

Construction
Solutions

DOW CORNING

Lasting Innovation:

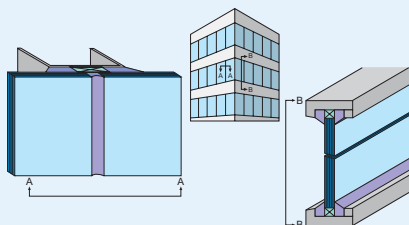
*20 Years of Structural
Silicone Glazing Success*





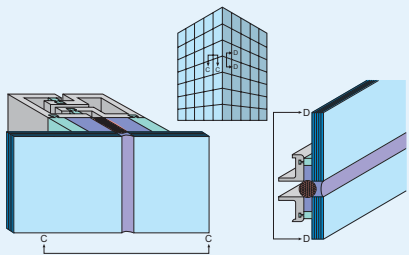
In structural silicone glazing, structural silicone adhesive, rather than metal fasteners, is used to attach glass, ceramic, metal, stone or composite panels to a building's frame. This creates a continuous flexible rubber anchor that absorbs stress and prevents air- and water-intrusion. Only silicone sealants possess the unique combination of strength, flexibility and weather resistance required for structural glazing applications.

The system may be two-sided or four-sided, depending on design requirements. In two-sided systems, only the vertical joints are structurally glazed with silicone, creating a ribbon effect. The dead load of the panel weight is supported mechanically.



Two-sided structural silicone glazing.

In four-sided systems, both the vertical and the horizontal joints are structurally glazed with silicone, enabling the creation of an uninterrupted wall of glass. Dead loads are either supported mechanically by a horizontal fin or by the silicone sealant itself, depending upon the design.



Four-sided structural silicone glazing.

Structural Silicone Glazing from Dow Corning:

CHANGING THE FACE OF THE WORLD'S CITIES

In the 1960s, Dow Corning Corporation pioneered a construction technology that has changed the face of the world's cities – structural silicone glazing. No longer limited by the need for intrusive mechanical fasteners, architectural imaginations soared.

Today, reflections of sun and clouds glide across uninterrupted facades of mirrored glass, metal and stone ... thanks to the innovative spirit and technological mastery of Dow Corning.

Designed to transmit windloads from the glass to the building's framework, structural silicone glazing systems must flex, extend and compress in rhythm with the daily stress of differential thermal shear. They must maintain their adhesive and cohesive strength in the face of earthquakes, hurricane-force winds, the sun's ultraviolet rays, temperature extremes, moisture and acid rain.



Unleashing the Potential

In the early 1960s and '70s, structural silicone glazing was a new and unproven concept. The possibilities were tantalizing. But who would risk the success of a multi-million-dollar building project on an untried structural sealant?

Dow Corning had already earned the industry's respect through the proven performance of its weatherproofing sealants and the expertise of its technical people. Innovative architects, glass and curtainwall manufacturers and contractors accepted the structural glazing challenge, confident that Dow Corning would work beside them to ensure their projects' success.

The Dow Corning structural glazing team tested, retested and tested again ... in the lab, in full-size mockups and on the job site. They evaluated their sealants' compatibility with all possible substrates. They tested for adhesion, movement capability, fatigue and failure. They analyzed joint designs, stresses and environmental variables, and monitored every design and installation detail.

Pushing the Envelope

Every conquest opened the door to a new structural glazing application. If the application was within the material's capabilities, Dow Corning helped the industry attempt it and succeed.

"It was an exciting time. There was such a spirit of camaraderie in the industry. All of us working together in a community of trust to develop a new architectural concept and prove to the world that it would work."

JERRY KLOSOWSKI
Dow Corning Corporation

“When these products became available, we were all talking about what kinds of information would give people a degree of confidence. Dow Corning started doing various kinds of testing to prove that the materials would work. They did a lot of good basic test work that I’m not aware of anyone else doing at that time. Dow Corning was one of the prime movers in getting properties tested and working with the rest of us at ASTM to develop industry-accepted standards for structural silicone glazing.”

TOM O’CONNOR, Building Technology Studio Director, The Smith Group
Architects of the world’s first four-sided structural silicone glazing project – the Smith, Hinchman & Grylls (SH&G) building, Detroit, Michigan

They worked with their customers to master windload, dead load and then shared load. Two-sided structural glazing served as a springboard for four-sided glazing, and then for the structural glazing of insulating glass panels.

No longer satisfied with square shapes and two dimensions, architects asked for and received the technical support they needed to structurally glaze triangles and other unexpected shapes and to create three-dimensional curtainwalls.

Curtainwall manufacturers asked for greater control over construction variables and faster production times. They received both through the introduction of a two-part, fast-cure sealant for unitized (in-shop) curtainwall construction. Curtainwall quality and performance improved, and the use of structural silicone glazing blossomed.

When world, weather and geologic events triggered the need for blast- and hurricane-resistant protective glazing systems, Dow Corning stepped forward with an effective solution.

With breakthrough materials and innovation support from Dow Corning, the construction industry has continued to push the structural silicone glazing envelope and succeed.

Challenging the Elements ... and Winning

In the following pages, you will find a sampling of the thousands of structures around the globe that owe their lasting strength and beauty to structural silicone glazing breakthroughs and products from Dow Corning. These structures typify the superior longevity and performance of Dow Corning’s structural glazing technology.

Through these projects, it is easy to see why, for more than 35 years, the global construction community has placed its trust in innovative structural glazing solutions from Dow Corning.

1964

The first structural silicone glazing application – the Total Vision System (2-sided structural glazing with glass mullions)



1968

Two-sided structural silicone glazing in curtainwalls

1971

The world’s first four-sided structural silicone glazing system

1976

Two-sided structural silicone glazing with insulating glass

1978

Four-sided structural silicone glazing with insulating glass

1984

Fast-curing two-part structural silicone for faster, better, easier shop glazing of unitized curtainwalls



1992

Blast- and hurricane-resistant protective glazing



Tomorrow

The next structural silicone glazing revolution from Dow Corning



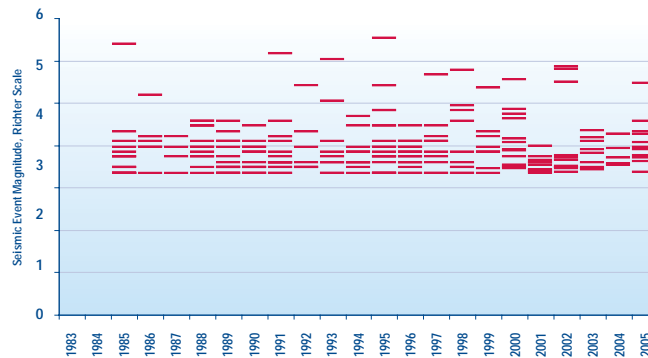
BP Exploration Alaska

ANCHORAGE, ALASKA

Standing Strong on Shaky Ground

Located in an active earthquake zone, the 16-story BP Exploration Alaska building stands on shaky ground. Twelve seismic events of Richter magnitude 7 or greater have occurred during its lifetime. Yet the performance of the *Dow Corning®* brand structural silicone used in its construction has remained unshakable. When the building was erected in 1983, HOK Architects specified *Dow Corning®* 795 Silicone Building Sealant to attach the insulating glass panels to the *Kynar®*-painted metal in the building's two-sided, structurally glazed unitized curtainwall system. A wise choice. In addition to repeated ground tremblers, the structure has weathered more than 20 years of temperature extremes (from -37 to 29°C [-34 to 85°F]) and an annual precipitation rate of 414 mm (16 in.).

Seismic Profile



Key Structural Innovators:

- HOK Architects
- Olympian Stone
- Fenpro Contract Glass Co.
- Dow Corning Corporation

Curtainwall Details:

- 2-sided, unitized (factory-glazed) construction
- Sealant design strength: 138 kPa (20 psi)
- Sealant bite: 13 mm (0.5")
- Lite dimensions: 1880 x 2134 mm (74 x 84")
- Windload: 1.91 kPa (40 psf)
- Substrates: Insulating glass, granite, *Kynar®*



The U.S. Geological Survey estimates that there are 500,000 detectable earthquakes in the world each year. One hundred thousand of those can be felt, and 100 of them cause damage.



World Savings Center

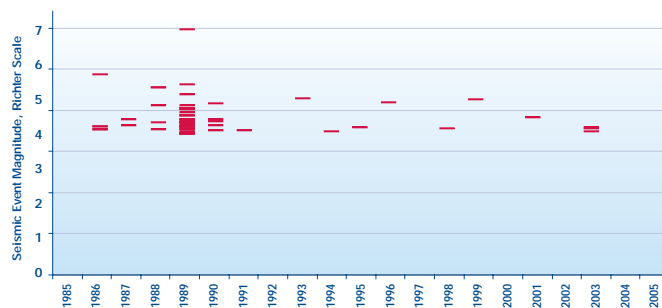
OAKLAND (SAN FRANCISCO), CALIFORNIA

Magnitude 7.1 Performance

On October 17, 1989, a 7.1 magnitude earthquake struck Loma Prieta in the Santa Cruz, California, mountains, 105 km (65 miles) southeast of San Francisco. The worst California earthquake since 1906, the Loma Prieta quake did billions of dollars of damage to the San Francisco Bay Area. Less than 1 km (0.6 mile) from the World Savings Center in Oakland, an entire section of the Nimitz Freeway collapsed. But the World Savings Center simply shrugged and went about its business, with no damage to the structural silicone in its unitized curtainwall.

Dow Corning® 983 Silicone Glazing and Curtainwall Adhesive/Sealant was used to adhere the monolithic tinted glass to the polyester powder painted metal when the building was constructed in 1985. Since then, the World Savings Center has been exposed to numerous seismic events, more than 20 years of natural weathering and, in 1995, to a wind storm with gusts in excess of 170 kph (106 mph). Yet no problems have ever been reported with the *Dow Corning* structural silicone in its curtainwall.

Seismic Profile



Key Structural Innovators:

- Curtainwall: PPG Industries
- Curtainwall contractor: RPS Architectural Products
- Dow Corning Corporation

Curtainwall Details:

- 4-sided, unitized (factory-glazed) construction
- Sealant bite: 19 mm (0.75")
- Lite dimensions: 1524 x 1828 mm (60 x 72")
- Windload: 2.15 kPa (45 psf)
- Substrates: *PPG®* grey float glass; Revere polyester powder coat paint





Center Tower

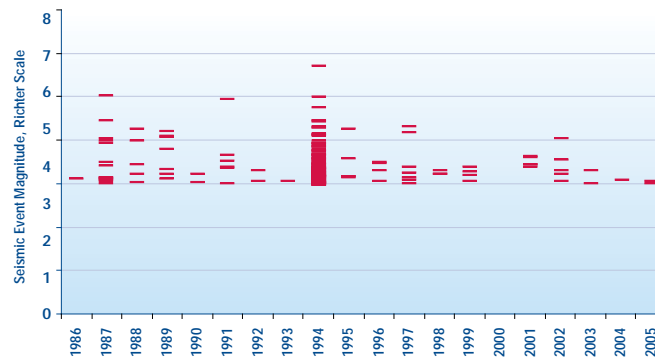
COSTA MESA (LOS ANGELES), CALIFORNIA

Performance in Motion

They say “it never rains in Southern California.” But even with an average of 260 sunny days each year, it sometimes pours. And seismic activity is common. At 4:30 a.m. on January 17, 1994, the greater Los Angeles area was shaken awake by an earthquake. According to the Southern California Earthquake Data Center, the Northridge quake produced the strongest ground motions ever recorded in a North American urban setting. Office buildings, freeways and parking structures collapsed. But the curtainwall on the Center Tower in nearby Costa Mesa held fast.

Erected in 1985, the unique shape of this 21-story building necessitated a structural silicone glazing design that would handle significant windload. The project was structurally glazed in the field using *Dow Corning® 795 Silicone Building Sealant*. There has never been a reported problem.

Seismic Profile



Key Structural Innovators:

- Architect: CRS Serrine
- Consultant: Heitmann & Associates
- Curtainwall contractor: Benson Industries
- Dow Corning Corporation

Curtainwall Details:

- 4-sided, field-glazed construction
- Sealant design strength: 138 kPa (20 psi)
- Lite dimensions: 1524 x 1524 mm (60 x 60")
- Sealant bite: 30 mm (1.175")
- Windload: 5.27 kPa (110 psf)
- Substrates: Monolithic glass; *Kynar®*-painted aluminum

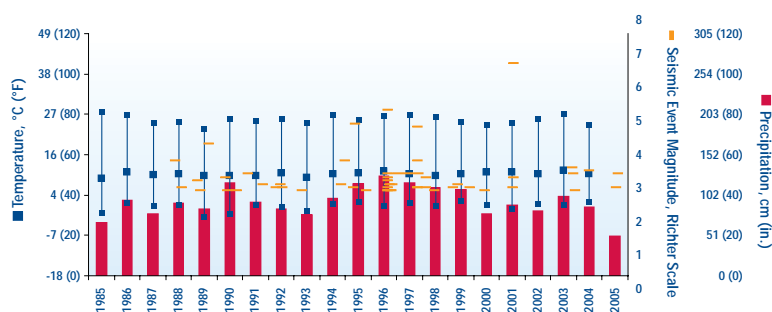
Washington Mutual Tower

SEATTLE, WASHINGTON

Holding Back the Damp

Standing tall in the “rain shadow” of the Olympic Mountains, the 55-story Washington Mutual Tower experiences few dramatic storms. Instead, it is continually shrouded in clouds and coated in drizzle, rarely seeing a sunny day. Moisture is a great degrader of construction materials, but in nearly 20 years of damp and gloom, punctuated by repeated seismic events, there have been no reported changes in the *Dow Corning®* structural sealants used in the building’s construction. Both *Dow Corning®* 983 Silicone Glazing and Curtainwall Adhesive/Sealant and *Dow Corning®* 795 Silicone Building Sealant were used to attach the insulating glass lites to the natural anodized aluminum in the building’s four-sided structurally glazed unitized curtainwall. The building was completed in 1987.

Temperature, Precipitation and Seismic Profile



Key Structural Innovators:

- Curtainwall contractor: Harmon Contract
- Contractor: Howard S. Wright
- Architect: McKinley Architects
- Dow Corning Corporation

Curtainwall Details:

- 4-sided, unitized (factory-glazed) construction
- Sealant design strength: 138 kPa (20 psi)
- Lite 1
 - Dimensions: 1524 x 1676 mm (60 x 66")
 - Sealant bite: 19 mm (0.75")
 - Windload: -3.83 kPa (-80 psf)
- Lite 2
 - Dimensions: 1524 x 1803 mm (60 x 71")
 - Sealant bite: 25 mm (1")
 - Windload: -4.55 kPa (-95 psf)
- Substrates: Insulating glass, 6063 clear/natural alloy anodized aluminum



The use of structural silicone glazing provides a natural thermal break between the glass and framing members. Attachment of insulating glass using this system results in no exterior exposed aluminum. The structural silicone attachment is also a barrier to the passage of air and water. This built-in thermal barrier keeps the interior framing members and insulation dry and comfortable.





Metropolitan Tower

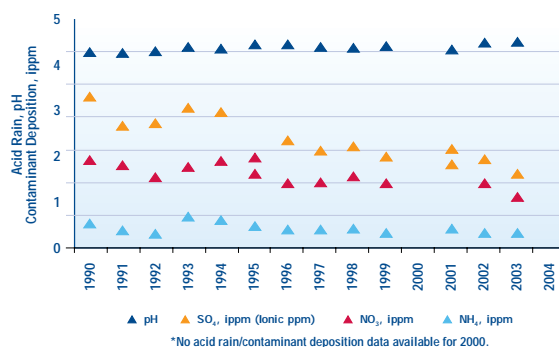
NEW YORK, NEW YORK

Passing the Acid Test

The 67-story Metropolitan Tower was New York City's first structural silicone glazed curtainwall. In 1985 when it was erected, it was the tallest residential building in the city and the sixth tallest concrete structure in the world.

Dow Corning® 983 Silicone Glazing and Curtainwall Adhesive/Sealant and Dow Corning® 795 Silicone Building Sealant were used, successfully, to adhere the 70,000 panes of insulating glass to the Metropolitan Tower's extruded aluminum frame. Every year, the building is subjected to an average of 1092 mm (43 in.) of acid-laden rain. But the structural silicone joints in the Metropolitan Tower's curtain-wall have remained steadfastly resistant to its degrading effects.

Pollution Profile



“When the curtainwall manufacturer tested the full-panel mockup for this building, a problem surfaced that could have jeopardized the entire project. The silicone glazing sealant they were using, an acetoxycure material, was incompatible with the secondary silicone seals in our insulating glass units, and it was causing them to lose adhesion and fail. We knew from experience that the only solution was to switch to a neutral-cure structural silicone, but the original sealant manufacturer didn’t make one. We immediately got on the phone to Dow Corning. They had exactly the material we needed and helped us get the project back on track.”

ROBERT SPINDLER

Director of Technical Services
Cardinal IG Corporation

Key Structural Innovators:

- Building owner (at the time of construction): Harry Macklowe
- Consultant: Gordon H. Smith Corporation
- Architect: Schuman, Lichtenstein, Claman & Efron
- Curtainwall contractor and erector: Diamond Architectural
- Construction manager: HRH
- Curtainwall manufacturer: Glassalum Engineering
- Insulating glass manufacturer: Cardinal IG Corporation
- Dow Corning Corporation

Curtainwall Details:

- 4-sided construction
- Sealant design strength: 138 kPa (20 psi)
- Lite 1
 - Dimensions: 1365 x 1210 x 25 mm (53.75 x 47.625 x 1")
 - Windload: 4.79 kPa (100 psf) – Sealant bite: 19 mm (0.757")
- Lite 2
 - Dimensions: 1480 x 603 x 25 mm (58.25 x 23.75 x 1")
 - Windload: 4.79 kPa (100 psf) – Sealant bite: 9.5 mm (0.375")
- Substrates: Gray-tinted insulating glass; Cardinal® SS-20 reflective coating on gray glass; black-painted aluminum



Acid rain erodes the surface of building material and causes corrosion and discoloration, cracking and pitting. It has accelerated the rate of deterioration of some of the world's most treasured monuments and historic structures.

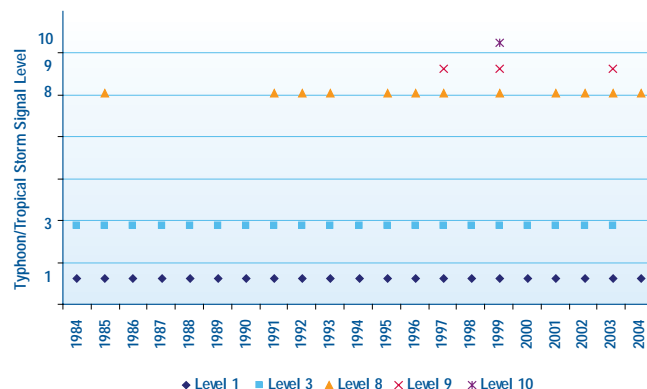
Exchange Square

HONG KONG

Where Tropical Weather Met Its Match

In spite of tropical heat and humidity, frequent heavy rains and typhoons, and the degrading effects of air pollution, Exchange Square is a prominent and enduring feature of the Hong Kong skyline. Constructed in 1984, it was the largest structural silicone project of its time. *Dow Corning*® 795 Silicone Building Sealant and *Dow Corning*® 983 Silicone Glazing and Curtainwall Adhesive/Sealant were used to adhere the monolithic glass to Exchange Square's massive 200-m (656-ft) towers. For more than 20 years, these sealants have continued to perform as reliably as the day they were installed.

Sustained Wind Speed Profile



Key Structural Innovators:

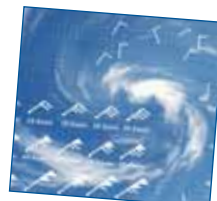
- Architect: Palmer and Turner
- Curtainwall contractor: Gartner and Builders Federal HK
- Consultant: Victor Mahler
- Dow Corning Corporation

Curtainwall Details:

- 2-sided, unitized (factory-glazed) system
- Sealant design strength: 138 kPa (20 psi)
- Lite 1 – vision glass:
 - Dimensions: 1600 x 1280 mm (63 x 50.4") – Windload: 5.27 kPa (110 psf)
 - Sealant bite: 40 mm (1.57")
- Lite 2 – spandrel glass:
 - Dimensions: 770 x 1280 mm (30.3 x 50.4") – Windload: 5.27 kPa (110 psf)
 - Sealant bite: 40 mm (1.57")
- Substrates: Monolithic glass; 10,000 factory-glazed units, including glass and granite spandrel



The warm ocean waters of the Western Pacific and the South China Sea fuel some of the most powerful typhoons on Earth. One of the strongest, Typhoon York, scored a direct hit on Hong Kong in September 1999. Sustained wind speeds reached 150 kph (93 mph), and the city remained under a Number 10 storm signal alert for a record 10 hours.





Condomínio River Park

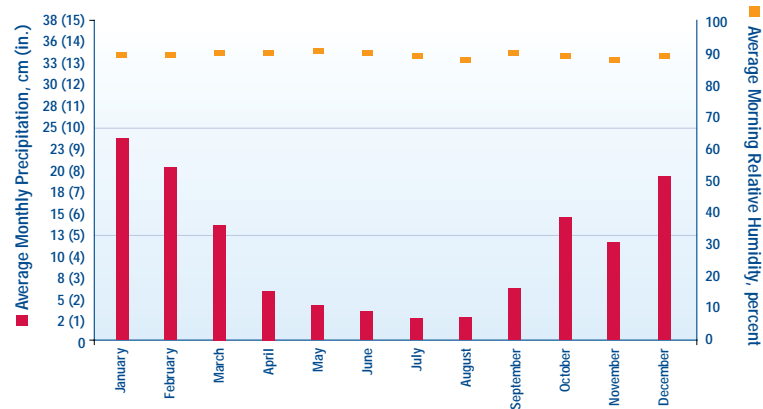
SÃO PAULO, BRASIL

A Fitting Addition

The Condomínio River Park, which features two 70-m (230-ft) verticals joined by a gracefully curved plaza lobby, is a fitting addition to a city known for its modern high-rise architecture. Constructed from natural-color anodized aluminum panels and blue laminated glass over *Corten*® steel, the building was structurally glazed in 1990 with *Dow Corning*® 795 Silicone Building Sealant.

São Paulo's tropical climate is moderated by its altitude. The city seldom experiences temperatures higher than 30°C (86°F), and frost is rare. However, rainfall is abundant and constant humidity combines with vehicle emissions to create a serious air pollution problem. Moisture and pollutants can be damaging to sealants. But the *Dow Corning*® 795 Silicone Building Sealant in the Condomínio River Park continues to perform as expected, untroubled by either the weather or the smog. At this rate, the sealant is sure to exceed its 20-year capability promise.

Precipitation/Humidity Profile

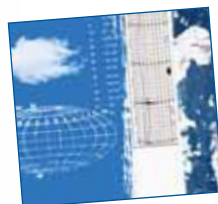


Key Structural Innovators:

- Architect: Botti Rubin Architects
- Curtainwall contractor: Algrad Frame and Special Facades Ltda.
- Dow Corning do Brasil Ltda.

Curtainwall Details:

- 4-sided, unitized (factory-glazed) construction
- Sealant design strength: 138 kPa (20 psi)
- Lite dimensions: 1850 x 1850 mm (72.8 x 72.8")
- Sealant bite: 17 mm (0.67")
- Windload: 1.2 kPa (25 psf)
- Substrates: Blue laminated glass, natural-color anodized aluminum plate panels, aluminum frame, *Corten*® steel with a naval hardboard



São Paulo is located directly on the Tropic of Capricorn, the parallel of latitude that marks the southern boundary of the tropics.

Messe Frankfurt

FRANKFURT, GERMANY

Weathering It All

The third-largest trade fair complex in the world, located in Frankfurt, Germany, covers 476,000 m² (5,123,621 ft²). Extreme variations in temperature, humidity, infrared and ultraviolet radiation in the region required the building to have sealants that can handle the most arduous conditions.

While the weather fluctuates, the *Dow Corning*® 983 Silicone Glazing and Curtainwall Adhesive/Sealant and the *Dow Corning*® 3332 Insulating Glass Sealant installed in this building's structural silicone glazing system in 1986 continue to thrive.

Key Structural Innovators:

- Curtainwall contractor: Waagner Biro (Austria) and HeFi – Fischer – Talheim (Germany)
- Architect: Murphy/Jahn (USA)
- Glass processor/IG-manufacturer: Okalux – Marktheidenfeld (Germany)
- Dow Corning Corporation

Curtainwall Details:

- 2-sided structural glazing system for the facade, 4-sided structural glazing for the glass roof, 2-sided structural glazing system for the pyramid-shaped roof



THE INNOVATION CONTINUES

The Largest Glass Wall of Its Kind in the World

The seven-story stone and glass base of the Time Warner Center in New York City is fabricated with a steel frame. The towers that rise above it are constructed around 12.2 x 43 m (40 x 140 ft) concrete cores. The wall of the open mall that faces Columbus Circle is made of laminated glass panes attached to a non-rigid, 46 m (150 ft) high by 26 m (85 ft) wide cable mesh frame. Completed in 2004, it is the largest glass wall of its kind in the world.

With approximately 92,903 m² (1 million ft²) of custom-fabricated glass curtainwall, the performance of the structural sealants used in the center's construction could not be left to chance. The curtainwall panels, which employed a combination of *Dow Corning*® 983 Silicone Glazing and Curtainwall Adhesive/Sealant and *Dow Corning*® 995 Silicone Structural Glazing Sealant, were subjected to an elaborate, 60-part test for air and water infiltration as well as structural performance. The sealants performed as expected – flawlessly.

Key Structural Innovators:

- Architect: Skidmore, Owings & Merrill, LLP
- Curtainwall manufacturer and contractor: Glassalum International Corporation
- Caulking contractor: RSG Caulking & Waterproofing, Inc.
- Consultant: Gordon H. Smith Corporation
- Dow Corning Corporation

Curtainwall Details:

- 4-sided, unitized (factory-glazed) construction
- Substrates: Insulating glass, aluminum



THE TIME WARNER CENTER
New York, New York

“People constantly raise the question about structural silicone glazing, ‘How long is it going to last?’ What we tell them is this: We have experience with structural silicone on buildings going back over 25 years. The failures we’ve seen have been attributed to poor workmanship. These failures usually occur shortly after installation and are not attributed to the silicone itself. We know of no non-workmanship-attributed failures. We know of no long-term failures.”

GORDON H. SMITH, P.E.
Gordon H. Smith Corporation

Supporting the Industry

For more than 60 years, Dow Corning Corporation has provided the construction industry with groundbreaking solutions – from the industry's first silicone structural glazing sealant to non-staining sealant technology for aesthetically sensitive substrates.

Dow Corning offers a reliable, worldwide supply of top-quality silicone adhesives, sealants, coatings and chemicals for applications from structural glazing to weather-proofing, plus a full range of construction project support services.

Quality-conscious architects, contractors and building owners around the globe depend on Dow Corning for innovative technology, proven performance, outstanding technical support and one of the most extensive warranty systems in the industry.

For more information, visit the construction solutions website:
www.dowcorning.com/construction.

How to Contact Dow Corning

Dow Corning has sales offices, manufacturing sites, and science and technology laboratories around the globe. Telephone numbers of locations near you are available on the World Wide Web at www.dowcorning.com, or by calling one of our primary locations listed below.

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invent the future.™*

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