

Using concrete in cold weather



Special care must be taken when placing concrete in cold weather. If young concrete is allowed to cool much below freezing point it will be damaged to such an extent that it will be unfit for use. It should also be noted that **even if temperatures do not drop below zero** the concrete will develop strength much more slowly than during the warmer months.

The following is advice on practical measures that need to be adopted on small and medium size jobs.

Two different temperatures have to be considered when working with concrete in cold weather – that of the ambient air temperature and that of the concrete itself, the following advice makes it clear which is being referred to, it is important not to confuse the two.

If freshly placed concrete cools **below 0°C** the water in the mix will freeze and expand. This could damage the concrete so much that it becomes useless and has to be removed.

However, provided the concrete is able first to reach a strength of about 2 N/mm², it is likely to resist this disruptive expansion. For most mixes this strength is achieved within 48 hours if the concrete is kept **at or above 5°C**. However, even after the concrete has reached 2 N/mm² low temperatures will slow down the strength development.

The aim therefore, during cold weather must be to keep the concrete warm (above 5°C) for the **first 48 hours** and then ensure that the strength is permitted to develop, albeit at a lower rate.

The severity of the weather determines the precautions that need to be taken. For the purposes of concreting, cold weather can be divided into the following three categories.



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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 but it will take longer to develop strength.

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

It is impossible to give a hard and fast rule as to how long formwork should be left in place as the rate of gain of strength depends upon many factors including the ambient temperature, the amount of cement in the mix and the type of cement.

If necessary the **rate of gain in strength can be speeded up** by increasing the cement content of the mix and, if being used, reduce the proportion of GGBS or pfa or eliminate their use completely.



Slight frost at night.

Any concrete must be prevented from freezing so all freshly placed concrete must be protected straightaway. The temperature of concrete should not be less than **5°C when delivered**. There will be occasions when the ready-mixed concrete supplier cannot guarantee this temperature on delivery and you will need to decide whether you can adequately protect the concrete in these circumstances if you wish to proceed with concreting.

Necessary protection is **frost blankets and insulated formwork**, timber formwork by itself often offers sufficient insulation and when used for beams, columns and walls the only additional precaution necessary is to cover the exposed surfaces with insulating material or erect temporary covers and provide heating with space heaters.

Prior to placing ensure that sub-bases, formwork, reinforcement and any transporting or placing equipment are free from ice and snow.



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. Heated water is available from selected ready-mixed concrete plants. If heated water is not available it is advisable to delay concreting until the ambient temperature has risen.