TECHNICAL BULLETIN – TB189

FAÇADE RESTORATION

31st July 2024

INTRODUCTION & SCOPE

This technical bulletin details the necessary preparation procedures for repairing and reinstating damaged concrete and façade surfaces and applying an anti-carbonation membrane.
Several aspects of the repair and coating schedule are covered in each of the following sections.

STRUCTURAL CONSIDERATIONS

This technical bulletin incorporates a fairing and patch repair mortar suitable for repairing damaged or spalled concrete. Prior to any repair or application of repair mortars, a structural engineer should be consulted on the soundness of the substrate.

CORROSION PROBLEMS WITH FACADES

CONCRETE SPALLING

Concrete is highly alkaline (pH 11–12) and creates a passive environment around steel reinforcement. While the passive environment exists, the reinforcing steel will not rust, and concrete spalling will not occur. This passive environment can be destroyed by the acid attack, which neutralizes the alkalinity of the concrete, or by insufficient concrete cover over the steel reinforcement. When steel reinforcement rusts, it can expand to about 10 times its original volume, creating tensile forces within the concrete, hence the onset of concrete spalling.

BRICKS

Brick structures frequently exhibit fretting, where the brick loses its integral strength and starts to powder, causing surface erosion. Fretting mostly occurs in low-temperature fired bricks as they are more porous than the high-temperature fired types. These are usually exposed face brick. High fired bricks (construction grade) are also very susceptible because of cracks and fissures in the surface. A major cause of bricks fretting is acid attack caused by chloride ion forming acids in contact with water. Note that ground soil acid attack is the second major cause of bricks fretting.

ANT-CARBONATION COATING REQUIREMENTS

Anti-carbonation coatings are surface treatments that highly resist carbon dioxide and protect concrete from carbonation. These coatings should offer an exceptional level of protection from the elements and a long-term barrier against carbon dioxide, water, and oxygen while enhancing the exterior appearance of the building. They should also exhibit excellent weather ability, offer very good aging properties, and be water—and alkali-resistant. They should mask unavoidable surface irregularities after the repair of concrete spalling.

Anti-carbonation coatings, while having a low permeability to carbon dioxide, should allow water vapour through the membrane to avoid a build-up of vapour pressure behind the coating. This requirement is assisted by the fact that the molecular size of carbon dioxide is larger than that of water.

Note: Hydrophobic pore-lining and pore-blocking materials, such as silanes, siloxanes, and silicates, are not effective in controlling carbonation as they have no crack-bridging properties and do not keep out carbon dioxide.

ARDEX offers one general-purpose façade membrane, ARDEX WPM 310, and one anti-carbonation membrane, ARDEX WPM 330 Façade.

ARDEX WPM 310 is a general-purpose façade membrane that offers good water vapor transmission but does not resist carbon dioxide, chloride, and sulfide ion attacks. This membrane is more suitable in areas where atmospheric salt levels are low such as distant from the coast, and in areas of low atmospheric carbon dioxide or sulfide ion such as outer urban and country areas

ARDEX WPM 330 Façade membrane is the preferred membrane where high levels of sulfide ions normally exist in high-traffic areas, such as CBDs from vehicle emissions and some industrial areas, e.g., around petroleum refineries, and high salt-laden atmospheres, such as 5 – 7km from the coast. This distance may vary, such as in Perth, where the risk distance is far greater because of the “Freemantle Doctor,” driving spray inland.

FAÇADE SURFACE PREPARATION

PREPARATION

1. When confronted with corrosion damage, The obvious thing to do is to cut out the damaged areas, replace any steel weakened by section loss, and reinstate good-quality concrete. However, there are several problems with this approach:
   - ✘ Cutting out the area of damage may leave many areas about to crack and spall. Because of the electrochemical nature of the corrosion process, repairs can actually accelerate corrosion in adjacent areas, especially with chloride-induced corrosion. The removal of the corroding anode also causes the loss of the protective cathodes around it, and new anodes form when the material is renewed.
   - ✘ The repairs may be visually intrusive. It is very difficult to match the concrete used for repair to the colour and texture of the original, and it is almost impossible to get the new material to weather in the same way.
2. Signs of concrete spalling or mechanical damage should be repaired with a suitable repair mortar before applying any liquid membrane.

3. Reinforcing steel around spalled concrete areas should be exposed back to clean uncorroded steel with a wire brush to the extent that allows access to all surfaces of the steel. Suitably prepared reinforcing steel should be primed with ARDEX BR10 ZP zinc-based corrosion-inhibiting primer.

4. The concrete substrate surfaces to be coated must be clean, sound, and free from oil, grease, form release agents, bond breakers, and other contaminants. Loose or flaking paint must be removed or firmly bonded to the substrate. The concrete surface pores must be open to enable good adhesion.

5. Brick surfaces should be bagged or rendered or have the mortar joints flush with the surface before applying any façade membrane. This is required as mortar joints may shrink and crack over time.

PRIMING

After all damaged concrete and steel reinforcement has been removed and made good, prime the repaired areas with ARDEX BR10 ZP Anti-corrosive primer. Ensure the full circumference of the steel reinforcing bar is fully primed.

Apply ARDEX BR10 ZP Anti-corrosive primer with a paintbrush to the suitably prepared reinforcing steel and concrete, a thickness of approximately 2 mm.

PATCHING

The prepared substrate should be pre-soaked for 24 hours, but at least 2 hours before applying ARDEX BR 345. The surface should be mat-damp but without standing water. ARDEX BR 345 does not require priming on a properly prepared substrate. If priming is needed, the substrate should be primed using the following methods.

A slurry bond coat of 50% ARDEX BR 345 plus 50% ARDEX WR Prime should be made to a stiff, brushable consistency and applied to the dampened surface.

The ARDEX WR Prime/ARDEX BR345 slurry should be applied and worked into the substrate. Once the slurry coat has reached the initial cure, ARDEX BR 345 can be applied.
Do not let the bonding layer dry out completely. If the surface is too wet or too dry, the application of ARDEX BR 345 may be difficult.

Use approximately 3.0 - 3.3L water per 20 kg bag of ARDEX BR 345. Measure the appropriate amount of water into a clean, suitable-sized pail and then add approximately half to two-thirds of the powder to the water while mixing with a heavy-duty electric drill and spiral mixing paddle at slow-medium speed (approx. 400-600 rpm). Mix to wet out the powder fully; then, add the remaining powder, fully mixing to disperse the powder. Once the powder has been added, mix for approximately 2 to 3 minutes to homogenize fully. Let the mixed mortar sit for 1 – 2 minutes, then briefly remix the mortar before placement.

ARDEX BR 345 is to be applied onto the prepared, primed substrate. Ensure the patching mortar is applied whilst the priming layer is still wet (wet-on-wet). Apply using a trowel or by hand (wearing chemically resistant gloves). Ensure that the material is sufficiently forced and compacted into cracks and holes to fill all voids.

Note: The minimum application thickness is 10mm. If the repair mortar slumps, remove all ARDEX BR 345 and re-apply after re-priming the substrate, then apply the repair mortar at a reduced thickness.

Once the mortar has set, and the surface is hard enough, work can begin on the surface finish. The surface finish can be dense and smooth using a wooden or plastic float or coarse and sandy using a sponge to give the required effect.

FAIRING

The ARDEX BR345 Patching Mortar should dry for approximately 7 days before being overcoated with a façade coating. However, if the surface of the ARDEX BR345 patching mortar is coarser than the surrounding concrete, then ARDEX WR120FR render can be used as a fairing coat to provide a smoother finish.

Add approximately 3.0 to 3.5L of clean water to a bucket. Gradually add 20kg of ARDEX WR 120 FR to the water whilst mixing with an electric mixer to disperse the powder into a creamy, lump free consistency.

Apply the render with a steel trowel, evenly spreading the mix over the surface. A straight edge can be used to check for the level or flatness of the render.
After 10-30 minutes, depending on ambient and surface conditions, work can begin on the surface finish. To achieve the required effect, the surface finish can be made dense and smooth by using a wooden or plastic float or coarse and sandy by using a sponge.
The mixed material is useable for up to 30-40 minutes @ 23ºC and 50% relative humidity.

APPLICATION OF FAÇADE MEMBRANES

Note:

- Where damaged areas of the façade substrate have only been treated with ARDEX BR345 as a fairing coat, they should be allowed to dry for at least 7 days before overcoating with a façade membrane.
- Where the ARDEX BR345 patching repair mortar has been used with the ARDEX WR120 FR, the combination should dry for at least 14 days before overcoating with a façade membrane.

1. All façade substrates should be dry and have less than 5% moisture content before coating with a façade membrane. All façade surfaces to be coated shall be clean, sound, and free from oil, grease, form release agents or bond breakers, and other contaminants.
2. Façade substrates with existing coats should be high-pressure water-cleaned with a neutral detergent and thoroughly dry before overcoating with a façade membrane. Areas with loose or flaking paint must be removed to a firmly bonded substrate. Irregular surfaces resulting from peeled paint should be smoothed using ARDEX WR120 FR render.
3. Concrete surface pores must be open to enable good adhesion.
4. ARDEX WPM 310 or WPM 330 Façade membranes can be applied directly over hairline cracks less than 0.3mm in width. All other cracks should be treated with a neutral-cure silicone, such as ARDEX ST silicone, preferably after priming. Other deep surface imperfections should be repaired using ARDEX BR345 or ARDEX WR120 FR and allowed to cure for 7 days before applying the membrane.
5. Apply a primer coat of ARDEX WPM 270 solvent-based primer to all surfaces at a rate of 6m^2 per litre. Allow the primer to dry for at least 30 minutes before proceeding with ARDEX WPM 310 or ARDEX WPM 330 Facade. AAC (Hebel) or other highly porous surfaces may require two coats.
6. Apply ARDEX WPM 310 or ARDEX WPM 330 Façade with a nap roller, textured roller, or paintbrush. Ensure that the coating is applied evenly at the recommended coverage rates.

SURFACE FINISH OF FAÇADE MEMBRANES

Selecting the method of application can vary the surface finish achieved. Before the commencement of any project, it is recommended that a sample of the finish be prepared for approval and that the finish act as the standard.

	Roller Type

Surface Finish Profile	1st Coat	2nd Coat
High Texture	Medium Texture	Medium Texture
Medium Texture	Nap	Medium Texture
Low Texture	Medium Texture	Nap
Ripple Texture	Nap	Nap

The roller nap length will vary the texture profile, although the nap length must suit ***the substrate.***

A 12 – 15mm nap produces a low surface profile, while a 15 – 24mm nap produces a higher surface profile.

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