressed in litre of water required per bag (50 kg) of cement. A rich mix of concrete gives a higher strength than a lean mix of desired workability with less quantity of water. Thus lower the water-cement ratio, greater is the strength of concrete, strength of concrete decrease as the water-cement ratio increases. This fact is illustrated by plotting a graph with water-cement ratio as abscissa and compressive strength, in case the water-cement ratio is less than 0.45 the curve is seen bending downwards. This indicates that the concrete mix having water-cement ratio less than 0.45 by weight is not workable and causes honey-comb structure .but amount of water to be added also plays an important role in this

Keyword- *Concrete mixture, fine aggregate,* coarse *material, water-cement ratio, workability, strength*

INTRODUCTION

The concrete, when used requires a certain degree of workability. Higher workability is required if the section is thin and heavily reinforced. the workability of concrete depends on the properties of various ingredients of concrete. to enable the concrete to be fully compacted with given efforts, normally a higher water/cement ratio than that calculated by theoretical consideration may be required. that is to say the function of water is also to lubricate the concrete so that the concrete can be compacted with specified effort forthcoming at the site work. the lubrication required for handling concrete without segregation, for placing without loss of homogeneity, for compacting with the amount of efforts forthcoming and to finish it sufficiently easily the presence of a certain quantity of water is vital importance .many research worker tried to define the world workability .but ast it signifies much wider properties and qualities of concrete and does not project any one particular meaning .extensively studies the field of compaction and workability, defined workability as the property of concrete which determines the amount of useful internal work necessary to produce full compaction. Another definition which envelopes a wider meaning is that, it is define as the ease with which concrete can be compacted hundred percent having regards to mode of compaction and place of deposition. Assumption of right workability with proper understanding backed by experience will make the concreting operation economical and durable.

Conditions of application of water-cement ratio law and their effects

Internal moisture condition on hydration of cement should continue till the concrete grains complete strength.
The concrete specimens to be tested should be cured under standard temperature.
The concrete specimens to be tested should be of same age.
The concrete specimens to be tested should be of same size.

Importance of workability

The importance of meaning the workability of concrete is to check hour to hour day to day variation in the ingredients of concrete being fed into the mixers .if it is more it indicates unexpected increase in the moisture content of the

aggregate .it may also indicated deficiency of sand .it gives immediate warning to the engineer in charge to enable him to remove the fault if any mix is dry, the slump is zero. it indicates that the mix is not suitable for high strength concrete.

Internal friction.
Segregation.
Harshness.

Factors affecting on workability of cement concrete

Workable concrete is the one which exhibits very little internal friction between particle and particle or which overcomes the frictional resistance offered by the formwork surface or reinforcement contained in the concrete with just the amount of compacting efforts forthcoming .the factor helping concrete to have more lubricating effect to reduce internal friction for helping easy compaction are given below.

Water content
Shape of aggregate
Size of aggregate
Grading of aggregate
Surface texture
Porosity and absorption of aggregate
Air entraining agents
Temperature

Types of cements-cement are mainly divided into the following two categories.

1. **Portland cements such as**

   Ordinary Portland cement
   Rapid hardening cement
   Low heat cement
   Blast furnace slag cement
   Sulphate resistant cement
   Air entraining cement
   White and coloured cement

2. **Special types of cement such as**

   High alumina cement
   Pozzolana cement
   Oil well cement

Test on cement-to standardise the quality of a Portland cement, it should be tested before its use is recommended for any important engineering work. The suitability of cement the following laboratory tests are usually performed.

Fineness test by sieving
Consistency test
Initial and final setting time test
Soundness test
Compressive strength test

Classification of aggregate ñvarious aggregate being used for manufacture of concrete are classified

According to source.
According to size.
According to shape

According to source.- According to source or nature of formation ,aggregate are classified

Naturally occurring aggregates.
Artificial or processed aggregate.

According to size- According to size aggregate are classified

Coarse aggregate.
Fine aggregate.
All-in-aggregate.

According to shape- According to shape aggregate are classified

Rounded aggregates.
Irregular aggregates.
Angular aggregates.
Flaky aggregates.

Characteristics of aggregates-the aggregate constitute from 75% to 95% concrete mass. therefore the selection of aggregate is of particular importance in making concrete .some important characteristics of aggregate which greatly influence the properties mix proportions and economy of the concrete are discussed.

Particle size and shape
Surface texture
Specific gravity
Bulk density
Water absorption
Surface moisture
Bulking of sand
Deleterious material in the aggregate
Crushing strength
Impact value
Abrasion resistance
Soundness

Measurement of workability ñthe workability of concrete is expressed by water cement ratio. in the field the workability of concrete mix is measured by different test as below.

Slump test
Compacting factor test
Flow test
Vee bee consisto meter test

Workability ,slump and compacting factor of concretes with 20mm or 40mm maximum size of aggregate.

Degree of workability	**Slump mm**	**Compacting factor**		**Use for which concrete is suitable**
		Small apparatus	**Large apparatus**	
Very low Compacting factor is suitable	0-25	0.80	0.814	Roads vibrated by power-operated machine. at the more workable end of this groups, concrete may be compacted in certain cases with hand operated machines
low	25-50	0.85	0.87	Roads vibrated by hand-operated machine. at the more workable end of this groups, concrete may be manually compacted in road using aggregate of rounded or irregular shape. Mass concrete foundation without vibration or lightly reinforced section with vibration.
Medium	50-80	0.92	0.935	At the less workable end of this group manually compacted flat slabs using crushed Aggregates. Normal reinforced concrete manually compacted and heavily reinforced section with vibration.
High	80-100	0.95	0.96	For section with congested reinforcement. Not normally suitable for vibration for pumping and tremie placing.
Very high	-	-	-	Flow table test is more suitable

Mix Proportioning

W/cm (Kg/m3)	Cement(Kg/m3)	Fine Aggregate	Coarse Aggregate (Kg/m3)	Water (Kg/m3)	Compacting
0.4	450	630.75	1097.23	180	0.814

Values for the mix design

Specific gravity of cement	Specific gravity of FA	Specific gravity of CA	Bulk density of FA	Bulk density of CA
3.15	2.68	2.83	1773.2 Kg/m3	1647.2 Kg/m3

CONCLUSION:

Based on the limited experimental results following conclusions can be drawn.

The shapes of aggregate have great in- fluence on the workability of concrete. Angular and rough aggregates reduce workability.

The sizes of aggregate also affect the workability of concrete. Smaller size aggregate offer greater surface area than larger size aggregate and thus more quantity of water for lubrication.

The temperature at which the concrete mix is prepared also affects its workability. The slump of the concrete mix decreases as the temperature of the mix increase.

The workability of any concrete mix mainly depends upon the quantity of water into the mix. The determination of correct quantity of water needed for concrete depends on the shape and size of aggregate.

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