



Key to good concrete slabs



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There are plenty of things to consider when laying a concrete floor slab. Timing, the right amount of water and aftercare are all important.

DOES CONCRETE HAVE A USE-BY DATE? Certainly fresh concrete does, and if you are not well organised and prepared with the right skills and equipment, you might have a disaster on your hands!

Clock ticking once mixing starts

NZS 3104:2003 *Specification for concrete production* says that full discharge of concrete from ready-mix trucks shall be completed within 90 minutes after the commencement of mixing.

This is probably a little known clause, but we all know that concrete will stiffen as the cement starts to 'go off', particularly in hot weather. The use of retarding admixtures in summer and accelerating admixtures in winter will help alleviate issues, but being unprepared for the concrete truck comes down to bad planning.

Preparation, mix and workmanship key

BRANZ Bulletin 498 *Preparation for concrete floor slabs* outlines key areas needing attention when preparing for a concrete pour. Also, the recent BRANZ Study Report 340 *Revisiting concrete ground floor slabs* concludes that good mix design and workmanship are the key to producing crack-free concrete.

Even though the concrete pour is typically carried out by a specialist subcontractor, it pays for the supervising contractor to be aware of the facts.

Issue of uncontrolled cracking

Uncontrolled cracking is undoubtedly the biggest issue with concrete floors and pavements. As soon as the concrete starts to dry out, shrinkage

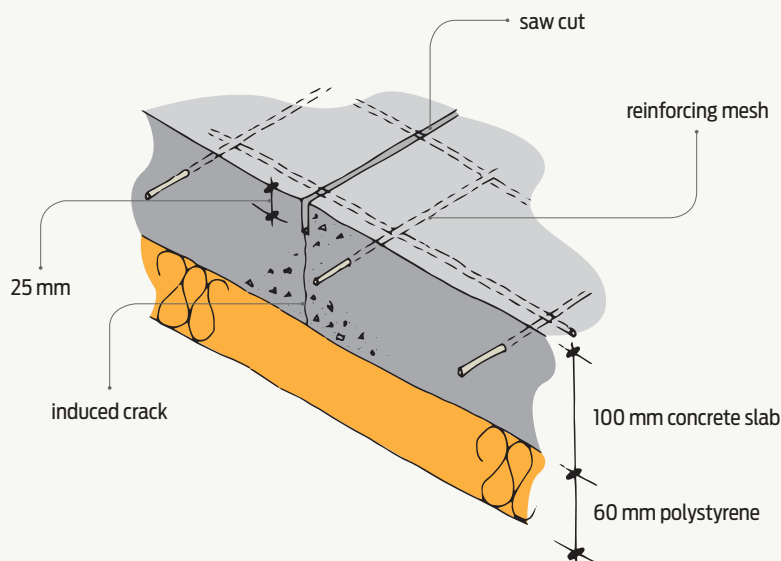


Figure 1 Shrinkage control joint.

commences, and there is potential for shrinkage cracking to occur given the low tensile strength of immature concrete.

Water in the concrete mix is the biggest protagonist causing shrinkage.

There needs to be just enough water to make the concrete workable in order to place and compact it. Inevitably around 7 mm of shrinkage will occur over a 10 m length of slab.

If more water is added to increase the slump of the concrete and make it easier to place, this shrinkage could increase to 12 mm in a 10 m slab length.

Controlled addition of water OK

Did you know that NZS 3104:2003 allows the addition of water to the truck but in a controlled manner – up to 10 litres/m³ of concrete? The concrete may dry out through evaporation from the truck, particularly in hot summer temperatures. This makes it hard to get the stiff concrete out of the truck and to place and fully compact it.

Also, where the transit time from the concrete plant to the site is considerable, slump loss may be an issue. Adding water is OK, but it must be a measured amount and with the agreement of the concrete plant. ➔

Adding water in an uncontrolled manner is inviting problems with high shrinkage and low strength.

Concrete is vulnerable until it has gained some strength. The hydration of cement is a chemical reaction affected by temperature and the presence of moisture. As soon as the fresh concrete starts to dry to the atmosphere, shrinkage will commence and strength gain will also slow.

Finishing

Download a localised weather forecast – some concrete suppliers offer this as part of their service. If conditions are unfavourable for concreting, delay the pour rather than taking a risk.

Curing ensures that the concrete does not dry out prematurely and will gain strength from an early age. If the commencement of curing is delayed, you cannot make up for it by curing later – you will lose around 50% of the potential concrete strength.

Alternatively, a plastic sheet can be laid on the surface and weighed down with sand or the like so that wind cannot get under the sheet. Curing



Unfortunately, adequate curing is often ignored in practice yet it is critical to achieving concrete strength gain and avoiding shrinkage cracking.

NZS 3604:2011 *Timber-framed buildings* requires saw cutting to take place the day after pouring in summer and 2 days after pouring in winter (see Figure 1). This timing is critical, and the occurrence of uncontrolled cracking due to saw cutting too late is far too common in slabs.

Once uncontrolled shrinkage cracks have formed, the saw-cut joints will not act as the weak link for shrinkage cracking to occur. Movement will always take place preferentially at the existing cracks.

For slabs designed to NZS 3604:2011, the spacing of saw-cut joints, shrinkage movement joints and location of the reinforcing mesh are all important in avoiding shrinkage cracking. The reinforcing mesh needs to be at 30 mm cover to the top of the slab (see Figure 2). Its main function is to prevent shrinkage cracks occurring between saw-cut joints.

The maximum distance between saw-cut joints is 6 m, and every fourth joint should be a free movement joint at a maximum spacing of 24 m (see Figure 2). Where parts of the floor are exposed, such as for a coloured or polished floor, the saw-cut spacing should be reduced to 5 m.