TECHNICAL BULLETIN – TB058

CONCRETE SURFACE PREPARATION FOR FLOORING, MEMBRANES AND ADHESIVES

JULY 2024

INTRODUCTION & SCOPE

The surface preparation of concrete before the application of floor leveling compounds, screeds, membranes, or adhesives is critical in achieving a quality application. All equipment for the correct preparation is available from hire companies, such as Kennards Hire, so there is really no excuse for not doing the job properly.

There are two major requirements of any surface preparation carried out before application of the subsequent coatings:

1. The pores or capillaries of the concrete must be open to allow absorption of the binding liquid component.
2. The surface profile or roughness should be at least 0.075 – 0.150mm to allow proper mechanical bonding and achieve a uniform film thickness (approximately CSP3).

Note that the surface profile should not be so excessive that it prohibits achieving a uniform coating, particularly with membranes.

This Bulletin covers the important aspects of the various concrete surfaces likely to be encountered.

COMMON TYPES OF SURFACE FINISHING OF CONCRETE

OFF-FORM CONCRETE

Off-form concrete is normally compacted at least to some degree, and the cement fines are moved to the outer surface next to the form during compaction processes. These fines then form a tightly closed structure at the surface, which is normally also very dense and has very low permeability, causing poor adhesion of subsequent coatings.
Because the cement fines tend to migrate to the outer surfaces, Off-Form concrete normally has a very smooth surface with an extremely smooth surface profile on which the subsequent coating cannot get a mechanical bond.

In compacting Off-form concrete, the entrapped air also migrates to the outer surfaces near the formwork, and a thin layer of cement fines forms adjacent to the formwork and over the top of the air pocket. These air pockets are commonly called “Blow Holes” and can cause major blistering of liquid membranes.

There is also a risk of surface contamination on Off-Form concrete from residual form-release oils. These are not always used (depending on the type of form), and most deteriorate after 3 - 4 months of exterior exposure.

Off-form concrete must be mechanically treated by abrasive blast cleaning or a similar process to open the pores and produce a surface profile.

Note: Abrasive blasting cannot be relied upon to remove grease, oil, or form-release agents, and high-pressure detergent water washing is necessary.

COMPACTED CONCRETE

Compacted concrete primarily applies to horizontal surfaces and produces a similar surface finish to Off-Form concrete. The compacting process vibrates the water and cement fines to the surface, resulting in a fine closed structure with very low permeability. Compacting horizontal slabs are also normally restricted to high-strength concrete, further reducing permeability.
Horizontal surfaces that are compacted may be trowel finished after compaction, but this does not change the surface structure; in fact, it may make it worse because the trowelling is carried out with excess surface bleed water (which is not recommended as it can create laitance on the concrete surface after final cure).

Steel-trowelled finished surfaces are particularly vulnerable to developing a smooth, tight, textured finish. The pores of wood-trowelled surfaces may be opened, provided this is carried out after the evaporation of the surface bleed water.

Compacted concrete surfaces should, therefore, be treated in a similar manner to Off-Form concrete.

Compacted Concrete Surfaces are treated as off-form concrete

ROTARY PLANER FINISH (HELICOPTERED) CONCRETE

Rotary-planed concrete surfaces produce a similar surface finish to steel trowelling, although the surface texture is normally denser, reducing permeability. In rotary planing, there is a greater tendency to draw water and cement fines up to create a closed finish.
In some instances, high-pressure water blasting is sufficient to open the pores of the concrete, and a nozzle pressure in the order of 20 - 30MPa (3000 - 4000 psi) is required. The efficacy of high-pressure water blasting reduces with increasing compressive strength properties; at greater than 30 - 35MPa, this will have little effect. The efficacy will also decrease with the aging of the concrete; for example, after 7 days from finishing, high-pressure water blasting will be very effective, while after more than 28 days, it will be significantly less effective. Water blasting is not acceptable before installing leveling cements, which require the substrate to be dry, as defined by AS1884-2012.

For concrete with greater than 35MPa compressive strength, mechanical preparation such as abrasive blast cleaning, scabbling, or scarifying must be used to achieve sufficient surface preparation.

STEEL TROWEL FINISH CONCRETE

Steel-trowelled concrete finishes vary considerably, ranging from dense closed surface structures (low permeability) to open pored. If the installers place the concrete and then, because they want to leave the job quickly, trowel finish immediately after the initial set, there is normally a high surface bleed water content, which attracts the cement fines and forms a closed surface texture. Because the concrete is difficult to finish at this stage, there is also a tendency to overwork the surface, exacerbating the surface finish problems. If the concrete installer takes his time and allows the initial surface water to dry and/or react, a permeable surface can be achieved with a low surface profile that is more suitable for coating application.

High-pressure water Blasting using a nozzle pressure of 20 - 30MPa (3000 – 4000 psi) can frequently be used to open the concrete pores successfully, provided the compressive strength is not greater than 35MPa. The efficacy of high-pressure water blasting decreases as the compressive strength increases. Water blasting is not acceptable before installing leveling cements, which require the substrate to be dry, as defined by AS1884-2012.

For relatively new concrete of high compressive strength, mechanical surface preparation such as abrasive blast cleaning, scabbling, or scarifying is necessary to open **the pores.**

WOOD TROWEL/FLOAT OR BROOM FINISH CONCRETE

This is the ideal surface finish for applying toppings, membranes, or adhesives to concrete. Because of the action of the wood trowel or broom, this form of finish is normally open-pored and has a good surface profile.

Wood trowel/float or broom finishing can be carried out following primary surface finishing using steel trowel equipment to achieve a surface finish suitable for membrane or adhesive application. However, this finishing must be carried out following the evaporation or reaction of almost all surface bleed water.

For wood trowelled/floated or broom-finished concrete of lower compressive strengths, a thorough clean down by high-pressure detergent washing and/or high-pressure washing using a nozzle pressure in the order of 8 - 15MPa (1200 – 2000 psi) is sufficient. Water washing or blasting is not acceptable before the installation of leveling cement, which requires the substrate to be dry, as defined by AS1884-2012.

For high-strength concretes greater than 35MPa, mechanical surface preparation such as abrasive blast cleaning, scabbling, or scarifying may be necessary.

High-pressure Water Washing using nozzle pressures from 7 – 20MPa (1000 to 3000 psi), such as the normal household pressure washer, is only suitable for cleaning surfaces. It does not open the pores of the concrete to make it sufficiently permeable to allow good liquid bonding.

SPRAYED CONCRETE

Sprayed concrete substrates are normally relatively permeable when first applied. Once the concrete has been installed, it is normally finished either by steel or wood trowel/float, which changes the surface texture.

If the surface is not trowel-finished, the surface profile will likely be too coarse to be ideally suited to membrane application. If the surface is trowel-finished, the previously described treatments are recommended.

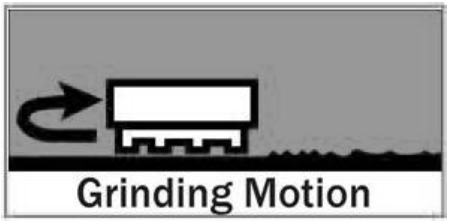
It should be noted that once the surface pores of sprayed concrete are opened, the surface is likely to be relatively highly porous, and membranes will be more susceptible to blistering.

COMMON METHODS OF CONCRETE TREATMENT

GRINDING

Fine Profile

This method is suitable for removing minor/moderate surface contamination. However, it is not a preferred method since if it is not done properly, there is a risk of polishing the surface and filling the pores.



Grinding consists of rotating a number of diamond grinding heads over the surface. This process only grinds the surface and does not penetrate the substrate, making it unsuitable for weak or heavily contaminated surfaces.

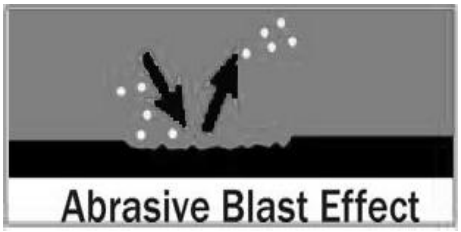
Grinding is ideally suited to small area detailing and performs best when using coarse grinding disks. Grinding has three major drawbacks concerning surface preparation:

1. The motion tends to polish the surface and fill the pores with removed dust or contaminant. The resulting surface profile is very low, and ground surfaces need to be high-pressure water washed to remove impregnated dust and contaminants.
2. The motion develops heat during operation, which can soften or melt most thermoplastic and some thermosetting materials. This softened material clogs the grinding disk and fills the concrete's pores.
3. Grinding is very time-consuming over larger areas.

ABRASIVE BLAST CLEANING

Produces a medium surface profile

It is the most common serious preparation method for off-form or high-strength concrete. It provides an ideal spiked profile up to 0.2mm.



Abrasive blasting involves firing a suitable aggregate at the surface which effectively chips away at the surface. Non-metallic aggregates such as copper slag should be used on concrete to avoid impinging metal, which can rust on the substrate surface. Almost all abrasive blast cleaning involves the collection of the spent aggregate; however, it should be noted that these collection units are rarely 100% effective, and surfaces need to be vacuumed before the application of membranes or adhesives.

Abrasive blast cleaning equipment is available in various sizes and is suitable for multiple applications, allowing substantial flexibility.

A specialist contractor should carry out abrasive blast cleaning.

SCARIFYING

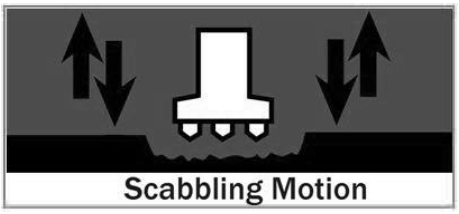
Produces a coarse surface profile

It is suitable for aged, weak, severely rain-damaged, or reasonably badly contaminated surfaces. The resulting surfaces normally require resurfacing.

Scarifying involves the mechanical impact and rotation of sectionalised rollers into the surface of the concrete. The sections of the rollers have specially designed teeth that gouge the surface, removing the uppermost layer. The surface achieved and the amount of surface removed can be varied by the type of scarifying roller and the depth setting of the equipment.

SCABBLING

Very Coarse Profile



This method suits very badly aged weak, or badly contaminated surfaces. It is used in worst-case scenarios and usually requires resurfacing.

Scabbling involves several disc heads containing heavy-duty spikes on each head. These heads are impacted onto the concrete surface with an oscillating motion to break up and remove the top layer. Most equipment also allows the heads to be rotated simultaneously, dramatically improving the impact effect.

Scabbling is the most severe of the mechanical methods of treating concrete and treated surfaces generally always must be re-surfaced.

HIGH-PRESSURE WATER WASHING

High-Pressure Water Washing is normally limited to nozzle pressures up to 10MPa (1500 psi) and includes most domestic-type pressure washers.

High-pressure Water Washing will clean the surface, but it will have little or no effect on the concrete's mechanical properties.

High-pressure Water Detergent Washing is a highly effective preparation for removing oil-based contaminants, particularly when used in conjunction with the ARDEX WPM 300 HydrEpoxy sealing system.

HIGH-PRESSURE WATER BLASTING

High-pressure Water Blasting is normally limited to nozzle pressures up to 25 - 28MPa (3500 - 4000 psi) and involves more heavy-duty pressure washers.

High-pressure water blasting can open the pores on low compressive strength concrete, up to 35MPa, rendering the surface suitable for membrane or adhesive application.

This effect is very limited on more dense or high-strength concrete and, therefore, unsuitable.

The efficiency of high-pressure water blasting in cleaning contaminants from the surface can be dramatically enhanced by using a turbo head on the nozzle. This head directs the water flow in a rotary jetting motion producing a cutting effect.

High-pressure detergent water blasting is highly effective in the removal of oil-based contaminants.

HIGH-PRESSURE WATER JETTING

High-pressure Water Jetting involves controlled pressures to 275MPa (40000 psi) and is extremely effective for stripping almost all contaminants from a surface. The uppermost surface layer is removed at these pressures, and the pores can be opened on most concrete.

An experienced specialist contractor must carry out high-pressure water Jetting because the pressures must be carefully controlled.

Note: Water washing and/or water blasting/jetting techniques for preparing concrete surfaces are not recommended for concrete floors receiving leveling cement underlayments and/or resilient floor finishes. The substrate must be dry as per the recommendations of AS1884-2012. Should these techniques be used, a moisture barrier system can be applied before installation of the leveling cement underlayment as per Ardex Technical Bulletin TB192 or TB006.

For further information, see Technical Bulletin TB041.

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