How To Make Concrete At Site? M 25 Example

By
Er. Kaushal Kishore ,
Materials Engineer, Roorkee

PORTLAND CEMENT:

Joseph Aspdin, a mason at Leeds prepared a cement in 1824 by heating a mixture of finely-divided clay and hard limestone in a furnace until CO2 had been driven off; this temperature was much lower than that necessary for clinkering. The prototype of modern cement was made in 1845 by Isaac Johnson, who burnt a mixture of clay and chalk until clinkering, so that the reaction necessary for the formation of strongly cementitious compound took place. The name 'Portland Cement' was given due to the resemblance of the colour and quality of the hardened cement to Portland stone- a limestone quarried in Doset.

The process of manufacturing of cement consists essentially of grinding the raw materials (calcareous materials such as limestone or chalk and argillaceous materials such as shale or clay), mixing them intimately in certain proportion and burning in a large rotary kiln at a temperature of upto about 14500C when the material sinters and partially fuses into balls known as clinker. The clinker is cooled and ground to a fine powder, with some gypsum added, and the resulting product is the commercial Portland Cement so widely used throughout the world.

MAKING CONCRETE:

Just mix cement, aggregates and water, cast this mix in a mould, open the mould next day. A uniform hard mass will be found, which is known as concrete, any body can make it. The simplecity in making concrete make this material to be look like very simple in its production, yet it as not so simple. Due to ignorance about concrete no other building materials ever mis-used as concrete in the construction. In India concrete is being used in the construction since the last 70 years. Yet 80% of the builders have no proper understanding of this materials. Go to any construction site (except big construction sites) you will find that sand and aggregates are being taken in iron tasla or cane baskets to charge the mixer without the consideration of site aggregates actual grindings, moisture content and bulking of sand. The water is poured in the mixer without any measured quantity. It could be well imagine what sort of concrete structure will be made with the concrete being produced in this crude method.

Most of the contractors, builders, masons etc. still follow 1:2:4 or 1:1.5:3 mixes they are not aware of Design Mixes and Concrete Admixtures. This paper described how Design Mixes can be converted into volume with 1 Bag Cement, 2 Boxes of sand and 4 Boxes of Aggregate. The site practical problem is the dispersion of water and liquid admixtures into the mixer. For this the site should fabricate a plastic circular graduated measuring container of 30 lit capacity with a tap fitted at its bottom. This container is to be fitted on top of the mixer. From this container water and liquid admixtures can conveniently poured direct into the mixer in a measured quantity.

EXAMPLE OF MIX DESIGN

1. For a construction site M-25 Grade of concrete is required to be designed as per IS: 456-2000. The mix will be taken by volume. Workability required is 50 mm slump. Normal Superplasticizer will be used in the mix. The materials will be mixed at site in a tilting drum mixer of one cement bag capacity.
2. For durability consideration, maximum free W/C ration = 0.50 minimum cement content 300 kg/m^3 including Fly ash.
3. Test datas of aggregates are as given in table-1.

4. Cement will be used PPC, having 7 days average compressive strength of 37.5 N/mm2

5. Mean design target strength:
25 + 1.65 x 5 = 33.3 N/mm2 at 28 days age
Table-1 Test Data of Dehradun Aggregates:

I.S. Sieve Size	**Percentage Passing**	
	River Sand	**20 mm Crushed Aggregate**
40 mm	100	100
20 mm	100	86
10 mm	95	3
4.75 mm	79	0

2.36 mm	72	
1.18 mm	56	
600 micron	47	
300 micron	27	
150 micron	6	
Specific Gravity	2.65	2.65
Water absorption %	0.80	0.50
Bulk density kg/lit	1.78	1.40

Note : The sand is not falling to any grading Zone of IS : 383-1970. The aggregate grading is 20 mm single sized as per IS: 383-1970.

If 95% this sand passes on 4.75 mm sieve, then the sand will become of Zone-II as per IS : 383-1970. The following mix is worked out as per Zone-II sand. For detail calculations refer reference of No. 1.

a) For the target strength and given cement and Aggregate W/C ration found to be = 0.49

b) Water for OPC 190 kg/m^3. For PCC 5/100 x 190 = 9.5 , Say 10

190 – 10 = 180 kg/m^3 to give 50 mm of Slump with the given aggregates. Normal Superplasticizer at a dosages of

7 ml/kg cement will give 15% water reduction without loss of workability.

Water = 180 – 27 = 153 kg/m^3

c) Cement = 153/0.49 = 312 kg/m^3

d) Density of OPC concrete = 2405 kg/m^3

Density for PPC Concrete = 2405 – 24 = Say 2380 kg/m^3

e) Aggregates = 2380 -153 – 312 = 1915 kg/m^3

f) Sand (Zone-II) = 1915 x 0.36 = 689 kg/m^3

g) 20 mm aggregate = 1915 – 689 = 1226 kg/m^3

Mix. No. 1 On the basis of saturated and surface dry aggregates-

Water =153 kg/m^3

PCC=312 kg/m^3

Sand=689 kg/m^3

20 mm Aggregate=1226 ml/m^3

Mix No. 2

95-79 = 16% oversized particles in the sand is to be adjusted in the above mix. The modified mix on the basis of saturated and surface dry aggregates is given below:

Water=153 kg/m^3

PCC=312 kg/m^3

Sand=820 kg/m^3

20 mm Aggregate =1095 kg/m^3

Normal Superplasticizer=2184 kg/m^3

Accordingly mix ratio by weight on the basis of saturated and surface dry aggregates is given below:

Cement : Sand : 20 mm Agg.

1 : 2.63 : 3.51 W/C Ratio = 0.49

Mix ratio by volume on the basis of room dry aggregates is given below:

Cement : Sand : 20 mm Agg.

1 : 2.14 : 3.63 Free W/C Ratio = 0.49

MIX RATIO BY VOLUME FOR ONE BAG OF CEMENT

1. Cement = One bag = 50 kg = 35 lit = 35000 cc
2. Sand (room dry) = 2.14 x 35 = 74.9 lit = 74900 cc
3. 20 mm Aggregate (room dry) = 3.63 x 35 = 127.05 lit = 127050 cc
4. Free Water = 24.5 lit
5. Normal Superplasticizer = 350 ml

MEASURING BOXES TO BE MADE AT SITE

1. Cement = One bag = 50 kg
2. Sand (room dry) = 33 x 33 x 34.4 cm …… two boxes
3. 20 mm Aggregate (room dry) = 33 x 33 x 29.2 cm ….. four boxes
4. Free Water = 24.5 lit
5. Normal Superplasticizer = 350 ml

In the above example M-25 Design mix is converted to the familiar 1 bag cement : 2 boxes of sand and 4 boxes of aggregate. While making concrete at site the moisture content of

site sand and aggregate must be taken into account in the mixing water and bulking of sand. In the field trial mixes are to be carried out to finalized the mix.

REFERENCES:

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2. Kishore Kaushal, "Combining Fine & Coarse Aggregates" CE & CR, Jun, 2004, pp. 46-50.

We are thankful to Sir Kaushal Kishore for sharing this utmost important research paper here on the website. This would be of great use to all the civil engineers who work in field

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