TECHNICAL BULLETIN – TB058

CONCRETE SURFACE PREPARATION FOR FLOORING, MEMBRANES AND ADHESIVES

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INTRODUCTION & SCOPE

The surface preparation of concrete prior to the application of floor levelling 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 prior to 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 forms of concrete surface 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 also 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 exterior exposure.

Off-Form Concrete must be mechanically treated by abrasive blast cleaning or similar 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 principally relates 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 very fine closed structure that has very low permeability. Compacting of horizontal slabs is also normally restricted to high strength concrete which further reduces the permeability.

Horizontal surfaces that are compacted may be trowel finished after compaction but this does not change the surface structure, in fact 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 and therefore permeability is reduced. 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 and at greater than 30 - 35MPa this will have little effect. The efficacy will also decrease with aging of the concrete such that after 7 days from finishing High Pressure Water Blasting will be very effective while after 28 days plus it will be significantly less effective. Water blasting is not acceptable prior to the installation of levelling cements which require the substrate to be dry as defined by AS1884-2012.

For rotary planed surfaces of concrete having 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 finishes of concrete can 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 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 more suitable for coatings application.

High Pressure Water Blasting using a nozzle pressure in the order of 20 - 30MPa (3000 – 4000 psi) can frequently be used to successfully open the pores of the concrete 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 prior to the installation of levelling cements which require the substrate to be dry as defined by AS1884-2012.

For concrete of high compressive strength that is relatively new 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 concrete on which to apply toppings, membranes or adhesives. Because of the action of the wood trowel or broom, this form of finish is normally open pored with 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. This finishing must, however, 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 prior to the installation of levelling cements which require 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 are only suitable for cleaning surfaces. They do 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, then it is likely that the surface profile will be too coarse to be ideally suited to membrane application. If the surface is trowel finished, then the previously described treatments are recommended.

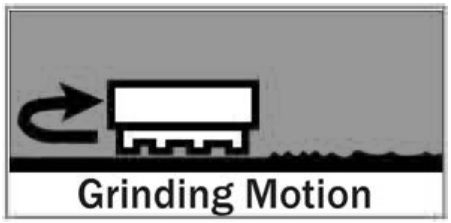
It should be noted that once the surface pores of sprayed concrete are opened, the surface is likely to be relatively highly porous and membranes will be more susceptible to blistering.

COMMON METHODS OF CONCRETE TREATMENT

GRINDING

Fine Profile

This method is suitable for removal of minor/moderate surface contamination. Not a preferred method since if 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 and is therefore unsuitable for weak or heavily contaminated surfaces.

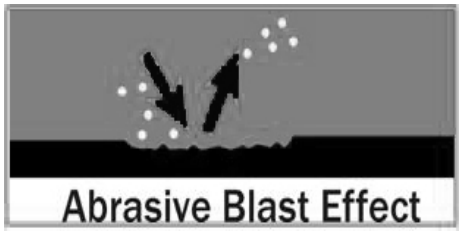
Grinding is ideally suited to small area detailing and performs best when coarse grinding disks are employed. Grinding has three major drawbacks in relation to surface preparation:

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 up the grinding disk as well as filling the pores of the concrete.
3. Grinding is very time consuming over larger areas.

ABRASIVE BLAST CLEANING

Produces a medium surface profile

Most common serious preparation method and is essential 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 into 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 prior to application of membranes or adhesives.

Abrasive blast cleaning equipment is available in a wide range of sizes suitable for various applications allowing substantial flexibility.

Abrasive blast cleaning should be carried out by a specialist contractor.

SCARIFYING

Produces a coarse surface profile

Suitable for aged, weak, severely rain-damaged or reasonably badly contaminated surfaces. 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 is suitable for very badly aged, weak or badly contaminated surfaces. Used in worst case scenarios and usually requires resurfacing.

Scabbling involves several disc heads containing several 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 at the same time 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 however will have little or no effect on the mechanical properties of the concrete.

HIGH PRESSURE WATER BLASTING

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

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

On more dense or high strength concrete this effect is very limited and is therefore unsuitable.

The efficiency of high-pressure water blasting in cleaning contaminants from the surface can be dramatically enhanced, by the use of 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 for 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. At these pressures the uppermost surface layer is removed, and the pores can be opened on most concretes.

High Pressure Water Jetting must be carried out by an experienced specialist contractor since these pressures have to be carefully controlled.

Note: Water washing and/or water blasting/jetting techniques for preparing concrete surfaces are not recommended for concrete floors that are to receive levelling 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 prior to installation of the levelling cement underlayment as per Ardex Technical Bulletins TB192 or TB006.

For further information see Technical Bulletin TB041.

IMPORTANT

This Technical Bulletin provides guideline information only and is not intended to be interpreted as a general specification for the application/installation of the products described. Since each project potentially differs in exposure/condition specific recommendations may vary from the information contained herein. For recommendations for specific applications/installations contact your nearest Ardex Australia or Ardex New Zealand Office.

DISCLAIMER

The information presented in this Technical Bulletin is to the best of our knowledge true and accurate. No warranty is implied or given as to its completeness or accuracy in describing the performance or suitability of a product for a particular application. Users are asked to check that the literature in their possession is the latest issue.

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