PREVENTING WATERPROOFING DEFECTS

External Waterproofing
 Waterproofing membranes (external), i.e. Decks, Balconies, Rooftops, Podiums is historically one of the Top 10 Defects reported to QBCC.

 Generally, one third of all waterproofing defects reported are related to external waterproofing.

 Rectification of defective waterproofing incurs significant costs of repair of the defects and consequential damage.

 EXAMPLE:
Nautilus Apartments, Auckland
Nautilus Apartments, Auckland

- 12 Level mixed use building with 150 Apartments
- Completed: 2004
- Construction cost: $35 million
- Waterproofing contract (est.): $500k - $600k
- Remediation cost awarded: $22 million
- Liability: Building Surveyor Auckland City Council)
National Construction Code

NCC 2016 is valid and current until 2019
National Construction Code

Performance

FP1.2 (P2.2.1) Requirements
(b) Surface water, resulting from a storm having an average recurrence interval of 100 years must not enter the building.

AND

FP1.4 (P2.2.2)
A roof and external wall (including openings around windows and doors) must prevent the penetration of water that could cause—
(a) unhealthy or dangerous conditions, or loss of amenity for occupants; and
(b) undue dampness or deterioration of building elements.
National Construction Code

Deemed to Satisfy Provisions

External above ground membranes

Waterproofing membranes for external above ground use must comply with AS 4654 Parts 1 and 2.

- Part 1 – Materials
- Part 2 – Design and Installation
Defect?

Efflorescence has a negative impact on slip resistance

Waterproofing or Tiling defect?
How do we prevent waterproofing defects?

- Design (compatibility chain)
- Specification (compatibility & installation)
- Membrane Application (thickness and detailing)
- Adherence to specifications and standards
- Maintenance (other contractors)
- Common sense
DESIGN

- Designed as appropriate for the intended installation (Information and Detail drawings AS 4654.2 – 2012)

Prevention of Damage

- Abrasion
- UV exposure
- Plant roots
- Overlay materials
- Birds and pests
- Differential movement
- Moisture (including negative pressure)
The design must take **movement** into account

AS 4654.2 - 2012

2.3 Movement

The design and installation of a waterproofing membrane system shall be Class I, Class II or Class III movement in accordance with AS 4654.1.
Movement may occur from:

- Deflection before, during and after installation
- Shrinkage and creep of materials after installation
- Movement due to temperature variation
- Movement due to moisture variation
- Movement at joints
- Movement at transitions
- A combination of the above

Stresses are increased when tiles are installed.
Specification

The selected products must be appropriate for the selected application

- Tiled Rooftop, Balcony or Deck
- Exposed Membrane (Heavy Traffic – Maintenance only)
- Render
- Green Roof
- Planter Box

The installation of the membrane system is generally identical for all of the above. However, the product specification changes
Specification

Compatibility

- Substrate – Primer
- Primer – Membrane
- Membrane – Tile adhesive
- Tile adhesive - Tile

The entire system must also be capable of accommodating the expected movement.
Membrane Classification

- Class I membrane: < 60% elongation
- Class II membrane: 60 – 299% elongation
- Class III membrane: > 300% elongation
Elongation

The ability of a waterproofing membrane of the **correct thickness** to stretch without breaking, where it is not bonded to the substrate

The classification of the membrane determines how to design the bond breakers at critical junctions

The bond breaker design for each class of membrane allows for around 5mm of movement without detrimental effects.

Membrane classification should not be used as the primary factor in choosing the waterproofing membrane.
Movement
Bond Breakers / Fillet

AS 4654.2 – 2012 Clause 2.7 Fillets

- 40mm x 40mm fillets/coves required for sheet membranes at any horizontal to vertical transition or vertical to vertical transition.

- 15mm x 15mm bond breaker required for liquid membranes at any horizontal to vertical transition or vertical to vertical transition.
Drainage Design

AS 4654.2 – 2012 Clause 2.10 Drains

- The membrane shall be connected to the stormwater drainage system through a downturn of the membrane into the inlet of the system.
- An alternative connection may have a flange to which the membrane is clamped or attached.
- Allow for sub-surface drainage at the membrane level

- Exterior compressed fibro floors must drain to the outside edge of the deck or balcony.
- Fibro floors must not drain to a floor waste.
2.5 Substrate

The substrate material in contact with the waterproofing shall be suitable for and compatible with the waterproofing membrane system.

**Particleboard sheeting shall not be used as a substrate for external waterproofing systems.**

The substrate shall be resistant to moisture damage caused by condensation forming on the underside.
Deck, Balcony and roof substrates

- Concrete
- Compressed Fibre cement
- Scyon
- Durafloor
- Inex
FALLS

AS 4654.2 – 2012 Clause 2.5.2 Falls

- Falls in finishes shall ensure that water drains to the drainage outlet.

- Water shall not be retained on the finished surface with the exception of residual water remaining due to surface tension.

- Falls for surface drainage should be no flatter than 1:100

- The fall shall be in the structural substrate, or formed by a screed over the structural substrate.
Solution?

- Primary Membrane in accordance with the contract
- Un-bonded screed
- Secondary Membrane
- Ceramic tiles
Proper Solution

- Secondary Membrane in accordance with the contract
- Bonded Screed or double layer slip sheet
- Screed Reinforcing
- Movement control joints in screed
- Primary Membrane
- Ceramic tiles installed with compatible tile adhesive
Concrete Substrates

AS 4654.2 – 2012 Clause 2.5.3.1 Fully bonded or liquid applied

- The preparation of the substrate or fully bonded or liquid-applied membranes shall result in the surface of the substrate being smooth, without protrusions, voids or formwork distortions, and clean, dry, and free from dust and contamination.

- To aid in adhesion on a concrete or screeded surface, the smoothness of substrate should be at least the equivalent to that of a wood float or light broom finish.
Concrete Substrates

Concrete Surface Profile (CSP) Scale

International Concrete Repair Institute (ICRI)

CSP1 - Acid Etched
CSP2 - Grinding
CSP3 - Light Shot Blast
Liquid Applied Membranes
CSP 1 - 2

Sheet Applied Membranes
CSP 2 - 6
Staggered Sheet Layout: Mortar Bed

Butt joint
See Figure 9

Sheet control joint,
see figure 19

Sheet control joints at 4.1m max. centres
(Tile mortar bed control joints 4.5x4.5m)

FIGURE 18 STAGGERED SHEET LAYOUT
This method relies on applying a waterproof system, dual layer of slip sheet, 40mm minimum reinforced mortar bed, additional waterproof system and tiles.
Continuous bead of sealant

Incorporate in the adhesive 10mm wide drainage slots at 200mm centres to allow membrane to drain

Waterproof membrane carried down face of sheet

Recommended 40 min. 60 max.

NOTE: Edge tile may require mechanical fixing in addition to adhesive fixing.

12 x 12mm aluminium angle drip mould with continuous bead of sealant

FIGURE 21 METHOD 2 - DECK EDGE DETAIL USING TILE
Scyon Installation Guide 2016

Squared Sheet Layout: Tiled Direct

FIGURE 12 SQUARED SHEET LAYOUT

Tongue and Groove joints, see figure 15

Floor joists

4.2m tile control joint, see figure 14

Sheet and tile control joints at 2.7m max. centres and at all square sheet edges, see figure 13
FIGURE 13
STAGGERED SHEET LAYOUT

Do not direct stick tiles to this layout
To be used with floating mortar bed only

Minimum fall 1:100

Control joints at 4.5m max along the length and 4.2m along the width and where structural joints are positioned
FIGURE 14
SQUARED SHEET LAYOUT

Sheet Control Joint
Tile joint to coincide with sheet control joint

Tile control joint is at 3.6m max
To be positioned over tongue and groove joint and where structural joints are positioned

MINIMUM FALL 1:100
WATERPROOF WITHOUT MORTAR BED

- Square sheet layout – refer Fig 20 (max deck width 3600mm)
- Suitable for tiling (control joints required 2400 – 3600mm in either direction)
- Applied liquid membrane
- Not suitable above a habitable room or living space
Not suitable above a habitable room or living space
WATERPROOF WITH MORTAR BED

- Staggered sheet layout – refer Fig 21
- Suitable for large decks
- Suitable for tiling
- Minimum requirement over a habitable room or living space
- Achieved via sheet and/or applied membranes plus slipper sheet and floating reinforced mortar bed
Minimum requirement over a habitable room or living space
Membrane Application

Membrane Thickness

posiTector®

233 microns

200
# Detailing of membranes

## Membrane Terminations

Termination heights

## TABLE A1

**VERTICAL UPWARD TERMINATION HEIGHTS**

<table>
<thead>
<tr>
<th>Wind class Regions A and B (non-cyclonic) AS 4055</th>
<th>Wind class Regions C and D (cyclonic) AS 4055</th>
<th>Ultimate limit state wind speed ($V_{h,u}$) AS/NZS 1170.2</th>
<th>Termination height mm</th>
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<tbody>
<tr>
<td>N1</td>
<td>—</td>
<td>34</td>
<td>40</td>
</tr>
<tr>
<td>N2</td>
<td>—</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>N3</td>
<td>C1</td>
<td>50</td>
<td>70</td>
</tr>
<tr>
<td>N4</td>
<td>C2</td>
<td>61</td>
<td>100</td>
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<td>N5</td>
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<td>150</td>
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<tr>
<td>N6</td>
<td>C4</td>
<td>86</td>
<td>180</td>
</tr>
</tbody>
</table>

AS 4654.2 – 2012 Appendix A
2.8.1 Upward terminations

Where the membrane is to prevent water entry, the finished height of the membrane above the finished surface level shall be sufficient to prevent water, including wind driven, flowing over the top of the membrane.

NOTE: For details, see Clause 2.5.2.

DIMENSIONS IN MILLIMETRES

FIGURE 2.2 TYPICAL VERTICAL UPWARD TERMINATION—DETAIL OF OVER-FLASHING FOR LIQUID OR FULLY BONDED SHEET MEMBRANES.
2.8.2 Downward Terminations

For balconies with a fully bonded membrane, the membrane may be terminated at the drip groove.
Continuous bead of sealant

Incorporate in the adhesive 10mm wide drainage slots at 200mm centres to allow membrane to drain

Recommended 40 min. 60 max.

NOTE: Edge tile may require mechanical fixing in addition to adhesive fixing.

Waterproof membrane carried down face of sheet

12 x 12mm aluminium angle drip mould with continuous bead of sealant

FIGURE 21 METHOD 2 - DECK EDGE DETAIL USING TILE
Doors onto external waterproofed areas

FIGURE 2.8 (in part) TYPICAL DETAILS OF MEMBRANE TERMINATION AT EXTERNAL OPENING DOORS

NOTES:
1. No sub-sill is installed.
2. Seal between sill/packer and membrane before drilling fixing holes.

(c) Option 3 Sill—No sub-sill

NOTE: For falls, see Clause 2.5.2.
NOTE: For falls, see Clause 2.5.2.

(a) Option 1 Opening higher than sill upward termination

FIGURE 2.8 (in part) TYPICAL DETAILS OF MEMBRANE TERMINATION AT EXTERNAL OPENING DOORS
Doors without step up

FIGURE 2.9 TYPICAL DETAILS OF MEMBRANE TERMINATION AT WALL OPENINGS WHERE THE INTERNAL AND EXTERNAL FINISHED FLOOR LEVELS DO NOT ALLOW FOR AN UPTURN

AS 4654.2 – 2012
Adherence to Specifications and Standards
AS 4654.2 – 2012 2.13 PLANTER BOXES

The membrane shall be sealed to the drainage outlet. It shall extend vertically to a height of 100 mm above the soil or fill level.

Falls in the base of the planter shall be in accordance with Clause 2.5.2.

NOTES:

- The planter box should be provided with a suitable overflow.
- Protection boards should be provided to minimize root damage to the waterproofing membrane. The suitability of the plants to be installed should be considered, as certain rooting systems are aggressive and may penetrate the membrane.
- Mulch should be considered when determining the soil fill level.
- Externally exposed walls of planter boxes should be waterproofed to prevent failure of the internal planter box membrane.
- A typical example of waterproofing inside a planter box is shown in Figure 2.17.
Bonded Systems

- Where the topping or bedding mortar is to be bonded to the membrane, sufficient movement joints shall be provided in the topping or bedding mortar to accommodate the movement over the membrane.

- Ideally movement joints of a minimum width of 10mm are installed at 4.5 m intervals in any direction.

- Note: Movement joints need to carry through the tile installation
AS 4654.2 2012

Un-bonded or partially bonded systems

- Where the topping or bedding mortar is structurally sufficient not to require bonding to the substrate, a double slip sheet shall be laid over the membrane to separate it from the screed.

- A structural un-bonded screed should be a minimum thickness of 50mm with lightweight mesh reinforcing.

- In some instances, additional movement joints may be required in the bonded or un-bonded finish.
On completion of the installation of the membrane system, inspection and/or acceptance testing shall be conducted.

A visual inspection should be conducted and/or one of the following test procedures undertaken.

1. For a liquid membrane system, the dry film thickness to be conducted by non-destructive means

2. A controlled water test to be conducted for a minimum duration of 24 hrs
Maintenance

- Exposed (maintenance programme)
- Non-Exposed
- Other contractors
Allow the membrane to cure
Successful waterproofing systems rely on:

- Design (compatibility chain)
- Specification (compatibility & installation)
- Membrane Application
- Adherence to specifications and standards
- Maintenance (other contractors)
- Common sense
Thank You

Questions?