Concrete Curing Compound

By
Er. KAUSHAL KISHORE
Materials Engineer, Roorkee

NEED FOR CURING

The necessity for curing arises from the fact that hydration of cement can take place only in water-filled capillaries. That is why a loss of water by evaporation from the capillaries must be prevented. Evaporation of water from concrete, soon after placing depends on the temperature and relatively humidity of the surrounding air and on the velocity of wind over the surface of the concrete. Curing is essential in the production of concrete to have the desired properties. The strength and durability of concrete will be fully developed only if it is properly cured. The amount of mixing water in the concrete at the time of placement is normally more than required for hydration & that must be retained for curing. However, excessive loss of water by evaporation may reduce the amount of retained water below what necessary for development of desired properties. The potentially harmful effects of evaporation shall be prevented either by applying water or preventing excessive evaporation.

CURING METHOD

The two systems of maintaining a satisfactory moisture content are: (1) continuous or frequent application of water through ponding, sprays, steams, or saturated cover materials such as burlap or cotton mats, rugs, earth, sand, sawdust and straw. (2) prevention of excessive loss of water, from the concrete, by the application of a membrane forming curing compound to the freshly placed concrete.

WATER CURING

Curing by water not more than 11 deg C cooler than the concrete is one of the most efficient way for curing concrete. The curing should begin as soon as possible after the casting of concrete. Any delay in curing will lead to evaporation of mixing water and the early drying may lead to shrinkage and cracking of concrete. However, in practice, on some construction sites regular supply of potable water for curing may not be available or it may

be inconvenient and expansive. To such sites, concrete curing compound is recommended in place of water curing.

CONCRETE CURING COMPOUNDS

Concrete curing compound consists essentially of waxes, natural and synthetic resins, and solvents of high volatility at atmospheric temperatures. The compound forms a moisture retentive film shortly after being applied on fresh concrete surface. White or gray pigments are often incorporated to provide heat reflectance, and to make the compound visible on the structure for inspection purpose. Curing compound should not be used on surfaces that are to receive additional concrete, paint, or tile which require a positive bond, unless it has been demonstrated that the membrane can be satisfactorily removed before the subsequent application is made, or that the membrane can serve satisfactorily as a base for the later application.

The compound should be applied at a uniform rate. The usual values for coverage range from 0.20 to 0.25 m2/lit. Curing compound can be applied in two applications at right angles to each other by hand or power sprayer usually at about 0.5 to 0.7 MPa pressure. For small areas, the compound can be applied with a wide, soft-bristled brush or paint roller.

For maximum beneficial effect on open concrete surfaces, compound must be applied after finishing and as soon as the free water on the surface has disappeared and no water is visible, but not so late that the liquid curing compound will be absorbed by the concrete.

When forms are removed, the exposed concrete surface should be wetted with water immediately and kept moist until the curing compound is applied. Just prior to application, the concrete should be allowed to reach to a uniformly damp appearance with no free water on the surface and then application of the compound should begun at once.

USES

Curing compound can be used with advantage where wet curing is not possible. It is very suitable for large areas of concrete which are directly exposed to sunlight, heavy winds and other environmental influences. It can be used for curing of:

- Concrete pavements, airport runways, bridge decks, industrial floors.
- Canal linings, dams and other irrigation related structures.

- Sport arenas and ice ring.
- Precast concrete components
- Roof slabs, columns and beams
- Chimneys, cooling towers and other tall structures.

TESTING OF CURING COMPOUND

The curing compound should be tested in accordance to ASTM for the following tests:

a) Water retention – The test should be conducted in accordance with test method C 156.

b) Reflectance – Determine the daylight reflectance of white – pigmented compound in accordance with test method E 97.

c) Drying time – The test should be conducted in accordance to ASTM C 309 clause 10.3

d) Long term setting – For routine testing use test method D 1309. In case of dispute use method D 869.

e) Nonvolatite content – Test in accordance with test method D 1644 method 4.

EXPERIMENTAL INVESTIGATION

15 cm size Cubes were cast from concrete having w/c of 0.6, 0.5 and 0.4, nine cubes of each w/c ratio. After casting, the cubes were left in the open air as per the identical condition of our local construction sites. From open surface of the cubes, just when surface sheen has disappeared, 3 cubes of each w/c ratio were identified randomly for the application of curing compound. On top surface of these cubes, curing compound was applied by bush as per manufactures instructions.

After 24 hours all the 27 cubes were demoulded, 3 cubes of each W/C ratio were kept in the open air. The other sets of 3 cubes were also kept in the same place but covered with wet gunny bags. They were cured for 7 days by sprinkling of water on the gunny bags. After which the curing was stopped. The cubes which were identified for the application of curing compound were also kept at the same place. Curing compound was applied by brush on the remaining 5 faces of these cubes.

All the cubes were left at the same open place for 27 days. After which curing compound coated cubes faces were cleaned with hot water. Then all the cubes were fully immersed in

clean water for 24 hours and then tested in saturated surface dry condition. During this period there were no rains. Day temperature was between 34°C to 39°C and nigh temperature was between 20°C to 27°C. The test result is given in Table-2.

CONCLUSIONS

1. Concrete curing compound, provided it is not punctured or damaged will effectively prevent evaporation of water from the concrete but will not allow ingress of water to replenish that is lost by self-desiccation.

2. At most of the construction sites, wet curing is often applied only intermittently so in practice curing compound may lead to better results.

3. Where water curing is inconvenient or potable water for curing is not available, sealing fresh concrete surfaces with curing compound is the best way of curing.

Table – 1: ASTM C-309 specifications of curing compound

S.No. Detail of test	**Requirement as per ASTM C-309**
1. Water retention – Water loss After 72 hours in kg/m^2	Not more than 0.55 Kg/m^2
2. Reflectance	The white-pigmented compound when Tested as specified herein, shall exhibit. A day/light reflectance of not less than 60%of that of magnesium oxide.
3. Drying time	Note more than 4 hours.

Table – 2: Average compressive strength of cube

Sl. No.	Condition of curing	W/C ratio	OPC 43 Grade Kg/m^3	28-days compressive strength N/mm^2
1.	In air	0.6	300	13.9
2.	Wet cured	0.6	300	21.5
3.	Curing compound (Roffcure WB 2)	0.6	300	19.6

4.	In air	0.5	360	18.5
5.	Wet cured	0.5	360	29.3
6.	Curing compound (Roffcure WB 2)	0.5	360	25.8
7.	In air	0.4	450	27.6
8.	Wet cured	0.4	450	46.0
9.	Curing compound (Roffcure WB 2)	0.4	450	38.5

REFERENCES

1. Birt, J.C., Curing concrete – an appraisal of attitudes, practices and knowledge. CIRIA Rep. 43, 1981, 31, pp.

2. R. Shalon and D. Ravina, Studies in concreting in hot countries RILEM Int. Symp. On concrete and reinforced concrete in Hot countries, Haifa, July, 1960.

3. ASTM C-156, Standard Test Method for water retention by concrete curing materials.

4. ASTM C-309, Standard specification for liquid membrane-forming compound for curing concrete.

5. Kishore Kaushal – Seminar on Construction Admixtures, School of Building Science & Technology, Ahmedabad, December 17, 1994, pp. 110-112.

*We at engineeringcivil.com are thankful to **Er. Kaushal Kishore** for submitting the paper on **Concrete Curing Compound**. This will be of great help to fellow civil engineers and will answer many questions which arise due to various problems related to curing of concrete.*

Source: http://www.engineeringcivil.com/concrete-curing-compound.html