

# INSTALLATION CHALLENGES AND SOLUTIONS: EXTERIOR DECKS AND BALCONIES

**Note:** The recommendations within this document are common industry standards and Custom Building Products' requirements. Additional limitations or specific recommendations may be listed within the Technical Data Sheets of products used in an installation assembly. When those instructions conflict with this document, the most stringent requirements and limitations shall apply.\*

Using manufactured tile or natural stone tile on exterior decks and balconies not only creates a beautiful design feature for your project but provides a durable and long lasting surface that's easy to maintain!

To specify and install a long lasting and trouble-free assembly, design considerations must address potential site conditions and typical substrate requirements along with the building's usage to make correct product and design choices. Please consider some of the installation challenges and solutions below.

## **Installation Challenges:**

Water evacuation from horizontal surfaces is always the key factor in exterior designs. The faster and more effectively water drains from a tiled surface, the less risk of detrimental freeze-thaw effects and unwanted mineral growth (efflorescence). Note that efflorescence of soluble salts in concrete, mortars and grouts that discolor tile assemblies is not only unpleasing to a project's aesthetics, these mineral growths can be expansive and lead to tile delamination. To be successful at water evacuation, multiple planes in the assembly have to be properly pitched meeting the required  $\geq 1/4$ " per linear ft slope.



Starting at the substrate, not only does its plane need to direct water to drains or away from the structure, it needs to be consistently flat without low areas commonly referred to as "birdbaths". Specifications for flatness should call out that variation from the plane is to be  $\leq 1/8$ " in 10' and  $\leq 1/16$ " per 24" while considering AHJ and ADA requirements.

The next plane that is required to be properly pitched and flat as the substrate is the water-proofing membrane. For whichever membrane is chosen, one of the most overlooked elements in these tiled designs is the relation of the waterproofing membrane to the elevation required for the assembly.

The choice of the membrane composition determines the required components of the assembly and suitability for direct bonding = thickness/elevation. (Although uncoupling membranes are commonly specified, their divots may slow water evacuation.)

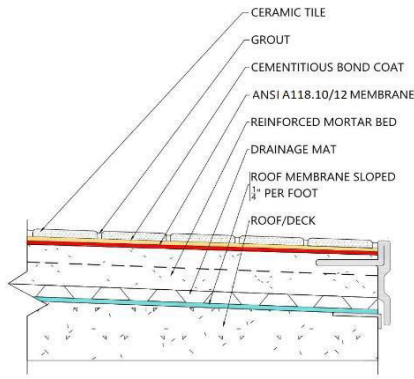
Consider the following design details and examples that follow.



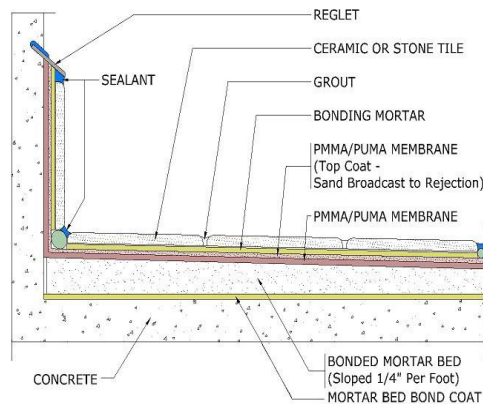
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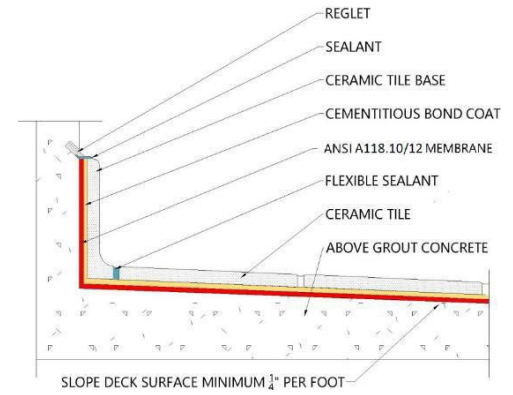
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1. Non-bonded - Roofing Membrane



2. Bonded - PMMA/PUMA Membrane



3. Bonded - ANSI A118.10/A118.12 Membrane

**Detail 1.** - Asphaltic-based roofing membranes require using mortar beds  $\geq 1\frac{1}{4}$ " or other toppings  $\geq 2$ "-4" in non-bonded systems. Substrate can also be pitched wood framing and plywood. A cleavage membrane may be substituted for the drainage mat.

**Detail 2.** - Polymethyl methacrylate (PMMA) and polyurethane methacrylate (PUMA) systems can incorporate a two-coat system with a sand broadcast to rejection for adhesive mortars to bond to the sand.

**Detail 3.** - ANSI A118.10 membranes can be bonded to directly with adhesive mortars, most on both horizontal and vertical exterior surfaces and some are recommended for over occupied living space. Although tile can be bonded directly to an exterior concrete slab, the use of a waterproofing membrane helps protect steel reinforcement as well as providing elongation and protection against tile cracking. When applying a waterproofing membrane, it must also be installed without excessive buildup so as not to restrict water flow. Placement of the membrane with flashing and counterflashing at changes of plane must accommodate rain and snow.

The flatness of the finished plane of the tile surface can also make a big difference in the effectiveness of water drainage.



Consider that tile or stone formats when installed in patterns that are offset, in Versailles or basketweaves may slow water flow by trapping water in the grout joints. Water then percolates downward into the mortar and the underlying substrate potentially creating salt migration and free/thaw degradation. Clefled tile or stone may also collect water flow from the assembly. Increasing the overall pitch may be required in these designs. The choice of drain configurations is also a factor especially with large format tiles. Linear drains are much more effective and athletically pleasing than small or round drains to pitch the entire tiled surface.



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Installations on-ground and above ground can be installed similarly in many aspects but have their own distinct challenges. In both cases, methods over concrete can be specified as direct bonded or non-bonded using wire-reinforced mortar beds. Over wood framing and plywood, the assembly should always be a non-bonded method with a roofing membrane protecting the wood. For suspended, above ground installations, anticipated deflection must be considered, especially on cantilevered balconies or wide-spanned decks. Accommodation using movement joints and crack isolation membranes provides options proven to be effective. On grade assemblies are very dependent on having a stable ground base with adequate drainage to prevent settling and heaving as seen in many sidewalks.

All building materials expand or contract to some degree due to thermal changes. So regardless of the climate conditions of the project's location, the effects from sun, rain, snow, cold and heat must be considered in design for every tile installation. When areas experience a large temperature differences (>100°F / >37.77°C) with the change of seasons, even greater attention to design and product choice is needed. In areas that experience heavy winds, local codes may restrict non-bonded assemblies if uplift could cause damage to the system. Again, a reminder of confirming the compatibility of the waterproofing membrane and required elevations.

### **Addressing Challenges - Specification**

All the above "challenges" should be considered and detailed in the project specification as precautions for addressing on-ground concrete assemblies. The slab must have an intact vapor retarder, enough reinforcement, proper drainage and irrigation that will not impact the tile assembly. Well-placed concrete control and expansion joints around columns and in rectangular sections can help prevent out of plane cracking and heaving. For above grade installations, consider the benefits of gutters and drains vs directing water over a balcony using drip edges alone to avoid the potential risk of efflorescence and staining. Sealant treatment at railing bases and other penetrations of the primary membrane require watertight connections and therefore must be properly installed and detailed especially if attachments or penetrations occur after the tile is installed.

Aside from confirming a tile or natural stone's suitability for exterior applications, every tile's coefficient of thermal expansion rate must be accounted for in the project's design. Using this valuable information, movement joint widths and frequencies can be plotted to accommodate thermal expansion and shock. *Refer to the current Tile Council of North America's Handbook Section- Movement Joints for guidelines and formula calculations. Exterior applications require minimum 3/8" (10mm) wide joints placed in frequencies at a minimum of -8'-12' (2.4m -3.65m).* Joint widths are based on using Class 25 ASTM C920 sealants which elongate or compress at a +/- 25% rate while requiring a minimum hardness. **Important Note: inadequate movement joint treatment is the number one cause of failure in exterior tile applications.**

The choice of the waterproofing membrane matters greatly in the success of the tile assembly system to protect the structure and assembly! The closer it is placed to the tile underside, the fewer components in the system are saturated with water and can effloresce minerals. Consider these benefits in using multiple membranes when using a non-bonded system with the primary membrane protecting the structure and the secondary membrane above the mortar bed. Adequate movement joints with sealant or pre-formed joint profiles for movement are to be specified along with these membranes to relieve thermal expansion and contraction stresses. Additionally, most ANSI A118.10 membranes provide crack isolation protection  $\geq 1/8"$  (3mm).

Mortars that meet ANSI A118.15 for high performance are best to adhere Porcelain and natural stone in a demanding exterior environment. Most of these mortars are rated for deformability (flexibility) with S1 or S2 high performance ratings and aid with managing movement from deflection and thermal changes. Rapid setting/curing adhesive mortars use different cement compositions that have much less potential for efflorescence. Additional benefits are curing faster in cool conditions or where there is potential rain or snow. Installation methods using these mortars should be specified to meet ANSI A108.5 which covers the broad range of best practices. To achieve the required mortar coverage of  $\geq 95\%$ , the proper troweling technique is well described in the National Tile Contractors Association's video [Trowel & Error](#). (Also available in [Spanish](#) and [Russian](#)).



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**Important Note:** Excessive voids in adhesive mortar applications lead to water intrusion potentially causing expansion in both hot and cold environments. And after a few cycles, eventual bond loss. Flat back troweling tiles in exterior applications is always best practice.

Cement grout specifications should call out ANSI A118.7 performance. These grouts have higher physical strengths and lower absorption rates than standard grouts. Most are fast setting and/or rapid curing and based on their composition can greatly reduce efflorescence.

To improve the ease of maintenance, consider sealers that penetrate the surface of natural stones and grout, reducing water absorption and traffic staining. There are sealers that accomplish this without changing the appearance of the finish or that enhance the color of a natural stone.

Due to the complexities of exterior applications, involve your installation material representatives early in the project for specification review, product selection and warranty provision discussions, mockup evaluations and at the project startup.

For best results on your project, specify the use of a qualified installation company as described below.

A. Installer Qualifications:

- 1) Company specializing in performing the work of this section with minimum five years documented experience.
- 3) Installer shall be a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
- 4) Installer's on-site supervisor shall hold the International Masonry Institute's Foreman Certification.
- 5) Installer shall employ Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.
- 6) Installer employs at least one installer for Project that has completed the Advanced Certification for Tile Installers (ACT) certification for installation of **[mud floors] [mud walls] [membranes] [shower receptors] [gauged porcelain tile/gauged porcelain tile panels and slabs] [and] [large format tile]**.

### **Product Selection\***

CUSTOM® products have been successfully used in specifications for millions of tiles and have lasted for decades. Please consider these options for your project.

√ **Products to specify that will reduce or not contribute to efflorescence. Include a membrane along with other products marked below:**

**Crack Isolation and/or Waterproofing** (Primary or secondary membrane over concrete/occupied space)

√ [RedGard® Waterproofing and Crack Prevention Membrane](#)

√ [JAMO WATERPROOF - Waterproofing Membrane](#)

#### **Adhesive Mortars**

√ [MegaLite® Rapid Setting Crack Prevention Mortar](#) (650-725 psi bond strength to Porcelain tile)

√ [ProLite® Rapid Setting Tile & Stone Mortar](#) (400-500 psi bond strength to Porcelain tile)

[MegaLite® Crack Prevention Mortar](#) (650-725 psi bond strength to Porcelain tile)

[ProLite® Tile & Stone Mortar](#) (400-500 psi bond strength to Porcelain tile)

√ **Mortar Beds** (Will not contribute to efflorescence when encapsulated by CUSTOM or JAMO Waterproofing Membrane)

[Thick Bed Bedding Mortar](#) gauged with [Thin-Set & Mortar Admix](#)

[JAMO Floor Mud](#) gauged with [JAMO StarSet 1000](#)



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**Grout**

√ [Prism® Ultimate Performance® Grout](#)

**Sealant**

√ [CUSTOM® Commercial 100% Silicone Sealant](#)

**Sealers**

√ [Aqua Mix® Sealer's Choice® Gold – Rapid Cure Formula](#)

√ [Aqua Mix® Penetrating Sealer](#)

CUSTOM® Limited Installation System Warranties are available for assemblies using these products covering labor and material replacement.

**Note:** Project conditions will vary and may affect product recommendations. Consult individual product Technical Data Sheets for specific recommendations and limitations regarding project conditions. Assembly mockups can determine suitability for these conditions on specific projects. For project specification review, onsite technical assistance, product, specification & warranty details contact CUSTOM Architectural Services or Technical Support at (800) 282-8786 [Custom Building Products - Contact us](#)

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