

Cementitious Self-levelling Flooring

[Excerpts from the Masterbuilder - January 2014 p.p. 192 - 194]

1.0 Introduction

The flooring industry has always placed a strong emphasis on smooth and level concrete surfaces upon which to install resilient flooring. With today's large amount of commercial remodelling/renovation projects, the attempts to reduce costs in the new construction market and the declining availability of competent cement finishers, there is a need of a product that helps to solve most problems related to floor levelling and repair. Fortunately, modern self-levelling cements provide the best solutions that are technically sound and cost effective.

Cementitious self-levelling flooring is polymer-modified cement that has high flow characteristics and, in contrast to traditional concrete, does not require the addition of excessive amounts of water for placement. Self-levelling products (Fig. 1) also called self-levelling concrete, is typically used to create a flat and smooth surface with compressive strength similar to or higher than that of traditional concrete prior to installing interior floor covering. Self-levelling concrete has increased in popularity as the degree of flatness and smoothness required for floor covering products has increased, with vinyl goods getting thinner and floor tiles getting larger.



Fig. 1: View of self-levelling cementitious flooring product

2.0 Areas of Application

Cementitious self-levelling floorings are classified into two main groups of materials: Underlayments and toppings are two main groups of materials. Underlayments are installed over an existing subfloor to smooth it out and correct any surface irregularities prior to the installation of all types of floor coverings, including sheet vinyl, vinyl composition tile (VCT), wood, ceramic tile, and carpet. Toppings perform a similar function but act as the actual finished floor without the need for a floor covering. Some typical applications for concrete toppings include warehouse floors, light industrial applications, retail stores, and institutional facilities.

Concrete toppings can also receive pigmented colour dyes, stains, saw cuts, or mechanical polishing to produce a decorative concrete finished wear surface. These floorings can also be coated with advanced coatings based on epoxy, acrylic, and polyurethane resins.

When self-levelling concrete is poured, it has a viscosity similar to pancake batter. A gauge rake is used to move it into place without spreading it too thin. The finishing is then done by lightly breaking the surface tension of the product using a tool called a smoother. The polymers in the self-levelling mix keep the viscosity of the product such that it remains uniform in composition from top to bottom, without the sand aggregates sinking to the bottom of the installed layer. The typical installation thickness of these products ensures there is enough mass present for the material to flow, although some self-levelling products now exist that can be installed at an average thickness of 3 mm to 75 mm for highly undulated subfloors.

Self-levelling means that the mixture of powder and water has a flow viscosity that allows the material to seek its own level before setting. The material can be taken to another place with a gage rake and smoother.

3.0 Advantages

Traditional methods of levelling and repairing concrete floors are both labour intensive and require the use of screeds, trowels, and sanders that are less than desirable because of site mixing, waves, cracks, etc. Self-levelling products have a variety of advantages over trowelable underlayments as follows:

- Application is about eight times faster than trowelable underlayments.
- They do not require the same high degree of expertise as hand trowelling.
- They can be used to repair a variety of substrates.
- They are fast setting and can be walked on in a few hours.
- Floors can usually be installed the next day.
- They can be installed from a feather edge to several mms in one pour with little to no shrinkage.
- They develop high compressive strength (28 MPa or greater).
- They are water resistant and do not promote the growth of microbial contaminants.

4.0 Application Methodology

4.1 Substrate Preparation

The key to success when installing self-levelling products is to achieve a good bond between the substrate and the self-levelling underlayment. Proper preparation of the concrete surface is the most important factor. The surface must be sound, clean, and free of such residuals as oil, grease, wax, dirt, sealers, curing compounds,

and adhesives. Most self-levelling substrates are shot blasted to ensure that the substrate is clean and free of contaminants. It can be noted that taking a shortcut in substrate preparation is an open invitation to failure.

4.2 Priming

In almost all self-levelling products it is being recommended to use the primer to work as a bonding agent. There are two types of primers used. One is for porous and absorbent substrates, while the other type is used when going over non-porous substrates such as ceramic, quarry, terrazzo, marble, steel, lead, and cutback adhesive residues.

On special types of substrates, an additive may be recommended such as metal substrates and or cutback adhesive residue. The additive will add additional bonding strength and will allow a little bit of deflection into the mix.

4.3 Temperature Control

Temperature control is vital to the success of using self-levellers. With self-levellers, heat is the worst enemy. When dealing with a self-levelling product, one must monitor four temperatures.

- Ambient temperature
- Slab temperature
- Powder temperature
- Mix water temperature

If any of these temperatures exceed 28.0°C it will provide to be detrimental to the application. In warm weather conditions the pour may have to be done early in the morning or late in the evening when temperatures are cooler. Powders can be stored in a cool place and the mix water container can be filled with several blocks of ice to cool the mix water. Heat causes the self-levelling mix to stop flowing prematurely, usually less than the minutes, making it difficult to get it placed on time. In cold conditions the self-leveller will slow its set time down, but beware of any temperatures below 10.0°C, as it will also have an adverse effect on the mix.

4.4. Mixing

When mixing, it is critical to use the correct water-to-powder ratio. Mixing is done by adding the correct amount of powder to a premeasured amount of water. Once the powder is added to the water it is necessary to power mix with a heavy duty drill at about a 650 rpm for approximately two minutes. Power mixing will break the surface tension in the water, allowing for a smooth mix that will flow easily for about six to eight minutes. Once the mixing is complete, the mix should be taken out of the container and on to the floor without delay. The approximate time from the time the powder hits the water to the stop of the flow time is about 10 minutes at room temperature and still some time is needed for the spreading and smoothing process.

4.5 Spreading

Immediately after the mixing process is completed, the mix should be poured onto the floor and moved with a spreader to obtain a uniform thickness. The spreader is a stand-up, handheld device that can be set to apply a desired even thickness of underlayment over the substrate (Fig. 2).



Fig. 2: Spreading self-levelling cementitious flooring product

4.6 Smoothing

The smoother is a second handheld device for the final smoothing by removing the spreader marks, footprints, and all irregularities. The working time varies from eight to ten minutes, depending upon the temperature. While this doesn't seem like much time it is more than adequate to spread and smooth the area. For example, a crew of three can cover about 140 m² per hour without any difficulty.

4.7 Pumping

For large installations, self-levelling underlayment can be pumped. The pump will control the critical water-to-powder mixture and allow for a faster installation. For example, a three-man crew can easily do 650 m² per hour.

4.8 Drying

The usual drying takes about two hours before you can walk on the newly installed surface, and resilient flooring can be installed the next day. Care must be taken to not allow the underlayment to dry too fast.

5.0 Condition Requirements Prior to Application

It is typically recommended that self levelling cementitious flooring be applied in conditions where ambient temperature is above 10°C, and not more than 28°C. To ensure the integrity of the primer, the moisture vapour transmissions rate (MVTR) from the substrate should not be in excess of 2.2 kg of water/day/93 m², based on ASTM F-1869 (Calcium Chlorid test), or 80% RH, based on ASTM F-2170.

6.0 Conclusion

One recent trend in the formulation of self-levelling underlayment is the addition of post consumer recycled aggregates to enhance the materials' contribution to LEED certification and green building. This is most suitable for repair of any damaged floor and where cost economy is required.