

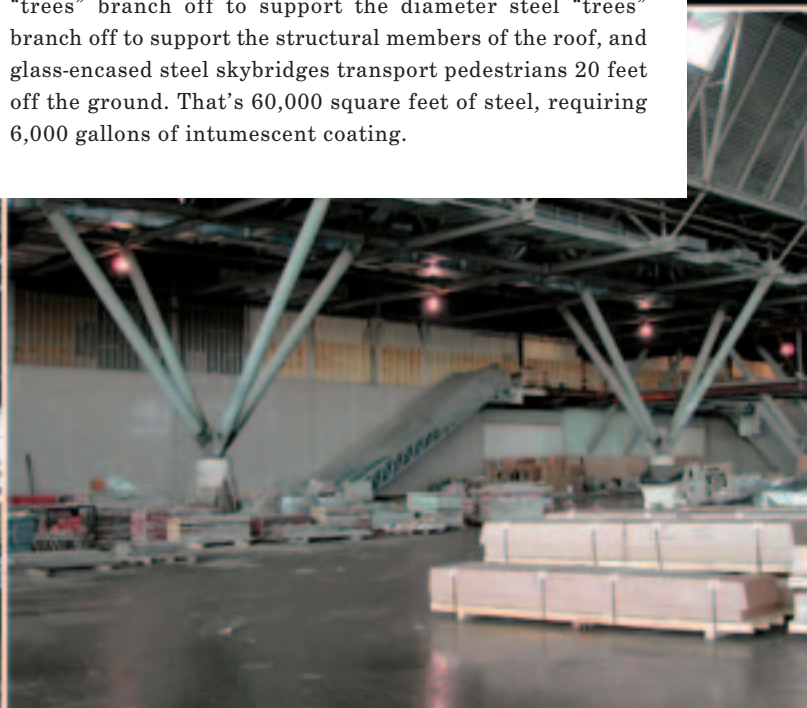


## Showcasing Structural Steel: **INTUMESCENT COATING** Adds Beauty and Fire-Resistance To Boston Convention and Exhibition Center

*By Michele Ostrove*

Traditionally concealed behind gypsum-board walls and ceilings and glopped with unsightly fireproof coating, structural steel is finally coming out of the closet. With the new generation of thin-film, intumescent coatings, architects today are using structural steel beams as an integral part of a building's décor, combining function and form. Intumescent fire-resistant coatings are hard and durable with a paint-like finish, need no special topcoat, and can often receive any type of decorative paint. And it's safe to say that the steel will remain intact in the event of a fire.

There's no better example of structural steel being showcased than the new Boston Convention and Exhibition Center, a massive, architecturally stunning, 1.6 million-square-foot facility that's due to open this summer. Inside the convention hall, 110-foot-tall, 36-inch-diameter steel "trees" branch off to support the diameter steel "trees" branch off to support the structural members of the roof, and glass-encased steel skybridges transport pedestrians 20 feet off the ground. That's 60,000 square feet of steel, requiring 6,000 gallons of intumescent coating.



Coating the 1.6 million-square-foot Boston Convention and Exhibition Center was a daunting task for the MacKenzie Service Corporation. The building's more than 60,000 square feet of steel support structures and pedestrian walkways required 6,000 gallons of thin-film intumescent material. The entire process — from prepping the steel to application of the intumescent topcoat — is taking more than four months to complete.



Located in the heart of Boston, the new Convention and Exhibition Center is expected to be one of the most spectacular and user-friendly trade show facilities in the world. The Center is slated to open in the summer of 2004. Two 480-foot pedestrian skybridges traverse the 516,000-square-foot exhibit hall. Located 20 feet from the ground, the steel bridges received a coating of intumescent material before they were encased in floor-to-ceiling glass and trimmed with finished metals.





MacKenzie crew members apply Isolatek's Cafco SprayFilm WB 3 intumescent coating on the support beams of a pedestrian walkway in the convention center. The two 480-foot-long, 20-foot-wide skybridges span the exhibit floor and are about 20 feet off the ground.

"It looks enormous when you're in there – like you could fly an airplane inside," says Ray Romeo, president of the Advanced Applications Group (AAG) of Crestwood, New York, and consultant to the MacKenzie Service Corporation, which is applying the coating. "It makes you feel very small in comparison."

## The Growth of Intumescent

The Convention Center is one of many high-profile public buildings to use steel as a dramatic design element in their large spaces; others include the New York Psychiatric Institute, the World Trade Centre East in Boston, and JFK Airport's new International Arrival Terminal 4. It's all been made possible by the use of thin-film intumescent fire-resistant coatings, which appeared on the scene around 1996 and have become the fastest growing segment in the passive fire protection business.

Before thin-film intumescent coatings, fire-resistant coatings were thick (as much as 3/4-inch when applied), often had a strong, pungent odor, required specialized equipment and specially certified and trained applicators, and were very expensive, according to Tony Scott, head of strategic development for Contego International, a Carmel, Indiana coatings manufacturer. Unlike today's intumescent coatings, which are mostly water-based, the older versions were toxic, contained VOCs, and were very unaesthetic. "Now that fire-code compliance is affordable, attractive, and reliable, steel is the material of the future," notes Scott, adding, "The potential impact on the modular building industry is significant."

When exposed to extreme heat, intumescent coatings expand 15 to 30 times, creating a fire blanket-type barrier to protect the steel. Most intumescent coatings also generate an ash-like or char layer during the expansion process which erodes as the fire continues, exposing the remaining intumescent coating. Depending upon the shape of the structural steel, some intumescent coatings require the addition of a reinforcing mesh, usually fiberglass, to retain their insulating or char layer.

Intumescent coatings were first tested in military applications on torpedos and submarines, and later on rockets, says Charles Nuzzo, product manager for intumescent coatings for Isolatek International of Stanhope, New Jersey, which manufactured the coating for the Boston Convention Center. "The coating would char and pull heat away from the rockets," he said. Intumescent coatings' future uses include high-rise buildings, because they build up the durability of less expensive, lightweight steel and can withstand explosions – a concern that has arisen since the World Trade Center's September 11 inferno caused by the impact of a Boeing 767 fully loaded with 75,000 pounds of jet fuel.

"You can drastically reduce your overall cost by increasing the wall thickness of your steel or the thermal massivity/heat-absorption capacity of the steel, and, in turn, reduce the intumescent coating thickness," Nuzzo notes. "The end result is that you have beefier steel, which gives you more structural integrity, and you have a thinner coating thickness of intumescent, which will reduce your installed cost and provide a more aesthetically pleasing finish."

## Choosing the Intumescent

When MacKenzie Service Corporation was subcontracted by Island International of Pawtucket, Rhode Island to handle the fireproofing of the high-profile Boston Convention and

JOB at a GLANCE	
<p><b>PROJECT:</b> Coat exposed steel "trees," diagonal support beams, and pedestrian skybridge with intumescent fire-resistant coating in new Boston Convention and Exhibition Center.</p>	<p><b>DURATION:</b> 4-5 months</p>
<p><b>COATINGS CONTRACTORS:</b> MacKenzie Service Corporation 55 Moffitt St. Stratford, CT 06615 (203) 380-9000</p>	<p><b>UNUSUAL FACTORS:</b> Enormous size of facility (1.6 million sq. ft.); unusually tall ceiling and steel "trees" (110 ft.)</p>
<p><b>SIZE OF CONTRACTOR:</b> 60 painters</p>	<p><b>MATERIALS/PROCESS:</b></p> <ul style="list-style-type: none"> <li>• Clean and abrade steel where needed using grinders</li> <li>• Spot-prime with 2-mil coat of Tnemec 1099 primer</li> <li>• Apply 2 or more coats of Isolatek Cafco SprayFilm WB 3 intumescent coating to achieve desired 100-200 mil thickness (depending upon thickness of steel)</li> </ul>
<p><b>PRIME CLIENT:</b> Boston Convention and Exhibition Center</p>	<p><b>SAFETY CONSIDERATIONS:</b> Working from a 110-foot-tall, mobile aerial work platform required fall protection equipment. Half-mask respirators were needed to protect lungs from dust particulates.</p>
<p><b>SUBSTRATE:</b> Shop-primed steel</p>	
<p><b>SIZE:</b> 60,000 square feet of steel</p>	



With the help of a boom and sometimes a scissor lift, MacKenzie crew members can spray apply intumescent coating to the “branches” of the 110-foot-high steel structural supports that provide beauty and function in the Convention Center’s 500,000-square-foot exhibit hall. Intumescent coatings have given architects the opportunity to use structural steel as a design element, making them one of the fastest-growing segments of the coatings market.

Exhibition Center, they sought AAG's advice on which coating to use, says Ray Romeo.

"There were multiple materials listed in the specs, but we determined that we didn't need fiberglass reinforcement in order to provide the hourly rating that is based on the local building code," he says. "We chose Isolatek's Cafco SprayFilm WB 3 intumescent coating because it could give us the UL (Underwriters Laboratories, Inc.) designation we needed, was easily maintained, and abuse-resistant. Above all, it was water-based, so it wouldn't interfere with the other tradesmen who were working at the same time. That was an important factor."

The Convention Center coating job would have to be coordinated with several hundred workers on-site each day representing the whole gamut of trades, including electricians, mechanical contractors, masons, and everyone involved with the building's construction. "With water-based material, we didn't have to worry about the other trades complaining about the odor, and we also didn't have to deal with storing hazardous materials, cleaning out pumps with solvents, and other problems associated with solvents," Romeo says. Water-based coatings also typically dry in one-third of the time of solvent-based products, according to Nuzzo.

In the Convention Center, the steel had to be coated after it was erected, although intumescent coatings sometimes are applied in the shop prior to construction, especially when the job's location and the size of the steel beams make on-site application more difficult.

## What Do Fire Ratings Mean?

To meet fire code, the Convention Center's exposed steel needed a 1 1/2 hour rating, which means that it would theoretically take 1 1/2 hours for the structure to collapse during a fire. A UL classification requires a thin-film intumescent to demonstrate fire-resistive performance after being subjected to several simulated environmental conditions, including accelerated aging, humidity, ultraviolet light, salt spray, and other conditions. The standard UL 263 test exposes a two-foot sample of the coated steel to 1,000° F temperatures for 10 minutes; the more stringent UL 1709 hydrocarbon fire test takes it to 2,000° F or greater within five minutes and maintains that temperature through the duration of the test.

"UL also offers a follow-up service for all tested products, and they do quarterly, unannounced spot-checks to verify that the materials are being manufactured in accordance with the same specifications as the products tested at their laboratories," Nuzzo says. "When you see the UL label, you know you are getting UL-certified material. Other tests may be accepted, but you don't get the guarantee that you have with a UL certification." Foreign-made intumescent coatings, in particular, may have had other independent tests, but he feels that the ASTM standards adopted by UL should be the standard by which all thin-film intumescent coatings are measured.

One of the factors affecting the hourly rating of intumescent coatings is the coating's thickness, which is dictated by the thickness of the steel, Nuzzo says. "Steel that is 1/2-inch-thick requires less coating than steel that's 1/4-inch-thick," he explains. "That's why some structural members might get 100 mils, while



Photo courtesy of Contego International Inc.

Intumescent coatings, part of the category of Spray-Applied Fire Resistant Materials (SFRMs), are required to undergo a series of stringent tests by Underwriters Laboratories, Inc. (UL) to assure their long-term thermal performance. When exposed to extreme heat, they swell and produce ash that is 20 to 50 times thicker than the original coating. The ash insulates the steel from fire, prolonging the length of time before a structure collapses. To ensure that intumescent coatings will perform after they age, they must demonstrate fire-resistive performance under many environmental conditions before they can receive a UL classification.

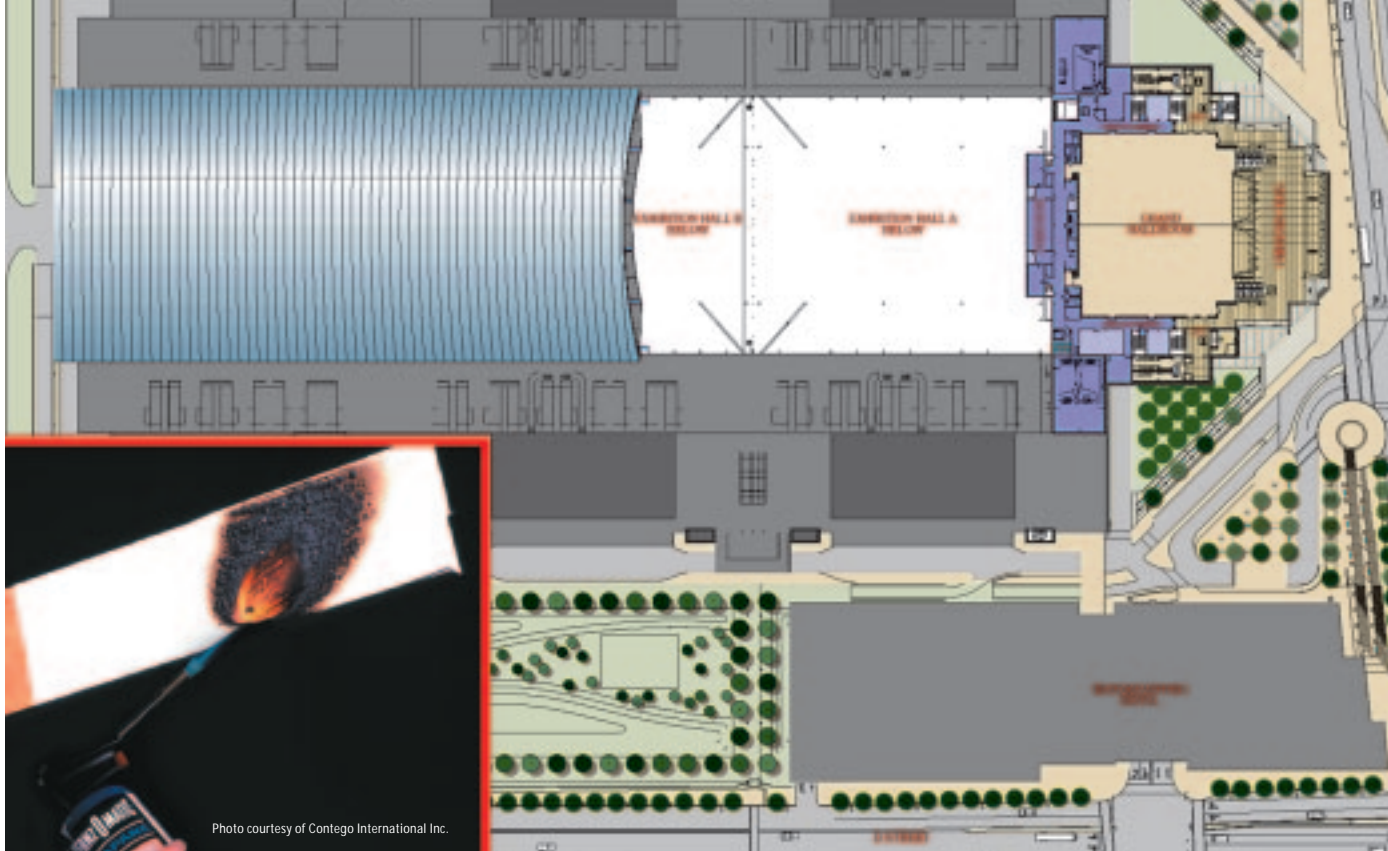
others need 200 mils." Steel will need a thicker milage for a three-hour rating than for a one-hour rating, he says.

## Fireproofing a Forest of 'Trees'

Meeting fire code specs at the Boston Convention and Exhibition Center began in August 2003 with the process of surface prep, which meant ensuring that the steel was clean and spot-primed where needed, says Tom Bassett, chief estimator for the MacKenzie Service Corporation. "It was standard, shop-primed steel, but it got beat up during erection and contained some slag from the mill, so it needed abrading in some areas," he says. "They had to grind those areas using DeWalt grinders with 80-grit sandpaper. In some cases to SSPC-SP2, that may have taken a couple of hours; in other cases, a couple of days."

The MacKenzie crew then did the needed spot-priming, applying a 2-mil coat of Tnemec's 1099 primer. After an overnight cure, it was ready for the intumescent topcoat, which required multiple passes to achieve the needed 100-to-200-mil thickness. The single-component material, stored in five-gallon pails, was spray-applied using either a Speeflo 5500 or a Graco 1595 sprayer, Romeo says. The workers used 100-foot hoses with a 3/8-inch line and tried to stay as close as possible to the pumps.

"Each coat went on about 70 mils wet and dried to about 50 mils DFT," he adds. "The length of time each coat needed to dry depended upon the humidity. The building is heated now, but when we started in August we had summer rains to contend with, so it took longer than the four- or five-hour average. We can usually apply about two coats a day." MacKenzie typically used two two-man crews — "one in the bucket, and one down on the ground," Romeo says. The company employs about 60 painters in all.



The new Boston Convention and Exhibition Center is slated to open in the summer of 2004. When exposed to fire (*inset*), intumescent coatings expand 15 to 30 times and generate a char layer that erodes as the fire continues.

Coating the steel “trees” that reached up to the 110-foot ceiling (advertised by Convention Center officials as “100% higher than standard facilities”) was no easy feat. Says Romeo, “If we’re spraying above 40 feet, we use a JLG aerial mobile platform, then switch over to a scissor lift with an articulating vertical platform.” While in the boom, the workers were secured with MSA safety harnesses. To protect themselves from breathing in dust particulates, they wore 3M charcoal half-mask respirators.

The pedestrian bridges presented a different challenge: since their construction called for finished metals and glass panels to be installed over the steel frame, application of the intumescent coating had to be coordinated with several other trades, says Romeo. The two 480-foot-long, 20-foot-wide sky-bridges span the exhibit floor and are designed to “maximize easy point-to-point movement for event goers,” according to Convention Center officials.

## Design Options for the Future

When the Boston Convention and Exhibition Center opens in July, it will be the largest convention facility in the Northeast and a unique architectural showpiece. But unless it serves as a venue for a coatings industry trade show, chances are that few of its visitors will appreciate that its dramatic steel elements are coated with a state-of-the-art material that adds aesthetic value and also protects the building in the event of a fire.

“What they will be seeing is an exciting design option for the future,” notes Nuzzo. “Only a few years ago, architects and structural engineers had to bury all the steel. Now we’ve given them the freedom to design whatever their imagination calls for using the lightest possible steel, quite cost-effectively. And they’re embracing it.” CP

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