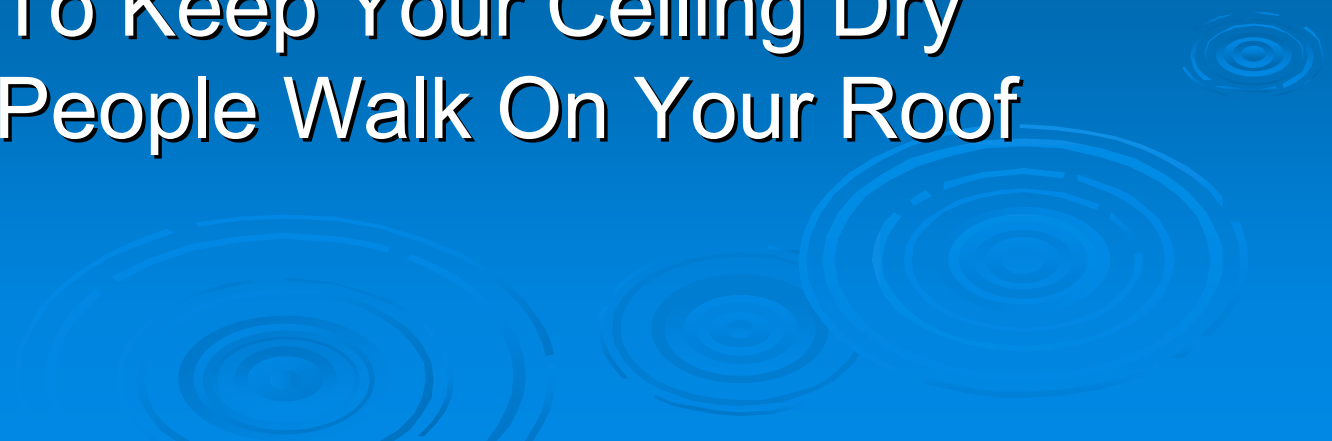


Waterproof Rooftop Balconies & Decks

Or

How To Keep Your Ceiling Dry
When People Walk On Your Roof



Overarching Concerns That Apply to All Walkable Decks Over Roofs

- Structure must be strong enough to support the load.
- Proper guardrails that don't interfere with the waterproofing system.
- “Flat” roofs must slope **at least** $\frac{1}{4}$ ” per foot. No exceptions.
- Waterproof and have good drainage.

Structure Must Be Strong Enough To Support The Load

- This sounds obvious. But if the walkable deck is a retrofit, it won't be strong enough to provide proper support for the additional loads.
- Truss-framed roofs in particular will not have been designed to support further loads and will be very difficult to beef up.

Proper Guardrails

- **GUARD.** A building component or a system of building components located near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to the lower level.

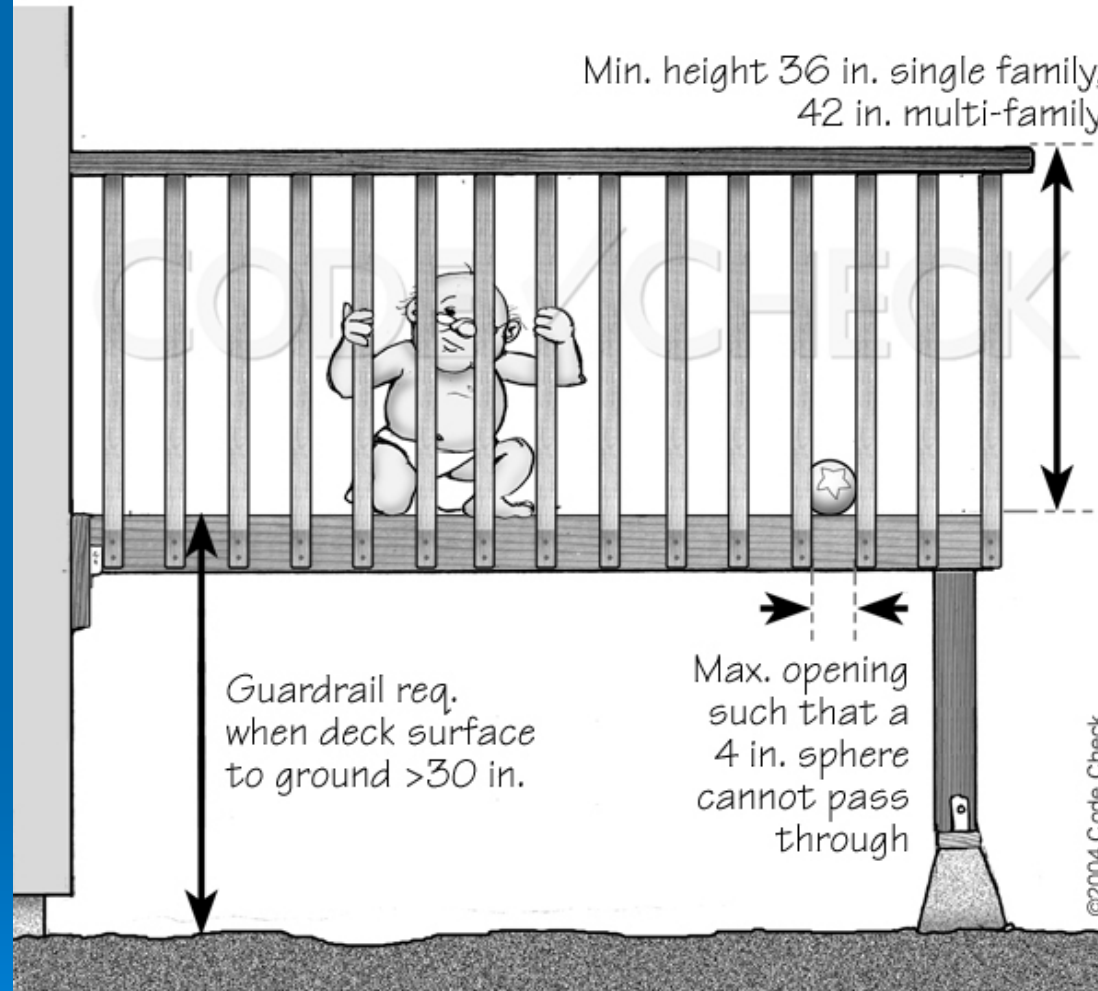


Guard Rules Are The Same For All Elevated Standing Surfaces.

- A deck more than 30" above the floor or grade below requires a guard.
- The top of the guard must be at least 36" above the standing surface.
- The guard must support a 200# load in any direction along its top edge without deflecting more than $1/240^{\text{th}}$ of the span.
- The infill area must support a 50# lateral load spread out over any 1 sq ft area without deflecting more than $1/240^{\text{th}}$ of the span.
- The infill area must be small enough to prevent a 4" sphere from passing through it.

Guardrails

Min. height 36 in. single family,
42 in. multi-family



Glazed Guards

New Rules as of 2008

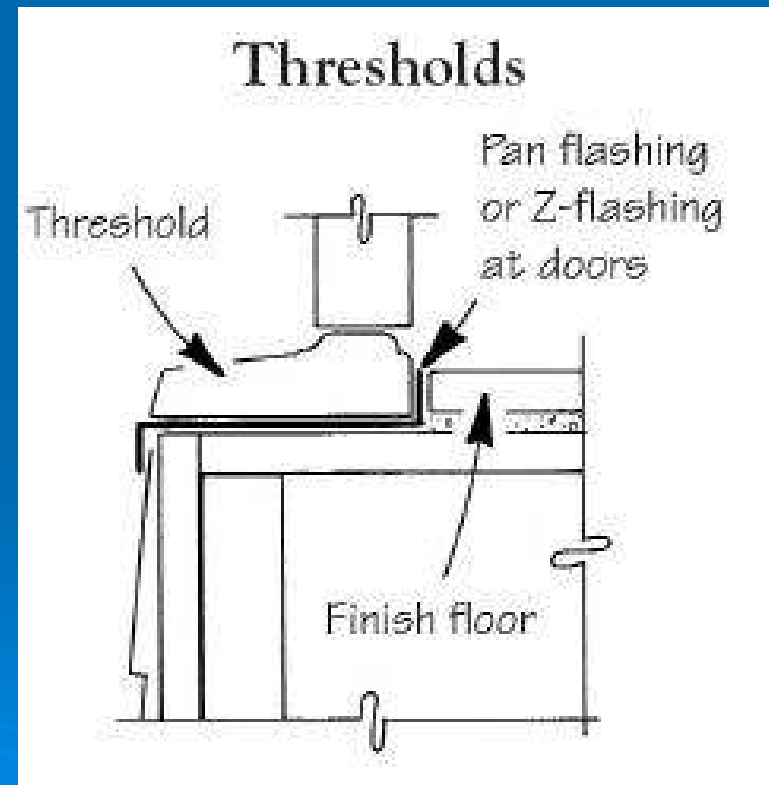
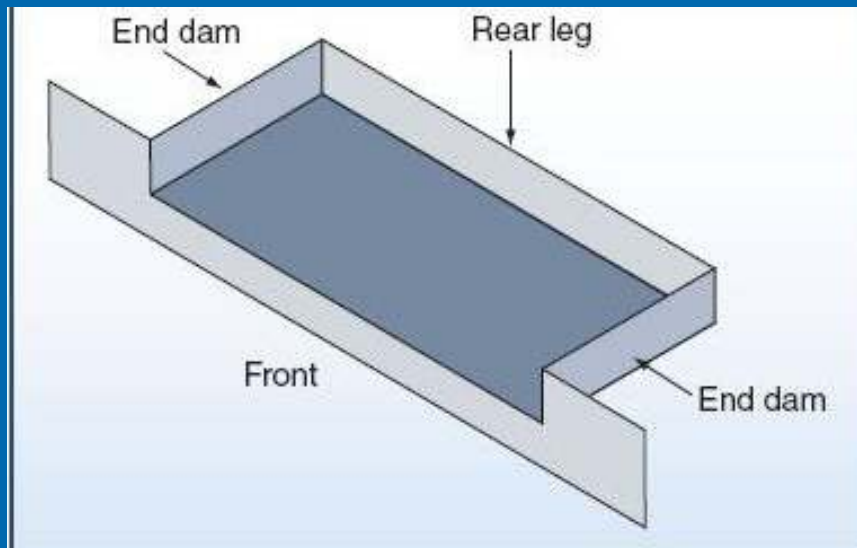
- Glazing used in handrail assemblies and guards shall be designed with a safety factor of 4. The safety factor shall be applied to each of the concentrated loads applied to the top of the rail, and to the load on the in-fill components.
- These loads shall be determined independent of one another, and loads are assumed not to occur with any other live load.

Waterproofing tricky areas

- If a door opens out onto a raised deck or patio, it must be flashed properly at the threshold. Do not rely on sealants in this area. There should be pan flashing that integrates with the roof's drainage plane.



Pan Flashing At Thresholds



Two Broad Categories For Weatherproof Decks

- Dual Systems. Decks in which the waterproofing surface and the walking surface are different assemblies.
- All-in-One Systems. Decks in which the waterproofing surface and the walking surface are the same material or part of the same assembly.

Decks With Different Waterproofing And Walking Assemblies Two Broad Categories

- Roofing materials which cannot bear pressure from a deck. Deck must be supported independently of the roof surface and suspended over it.
- Roofs that can directly support the walking assembly.

Roof Surfaces That Can't Directly Support A Deck

- This includes any kind of shingle or tile. Asphalt, shake, wood shingle, clay, concrete, aluminum, etc. None of these products is intended to support a structure. If you want a deck above these products, you'll have to suspend it above the roof surface. For this support, round pipes work better than square wood because it's easier to integrate their flashing into the shingles or tiles. The supports, of course, have to bear on an adequate load path.

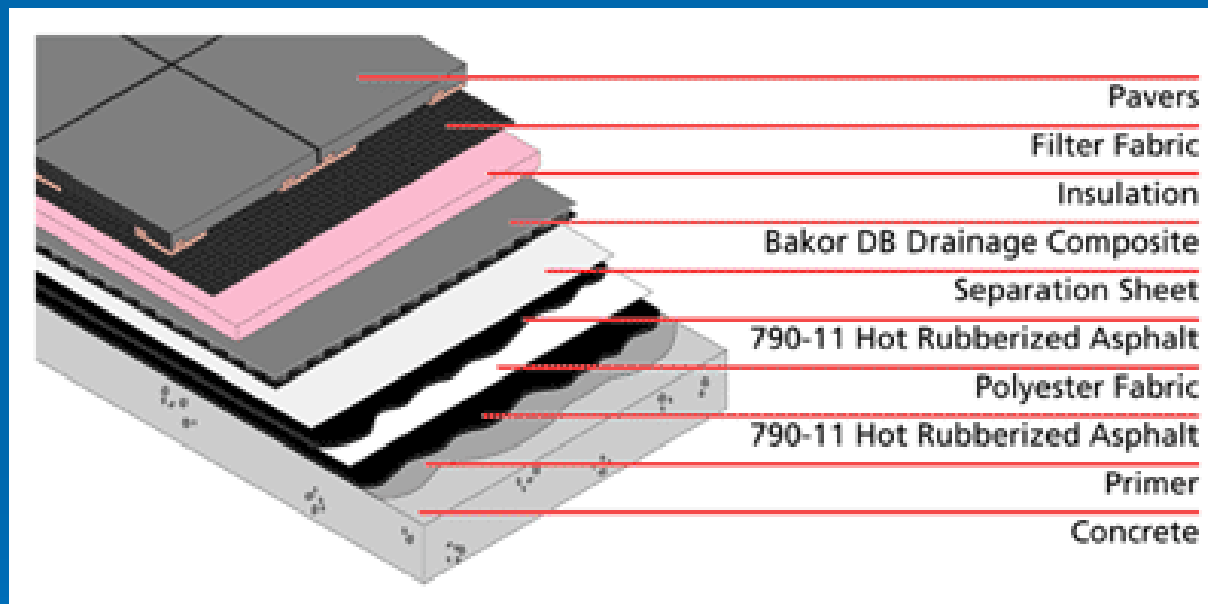
Some Roof Surfaces That Can Support A Separate Deck Assembly

- Protected membrane roof systems (PMRs) or upside down roofs.
- Traditional insulated built up roofs with paving units placed on top.
- Framed wood deck over wood sleepers.
- Duckboard decks.

Protected Membrane Roof (PMR) AKA An Upside Down Roof

- Invented by Dow in 1968. Not a new idea.
- Built-up or single-ply membrane roofs with insulation boards bonded to the top and ballast placed on top of the insulation. Some insulation boards come with a concrete surface bonded to one side. Garden roofs (green roofs) are a type of PMR.
- These roofs have lots of advantages and are an excellent way to have a long-lasting, good-looking walkable roof.

Protected Membrane Roof



Protected Membrane Roof.



Mountain Equipment Co-op Building In Montreal



Traditional Insulated Built-up Roofs With Paving Units Placed On Top.

- Problematic if organic felts are used because the organic fibers & fillers can break down in the constant wet environment of a paved-over deck. These felts are fine if the roof is left open, but can decay if pavers are placed on top.
- Brick or stone pavers.
- Rubber interlocking pads. (SofTile)

SoftTile



Schluter Troba With Pavers



Framed Wood Deck Over Wood Sleepers

- Sleepers must not interfere with the flow of water off the roof.
- Sleepers must not overly compress the roofing.
- The deck must be securely anchored but penetrations must be well sealed. Very difficult.
- Can work well over metal roofing.
- Unless it doesn't.

Wood Deck Over Metal Roof



Wood Deck Over Metal Roof. Underside



Duckboard Decks

- Relatively easy to construct.
 - Easy to remove in sections for cleaning & maintenance.
 - Nearly impossible to secure thoroughly.
 - Excess movement = excess wear = early roof failure.
 - Might lift if subjected to high winds.
- 

Duckboard Deck



Some All-in-one Systems

- Magnesite.
- Concrete over felt.
- Metal lath & acrylic such as Dessertcrete.
- Liquid-applied elastomeric membranes in polyurethane or acrylic such as Gaco.
- Fiberglass assemblies.
- Slip sheet systems such as Dex-O-Tex and Weatherdeck.
- Ceramic, stone or porcelain tile over Ditra & Troba
- Vinyl membranes such as Duradeck.

Magnesite

- This great granddaddy of all-in-one deck/roof coverings has been in use since the '20s.
- Magnesium oxychloride cement with inert fillers and aggregates. Pre-1972 formulations contained asbestos.
- It cracked & leaked, particularly at railing penetrations & proved itself to be a poor choice for an all-in-one system.
- Still used today for precast stairways and other hard surfaces that don't have to remain waterproof.
- These surfaces need to be resealed every year or so.
- Best to recoat them with Dessertcrete or something similar.

Magnesite Deck



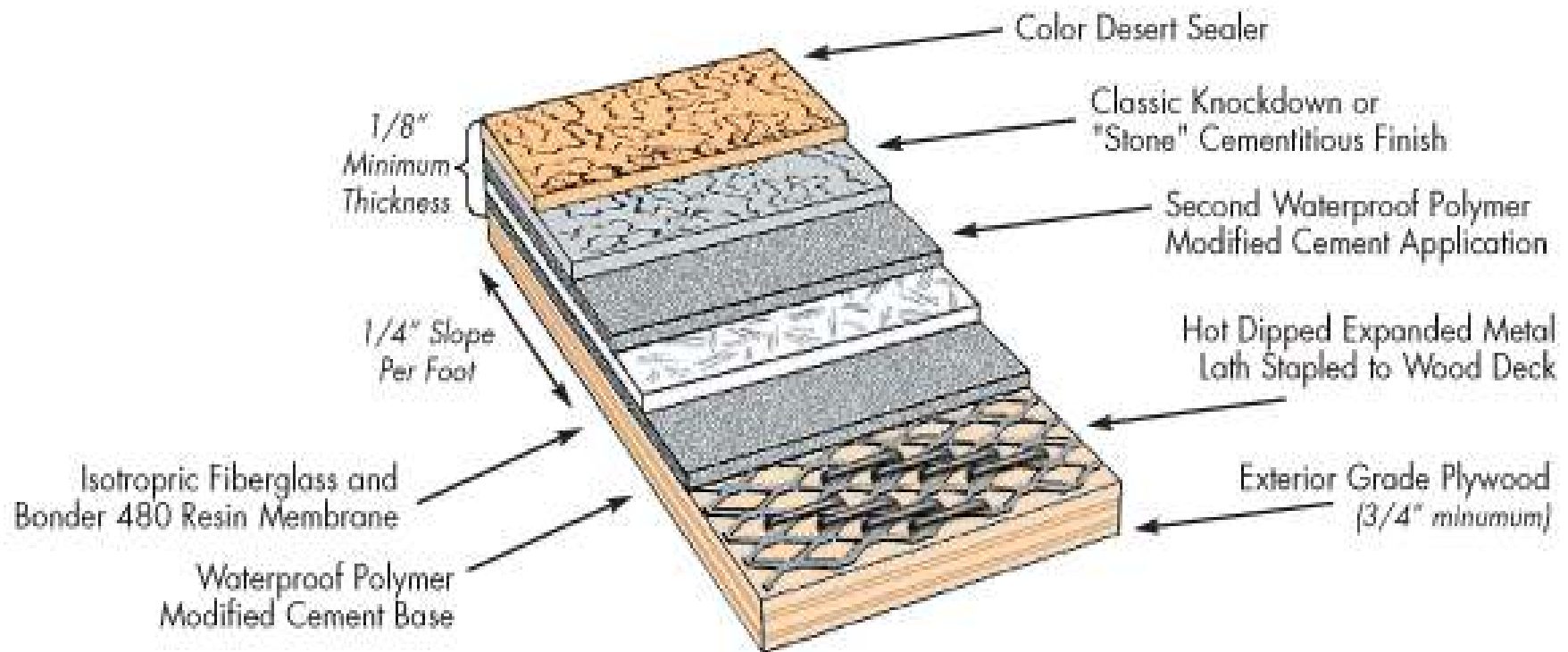
Concrete Over Felt

- Very popular in apartments & condos from the '60s to the '90s.
- Water penetrates the concrete via the perimeter, via cracks, and via porosity.
- The water moves through gaps in the felt and eventually causes the felt to decay.
- These systems were almost never flashed properly.
- They can sometimes be repaired by applying one of the systems we're about to discuss.

Metal Lath & Acrylic (Desert Crete)

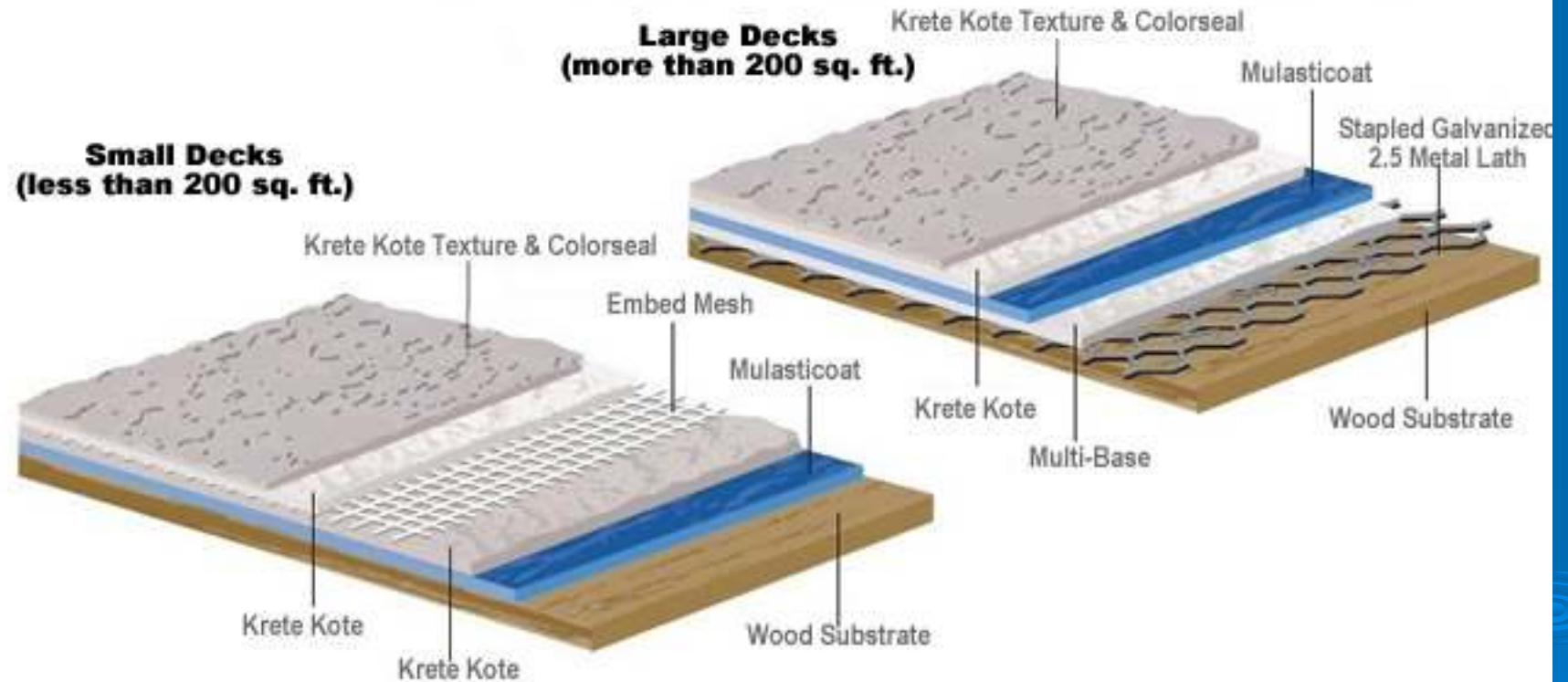
- High tech layered system of galvanized metal lath, acrylic modified cements, fiberglass and a pigmented sealer.
- Excellent resistance to UV, cracking, and abuse.
- A high quality product at a high quality price.
- A demanding installation process that's easy to screw up.

Desert Crete Includes A Fiberglass Layer



Slatex

No Fiberglass Layer



Elastomerics

- Liquid-applied elastomeric membranes in polyurethane or acrylic.
- There are two broad classes: solvent based and water based.
- They include products such as Gacodeck, Spanex, Procor, Polydeck, Dex O Tex, Slatex, etc.
- Relatively inexpensive & easy to install.
- Must be recoated every few years.
- Easily damaged. Easily repaired.



Gacodek



Procor Installation In Progress



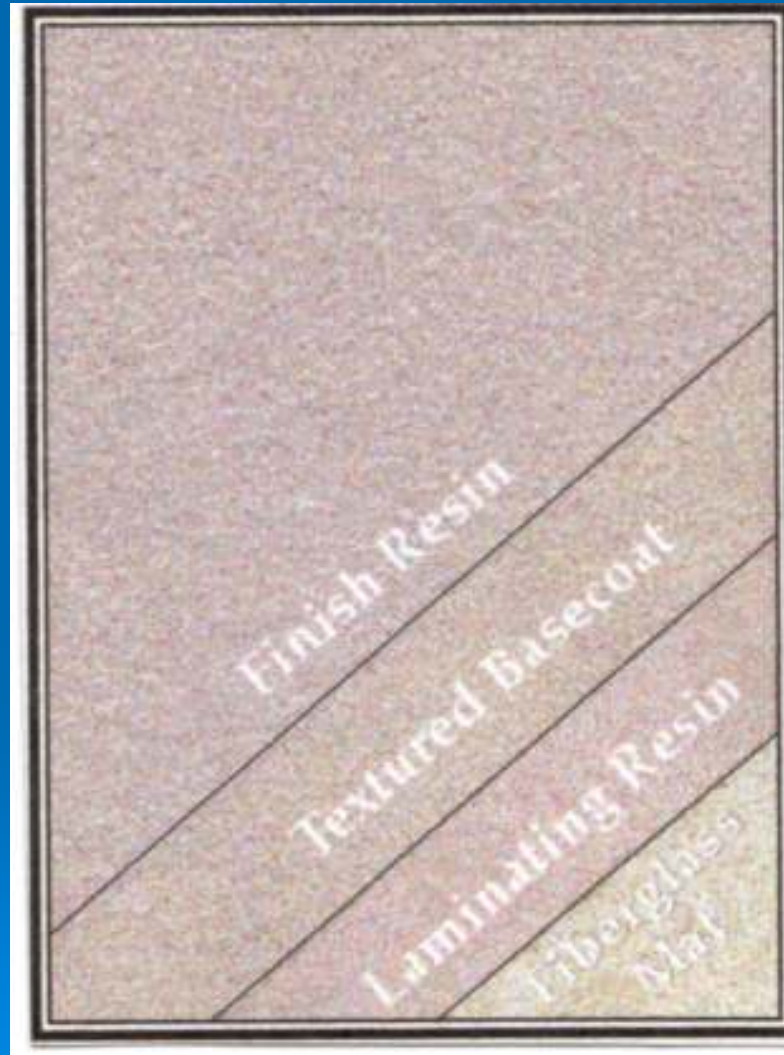
Finished Procor Installation



Fiberglass Assemblies

- Layered assembly of resin, fiberglass mat, basecoat & finish resin.
- They're self flashing, tough, and easily repaired.
- An excellent choice to use when repairing failed concrete or magnesite decks because the fiberglass bridges cracks very well.
- History of problems when bonding fiberglass to plywood decks. The fiberglass performs adequately on smaller decks, but not on larger ones.
- Manufacturers include All Deck, Pli-Dek, Excellent Coatings, & Dessert.

Alldeck Fiberglass Coating



Slip Sheet Systems

- Meant for use over plywood decks.
- Dex-O-Tex and Weatherdeck
- Layers of membranes and troweled on liquid rubber latex that float over the plywood and are bonded only at the perimeter flashings.
- It's essential that the perimeter flashings be properly secured and cleaned before the membranes are installed.
- These have fussy installation requirements and the final product is easily damaged.
- Crossfield Products Corp (Dex-O-Tex) and Mer-Kote Products Inc

Weatherdeck Slip Sheet



Tile

- Almost never done properly in our area.
- There should be a drainage plane below the mortar layer. Otherwise the water will freeze and pop off the tiles.
- It's possible to have the drainage plane on top of the tile but it requires a perfect installation using frost resistant tiles and mortar and 95%-100% mortar coverage – no voids. Though it has been done this way, the Tile Council of North America does not recognize this as an adequate installation for use over occupied spaces in freezing climates.

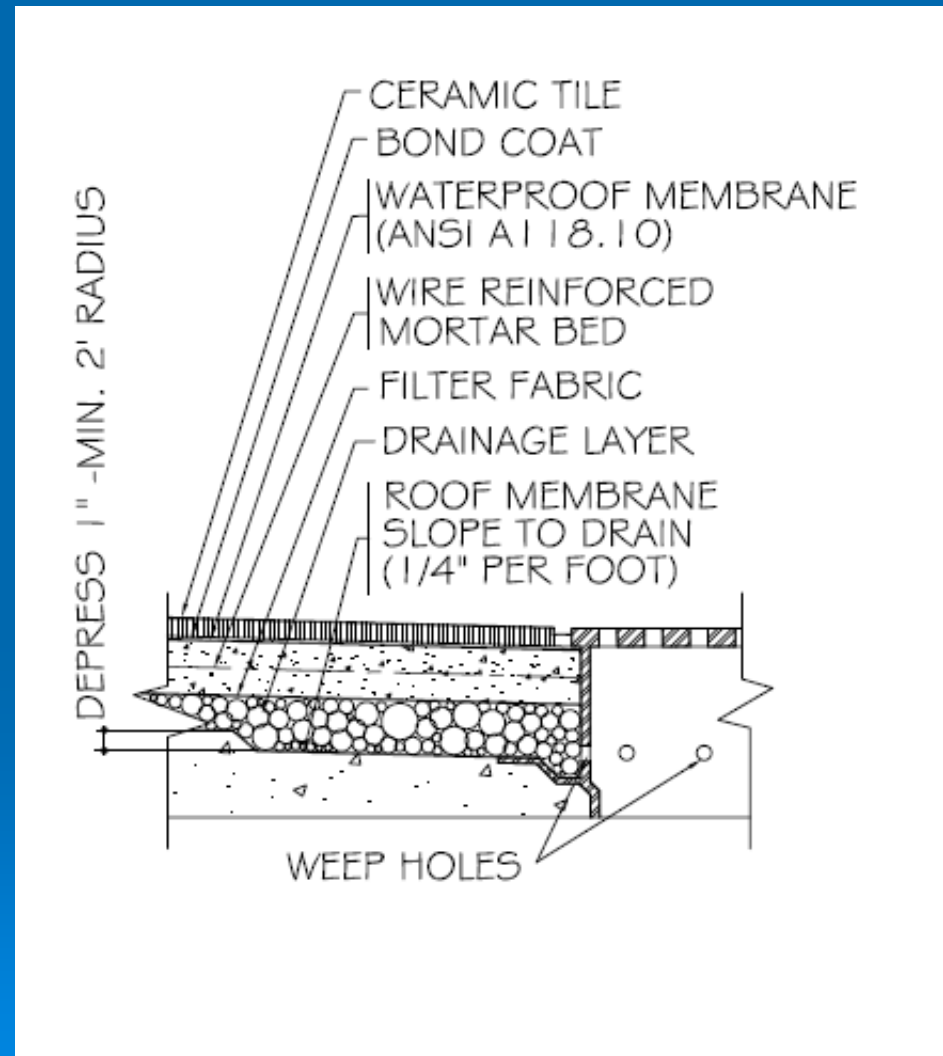
Non-Conforming Tile Installation. Not Approved By TCNA

- Roof deck covered with a built up roof or a membrane.
- ≤ 2 " mortar bed sloped to drain.
- Tiles set in exterior-rated, latex modified thinset mortar with NO VOIDS.
- Frost proof tiles (impermeable).
- Non-shrinking mortar & grout.
- Grout to be re-sealed often.
- Unforgiving. Unreliable. Tiles likely to pop off.
- If it leaks, you're screwed.

Drainage Plane Tile Installation

- Roof deck covered with a built-up or membrane.
- Crushed stone (max 1/2" stone) drainage plane 1" thick.
- Filter fabric – burlap or cheesecloth.
- A manufactured drain mat may be used in lieu of the stone & fabric.
- Mortar bed up to 2" thick with reinforcing mesh.
- Set frost proof tiles on dry-set mortar or latex/polymer modified portland cement mortar.
- Movement joints as necessary to the bottom of the setting bed.

Drainage Plane Tile Installation



Schluter System



Vinyl Membranes

- Thick single-ply membranes similar to vinyl flooring.
- Used to be installed with butted heat- or solvent-welded seams but those were unreliable.
- Not installed with lapped, heat-welded seams.
- Straightforward installation. Durable.

Duradek



Duradek Installed

