**BEST PRACTICE GUIDELINES FOR EXTERNAL WATERPROOFING MEMBRANES**

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### 1.0 Introduction

Increasingly, Building and Construction Industry are receiving complaints about failed and leaking basements, retaining walls, balconies and planter boxes. The Building Code requires constructions to safeguard occupants from illness or injury and protect a building from damage caused by surface water, external moisture entering a building, and internal moisture accumulating in a building. Concerns raised about roof, deck and balcony membranes, by building industry contractors and professionals nationally, has prompted Standards Australia to begin producing two new standards, where previously no contemporary and comprehensive standard existed. These are AS 4654.1 (Waterproofing membrane systems for exterior use) and AS 4654.2 (Waterproofing membrane systems for exterior use above ground level).

The aim of the completed standards is to produce a consistent and reliable approach to the materials used in the design and installation of external waterproofing. Industry research and experience has found that the design of roofs, decks, balconies and planter boxes contributes to many of the failures of waterproofing systems. By setting an industry standard for materials, design and installation, the failure rate of external membranes is expected to dramatically reduce.

### 2.0 Roof, Podium Slabs and Concrete Balcony Slabs

A number of significantly defective roof and podium slabs have been brought to attention. These include: delamination of tiles from the membrane to which they were adhered; dissolution of the membrane which results in water penetration; breaks or tears in membranes and/or tiles caused by thermal or footing movement; and inadvertent penetration of the membrane after it has been applied (e.g. by the fixing of balustrade posts).

#### 2.1 Design

Slabs should be laid with falls to drainage points. A minimum fall of between 1:80 and 1:100 is recommended for slabs in sheltered locations and falls of between 1:60 and 1:80 for slabs in exposed locations. This may vary however, dependant upon: the exposure conditions of the slab; the catchment area of the podium, balcony or roof falling to each drainage point; and the type of membrane being used.

Contractors should avoid penetrating slabs wherever possible, but where penetrations are essential they must be properly sleeved and waterproofed with flanged sleeves and collars.

Balustrade posts should be fixed to the face of the wall if possible (Figure 1). Where penetrations for balustrades are unavoidable, posts should be cored into the slab and the membrane turned up the post to at least 25 mm above the surface level of any finishes. The turned up membrane can then be concealed and protected from UV rays and mechanical damage by cover plates.

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**Fig. 1: Ballustrade post support detail**

It is, however, often impractical to face fix or core balustrades into the slab and a baseplate system of fixing is required. In these instances an initial layer of membrane should be applied under the area of the baseplate and a second layer of membrane should later be installed over the baseplate and turned up the post to at least 25 mm above the surface level of any finishes. The turned up membrane can then be sealed with a cover plate. When the membrane is laid over a baseplate, any fixings should be countersunk.

Another aspect of design that is critical to the end performance of the waterproofing system is the detailing of the membrane at its perimeter, e.g. the detailing at its junction with any parapet wall, hob, building envelope and under any door and window sills.

The detailing of membrane to parapet wall junctions (Fig. 2) can be successfully achieved in a number of ways.

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**Fig. 2: Upstand/parapet protection**
Commonly they are capped by metal flashings. Best practice procedures dictate that these cappings should be sloped or fall to shed water and should be side fixed rather than fixed through the top of the flashing. It is also important that the membrane is turned up the wall and preferably terminated behind the flashing.

For higher parapet walls, the membrane and capping may not overlap, however, in these situations the membrane should terminate in a rebate or reglet and be appropriately sealed and capped to prevent moisture penetrating behind the membrane.

Membranes should extend fully over any perimeter hob and be dressed down its external face, fixed into a rebate or reglet, and finished with a sealed finishing strip.

Detailing at external wall and floor junctions and under door sills are common areas where leaks occur. Although specific detailing will be influenced by the type of membrane to be installed, there are some key design concepts that should be incorporated irrespective of the type of membrane used (Figure 3). In addition to considering these best practice concepts it is important to follow the manufacturer’s instructions specific to the system being installed.

2.2 Membrane Selection
A large number of proprietary acrylic, bituminous and rubber-based waterproofing membranes are available for use on both trafficable and non-trafficable roof and podium slabs. Their ability to accept directly adhered floor tiles varies. Some modified bitumen and acrylic membranes are manufactured to accept tiling. Others require very specific steps to be followed to ensure the tiles adhere firmly to the membrane. Irrespective of which type of membrane is used, it is essential that the manufacturer’s installation instructions are stringently followed. A number of membrane manufacturers have worked with tile adhesive manufacturers to develop complete waterproofing and tile installation systems.

When selecting a membrane it is essential to consider a number of relevant factors including:

- Whether the membrane will be exposed to weather or protected by subsequently applied floor finishes
- The type of floor finishes and adhesives that will be applied
- The exposure conditions of the membrane (e.g. coastal or other aggressive environments)
- Anticipated substrate movement
- Ambient weather conditions (some membranes must be applied within specific temperature and humidity ranges)
- The durability of the membrane
- Ongoing maintenance requirements
- Availability of specialist contractors to apply certain systems
- Ease of application
- Re-coating time and time before subsequent finishes can be applied
- The moisture content of the substrate.
- Cost

2.3 Installation
Prior to installing any membrane system it is essential that the substrate to which it is being applied is appropriately prepared (Figure 4). Concrete must be appropriately cured for the type of membrane being applied and any debris, curing compound, oil, grease, dust and loose material should be removed.
Waterproof membranes rely on a complete system to ensure that the waterproofing of the roof or podium slab is not compromised. It is essential that the manufacturer’s instructions are meticulously followed and that:

- Any depressions, joints or cracks are filled and sealed as required
- Any required reinforcing tape or bond breaker is applied to joints and cracks
- Any necessary suitable primer is applied (Figure 5)
- Specified coverage thickness is maintained for liquid applied membrane
- Re-coating times are adhered as per specification
- For preformed membrane, rolled out and align the membrane over the primed surface (Figure 6)
- Torch on the membrane under side with acetylene gas to softening point (Figure 7) and press hard on to the surface
- Keep overlap for minimum 100 mm (Figure 8)
- Finishing the joints with slight torching (Figure 9)
- Finishing up to parapet and seal the edges with polysulphied sealant (Figure 10)
- The application of screeds or other finishes is not undertaken until the membrane has sufficiently cured
- Membranes are appropriately protected from damage until floor finishes are installed (Figure 11)
3.0 BASEMENTS AND RETAINING WALLS

Rectification of basement leaks is a particularly difficult and expensive task. The leak may be well underground, access around the building may not be possible, the perimeter of the building may be surrounded with pavements and landscaping and the basement may be fitted out for offices or other tenancies. Proper thought, good design, good installation practices and stringent supervision of the installation of waterproof membrane systems is essential to avoid these problems. An ideal basement detailing is given in Figure 12.

Traditional way of Basement waterproofing of SHAHBAD stone should be avoided because the joints of these stones need to be grouted properly otherwise leakage may occur through these joints. Also it is a labour intensive work for which it requires more time for installation.

Waterproofing membrane such as bituminous, polymer modified bituminous of APP (Atactic Poly Propylene) and SBS (Styrene Butadine Styrene), PVC, HDPE and EPDM are generally used for basements. Since APP membrane is torch applied, it requires more skilled labour and a protective screed to avoid any damages to the membrane. SBS is cold applied by simply sticking with a paste. But it is not suitable for high water table. It also requires a screed for protection. HDPE is the best material for waterproofing in high water table which is applied as loose lay. HDPE is also used on blind face of retaining wall. Bentonite is used for confined area of basement.

The primary components of any basement or retaining wall membrane system include:

- The structural wall
- The waterproof membrane
- Protection of the membrane
- Drainage behind the wall, and
- Drainage at or near ground level

In order to avoid some common causes of basement leaks it is recommended contractors pay particular attention to the following:

- Ensure that a continuous membrane system is installed under the slab and on the walls. If a different membrane is used under the slab and on the walls it is essential that a durable waterproof joint is provided at the junction of the two systems and that the two membranes are compatible.
- Ensure that the external wall to floor junction is appropriately designed, constructed and waterproofed.
- Ensure membrane selection is appropriate and that coverage is complete and of the required thickness. Use a vapour proof as well as a moisture proof membrane where the basement is used as a habitable space or for storage of sensitive equipment etc.
- Use a membrane that is able to resist aggressive chemicals or salts that may be present in the soil and is able to resist anticipated hydrostatic pressure.
- Follow membrane manufacturer’s instructions exactly, including issues like re-coating times.
- Adequately prepare the substrate prior to application of the membrane, including ensuring any concrete is appropriately cured.
- Apply the membrane with the specified coverage and thickness.
- Ensure that joints and penetrations are adequately sealed.
- Ensure the membrane is able to resist anticipated thermal movement, soil movement or building settlement.
- Install appropriate sub-soil and surface drainage systems.
- Avoid difficult joints and awkward shapes in basement design that complicate the application of the membrane and have the potential to introduce ‘weak points’ in the system.
- Adequately protect the membrane to prevent it from being damaged by construction activities or backfilling.

4.0 PLANTER BOXES

Many of the principles discussed earlier also apply to planter boxes. However, planter boxes do have some additional specific requirements. An ideal plant box detailing is given in Figure 13.

The most significant of these is the necessity for adequate drainage. Planter boxes must have a graded base to the drainage outlet and the drainage system must prevent the water level from rising above the overflow level of the membrane. A filtered drainage riser must also be provided to relieve hydrostatic pressure, to provide access for cleaning, and as an emergency overflow in the case of excessive rain.

The membrane must be extended up the sides of the planter box to a minimum height of 100 mm above the soil level and must be protected with a drainage cell wrapped in geo-textile fabric or a similar suitable material.

A filtered drainage riser must also be provided to relieve hydrostatic pressure, to provide access for cleaning, and as an emergency overflow in the case of excessive rain.

Care must be taken when selecting the type of plants to be grown in planter boxes. Those with aggressive root systems that may damage the membrane or clog the drainage system should be avoided. Trees or shrubs that grow and cause damage to the planter if they are blown over.

Finally, planter boxes require regular inspection and maintenance, perhaps more than any other membrane system. Building owners or their maintenance contractors need to regularly inspect and identify any damage or degradation caused by people, birds and other wildlife, pests, plant roots or general wear and tear. Prompt repair and maintenance should be undertaken based upon these inspections.

5.0 Roof Garden

Roof garden can be used for landscaping as well as vegetative roofing which is part of latest green roofing movement. But the waterproofing of the roof is more critical issue. An ideal detailing of waterproofing of roof garden is given in Figure 14.

Intensive green roofs utilize a wide variety of plant species that may include trees and shrubs which require deeper substrate layers (usually > 10 cm), and also require thicker membrane for waterproofing. In contrast, extensive roofs are limited to herbs, grasses, mosses, can be sustained in a shallow substrate layer (<10 cm), require minimal maintenance, and a standard membrane. But the membrane should be non root penetrating one. Like planter box here the most significant issue is drainage. After installing the membrane a drainage board has to be installed over which a separation sheet of chip stand of geotextile mat of 225 GSM over the extruded polystyrene foam has to be provided. But the system requires periodical maintenance.