

# Walkable and Waterproof

## PVC deck installation and application

by John Ogilvie

**W**hether it is a restaurant's rooftop patio or a townhouse complex's series of open-air terraces, a dearth of usable space means many urban projects are claiming their roof systems as pedestrian areas. Unfortunately, roofing products are rarely intended for this sort of traffic. Protective carpeting or treated wood can be placed over an assembly, but these materials are still susceptible to damage from the elements. Similarly, applied coatings and fiberglass have been used with limited success due to the inherent deficiencies in the materials themselves.

For multi-unit residential buildings (MURBs) and light commercial projects, walkable decks finished with heavy-duty polyvinyl chloride (PVC) thermoplastic waterproofing membranes have been used successfully in Canada for several decades, and are now growing in popularity in the

United States. However, these systems are not without their limitations, and design professionals must understand the installation considerations.

### Problems with deck waterproofing

Often built with a wood or concrete substrate, pedestrian roof decks can be waterproofed using various systems. In 'protected' assemblies, the waterproofed membranes are shielded from the elements by another surface (e.g. concrete pavers, tiles, or wood deck boards). However, these traditional methods can result in numerous problems, ranging from deterioration to delamination, that require costly maintenance and expensive repairs.

For example, while treated wood decks can have a unique aesthetic appeal, long-term exposure to moisture

can cause decking to split, warp, shrink, crack, and/or rot. Wood assemblies can also be highly combustible and slippery when wet, requiring constant maintenance, regular repainting, and restaining to ensure safety and acceptable appearance.

There are also difficulties with paver overlays since the structure has to be designed to accept the additional weight and clearance. Additionally, drainage is critical to the waterproof membrane underneath the paver system, which is difficult to get at should maintenance, repair, or replacement become necessary.

In exposed assemblies, the waterproof membrane—either a liquid-applied coating or a PVC product—is left open to the elements. However, since concrete substrates tend to shift in response to daily temperature fluctuations, the use of epoxy, urethane, and acrylic coatings can be challenging. Constant movement can put enormous stress on these waterproofing products, resulting in pinholes, blisters, or surface cracks that allow moisture to penetrate the membrane and cause further deterioration.

Even PVC is by no means problem-free. While normal pedestrian traffic should not damage the vinyl, removing snow, moving equipment, or sharp impact can cause

mechanical damage, extreme ultraviolet (UV) ray exposure can fade or 'chalk' the membrane, and abrasion can scuff the printed pattern.

To combat these issues, roof-grade PVC decking membranes should withstand the same rigorous material standards testing as thermoplastic single-ply roof coverings. In high traffic zones, solid-colored products are recommended to minimize issues of scuffing or abrasion.

#### Vinyl advantages

PVC membranes are extremely durable—even when exposed to heavy traffic and severe weather conditions, they do not peel, chip, delaminate, or crack. The product offers varying degrees of slip resistance as required for the particular project and can consequently be considered safer than traditional surface materials that become slippery when wet. Walkable PVC membranes are designed and tested to offer a static coefficient of friction (or slip resistance) of:

- dry conditions: equal to or greater than 0.50 for leather and equal to or greater than 0.70 for rubber; and
- wet conditions: equal to or greater than 0.60 for leather and equal to or greater than 0.65 for rubber.

## CYBERCAT FIRE ALARM SYSTEMS



### SOMETIMES AN UNEVENTFUL DAY CAN BE A GOOD THING.

THE IMPACT OF A FALSE FIRE ALARM CAN BE COSTLY. MEET CYBERCAT, THE FIRE ALARM SYSTEM THAT IS AS SERIOUS ABOUT RELIABILITY AS YOU ARE.

Fike's Cybercat™ passes the test in all categories:

- Split second speed - .25 second response time.
- Exceeds all UL requirements.
- Intelligent, peer-to-peer, bi-directional communication.
- Flexible: Ideal for any size of facility.
- Value-priced and competitive.



1-866-326-FIKE (3453)

**Fike**  
CORPORATION

VISIT WWW.FIKE.COM

PROVEN SAFETY SOLUTIONS FOR OVER 60 YEARS

Free info at [www.constructionspecifier.com](http://www.constructionspecifier.com) Click on LinkPath

Since it is pre-manufactured, the material can be fabric-reinforced to provide additional stability and multi-directional strength. Walkable PVC roof membranes can cost up to 50 percent less than conventional membranes installed with a protective overlay. They also feature benefits in terms of its easy installation and low maintenance requirements—while coated systems can require recoating, vinyl deck systems are maintainable with periodic washing to remove surface dirt. Rougher membranes can require washing with a scrub brush and mild detergent or pressure washing. Regular inspection of caulking and immediate attention to any loose seaming help ensure the PVC membrane lasts for years to come.

A properly specified PVC membrane should incorporate mildew inhibitors, be fire-retardant, resistant to chemicals, and meet all building code standards. It should also have UV and heat stabilizers to resist the potential of vinyl cracking, embrittlement, and discoloration.

While waterproofing is the most significant attribute of a PVC membrane, appearance is also important. Vinyl products come in a wide variety of patterns, colors, and textures geared to diverse needs and budgets that can create complimentary or contrasting borders.

### Deflection considerations

The deck's ability to control surface water is affected by several factors, including slope, drip edges, and diverters. For the best performance, the structure should be sloped to eliminate ponding water, while accounting for building shrinkage or settlement. When the deck is designed with the correct slope, water should flow away from the building into a gutter system or over a drip edge away from the exterior wall system.

On new construction, wood-frame buildings can shrink as much as 12.7 mm (0.5 in.) per floor, which can result in the balcony sloping in the wrong direction—a situation that can have adverse consequences for controlling surface water. Furthermore, building settling can make things worse if enough slope has not been built in. Nevertheless, given the proper grade—approximately two percent or 1:50—a simple drip edge detail is usually the most expedient way of removing surface water from the deck surface. (False fascia detailing can be used to hide the gutter, fascia, railing mounts, and deck slope.)

Severe structural damage can occur when the waterproofing detail is incorrect. To address this situation, simple pre-manufactured diverters can be installed and waterproofed to steer water away from adjoining walls and other critical junctions.

### Dealing with drainage

Drainage is dependent on flashing, the proper sequencing of moisture barriers, and the detailing of wall openings. Special attention to flashing is important, as incorrect detailing of these elements invariably leads to leaks and water damage. For example, curbs or knee walls higher than 76 mm (3 in.), or higher than a wall opening, result in a 'trapped' deck system that needs special drainage. Should a trapped deck occur, the top plate of the curb or knee wall must slope back toward the deck surface. The PVC membrane should also extend to the line of the outside drip edge, which, in turn, should extend well beyond the building wall surface.

Proper sequencing of moisture barriers is critical, and installing the PVC membrane after the wall assembly has been completed almost always leads to failure. In the first step, the vinyl is installed on the floor and extended up the wall at least 152 mm (6 in.), with the actual height dictated by the local building code.

Vertical surfaces are then covered by a building paper (or other wall moisture barrier) that overlaps the vinyl by at least 52 mm (2 in.). Horizontal surfaces (e.g. the top of stub walls or solid railings) should be covered with a peel-and-stick membrane, with special attention paid to the 'saddle' where they meet vertical surfaces.

## Reprints: Marketing for the World

Reprints of articles make it easy to place information into the hands of your target audience. Having been featured in a well-respected publication adds the credibility of a third-party endorsement to your message.

Give yourself a competitive advantage with reprints. Contact FosteReprints for information regarding reprints and additional applications designed to meet your challenging market needs.



**FosteReprints**  
866.879.9144  
sales@fostereprints.com



*In high-density areas such as Washington, D.C., efficient use of space is critical. For townhouse complexes, being able to claim the roof as a patio is a crucial selling point for owners.*

Many decks have posts and columns that need proper construction and sequencing of moisture barriers to prevent water from seeping under the PVC. Water may find an entry point in the post itself and get in behind the waterproof membrane. As wood posts or columns can crack and allow water to get into the subsurface, they should be covered with a moisture barrier and then finished with siding. Where the aesthetic effect of a rough-hewn wood post is required, special consideration must be made for post attachment.

Curbs, knee walls, posts, and wall openings must be built and detailed to ensure membrane performance. In constructing or modifying door openings, door sills should be sloped toward the deck surface for optimum drainage, and the waterproof membrane should continue into the rough door opening saddle to deflect any moisture intrusion.

Building authorities can require overflow drains or scupper boxes on trapped decks to provide a path for water to drain from the deck. Drains and scuppers should be sloped toward the outside, and scuppers should be inserted into the deck surface to prevent ponding. Scuppers are generally quite difficult to detail in such a way that makes them impervious to wind, rain, snow, and structural deflection.



*When considering waterproof, walkable roof decks, specifiers must consider the six Ds—deflection, drainage, drying, durability, detailing, and deconstruction.*

Drains should be approved roof products—acrylonitrile butadiene styrene (ABS)-shower drains are only acceptable for showers and are unsuitable for any roof deck or MURB application. PVC-coated drains or drains with a positive clamping system are suitable to allow water to drain into the building's stormwater system. With PVC-coated overflow devices, the decking membrane can be welded directly to the PVC-coated surface, without caulking.

#### Drying and durability

Drying can be aided by the use of a rainscreen wall assembly or the venting of trapped air spaces. To reduce moisture buildup, venting of the space underneath decks, balconies, and walkways with a closed soffit or ceiling is especially important. (To be effective, the vent area should have a 1:150 ratio to the insulated ceiling area.) If equal venting cannot be provided at both ends of the joist runs, then purlins should be installed above the joists to allow for cross-ventilation. Some manufacturers also offer snorkel-like deck ventilation systems (with mesh bug screens) that allow for venting of the roof space joists in new and retrofit construction.



*Specifying the proper walkable roof deck is not only a concern for designers working on multi-unit residential buildings (MURBs). Light commercial projects, such as this restaurant patio and golf course terrace, can also benefit from the increased usable space a rooftop pedestrian area provides. However, waterproofing these assemblies is crucial.*

While drying helps prevent mildew, mold, and rot, the roofing components must also be tough enough to stand up to foot traffic, chemicals, and other environmental conditions. The assembly's durability is affected by the quality of the waterproofing membrane and its overall maintenance. While two membranes can have a similar appearance, the quality of their ingredients can give the product a price differential of up to 25 percent, and a difference in life expectancy of as much as 75 percent.

Walkable PVC roof deck membranes have to go through the same rigorous product 'material standards' and 'fire test of roof coverings' as thinner thermoplastic single-ply roofing membranes, respectively:

- ASTM International D 4434, *Standard Specification for Polyvinyl Chloride Sheet Roofing*; and
- either ASTM E 108, *Standard Test Methods for Fire Tests of Roof Coverings*, or Canadian General Standards Board (CGSB) 37.54-95, *Polyvinyl Chloride Roofing and Waterproofing Membrane*.

When evaluating a thermoplastic roofing membrane that will face light pedestrian traffic, it should be subjected to additional abrasion and slip resistance testing.

Any alternative material, type, or method of construction can be accepted as long as it demonstrates compliance with the performance features of the applicable code. In the United States, the International Code Council Evaluation Service (ICC-ES) evaluates membranes in accordance with AC 39, *Acceptance Criteria for Walking Decks*. Roof and walking deck membranes can be listed by ICC as 07 18 00—Traffic Coatings or 07 54 00—Thermoplastic Membrane Roofing.

Waterproofing membrane products must also be manufactured under an approved quality control program with visits by an inspection agency under the International Accreditation Service (IAS). It is also important to ensure the compatibility of the waterproofing system's components (e.g. membrane, tapes, sealants, adhesives, drains, scupper boxes, flashings, perimeter fastening devices).

With proper care and cleaning, waterproof PVC membranes can be expected to last for 10 to 15 years or more. De-mountable flashing systems are one way to reduce the deconstruction required when one must eventually repair or replace a membrane. These systems are easy to remove, and allow the PVC to be repaired or replaced quickly and easily with minimum destruction. Membrane and trim panels can be replaced without disrupting the existing wall system and doors, which means one need not remove the siding or stucco or compromise the second waterproofing job.

#### Pre-installation decisions

For best results, installation and seaming plans showing joints, termination details, and material interfaces should be prepared, along with two labeled samples (216 x 279 mm [8.5 x 11 in.]) of the specified PVC membrane illustrating finish, pattern, color, and backing. At least one week before installation, a pre-installation meeting should be held involving the client's representative, manufacturer's representative, contractor, and installer to discuss pedestrian deck waterproofing practices, as well as any precautions applicable to the specific project.

When it comes to the actual PVC product used for the roof deck system, there are several factors to keep in mind. It is important to specify a polyester-reinforced PVC membrane with UV resistance for fully adhered installation with heat-welded seams and perimeter attachment. One must always specify overall sheet thickness, as well as width and color.

With the exception of cap flashings (which are typically manufactured and installed by other parties), all perimeter fasteners and PVC-coated metal scuppers, overflow drains, roof drains, and trim should be provided by the membrane manufacturer. Whenever possible, the color of the perimeter fasteners should be coordinated with the membrane.

Prior to installation, an examination should be conducted to verify the existing deck is secure and solid in accordance with local code structural requirements, and that the surface is clean and smooth, free of depressions, waves, and projections, and properly sloped to drains, valleys, and eaves. Any joints, voids, or low areas of a wood deck should be filled and sanded smooth. Any surface imperfections or variations on a concrete deck should be filled with leveling compound and the surface cleaned of any contaminants.

### System installation

This author recommends walking membranes be adhered directly to the structural deck, either concrete or plywood. In wood-frame construction, this can be achieved under typical 'cold roof' design, with the batt insulation installed between the roof joists. In concrete's case, when the insulation is applied atop the slab, this author recommends the plywood substrate be fastened to wood blocking/sleepers/purlins. The

## SHOW & CONVENTION LAS VEGAS 2006

MARCH 28 - APRIL 1, 2006  
LAS VEGAS, NV

[WWW.THECSISHOW.COM](http://WWW.THECSISHOW.COM)

Only Days Away - Register Now!  
[www.thecsishow.com](http://www.thecsishow.com)



### Keep up-to-date on advances in the industry!

- ◆ Gain access to more than 120 education sessions
- ◆ Experience Las Vegas architecture first-hand with technical tours
- ◆ Visit hundreds of exhibitors on the show floor

### Register Now!

To get more information  
& register visit  
[www.thecsishow.com](http://www.thecsishow.com)



### The 50th Annual CSI Show™ & Convention Technical Tours

Learn from the professionals behind some of Vegas' most amazing architecture — take a CSI Technical Tour. Our Las Vegas tours offer you a chance to see the city with the best tour guides available — the people who built it!

Tours Include:

- ◆ Bellagio Theater **Sold Out**
- ◆ Caesars Colosseum—Céline Dion Theater & Elton John Concert
- ◆ Clark County School District K-12 School
- ◆ Hoover Tower **Sold Out**
- ◆ MGM Grand "K" Theater **Sold Out**
- ◆ Nevada Test Site
- ◆ Project City Center
- ◆ Regional Animal Campus - Sustainable Design
- ◆ Ultra Restaurant Tour
- ◆ The Cosmopolitan - Retaining Wall Systems
- ◆ Trump Towers - Column-Hung Flyer System
- ◆ Ultra Lounges

For complete tour details visit [www.thecsishow.com](http://www.thecsishow.com)

#### The Construction Specifications Institute

99 Canal Center Plaza, Suite 300 ◆ Alexandria, VA 22314  
800-689-2900 (option 1) ◆ [www.thecsishow.com](http://www.thecsishow.com)



Although they are usually thicker and subjected to additional abrasion and slip resistance testing, walkable PVC roof deck membranes must go through the same product material standards and fire tests as thermoplastic single-ply roofs.

concern is when the insulation is sandwiched between the plywood layer and the structural deck, it could compress (even in the case of high-density expanded polystyrene [EPS]), allowing the fastener to ride up and create a 'nail pop.'

Before the product hits the deck, there needs to be a thorough examination of the space to be covered. Sanded plywood or cement board provides the best finished surface possible. For the flattest face, it is recommended to use minimum 16-mm (0.63-in.) and preferably 19-mm (0.75-in.) plywood—anything thinner can warp due to the material's absorption of moisture from the atmosphere. The deck must also be secure, well-supported, clean, smooth, and properly sloped to drains, valleys, or eaves. PVC deck membranes should not be applied directly to treated structural deck panels. Additives used in the various factory-applied treatments have caused 'backup' staining in the past. When pressure-

treated plywood is required for deck construction, this author recommends an overlay with the aforementioned recommended plywood.

Surfaces and site conditions should be ready to receive the PVC membrane, and conform both to the membrane manufacturer's requirements and to local building code standards. If problems are seen, the installation consultant must be notified, with further inspection necessary in cases where a waterproof PVC membrane is being installed over an existing system. The deck must be thoroughly inspected for rot, weakness/delamination of plywood, loose panels, or spalling concrete that is hidden under the existing waterproofing membrane.

The surface must then be prepared. For wood decks, this means filling in joints, knot holes, voids, and low areas with filler and sanding until a smooth surface is achieved. For a Class A fire-rated application, a plywood deck should be covered with a cementitious

# X-SEAL™ VENEER ANCHOR

20% STRONGER THAN THE ORIGINAL!



- 1 NEW FEATURE!**  
BACKPLATE SEALS SHEATHING FROM AIR & MOISTURE INFILTRATION, IMPORTANT IN REDUCING POTENTIAL FOR MOLD INFESTATION
- 2 100% PROTECTION AGAINST SEPARATION OF WIRE TIE FROM ANCHOR** [See ACI-530-02 Sec. 6.2.2.5.5.3]
- 3 BUILT-IN "SCREW TRACK"** ON PRONGED LEGS AIDS IN THE CORRECT ALIGNMENT OF SCREW INTO STUD, WHILE REDUCING FUTURE "ROCKING" OF SCREWS
- 4 CAPABLE OF WITHSTANDING A 100# LOAD IN BOTH TENSION AND COMPRESSION WITHOUT DEFORMING OR DEVELOPING PLAY IN EXCESS OF 0.05"**

CAN BE INSTALLED ON LARGE 4' X 8' INSULATION BOARDS, REDUCING HORIZONTAL JOINT SEAMS BY TWO-THIRDS [FURTHER REDUCING POTENTIAL FOR AIR & MOISTURE INFILTRATION]

THE X-SEAL™ ANCHOR MEETS OR EXCEEDS REQUIREMENTS OF THE COMMONWEALTH OF MASSACHUSETTS STATE BUILDING CODE FOR AIR LEAKAGE AND WATER PENETRATION. CONTACT H&B'S TECHNICAL DEPARTMENT FOR TEST RESULTS.



**NEW X-SEAL™ TAPE**  
"PRESSURE SEALS" BETWEEN ANCHOR & SHEATHING FOR ADDED PROTECTION



Free info at [www.constructionspecifier.com](http://www.constructionspecifier.com) Click on LinkPath



*For waterproof decks intended for hospitality projects, polyvinyl chloride (PVC) assemblies offer myriad benefits, including durability, ease of maintenance, and even slip-resistance (an important attribute for those descending the stairs).*

board that meets all requirements. For concrete decks, surface imperfections and variations must be filled with leveling compounds. It is also important to test for—and remove—surface contamination.

Waterproof PVC membranes should not be installed when temperatures are below  $-4\text{ C}$  ( $25\text{ F}$ ), above  $37\text{ C}$  ( $98\text{ F}$ ), or when winds are more than  $48\text{ km/h}$  ( $30\text{ mph}$ ). To ensure adequate adhesion, installers should glue a small test patch of the PVC membrane (about  $0.2\text{ m}^2$  [ $2\text{ sf}$ ]) to the existing surface. After 24 hours, the adhesion should be checked. If there are any concerns about the membrane's ability to bond to the existing surface, the coating must be removed and the deck resurfaced with a suitable underlay.

The process of seaming two sheets of PVC membrane together is the most critical element of a PVC system. The vinyl sheets should be overlapped and heat-fused, with the membrane affixed to the substrate with as few seams as

possible. However, all seams should be extremely strong and visible. Offering invisible butt seams, as has been done in the past, compromises the waterproofing.

To allow for a strong, hot-air-welded seam, adjacent membranes should overlap by a minimum of  $19\text{ mm}$  ( $0.75\text{ in.}$ ). It is important to remember proper fusing cannot take place when the back of the overlapping piece of PVC has been glued. Seam strength and integrity should be checked every few feet—if the seam comes apart, the welding is incomplete and must be redone. Extreme care must be used when welding a PVC membrane where the seam runs into a 90-degree corner and vertically up a wall or over an edge. All wall and corner seaming must be carefully inspected for pinholes. A strip of PVC can be welded on top of any critical junctions for added security.

Although building papers do not cause an issue, asphaltic products (e.g. peel-and-stick membranes) must be

## Additional Information

### Author

John Ogilvie has been involved with waterproofing decks and balconies with Duradek since 1976. He teaches new contracting firms how to install walkable membranes,

certifies installers, and runs 'best practices' seminars to building envelope specialists throughout North America. He can be contacted via e-mail at [john@duradek.com](mailto:john@duradek.com).

### MasterFormat No.

07 54 19—Polyvinyl Chloride Roofing

### UniFormat No.

B3010—Membrane Roofing

Division 07

Polyvinyl chloride

### Key words

Walkable roof decks

Waterproofing

### Abstract

For multi-unit residential buildings (MURBs) and light commercial projects, walkable decks finished with heavy-duty polyvinyl chloride (PVC) thermoplastic

waterproofing membranes offer several benefits. Nevertheless, these systems are not without their limitations, and design professionals must understand the installation considerations.

