WHEN IS A CONCRETE SLAB DRY ENOUGH?

Covering a concrete slab too soon can result in the floor covering being damaged. To get the timing right, it helps to understand what the various measurements are telling you.

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Three figures appear regularly in product literature and guides to trade practice for deciding if it is safe to lay flooring over a new drying concrete slab – 5.5% moisture content, 15 g/m^2/24 hours and 75% relative humidity. What are these figures, and how should they be used?

First, we need to understand how the moisture content of concrete changes as it dries. Figure 1 shows moisture profiles through a drying concrete slab. If, at some stage during drying, the concrete is topped or overlayed with a flooring material, then over a period of weeks, the moisture redistributes itself until there is a uniform moisture profile through the concrete.

Second, we need the key concept of a sorption curve (see Figure 2). This shows the moisture content the concrete will come to once all drying has ceased (its equilibrium value), given the relative humidity of the ambient air. While concrete is drying, it is not in equilibrium – as Figure 1 shows, it is wetter in the depths than it is on the surface and changes continuously until it has completely dried.

With these facts, we can start to understand the meaning of 5.5% moisture content, 15 g/m^2/24 hours and 75% relative humidity.

5.5% moisture content

This is a trigger figure used by some product manufacturers to specify when concrete is dry enough to allow their product to be applied to it.

However, Figure 2 shows that concrete with a 5.5% moisture content is in equilibrium when the relative humidity of the ambient air is 90%. If the ambient relative humidity is lower, say, 60%, the equilibrium moisture →

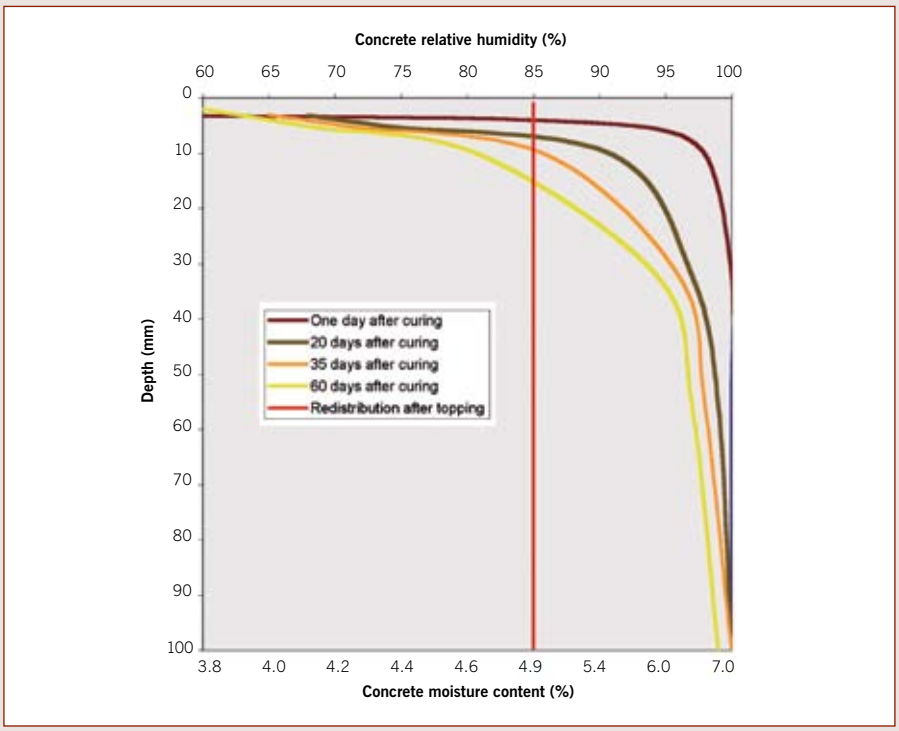

Figure 1: Moisture profiles in a drying concrete slab.

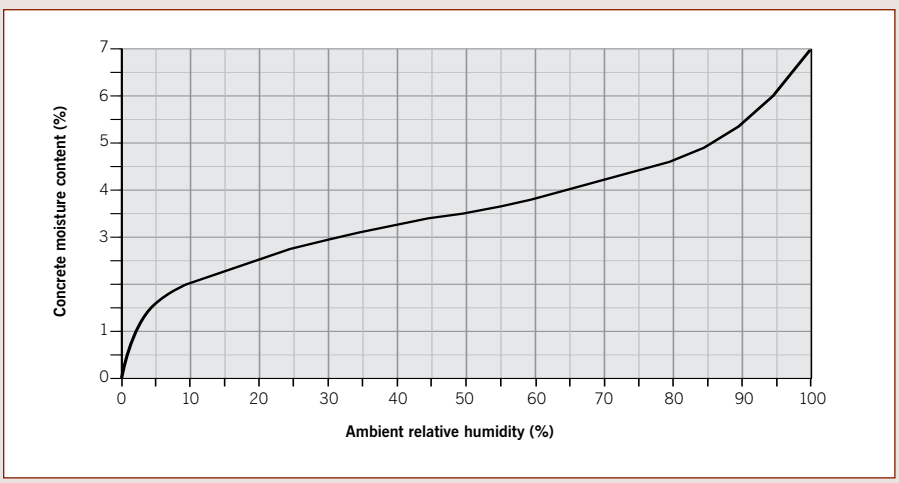

Figure 2: Sorption curve for concrete.

content of concrete is also lower, at 3.9%. In other words, at lower humidities, concrete with a 5.5% moisture content is still very wet, and approximately 25 litres per m^3 more moisture has still to be dried out of it.

The upshot? Only products that can tolerate high moisture content should be used when using the trigger figure of 5.5%.

15 g/m²/24 hours

No standard test method seems to exist to confirm whether the concrete moisture content is below 5.5%. But because the rate of evaporation falls as concrete dries, standard test method ASTM F1869-04 can be used to measure this rate of evaporation. If the evaporation rate is found to be below 15 g/m^2/24 hours, it is usually taken as indicating that the concrete moisture content is below 5.5%.

The same warning applies – if the evaporation rate is measured as 15 g/m^2/24 hours, the concrete is still very wet, and only products that can tolerate high moisture contents should be used.

75% relative humidity

The figure of 75% relative humidity is used to decide whether flooring, including gluing where necessary, can safely be undertaken. The sorption curve (see Figure 2) shows that 75% relative humidity is equivalent to an equilibrium moisture content of 4.4%.

This test is undertaken with an Edney flooring hygrometer. A description of the hygrometer and how to use it can be found in BRANZ Bulletin 330 *Thin flooring – (2) Preparation and laying*.

This hygrometer reads the relative humidity in the top few millimetres of the concrete only. Figure 1 shows that, if the relative humidity close to the surface of the concrete is 75%, it is still quite wet in its interior. Once topped, the moisture redistributes itself to a uniform moisture content that may be as high as 5% (85% relative humidity).

It is very important to realise that, if the slab has been force-dried (for example, with heating or dehumidification) or if the concrete has been rewetted, with rain for example, the Edney gauge can no longer be used. It measures the surface relative humidity, which will have been reduced by the force-drying, while the interior of the concrete, which is what really counts, has remained quite wet.

What can happen

Damage to flooring laid over a slab that is too wet includes:

- swelling and lifting of timber overlays
- moisture bubbles under vinyls and other resilient sheet flooring
- cracking of tiles (typically due to concrete shrinkage)
- condensation under carpet underlay
- loss of adhesive bond for fully adhered flooring.