



SUSTAINABLE SOLUTIONS SPECIFIED FOR WORLD TRADE CENTER CONSTRUCTION



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The World Trade Center (WTC) site is arguably one of the most extraordinary commercial building sites anywhere in the world. More than two decades after the tragic September 11, 2001, attacks, the rebuilt 16-acre WTC site in lower Manhattan represents a momentous undertaking.

From innovative architectural design and engineering precision to thoughtful product specification and world-class workmanship, every step of the reconstruction process reflects a commitment to excellence. The WTC site is comprised of multiple elements, including five skyscrapers (1, 2, 3, 4, and 7 WTC), the National September 11 Memorial and Museum, the World Trade Center Transportation Hub, retail space, and a performing arts center.

As a leading producer of commercial building insulation materials, glass-fiber reinforcements and engineered materials for composite systems, Owens Corning products were specified in several WTC structures, including One World Trade Center, the World Trade Center Transportation Hub, and the National September 11 Memorial. Product solutions were selected to deliver performance, help address life safety and support sustainable building goals. In specific, Owens Corning® FOAMULAR® Extruded Polystyrene (XPS) Insulation, Thermafiber® Mineral Wool Insulation, EcoTouch® fiberglass insulation and Advantex® Corrosion-Resistant Glass Reinforcements are incorporated into the construction of these structures.

"As an American company with our world headquarters based in Toledo, Ohio, Owens Corning is proud to have our broad portfolio of composite and commercial solutions contributing to the success of the World Trade Center construction," said Todd Fister, Global President, Insulation Owens Corning. "The process to rebuild the World Trade Center site is creating a new benchmark for the future of commercial sustainable building."

ONE WORLD TRADE CENTER

The construction of One World Trade Center transformed New York City's skyline. Soaring above Manhattan at 1,776 feet, One World Trade Center is America's tallest building — and an iconic New York landmark.

Built on the northwest corner of the site where the Twin Towers once stood, the 3.5-million-square foot building includes office space, an observation deck, world-class restaurants, and broadcast and antennae facilities.

Under the leadership of architects Skidmore, Owings and Merrill, structural engineers WSP Group, Tishman Construction, and The Port Authority of New York and New Jersey, the One World Trade Center construction and operation incorporates technologies and sustainable solutions to maximize efficiency. In keeping with this goal, construction conforms to the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED®) Gold standard.

To meet the LEED certification requirements, Owens Corning® Thermafiber® Mineral Wool Insulation was specified. Among other properties, the material contains a minimum of 70% recycled content and helps support energy conservation. These attributes allow it to contribute to LEED certification calculations.

SAFETY CONSIDERATIONS AT ONE WORLD TRADE CENTER

Thermafiber® mineral wool insulation was also of interest because it is non-combustible, is inorganic, fire, and mold resistant. With a proven history of performance for more than 30 years and extensive testing by Underwriters Laboratories (UL), Thermafiber® FireSpan® 90 Curtain Wall Insulation was used in conjunction with Thermafiber® Safing Fire Containment Insulation to achieve outstanding fire resistance in curtain wall and perimeter fire containment systems. Additionally, a custom-designed Thermafiber® Impasse® Insulation Hanger System was developed to help make installation simple, accurate, and fast.

Perimeter fire containment (PFC) is a complicated and not always well understood topic. However, when properly designed and installed, PFC systems provide passive protection to help keep fire from spreading in the event of an emergency and help address life safety by allowing more time for building occupants to escape and fire crews to control the spread of the fire. Thermafiber® Safing and Thermafiber® FireSpan® along with the Thermafiber® Impasse® Hangers have been tested and listed for use in perimeter fire containment systems in commercial high-rise buildings.

Additionally, several Thermafiber® mineral wool insulation products specified for use in One World Trade Center, including Thermafiber® FireSpan® 90, Thermafiber® Safing and the Thermafiber® Impasse® Patented Hanger System, have earned a Support Anti-Terrorism by Fostering Effective Technologies (SAFTEY) Act designation.) To receive this designation, materials go through an application and review process with the U.S. Department of Homeland Security. The evaluation considers if a product would be effective in helping to save lives after a terrorist attack on a building's structure, and assesses if the material functions as expected, meets set specifications and is safe to use. Owens Corning was the first insulation manufacturer publicly recognized and able to deliver perimeter Fire Containment System options carrying a SAFETY Act designation.

The designation is intended to allow for research and development of products for safe and durable buildings. It provides some liability protection from third-party legal cases for architects, contractors and builders in the event of attack on a facility.

Another non-combustible insulation installed on site in One World Trade Center is EcoTouch® sound attenuation batt insulation, which was used on the interior walls. The flexible, blanket insulation supports thermal efficiency but can also reduce noise,



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improving sound transmission class ratings by 4 to 10 points depending on installation.

THE NATIONAL SEPTEMBER 11 MEMORIAL

The National September 11 Memorial is also located at the site of the former WTC complex. It serves as a tribute of remembrance and honor to the 2,983 victims who were killed in the September 11th attacks in New York City, Washington, DC, Pennsylvania, and the February 1993 WTC bombing.

Entitled "Reflecting Absence," the design by architect Michael Arad and landscape architect Peter Walker was selected from a worldwide design competition that included more than 5,000 entrants from 63 nations. Occupying an eight-acre plaza set within the footprints of the original Twin Towers, the memorial has two recessed reflecting pools that feature 30-foot, man-made waterfalls. This poignant memorial was officially unveiled on the 10th anniversary of the 9/11 attacks in a dedication ceremony for victims' families and was opened to the public the following day.

In addition to the external beauty of the memorial, special attention was paid to the internal workings to help the memorial plaza become one of the most sustainable plazas ever constructed.

A team of project engineers, specifiers, and representatives from Industrial Fiberglass Specialties, spent three years perfecting the design and engineering to ensure the 600,000 gallons of water in each of the vast reflecting pools would continuously flow without any disruptions.

Industrial Fiberglass Specialties also provided the guided specifications for the quality and performance standards needed in the composite piping system. It was determined that composite piping for larger diameter sections should be specified as the material was lighter weight than stainless-steel pipe, making it easy to install in the tight space constraints. Industrial Fiberglass Specialties custom-fabricated 4,300 lineal feet of 12- and 16-inch-diameter FRP composite pipe, using a dualwound construction designed to handle corrosive water treatment chemicals and avoid the complications that might occur with some metal alloys.

To help create the FRP composite pipe's interior liner, structural wall, and exterior fire-resistant reinforcement, Industrial Fiberglass Specialties used Owens Corning® Advantex® Corrosion-Resistant Glass Fiber Reinforcements. Both the inner and outer layers of the FRP composite pipe are reinforced with boron-free Advantex® E-CR glass fiber reinforcement. Introduced to the market in the late 1990s, Advantex® Corrosion-Resistant Glass Reinforcement is a proven composite product that offers excellent performance in composites facing corrosive environments.

WORLD TRADE CENTER (WTC) TRANSPORTATION HUB

The multi-facility site also features the World Trade Center Transportation Hub, which expands transit access and brings dramatic architectural beauty to downtown Manhattan.

Designed by renowned engineer and architect Santiago Calatrava, the \$3.9 billion hub serves as the home to the Port Authority Trans-Hudson (PATH). The hub's primary function is linking virtually all forms of mass transit. This includes connecting to 13 subway lines via the Fulton Street Transit Center, other terminals and linking pedestrians to the World Financial Center (WFC) and its ferries through an underground concourse. The hub also makes the rebuilt WTC easier to access for 250,000 daily visitors and commuters and connects them to other parts of the city and region.

During construction, approximately 10,000 jobs were created to bring the 800,000-square foot transportation hub's innovative design features to life. Notable architectural elements include a largely column-free interior space with a retractable skylight that allows natural light to reach the rail platforms 60 feet below street level.

Padilla Construction and Wolkow-Braker Roofing were among the New York City-based companies awarded contracts to work on the transportation hub. Wolkow-Braker Roofing installed FOAMULAR® 404 XPS Insulation while Padilla Construction installed 50,000 square feet of the moisture-resistant 2-inch-thick Owens Corning® FOAMULAR® 1000 Insulation in a temporary moisture barrier application under the hub's concrete deck capitalizing on the material's resistance to moisture and its comprehensive strength. When tested for water absorption, the material demonstrates a 0.3% maximum water by volume.¹ Padilla Construction also installed an additional 120,000 square feet of Owens Corning® FOAMULAR® 1000 Insulation, using a sandwich construction.

GREEN SPACE AT THE WORLD TRADE CENTER SITE

Along with sustainable buildings built to LEED specification, the reimagined World Trade Center site features several green spaces including Liberty Park and Memorial Plaza, which are vegetative roof assemblies. These green spaces provide vegetation, help mitigate urban heat islands and collect storm water for irrigation and to protect the city's water management system.

These multilayer constructions require materials like FOAMULAR® Extruded Polystyrene (XPS) Rigid Foam Insulation, which provides several performance attributes to the enclosure, including compressive strength, thermal performance, and moisture resistance. Because of these performance properties the insulation is a go-to solution across the enclosure – from foundations to assembly walls to some of the nation's largest vegetative roof assemblies.



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FOAMULAR® Insulation delivers exceptional moisture resistance and provides long-term durability and performance by retaining its high R-value. Available in a variety of compressive strengths, it is also the first XPS foam certified by Scientific Certification Systems (SCS) to contain pre-consumer recycled content. XPS Insulation also has the distinction of being the only foam plastic insulation available with a limited lifetime warranty for the life of the home or building.²

As part of the GREENGUARD Certification Program, Owens Corning® FOAMULAR® XPS Insulation has also achieved GREENGUARD GOLD Certification.

When incorporated across the series of elements comprising the redesigned WTC site, Owens Corning's materials, ranging from insulation to glass fiber reinforcement to hangers, function across the site to provide long-lasting performance, contribute to life safety features and help support larger sustainability goals.

REFERENCES

- 1 Data ranges from 0.00 to value shown due to the level of precision of the test method.
- 2 See actual warranty for complete details, limitations, and requirements at www.owenscorning.com.

GREENGUARD Certified products are certified to GREENGUARD standards for low chemical emissions into indoor air during product usage. For more information, visit ul.com/gg.

LEED is a registered trademark of the U.S. Green Building Council



For more about Owens Corning® FOAMULAR® Insulation and applications that can benefit from XPS insulation, visit www.owenscorning.com/foamular.

For more information about Owens Corning® Thermafiber® Mineral Wool Insulation and applications, visit www.owenscorning.com/thermafiber.



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