

# PRODUCT INFORMATION

## CONCRETING IN COLD WEATHER

Special care must be taken when working with concrete in cold weather. If young concrete is allowed to cool much below freezing it will be damaged to such an extent that it will be unfit for purpose. It should be noted that even if the temperature does not drop below zero, the concrete will not develop strength as quickly as it would during the warmer months.

**The following guidelines should help ensure your cold weather concrete project is completed successfully.**

Two temperatures have to be considered when working with concrete in cold weather - that of ambient air temperature and the temperature of the concrete.

If freshly placed concrete cools below 0°C, the water in the concrete will freeze and expand. This causes damage and micro cracking to the immature concrete, making it weak and unfit for purpose and it would have to be removed.

However, provided the concrete is allowed first to reach a maximum strength of about 2N/mm<sup>2</sup> it can largely resist such disruptive expansion. For most concrete mixes this strength is achieved within the first 48 hours, **if the concrete temperature is kept at or above 5°C.**

However, even after the concrete has reached a strength of 2N/mm<sup>2</sup> low temperature will slow down the strength development.

The aim during cold weather is to maintain the temperature of the concrete (above 5°C) for the **first 48 hours** after placing. This will ensure that the strength developed will achieve structural requirements, albeit at a slower rate.

The severity of the weather determines the precautions that need to be taken. Cold weather concreting conditions can be divided into the following three categories:

### **AMBIENT TEMPERATURE BELOW 5°C BUT NO FROST**

When the temperature is low, but does not drop below freezing, there is no danger that the concrete will be permanently damaged by freezing, but it will take longer to reach its strength.

It is important that formwork is not removed too soon, otherwise there is a risk that corners and arises could be knocked off and the concrete in beams and suspended slabs could still be too weak to carry its own weight.

It is impossible to give a hard and fast rule on how long formwork should be left in position as the rate of strength gain depends on a number of factors, including ambient temperature, cement type and the cement content in the mix and the dimensions/size of structure.

Rate of strength gain can be increased if necessary by reducing the proportion of GGBS or PFA in the mix, or supplying in straight CEM I.

### SLIGHT FROST AT NIGHT

It is essential to prevent concrete from freezing so all freshly placed concrete must be protected immediately. The concrete temperature should not be **below 5°C when delivered**. There will be occasions when the ready mixed concrete supplier cannot guarantee this temperature on delivery. If this is the case, the decision on whether to proceed with the delivery will have to be taken based on whether the concrete can be adequately protected once placed.

When overnight frost is expected the concrete must be protected with frost blankets and insulated formwork. Timber formwork by itself usually offers sufficient insulation and when used for beams, columns and walls, the only additional precaution necessary is to cover exposed concrete surfaces with insulating material or erect temporary covers and provide internal heating with space heaters.

Prior to placing ensure that formwork, sub bases, reinforcement and any transporting or placing equipment that will come into contact with the concrete are free from ice and frost. The minimum surface temperature should be 2°C.

### SEVERE FROST DAY AND NIGHT

Additional precautions for these conditions include the requirement for the use of heated water, to ensure that the concrete temperature is above 5°C. If heated water is not available it is advisable to delay concreting until the ambient temperature has risen to  $\geq 2^{\circ}\text{C}$ .