GLOBAL ROOFING TRENDS

Going Green:

COLD-LIQUID-APPLIED MEMBRANES OFFER Earth-Friendly Product

By Paul Allenstein, PE

The international roofing sector faces stiff competition industry-wide as manufacturers and companies compete to meet the demands of a discerning building community. The trend is moving toward green and garden roofs, while many building owners are demanding waterproofing and roofing products that are nontoxic and energy-efficient.

Cold-liquid-applied membranes

In the roofing arena, where 20-year warranties for roofing systems are the norm, there is a long-term solution that is environmentally friendly and energy-efficient. The next generation in waterproofing and roofing technology are cold-liquid-applied, fully reinforced waterproofing and roofing membranes. Their chief benefits are that they are odorless, nontoxic, solvent-free, and environmentally safe.

Although these hybrids are usually more expensive than single-ply and modified-bitumen membrane systems, the initial investment is justified by the potential for improved performance and can help building owners avoid costly repair and replacement expenses later.

These products, which are either reactive or atmospheric-cured materials, require a great deal of skill and consistency during application, so proper training of applicators is essential.

The cold-liquid-applied systems are monolithic, seamless, and conform to almost every configuration. The reinforced liquid resin membrane systems fully adhere directly to practically any structural surface, horizontal or vertical, thereby eliminating water migration behind and beneath the waterproofing and roofing membrane. The seamless bonding of the membrane to the substrate surface during application also eliminates any possibility of fatigue at laps and seams, because there aren't any.

Cold-liquid-applied reinforced systems are engineered to resist degradation from UV exposure and heat magnification and are resistant to chemical and biodegradation and most common chemicals, making them an excellent choice for buried applications where any failure is enormously expensive and inconvenient. In contrast, many conventional industry products break down when exposed to chemical or petroleum products and biodegradable conditions.

Cold-liquid-applied membranes are unaffected by standing water and ice conditions. Due to their exceptional bond strength to substrate surfaces, the membranes form full closure to field surfaces, irregular flashings, and penetrations of every shape or material.

Historically, most roof failures are due to the weakness in conventional systems' perimeter and penetration flashings, laps, and seams. This is where cold-liquid-applied systems can perform much better.

An example of the longevity of cold-liquid-applied membranes can be seen in one of Kemper System Inc.'s first such projects, applied 40 years ago, in 1967, to 3,000,000 square feet of exposed roof on a major Volkswagen plant in Germany. The membrane continues to perform today.

Several international projects that have successfully used the cold-liquid-applied waterproofing and roofing systems for particularly challenging assignments include the Berlin Television Tower, the Palm House in Frankfurt, Germany, the BMW Plant in Austria, and Reykjavik City Hall in Iceland.

Berlin Television Tower (Alexanderplatz)

In 1969, when it began operations, the Berlin television tower was the second-tallest structure in Europe. What distinguishes this building from comparable structures is its striking spherical head. The antenna equipment on the mast and the parabolic antennas above the tower head are used for broadcasting and relaying television and radio programs, as well as for radio links and mobile phone service. At 680 feet above ground level, the tower head

contains a "telecafé" that revolves twice each hour. There is also a viewing platform at the 670-foot level.

The concrete and topping were originally sealed with epoxy resin. At 754 feet above the ground, however, any sealing material is exposed to intensified loads due to extreme weather conditions, UV rays, and enormous temperature fluctuations.

In addition, features such as penetrations (in total: 18 floor entries and 20 erection hatches for cable penetrations), as well as expansion joints and superstructure supports, present waterproofing problems that are generally difficult to overcome.

The first step in this extremely challenging project was to strip away the old sealing material, a cast epoxy resin. Then, damaged topping and concrete areas were removed, and the caulking was worked out of the zones, forming the attachments to the structural steel of the working platforms. These zones were exposed and treated with corrosion inhibitor. Weathering had caused the worst concrete damage on the west side of the platforms. All base surfaces were sandblasted and then reprofiled with cement mortar or topping modified with synthetic resin.

Rehabilitation of the platforms became necessary, since moisture damage had developed in the tower head. Even the complex details of the platform (erection hatches, railing supports, floor entries, expansion joints with the tower shaft) were seamlessly and securely waterproofed.

Cold-liquid-applied waterproofing and roofing compounds have enormously high adhesive strength, are UV resistant, root resistant, and unaffected by flying sparks. The waterproofing compound is translucent, thus making inspection and elimination of any air bubbles easy. The liquid polymer waterproofing material bridges cracks and is permanently elastic. It can withstand the stresses resulting from the extreme temperature differences on the platforms of the television tower.

Once the work had been completed, the waterproofing system formed a seamless membrane, preventing water from ponding. For this reason, all expansion joints (totaling 2,460 feet) were also filled with elastic material flush with the surface.

A strong bond between old concrete and repair mortar was achieved with adhesive-bonded joints. Platforms at the 619- and 627-foot levels, which are designed as a safety evacuation area for guests and staff in case of fire, received a completely new topping. The base surfaces prepared in this way were coated completely with a solvent-free, two-component, cold-liquid-applied polyester membrane.

Alexanderplatz, the Berlin television tower built in 1969, presented waterproofing challenges. A strong bond was necessary between old concrete and repair mortar.

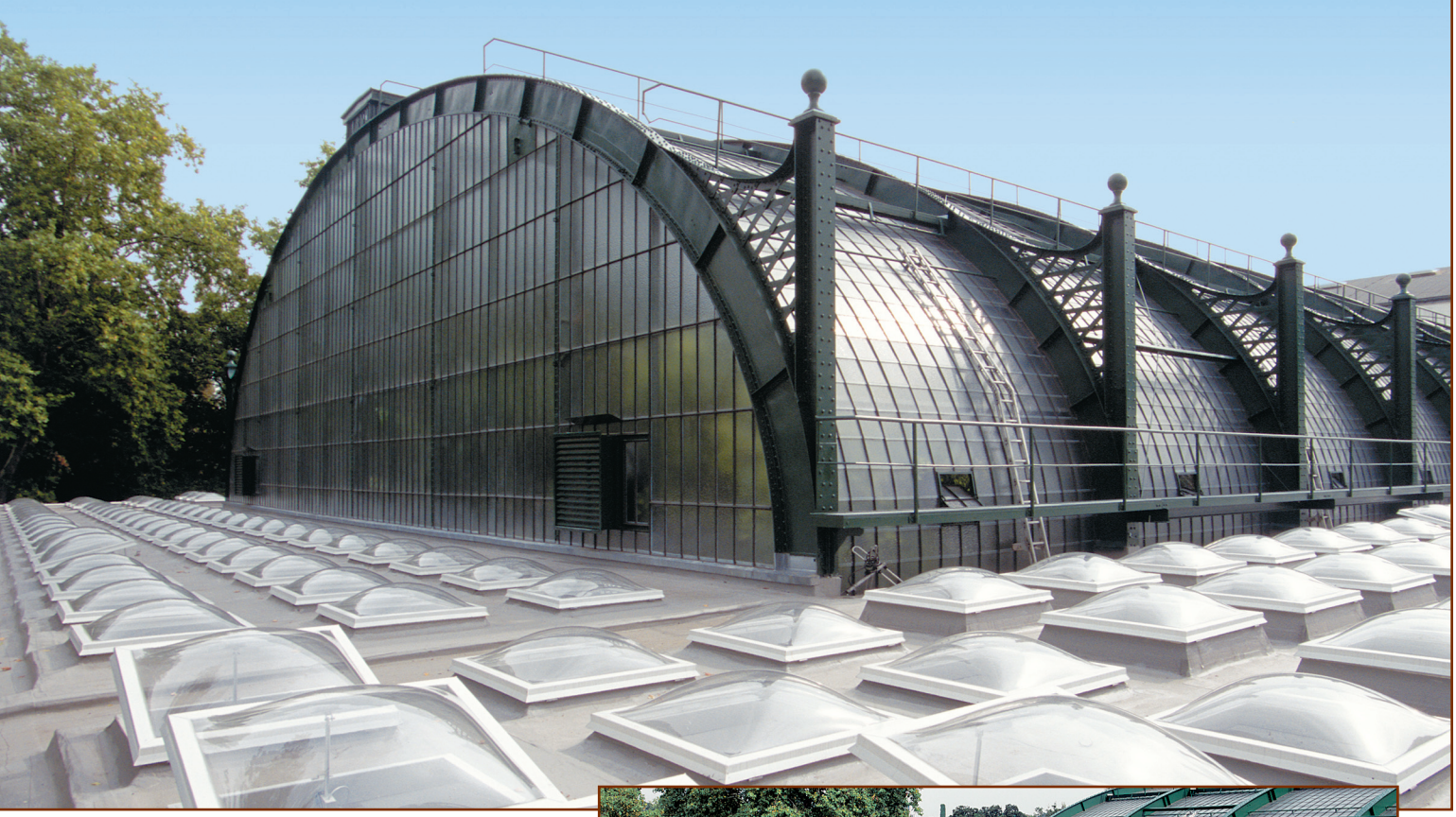
An epoxy primer ensured adhesive bonding to all parts. On outside structural areas, the primer was additionally sprinkled with quartz sand. In contrast to the standard application, platforms of the television tower were butt-jointed with fleece.

In view of the slight slope of the platforms and to avoid standing water (which would turn to ice in winter), the client opted for the more expensive treatment with a system comprising three layers of butt-jointed waterproofing membrane. The joints of the different layers were staggered.

The last layer was coated with a full-surface sprinkling of fire-dried quartz sand sealed with the waterproofing and roofing membrane. This improved wear resistance and, in particular, gave a good grip to the sealing surface.

Palm House, Frankfurt, Germany

Ever since a group of citizens of Frankfurt, Germany, took the initiative in 1868 to establish a municipal garden housing the famous tropical plants transported from Nassau by Duke Adolf, the Palmengarten (palm garden) has been an attraction of this large metropolitan city on the banks of the Rhine. The heart of the park area is the Palm House, built in 1869 to provide a tem-



Tightly packed rows of skylights were the weak points of the roof of the Palmengarten in Frankfurt, Germany. In 2000, renovation of the roof was accomplished with cold-applied-liquid membrane. Precut strips of fleece were embedded at the perimeters of the skylights and saturated with liquid polymer resin to form a watertight bond.

perature- and humidity-controlled environment for the plants. The green-painted cupola of the palm house is the focal point of the complex. The architectural gem, in the style of a similar structure at the Paris World Exhibition and consisting of a riveted steel and glass construction with external supporting structure, was completely renovated in 1979.

During the restructuring of the exhibition halls in the 1980s, the Tropicarium, located at the center of the complex, was extended at the sides by low annexes of the same length. Tightly packed rows of skylights – 169 in all – occupy an area of 11,840 feet, allowing the maximum amount of light to enter the building. These skylights, however, were the weak points of the roof, allowing water ingress over a period of years into the exhibition halls below. The resultant damage restricted the building's use. A roof with so many awkward details in a confined space usually presents a tough challenge for conventional materials, but it was perfect for a liquid-applied system.

In July and August 2000, the leaking flat roof of the annex was completely renovated with a cold-liquid-applied waterproofing and roofing membrane. Where the damage had occurred, the old felt system was removed down to the concrete base. New thermal insulation was laid, and the surface and details then treated with epoxy-based primer to ensure bonding to the base surface.

The cold-liquid-applied waterproofing and roofing membrane, based on unsaturated polyester resin reinforced with polyester fleece and with excellent vapor permeability, was applied to an average dry-film thickness of 2 millimeters. Each of the 169 skylights, arranged in three rows at regular intervals, received waterproofing around its perimeter. To achieve this, a layer of the membrane was applied to the primed curb, and precut strips of fleece were bedded in and thoroughly saturated with the liquid polymer resin.

The roof is watertight again and should remain so for a long time. The higher material costs are offset by significantly reduced labor costs when this type of application is compared with fitting a traditional sheet-type alternative.

BMW Plant, Steyr, Austria

In mid-1979, BMW Motoren GmbH started construction of a plant at Steyr in Austria. The result was the BMW Group's largest engine factory, covering 1.8 million square feet and built at a cost of some 2.3 billion euros. Every year, about 600,000

award-winning petrol and diesel engines come off the production line at this site.

In the late 1980s, the suppliers of about 30 different products were asked to set up test surfaces on the trapezoidal sheet metal roofs of the production buildings at BMW. Within a very short time, the number of potential refurbishment materials was reduced to a short list of five.

BMW had also asked the owners of a Volkswagen plant about their experiences with cold-liquid-applied waterproofing and roofing membranes. Receiving a positive recommendation, the BMW team inspected the reference surfaces at Volkswagen, where the liquid-applied synthetic material had been in place since the late 1960s. Backed up by Volkswagen's positive experience, BMW also chose the modern, liquid-applied waterproofing system.

All details, junctions, joints, and upstands on BMW's roofs were waterproofed with a seamless membrane spread over the surface and reinforced with a fleece inlay. Once it has cured *in situ*, the material forms a permanently resilient, seamless waterproofing layer that fits the intricacies of the existing structure like a tailor-made glove fully bonded to the substrate. As a rule, waterproofing and roofing systems can be applied to existing roof finishes without removing them first and thus incurring additional costs.

The synthetic material is tear-resistant and bridges over cracks up to 2 millimeters wide. It also remains permanently resilient and flexible over a temperature range of -30°C to +90°C. Therefore, this waterproofing system is able to accommodate structural movements and the different thermal movements of various building materials without damage.

Some 646,000 square feet of this liquid waterproofing system have been laid in Steyr over a period of 15 years. Extensions and rebuilding work continue at this plant, and on the roofs there are always individual components or even complete rooftop structures to be added or removed. The roofing contractor, therefore, welcomes the ease with which new sections of waterproofing can be easily joined to existing areas. Cold-liquid-applied systems bond fully to themselves and the use of a homogeneous waterproofing system preserves the appearance of the buildings.

Reykjavik City Hall

In 1990, the city of Reykjavik, capital of Iceland, situated in the permanently ice-free Faxa Bay area, constructed a new city hall with water as its main design feature. The open areas of the city hall were planned as attractive bodies of water and water courses.

Due to the location of the building in the harbor basin (two levels of its underground car park actually extend below the water level, and both upper parts of the building

Some 646,000 square feet of liquid waterproofing have been laid over the various roof components on the BMW plant roof in Steyr, Austria, over the last 15 years.

The Reykjavik City Hall in Iceland's Faxa Bay has two levels of parking below water level, and its upper stories are surrounded by water. All areas were waterproofed with cold-liquid-applied monolithic waterproofing and roofing membrane.

Conclusion

In all four of these examples, cold-liquid-applied waterproofing systems were used to solve difficult roofing and waterproofing challenges using odorless, nontoxic, solvent-free, environmentally safe products.

are surrounded by water), the demands placed on the waterproofing of the building were unusually high.

Complete waterproofing of the city hall and the underground car park against the surrounding water, using a cold-liquid-applied, monolithic waterproofing and roofing membrane, allowed exterior water-carrying structures to perform at peak levels while keeping the interior dry and well protected.

All watercourses were completely waterproofed, as were the building's walls and roof. This included all drainage channels, passages around the building that were below sea level, plaster on the seals, façade panels, expansion joint covers, window connections and entrance steps, roof surfaces without drainage, water cascades on the outer façade, and concrete pillars projecting out of the water.

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NRCA Issues Call for Design Award Entries

The National Roofing Contractors Association (NRCA) has announced a call for entries for its fifth annual SpecRight Excellence in Design Award, which honors those who design energy-efficient, environmentally friendly, and long-lasting roof systems.

Architects, specifiers, roof consultants, and roofing contractors who are responsible for the design of a nominated system are eligible for the competition. Nominated systems must have been designed and installed after Jan. 1, 2005, and entries must be postmarked by Dec. 17. Judging will be conducted by a panel of industry experts selected by NRCA.

A winner will be selected in late January 2008 and announced during a special awards ceremony held during NRCA's 121st Annual Convention, February 19-23, 2008. He or she will receive a $2,500 cash prize, publicity during the convention, and acknowledgement in *Professional Roofing* magazine and on NRCA's Web site, www.nrca.net. For an official entry form and more information about the award, visit www.nrca.net, or contact Ambika Puniani Bailey, NRCA's senior director of communications, at 800-323-9545, ext. 7555; fax 847-299-1183; or e-mail abailey@nrca.net.