

ORDINARY CEMENT CONCRETE

10.1 INTRODUCTION

The homogenous mixture of Cement, Sand and stone chips when casted by mixing it with adequate amount of water is called concrete. The process of preparing the mix is called concrete mix.

10.2 OBJECTIVES

After going through this chapter you will be able to:

- describe about the appropriate Mix ratio of Cement concrete;
- explain the method of mixing of concrete;
- describe the precautions which are required to be taken at the time of casting of concrete;
- describe the process and period of curing of concrete.

10.3 PREPARATION OF CONCRETE

As mentioned in the drawing, the raw materials for the proposed concrete mix should be available in the required proportion. After this the mixing of concrete is carried out. It is of two types:

Mixing by Hand

For mixing by hand, the material should be kept in a water proof tank. Before

adding water, the material should be properly/thoroughly mixed till the color of the mix becomes uniform in dry state and only after that the suitable amount of water should be added to make the mix workable one.

Mixing by Machine

All the raw materials of concrete such as cement, sand and stone chips are collected in the required proportion and then put into the rotating drum and is rotated firstly in dry state and then water is added in the amount sufficient to make a workable concrete. These machines are of both the types i.e. tilting and non-tilting. Mostly they are electrically operated. For small works using Cement up to one bag only, we have smaller mixing machines also. All these machines are available at job sites.

For big works such as Roads, Airport, and Embankments construction special types of mixers are also used. For still bigger works off site or distant Mixing Plants are also used. This is called Ready Made Concrete or Ready Mixed Concrete (RMC).



Fig. 10.1: Mobile Mixing Plant



Fig. 10.2: Concrete Mixer for use at site



Fig. 10.3: Truck Mixer (T.M.)

- Water should be added in the mixer only after pouring dry materials in it.
 - After using the concrete mixer, it should be washed properly. Otherwise small bubbles will get enjoined into it due to presence of cement.
 - Inspection of the mixer should be done at regular intervals and any broken part should be replaced.
 - The duration of mixing and its speed depends upon the specification of the concrete.
 - Concrete should be taken out of the mixer after the specified time.
 - Fresh concrete takes its place easily.
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Table 10.1: Ratios of Cement, Sand and aggregate for different works

Foundation base for temporary construction of general nature	1: 5: 10 or 1:6: 12
Foundation base for good building etc.	1:4:8 or 1:5:10
R.C.C. Bridge	1:2:4
Important Construction	1:1½ : 3

Table 10.2: Acquired strength of PCC with time

Time Elapsed	Acquired strength in % of F. Strength
After 3 days	40%
After 7 days	65% - 67%
After 28 days	100%
After 03 months	115% - 122%
After 06 months	120% - 146%
After 12 months (1 year)	130% - 155%

(Note: Strength acquired after the elapse of 28 days is considered full strength)



Fig. 10.4: Pouring of RMC

Concrete should be poured at the designated place and then tampered properly, so that it becomes dense and compact. This may be done by either of the two methods- 1. Tampering rod of steel 2. Machine called vibrator (electrically operated)



Fig. 10.5: Vibrator

Table 10.3: Requirement of material for preparing 1 Cub. M. of concrete

Concrete Mix (old system)	Water Cement ratio	Requirement of materials			
		Water in ltr.	Cement No. of bags	Sand Cub.m.	Stone chips (cub.m.)
1:1:2	0.54	27	12.2	0.45	0.90
1:1.5:3	0.60	30	8.0	0.44	0.882
1:1:4	0.64	32	6.4	0.47	0.94
1:3:6	0.74	37	4.4	0.485	0.969
1:4:8	0.90	45	3.4	0.50	0.963
1:5:10	1.20	60	2.6	0.475	0.921

10.4 CONSTRUCTION JOINT

All the concrete work should be carried out as a one single operation, this is most desirable. However, if due to any reason it becomes necessary to stop the

work, then construction joints are required to be provided. Various types of construction joints have been shown in Fig. 10.6 below.

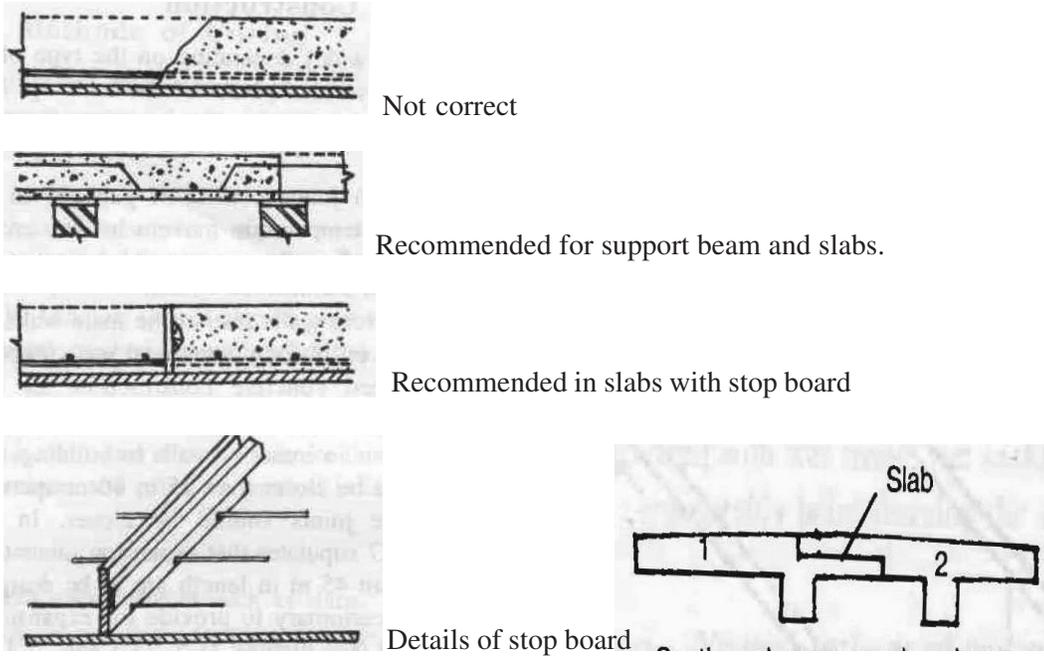


Fig. 10.6: Construction Joints

10.5 CURING

Initial setting of concrete though starts after 30 minutes of pouring, but it starts hardening after 2 hours.

After the elapse of 24 hrs after pouring of concrete, it is required to be kept wet (fully) for 14 days in continuation. This process is called curing. Any brickwork over the concrete can be started only after 48 hrs, but the curing should simultaneously continue for atleast 14 days.

Curing is an important thing in any concrete work. If not properly cured, the concrete loses strength and becomes easily breakable which is dangerous.

Measurement of concrete work

The thickness of the concrete work is measured to the accuracy of 0.5 cm. The length and breadth is measured in such a way so as to include the slope also and this is measured upto the accuracy of 1.0 cm.

Table 10.4: Consumption cement per Cub. M. of concrete Mix.

Mix/grade	Amount of cement in bags	Mix/grade	Amount of Cement in bags
1:5:10 (M5)	2.6	1:4:8 (M 7.5)	3.40
1:3:6 (M10)	4.40	1:2:4 (M 15)	6.40
1: 1½ : 3 (M 20)	7.20	1:1:2 (M25)	7.80
M30 (Design mix)	8.80	M 35 (design mix)	9.80

10.6 CONSISTENCY (CONCRETE WORK)

Consistency means the ease of flow of concrete. It depends on the amount of water used. The less the amount of water used the spreading of concrete becomes difficult but it gives higher strength, and if more water is used the spreading of the concrete becomes easier, but the strength reduces. Therefore, it always becomes necessary to use appropriate amount of water in the concrete work and this is controlled by specifying and determining the consistency of concrete. The measurement of consistency of cement (work ability) is done by a test which is called “Slump Test”. The procedure of conducting slump test is given below:

10.6.1 Slump Test

To determine the appropriate workability of concrete slump test is performed. The workability is controlled by controlling the amount of water in the concrete.

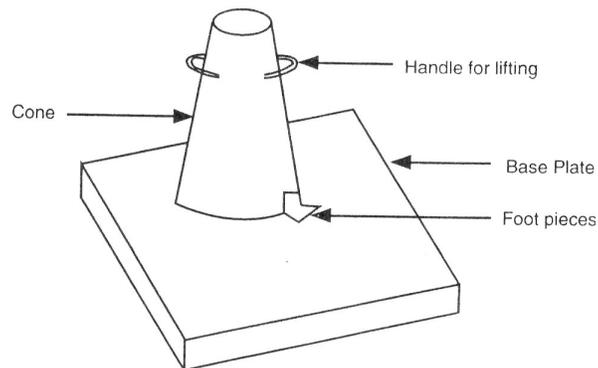


Fig. 10.7: Slump test (Step-1)

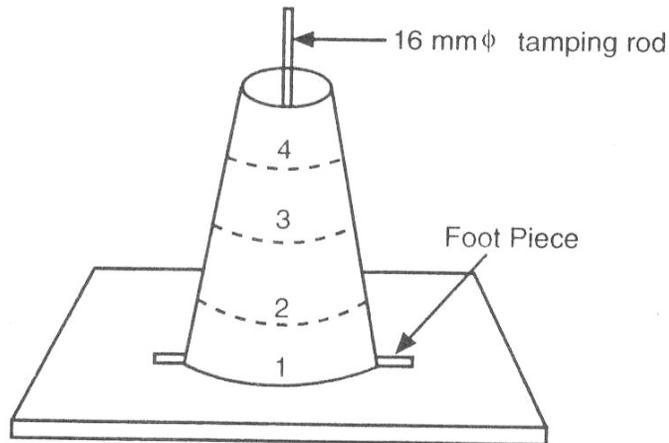


Fig. 10.7: Slump test (step 2)

The method of conducting this test is as follows:

- The slump cone and associated equipment should be cleaned such that no concrete particles are adhering to the walls.
- The concrete to be tested is mixed thoroughly so as to give a homogenous mix.
- The slump cone is so placed on the base plate that the wider face is at the base and the smaller face is on the top.
- The concrete sample is then poured into the cone in four layers and each layer should be tamped by tamping rod (16 mm and 600 mm length) 25 times. During tamping the rod should not penetrate into the lower layer.
- The concrete should be leveled at the top. Excess concrete should be removed.
- The cone should be cleaned both from inside and outside along with the plate. Thereafter, the cone is slowly lifted. When fully lifted the concrete will slump slightly. This slump in height is to be noted.
- Higher the slump value higher is the workability.

The table below gives the values of maximum value of permissible slump for different types of works.

Table 10.5: Permissible values of slump for different works

S.No.	Work	Amount of slump in cm	
		Compaction by using vibrator	Manual compaction
1.	Bulk concrete (R.C.C. foundation, footings and Retaining walls)	1.0 to 2.5 cm	5.0 to 7.5 cm
2.	General Reinforced slab, beam and columns	2.5 to 4.0 cm	10.0 to 12.5 cm
3.	Slender RCC sections/dense reinforcement section	4.0 to 5.0 cm	12.5 to 15.0 cm
	RMC (Ready made concrete from mixing plant)	As per Site engineer's direction	As per Site engineer's direction

10.7 POURING OF CONCRETE

Concrete will be poured slowly in Roof slab, columns or Beams, it is not to be thrown forcefully. If the place where the concrete is to be poured is below the pouring level, sheet of steel or chute will be used. So that it reaches the spot smoothly.

It is better to pour 1.0 m of concrete height only at a time in case of column construction.

10.8 BEAM

If it becomes necessary to give construction joint in beam it should be given in the middle away from the end locations.

10.9 EXPANSION JOINTS

If the R.C.C. work is more than 45 m in length, one or two expansion joints should be given.

10.10 WHAT HAVE YOU LEARNT

- What is concrete?
- What is the correct method of mixing of concrete?
- Points to be observed during pouring of concrete?
- Curing of concrete.

10.11 TERMINAL QUESTIONS

1. Describe the different methods of mixing of concrete.
 2. What is the time limit within which the concrete mix must be used after adding water to it?
 3. What is the aim of tampering/vibrating of concrete?
 4. What is the method of measurement of constituents of concrete in the directed proportions?
 5. Why slump test is performed?
 6. Why different slump values have been recommended for the same work for vibrator compacted concrete and manually compacted concrete?
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