ARMCON

Cold Weather

– *Temperature Effects on Concrete Production*

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Temperature Effects on Concrete Production: (Cold Weather)

Top Tips

- Never produce concrete in 0^{o}C or below as even admixtures will freeze in early minus temperatures.
- Use Portland Cement rather than blended cements during cold weather periods
- Use insulating blankets to help retain heat produced by the curing process
- If you can see your breath, it is too cold to make concrete
- In cold weather periods try to produce concrete when the ambient temperature is at its daily peak.

Overview

Most testing and research regarding concrete is performed in controlled laboratory conditions, where the temperature of the environment is monitored to ensure a temperature of between 18^{0}C and 21^{0}C.

In reality, concrete is very rarely mixed, poured, placed and cured in such a stringent environment.

In practice, concrete will usually be exposed to temperatures significantly below and above laboratory conditions, which means that it is essential that anyone who works with concrete knows how to deal with temperature differentials caused by seasonal weather changes.

The most important phase in concrete's lifecycle is the curing phase; this is when the concrete will start to develop properties that will directly affect its ability to perform the task for which it has been designed. During the curing phase, maximum strength and durability are affected by the weather. To ensure that both these properties reach their expected level it is important to maximise the hydration of the cement. How this is done will depend on which temperature extreme is present. (See our booklet for concreting in cold weather).

A properly cured concrete will have several durability characteristics, including:

- Increased wear resistance
- Better frost resistance
- Reduced surface erosion during exposed conditions

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Concrete being laid in two very different climates and encountering different problems that must be over come to ensure a strong, durable and quality *concrete is produced.*

Cold Weather Working

Cold and wintry conditions will cause permanent damage to fresh or hardened concrete that has not properly developed strength, so it is important to know when to pour and how to look after concrete during difficult winter conditions.

Temperature plays an enormous part in being able to produce concrete properly,

At 10^{o}C difficulties with the concrete will begin occur.
At below 5^{o}C precautions should be taken when producing concrete.
At 0^{o}C or below concrete should not be produced.

Difficulty in working during cold temperatures comes from two main areas;

1. The chemical reaction occurring in fresh concrete (the hydration process) requires more than 5 ^{o}C in the first 48 hours to give the concrete the best chance of achieving its specified final strength.

2. At below 5 ^{o}C water will be on the threshold of beginning its change of state from a liquid to a solid (ice), this creates problems inside the fresh concrete, with the water inside the concrete starting to freeze and crystallise.

Remedies

When the temperature is low (around 5 ^{o}C) but concrete production has been scheduled or is required there are several possible courses of action that a concrete producer can take to help keep a production going.

Temperature is the biggest factor in the ability of concrete to develop enough strength (more than 5MPa) to resist the effects of freezing weather conditions. Timing of the production is key, production should be scheduled as close to midday, during cold periods, to ensure maximum ambient temperature.

To give extra help with concreting during cold weather it is also possible to;

- Use an accelerator
- Use water reducing admixtures
- Increase the strength class of the concrete
- Use or change to Portland cement
- Warm/heat moulds or form work
- Use insulation on moulds or formwork
- Leave curing concrete in the mould or formwork for longer
- If possible use enhanced curing techniques like steam curing or autoclaving.