

Sub: Construction Management System: Circular – 66
Ref: Guidelines for Quality Concrete works at site.

It has come to notice that there are basic lack of understanding on what needs to be done to maintain quality concrete at site. This subject is amply covered in the QA/AC document of RUIDP and relevant Indian Standards. However the issues that seem to be confusing the personnel in field are dealt with for further clarity below:

1. Mix Design/Nominal Mix

Usually all concretes to be done for important works should have the mix designed in a standard test laboratory with the exception that the mixes upto M20 required for ordinary civil works maybe made by using standard nominal mixes for M15 and M20.

2. Raw Material and its Testing:

All components of the raw material used i.e. cement, coarse and fine aggregates and water should be of acceptable quality for which the tests are prescribed in the QA/QC Manual. Each lot of the raw material received should be tested before use.

In case of Mix Design concretes, the mix design should be done again as soon as the source of raw material changes. Therefore when a design mix is received, the source of each raw material used, the analysis of the raw material, water cement ratio and admixture if any used should also be received with it.

Storage of raw material is very important so as to avoid mixing of ordinary soil dust and other dirt in it. The cement should be stored in a dry covered storage and should be used fresh to the extent possible.

The aggregates should be stored on a hard surface enclosed by a small wall. If it is a dusty climate, it needs to be covered with polythene covers. The grit used should be washed to clean the sand deposit before use.

3. Concrete Cube sample collection, curing and testing:

Minimum Frequency for test sample collection (to be collected in spread out periods to be representative)

- One test for 1-5 m³ of concrete
- Two tests for 6-15 m³ of concrete
- Three tests for 16-30 m³ of concrete
- Four tests for 31-50 m³ of concrete
- Four plus one additional sample for each additional 50 m³ or part thereof for 51 and above

Each Sample should have three test cubes.

The test cubes will be placed in moist condition under damp matting at a vibration free place at a temperature of 22 – 32^o C for 24 hrs. (to be calculated from time of concrete mixing) after which they shall be marked for identification later, removed from moulds and put in clean water tank at temperatures of 24 – 30^o C.



The samples should be transported to test laboratory at least 24 hrs before testing in soaked matting sand etc.. On arrival the sample should be stored in water at a temperature of $27^{\circ} \pm 2^{\circ}$ C. The sample shall be wiped and tested in damp condition.

4. Slump Tests

The slump is indicator of the consistency for proper placement and consolidation of the concrete. The following standard may be followed:

S.N.	TYPE	SLUMP (mm)
1	Structures with exposed inclined surface requiring low slump concrete to allow proper compaction. Plain cement concrete.	25 25
2	RCC structures with widely spaced reinforcements; e.g. solid columns,	40 - 50
3	RCC structures with fair degree of congestion of reinforcement;	50 - 75
4	RCC and PSC structures with highly congested reinforcements e.g. girders, box girders, walls with thickness less than 300 mm	75 - 125

The slump should be adjusted by water cement ratio and or using suitable admixtures.

5. Placement of form work and steel prior to concreting:

- a. It should be ensured that the formwork is placed so as to be stable and provide rigid support during concreting. It should prevent loss of slurry from the concrete. The tolerances for dimensions of the concrete should be limited to the stipulations in clause 11.1 Form work IS 456-2000. Other related stipulations be also followed.
- b. Placement of steel reinforcement should be strictly as per the drawings in terms of cover, spacing, This should be ensured by placing and fixing the steel in position using spacers of same grade of concrete or PVC, tightening by steel flexible wires. Care should be taken to turn the ends of wire inside the structure to ensure that it does not show on surface of the finished concrete.
- c. Strictly ensure that no one walks over the steel after its placement or throws any kind of dirt (bidi butts, matches, etc.) in the concreting area. The weight of the persons walking is likely to displace the steel changing the spacing and cover requiring its dismantling and replacement.
- d. During concreting steel support that can be placed directly on the form work without disturbing the steel while labour walks on them should be used.

6. Curing on site:

- a. During Curing of concrete preference should be given to use of continuous spray, or ponded water, continuously saturated covering of sacking, canvas, hessian or other absorbent material, or approved effective curing compounds applied with spraying equipment capable of producing a smooth even-textured coat.
- b. Fresh concrete should be kept continuously wet for a minimum period of 10 days from the date of placing of concrete, following a lapse of 12-14 hours after laying concrete. However, curing of horizontal surface exposed to dry wind should begin immediately after the concrete has hardened. Water should be applied to formed surfaces immediately upon removal of forms.

- c. Immediately after the shuttering is removed, the IPIU/DSC Engineer should very carefully go over the entire surface of the concrete. Holes left by form bolts etc. should be filled up and made good with mortar composed of one part of cement and one and half parts of sand passing 2.36 mm IS sieve. Superficially honeycombed surface and rough patches should be similarly made good immediately after removal of shuttering and superficial water and air holes should be filled in. The mortar should be well worked into the surface with a wooden float and the surface irregularities should be removed by grinding.
- d. If reinforcement is exposed or honey combing occurs at vulnerable positions e.g. ends of beams or columns it may be necessary to cut the member partially or completely and reconstruct. If only patching is necessary, the defective concrete should be cut till solid concrete is reached (or to a minimum depth of 25 mm) the edges being cut perpendicular to the affected surface or with a small undercut if possible. Anchors, tees or dovetail slots should also be provided wherever necessary to attach the new concrete securely in place.

The above instructions are for works on the site. The details of the tests to be conducted and record upkeep for the raw material and the finished concrete should be as per the QA/QC document.

This circular is equally applicable to all members of PMU, IPIU, IPMC & DSC.

- Sd -
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4. Team Leader IPMC, Jaipur/ DSC-I, Jaipur/ DSC-II, Jodhpur/ DSC-III, Kota, RUSDIP.
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Chief Engineer (T)