Hot Weather Concreting Practice

Hot weather problems

During hot weather conditions a number of on-site factors can work against deriving optimum performance from concrete. When combined with low relative humidity and strong winds placing and finishing requires special care.

However, provided your premixed concrete producer supplies concrete made with sound, well-graded aggregates, with an adequate cement content, and with the precise water content needed o give sufficient workability for efficient placing and consolidation, there should be few problems in placing and finishing if reasonable care is taken.

There are a few simple precautions which will protect "summer" concrete and will make it easier to obtain the best concrete job.

The main problems arising during summer concreting are (a) to prevent the early loss of water from concrete, and (b) to prevent early setting through too-rapid drying. If these problems are not anticipated, there may be –

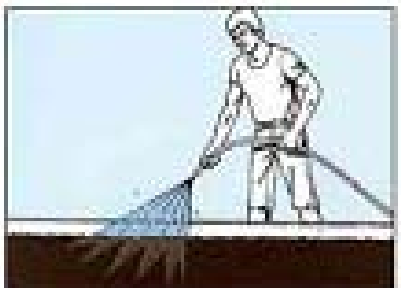
- strength reduction
- crazing or cracking
- shrinkage cracks
- finishing difficulties

Precautions for Hot Weather Concreting

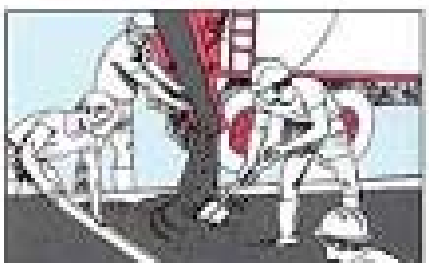
Planning ahead and preparation for each job will minimise the problems mentioned above, and will avoid irritating on-site delays.

Probably any experienced concrete contractor will know why it is sound sense to observe each one of the precautions set out below. Put together, they provide a time-saving and work-saving check list for supervisors and, perhaps, a guide for people not yet familiar with hot weather conditions in this country -

1. A first and very necessary step in retaining the water in mixed concrete (as delivered by the producer) is to thoroughly moisten the sub-grade, reinforcing steel and wooden forms before placing the concrete.
2. Avoid delay in placing the concrete. Have sufficient labour and equipment on hand to perform the placing quickly.
3. Don't order or try to place more ready-mixed concrete than you can reasonably expect to finish and cover.
4. Discharge concrete as soon as possible from the READYMIXT truck. Excessive temperature build-up may result from prolonged agitation on the job-site.
5. Care should be exercised with vibrators, to avoid over-vibration. Five to fifteen seconds of vibration, depending on the depth of the concrete, should give the desired compaction
6. During a pour in very hot weather, try to shade the concrete from direct sunlight.
7. Use wet coverings until final finishing can be completed, or spray with an aliphatic curing compound.
8. If a flat finish is required, uncover only a small section immediately ahead of the finishers. Cover again at once



Sub-grade should be damp, but not muddy, Saturate beforehand then sprinkle again just before concrete is placed.



Discharge concrete from waiting trucks as soon as possible. Heat evolution from cement hydration and continuous agitation results in temperature rises in the concrete which can cause a rapid loss in workability.

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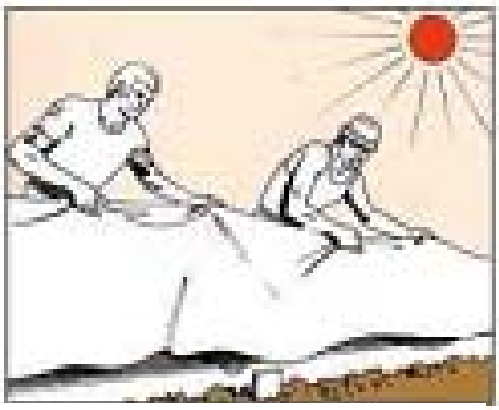
after final finish.

9. Keep covers wet.
10. Have sufficient labour and equipment on hand to finish the concrete.
11. In cases of extreme hot weather it may be wise to start jobs in the afternoon to take advantage of lower temperatures in the evening.
12. Keep a "weather eye" open. A gentle breeze on a hot, dry day cannot be ignored. The evaporation rate of moisture from freshly placed
13. Start curing as soon as possible, using a metod that will ensure moisture losses are minimised and protects the concrete from temperature extremes.



In very hot weathe, shade concrete from sunlight or use wet coverings until finishing can be completed.

Curing techniques

Curing is the protection of fresh concrete from evaporation and temperature extremes which might adversely affect cement hydration. If concrete is to gain potential strength and durability it must have –

1. Sufficient water for the hydration of the cement, and
2. A temperature conducive to maintaining this chemical reaction at a rapid, continuous rate.

To ensure the existence of these conditions, the concrete must be protected from the harmful influences of wind, sun and variable weather. As 23oC is considered the ideal temperature for hydration, it is desirable to maintain concrete temperature at or about this figure as curing proceeds.

Concrete curing techniques fall into two groups - those designed to prevent loss of water, such as the application of impermeable membranes; and those that supply moisture throughout the early stages of the hydration process, such as ponding or the application of wet sand or hessian.

Selecting the method of curing is generally a matter of economics, but another consideration is that the method used should cause the least interference to other operations on the site.

Water can be retained longer by using an absorptive cover.

Absorptive covers

An absorptive medium such as sand, Hessian or canvas will hold water on the concrete surface while curing progresses.

Any such medium must be kept damp constantly during the curing period, for if drying is permitted the cover itself will absorb moisture from the concrete. Alternate drying out and wetting of the cover may cause cracking.

The use of sawdust as a cover is not advisable, for it has on occasion retarded the hardening of concrete through the action of sugar in the sap still present in the sawdust.

Water addition curing

Theoretically, flooding, ponding or mist spraying are better than the retention methods mentioned above. But they are not always practical because of job conditions.

Care should be exercised to prevent large temperature differentials between the concrete mass and curing environment so as to avoid potential cracking due to temperature gradients within the concrete. This is generally known as thermal shock cracking.

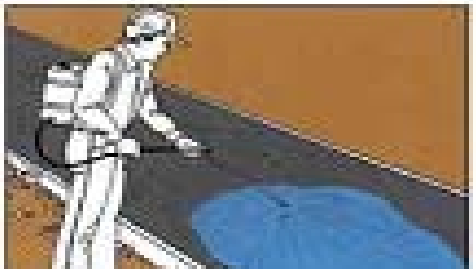
Water retaining materials

Chemical or liquid membranes are gaining in popularity because they are convenient to use. They can be applied by hand or power sprays.

These membranes come in four general categories: wax based; chlorinated-rubber based; resin based and PVA based.

When it dries, a membrane compound forms a vapour seal on the surface of the concrete, the water in the concrete is sealed in and good curing conditions are established.

Care should be exercised in the selection of an appropriate membrane coating in that compatibility with the intended applied finish



Chemical or liquid membrances reduce evaporation by seating the concrete.

Mechanical barriers

The use of waterproof building papers or plastic film (polyethylene sheeting) will also prevent the evaporation of moisture from concrete.

Any material used as a mechanical barrier to evaporation should be placed over the concrete as soon as the placing of it will not cause surface damage. The edges of the material should overlap several inches, and should be tightly sealed with sand, tape, mastic or wooden planks.

It is good practice, though one not always followed, to moisten the surface of the concrete with an atomising spray of water immediately prior to placing of the seating on the concrete.

Mechanical barriers should be placed over concrete as soon as the surface is set.

Avoid adding water to mixes

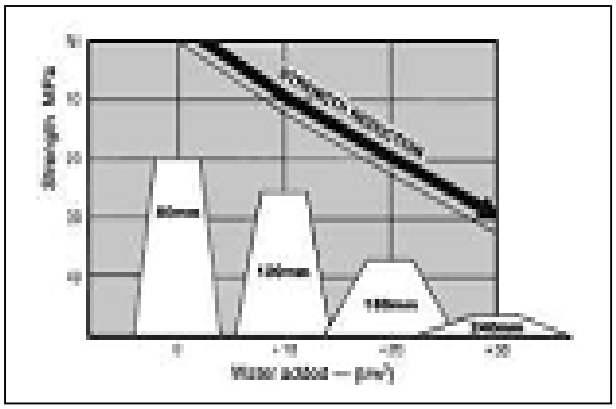
When handling low-slump concrete in hot weather, the placers will often ask for "more water". Excessive water added to the components of a mix can destroy the quality of poured concrete.

Wet concrete has a tendency to segregate and exhibit excessive bleeding properties. As the water bleeds to the surface and under certain conditions evaporates quickly cracking can and does result.

Better workability and longer setting times are best achieved using special chemical admixtures specified by Australian Standards AS 1478 and ASTM C494.

Inform your READYMIXT supplier of your special requirements, as most of these admixtures must be added at the concrete plant.

Effects of too much mixing water



ADVANTAGES OF ADDED WATER

- Easier Placing

DISADVANTAGES OF ADDED WATER

- Lower compressive strengths
- Segregation of the concrete mix under certain conditions resulting in variable quality throughout the concrete mass.
- Cracking - with too much water, there will be lower tensile strength, and a tendency towards high shrinkage and subsequent cracking.
- Dusting and scaling - bleeding of excess water brings too many fines to the floors
- Sand streaks. Excess water bleeding up the sides of forms washes out cement paste and leaves an unsightly streaked surface.
- Contamination. Too much water in concrete placed on grades causes contamination from the subgrade with the concrete leading to an array of quality problems
- Permeability. Voids left as excess water evaporates invite water to seep through walls and floors
- Dead losses - costly repairs, or in extreme cases, demolition and re-building at contractor's expense.

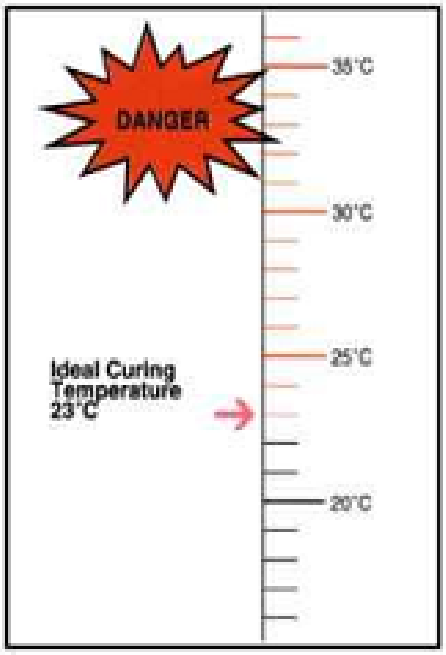
Reasons for curing

To sum up the advantages of careful control of moisture and temperature in curing

1. The strength of concrete increases with age if curing conditions are favourable.. Compressive strength of properly cured concrete is 80 to 100 per cent greater than the strength of concrete which has not been cured at all.
2. Properly cured concrete surfaces wear well.
3. Drying shrinkage cracking is reduced.
4. Greater watertightness of constructions is assured.

Points to keep in mind when curing

- Start curing operations as soon as possible after concrete has been placed
- For proper curing concrete needs moisture
- Continuity in curing is a must, alternations of wetting and drying promote the development of cracking
- If during curing the concrete is allowed to dry out, as may happen in hot weather, the chemical change stops right at the point where the concrete loses its moisture.
- The ideal curing temperature is 23^{o}C
- Cure concrete for at least 7 days.



Note: 35oC is the maximum concrete temperature for field placing alowed under AS1379.

The vicious cycle in inadequate curing must be obvious. If enough water evaporates from the concrete before it has attained its maximum strength, there will not be sufficient water remaining in the concrete to fully hydrate the cement and so achieve that maximum strength.