

# Lasting innovation

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**DOW**

®



# Structural silicone glazing from Dow

## Changing the face of the world's cities

In the 1960s, Dow 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.

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.

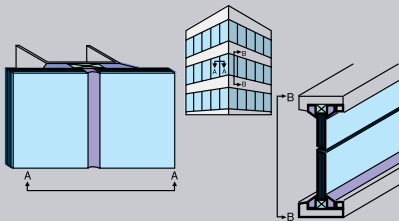
### Unleashing the potential

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## About structural silicone glazing

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

## Pushing the envelope

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

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 stepped forward with an effective solution.

With breakthrough materials and innovation support from Dow, 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. These structures typify the superior longevity and performance of DOWSIL™ structural glazing technology.

Through these projects, it is easy to see why, for more than 50 years, the global construction community has placed its trust in innovative structural glazing solutions from Dow.

## Timeline

- **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
- **2010'** High design strength structural glazing
- **T** The next structural silicone glazing revolution from Dow

# **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 DOWSIL™ structural silicone used in its construction has remained unshakable. When the building was erected in 1983, HOK Architects specified DOWSIL™ 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.).

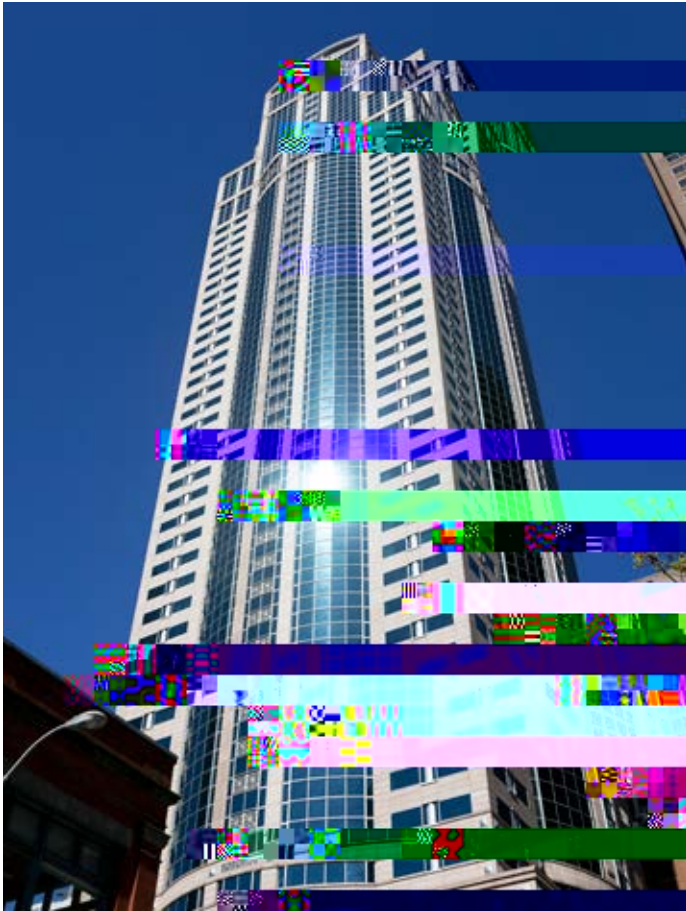


## **Center Tower**

Costa Mesa  
(Los Angeles),  
California

### **Performance in motion**

They say “it never rains in Southern California.” But even with



## 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 DOWSIL™ structural sealants used in the building’s construction. Both DOWSIL™ 983 Silicone Glazing and Curtainwall Sealant and DOWSIL™ 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.

### Key structural innovators:

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

### Seismic profile

Temperature, °C (°F)

Seismic Event Magnitude, Richter Scale

Precipitation, cm (in.)



# 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.

DOWSIL™ 983 Silicone Glazing and Curtainwall Sealant and DOWSIL™ 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 curtainwall have remained steadfastly resistant to its degrading effects.

## Key structural innovators:

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## **Sustained wind speed profile**



Rain and humidity



## Condomínio

### 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 DOWSIL™ 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 DOWSIL™ 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 could exceed its 20-year capability promise.

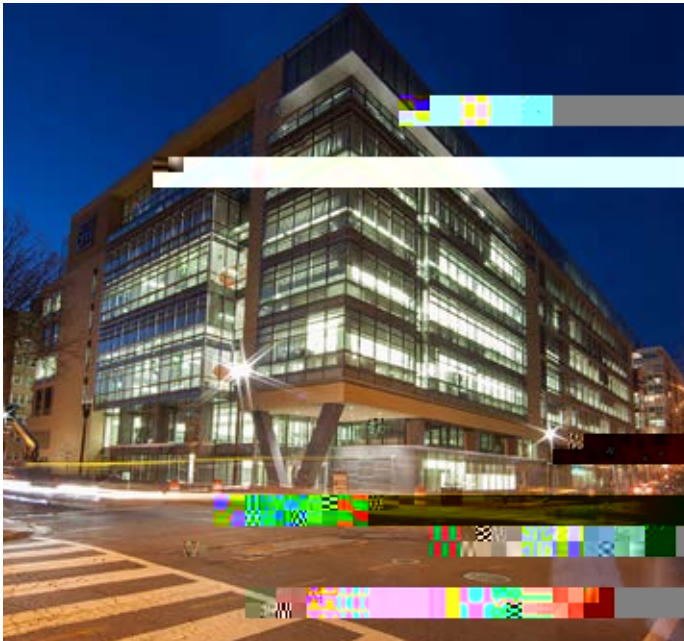
#### Key structural innovators:

- Architect: Botti Rubin Architects
- Curtainwall contractor: Algrad Frame and Special Facades Ltda.
- Dow 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 coating on gray glass; black-painted aluminum





## Science and Engineering Hall, George Washington University

Washington, D.C.

### Higher learning: signed, sealed, delivered

Construction of the new state-of-the-art Science and Engineering Hall (SEH) at the George Washington University (GW) created the largest academic building of higher education in the District of Columbia. The approximately 500,000 squarefoot building design features complex geometry including hundreds of unique transitions and multiple substrates. The design entailed considerable coordination between multiple substrates with additional field-glazing challenges.

To address the challenges, curtain wall and glazing contractor Harmon Inc. turned to Dow for its weathersealing and structural sealing needs. “Dow provides the sealants to do the whole job—from shop to field,” said Ronald Borza Jr., Regional Superintendent for Harmon.

“We field-glazed over 80 lites of glass on this project using either DOWSIL™ 995 Silicone Structural Sealant or DOWSIL™ 121 Structural Glazing Sealant,” said Kandace L. Shortt, Senior Project Manager for Harmon. “DOWSIL™ 121 Structural Glazing Sealant allowed us to remove the temporaries after 24 hours, which helped the schedule tremendously.”

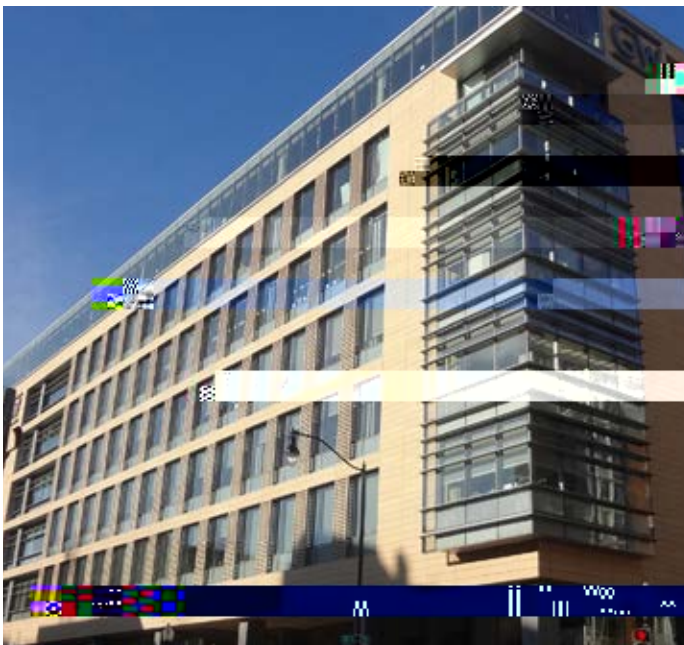
In addition to the curtain wall installation, the wide range of compatible, proven silicone construction materials from Dow helped address sealing needs for the variety of substrates used in the project.

### Key structural innovators:

- Architect: Ballinger (Philadelphia)
- Curtain wall and glazing: Harmon Inc.
- Dow Silicones Corporation

### Curtainwall details:

- Four-sided structural glazing; Sealant design strength: 138 kPa (20 psi)
- Fast-curing structural glazing sealant



The many proven weathersealing and structural glazing products from Dow gave contractors the tools they needed to confidently accommodate multiple substrates and complicated transitions.



Everyday weather

## **Raffles City Chengdu**

Chengdu,  
China

### **Specialized solutions for unique design**

A mixed-use development located in Chengdu's city center, Raffles City Chengdu will become a landmark in the city and

# Heathrow Airport Terminal 5

London,  
England

## Reaching for the sky

Heathrow Airport's new Terminal 5, which opened in 2008, is one of the largest single-span structures in the UK. The building is a striking example of airport architecture consisting primarily of steel and glass. Ensuring bomb blast resistance posed a unique challenge for Dow in collaboration with First Tier Contractor, Seele. Because of the use of glass throughout the internal fitting of the project—including glass stairway balustrades, glass doors, glazed elevators and shafts—additional bomb blast loading was required.

DOWSIL™ 3362 Insulating Glass Sealant was specified to provide an insulating glass edge seal for the glass units installed throughout many elements including the outer skin, the roof lights, the car parks and sky bridges.

The joints between the toughened elevator glass sections were bonded using DOWSIL™ 993 Structural Glazing Sealant technology. This project is another example of Dow



## Messe Frankfurt

Frankfurt,  
Germany

### Weathering it all

The third-largest trade fair complex in the world, located in Frankfurt, Germany, covers 476,000 m<sub>2</sub> (5,123,621 ft<sub>2</sub>). 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.

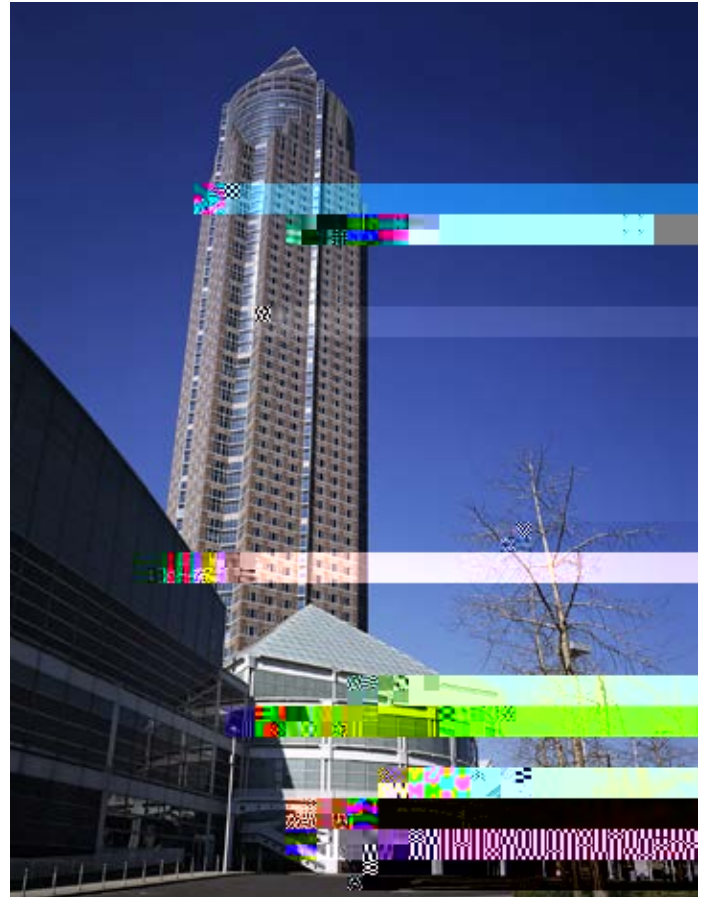
While the weather fluctuates, the DOWSIL™ 983 Silicone Glazing and Curtainwall Sealant and the DOWSIL™ 3332 Insulating Glass Sealant installed in this building's structural silicone glazing system in 1986 continue to thrive.

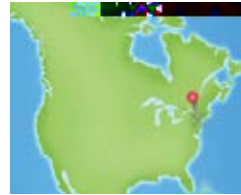
### Key structural innovators:

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

New York, New York

### 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 m<sub>2</sub> (1 million ft<sub>2</sub>) 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 DOWSIL™ 983 Silicone Glazing and Curtainwall Sealant and DOWSIL™ 995 Silicone Structural 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 Silicones Corporation

### Curtainwall details

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





Everyday weather



## ICE Kraków

Kraków  
Poland

### Silicones secure complex façade

Thanks to the opening of the Congress Centre in 2014, the ICE Kraków is the business and cultural flagship of the city. Located in the very heart of Krakow, it is a convenient place for the organization of diverse events – from international congresses, conferences, symposiums and business meetings, through cultural events such as concerts, opera, theatrical and ballet performances, to social meetings. Thanks to the opening of the Congress Centre, Krakow has an infrastructure that lets everyone enjoy their visit to the capital of Malopolska to the fullest extent – a prestigious facility, the atmosphere of the city and an extremely diverse cultural, culinary and commercial offer.

The building façade is comprised of a mixture of glass, ceramics and aluminium. The eastern side of the building is glazed to allow occupants to enjoy incredible city views, whilst the reverse of the building is covered with coloured ceramic tiles, which correspond to the interior colour-scheme. This dynamic use of substrates and colours is a reflection of the architect's desire to represent the vibrancy of the Debniki district on the right bank of the Vistula and which only joined the Kraków city limits in 1909.

DOWSIL™ sealants were extensively used for the façade construction. DOWSIL™ 3362 HD Insulating Glass Sealant was specified for the secondary seal of the insulating glass units, DOWSIL™ 993 Structural Glazing Sealant was used to structurally attach the glass units, DOWSIL™ 791 Silicone Weatherproofing Sealant for the movement joints around windows and doors and the DOWSIL™ PanelFix System secured the ceramic panels to the curtain wall frame.

### Key structural innovators:

- Architect: Ingarden & Ewý Architekci Arata Isozaki & Associates
- Façade consultant: WB Projekt
- General contractor: Budimex S.A.
- Insulating glass and structural glazing fabricator: Quality Bond™ from Dow Member – Press Glass S.A., Poland
- System supplier: Quality Bond™ from Dow Member – Aluprof S.A., Poland
- Curtain wall contractor: Quality Bond™ from Dow Member – Alsas Sp. z o.o. Sp.K. Poland Quality Bond™ from Dow Distributor – Proventuss Poland

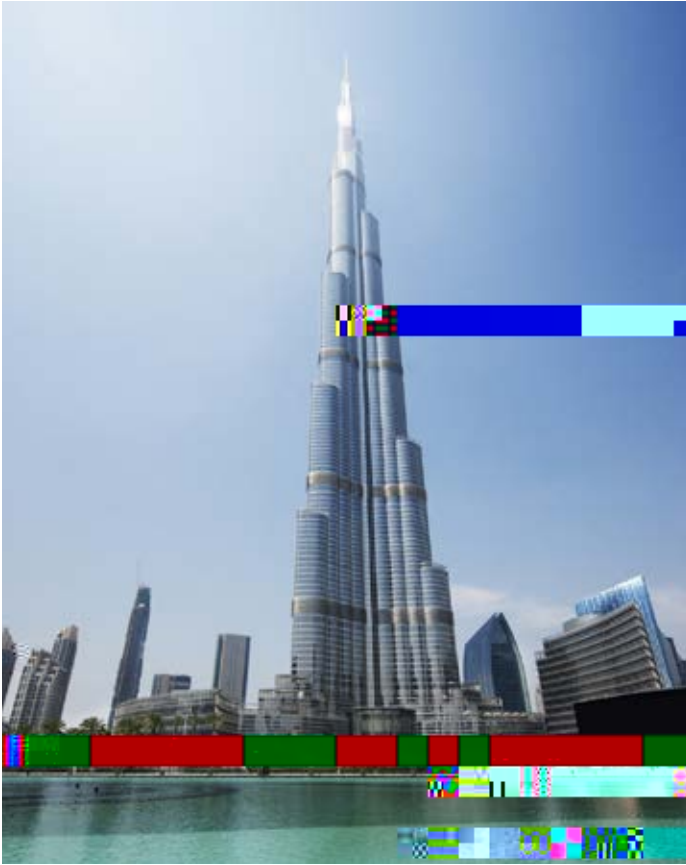








Extreme weather



## **Burj Khalifa**

### Dubai, United Arab Emirates

#### **Solving high altitude technical challenges**

With a budget for this project exceeding \$1.5 billion, the final height of the spectacular Burj Khalifa skyscraper soars to 828 m above ground level, holding the record for being the world's tallest building and also for the highest installation of an aluminium and glass facade.

Opened in 2010, this iconic project has overcome the greatest of challenges and technical difficulties, not least of which are the wind forces dominating the structural design of the tower, the logistics of moving men and materials at extreme heights and construction of the building envelope.

Managing the internal pressure foreseen within the insulating glass units due to the high altitude culminated in the specification of DOWSIL™ 3362 Insulating Glass Sealant.

DOWSIL™ 993 Structural Glazing Sealant was specified to bring additional security to the insulating glass units which were mechanically fixed to the superstructure.

#### **Key structural innovators:**

- Architects: Adrian Smith, Skidmore, Owings & Merrill
- Structural glazing fabricators: Far East Aluminium, Hong Kong Arabian Aluminium, UAE
- Insulating glass fabricators: White Aluminium, UAE
- Main contractor: Samsung Engineering & Construction
- Developer: Emaar Properties



## Supporting the industry

For more than 60 years, Dow 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 offers a reliable, worldwide supply of top-quality silicone adhesives, sealants, coatings and chemicals for applications from structural glazing to weatherproofing, plus a full range of construction project support services.

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

## Quality Bond™

The high quality of crystal clear bonding is reinforced through the well established Quality Bond™ Program. Quality Bond™ lifts silicone sealing and bonding to the highest level through the instigation of standards of best practice in quality control, quality assurance and product application by specialist silicone fabricators

and applicators. Quality Bond™ allows customers and specifiers to share in Dow's industry leading expertise and benefit from our proven global performance track record. For more information, please visit [www.dow.com](http://www.dow.com). Quality Bond™ is currently available in Europe, the Middle East, Africa, India, ASEAN and Greater China.

**DOWSIL**™