



Provider Number: K216

*How to Effectively Integrate Acid-etched Glass
in Exterior Glazing Systems*

Course Numbers
AIA: WA1703-20
USGBC: 0920013125



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Walker Glass Company Ltd.

WALKER

COURSE DESCRIPTION

Acid-etched glass can be used in a variety of exterior applications. This presentation will help you understand how design, function, performance and sustainable objectives can be achieved with this type of product. The session will focus on the integration of acid-etched glass in exterior glazing systems and will cover daylighting, properties, specifications and constructability, to facilitate and improve the decision making process. The course also covers how acid-etched glass can support the LEED certification process.

LEARNING OBJECTIVES

The participants will :

- Understand the design, functionality, performance and sustainable properties of acid-etched glass
- Evaluate how acid-etched glass impacts different elements of exterior glazing systems, including daylighting, color rendering, visual appearance and bird collision deterrence
- Understand how acid-etched glass can meet the glazing performance and sustainability objectives of a project.
- Review acid etched glass specifications that are critical to maintaining the objectives of the project

A modern office interior with large windows and a diagonal beam of light. The scene is brightly lit, with a polished floor reflecting the light. A semi-transparent white rectangle is centered over the image, containing the title text.

UNDERSTANDING ACID-ETCH GLASS



THE PROCESS

WHAT IS ACID-ETCHED GLASS?

The surface of which has been treated with an aqueous solution of hydrofluoric acid, resulting in a smooth satin texture and a matted translucent appearance.

- Acid-etching is a smoothing process providing various levels of translucency
- Acid-etching is not a coating

THE BENEFITS

- No impact on visible light transmittance
- No significant impact on solar performance
- No impact on structural strength
- Significant glare reduction
- Excellent light diffusion
- Enhance rendering of color on glass
- Add a measure of privacy

ACID-ETCHED GLASS



THE BENEFITS

- Apply a Low-E coating on the opposite side
- Provide appropriate concealment for spandrel conditions
- Unique design
- Brilliance on the surface
- Depth in the glass
- Closed-pore surface, does not trap dirt & particles
- Cleaning & maintenance similar to un-etched glass

ACID-ETCHED GLASS





GLASS FABRICATION

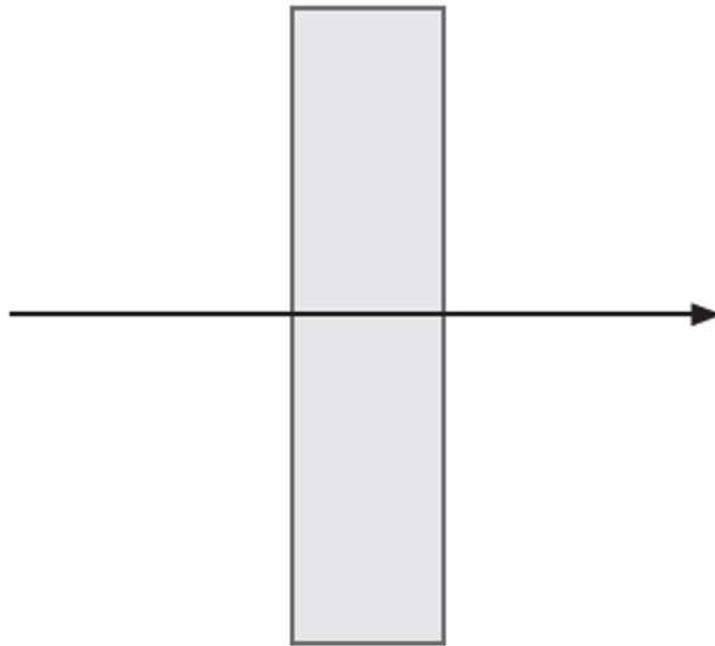
PROCESSES COMPATIBLE WITH ACID-ETCHED GLASS

- Cutting
- Polishing
- Beveling
- Laminating*
- Insulating
- Bending
- Drilling
- Tempering

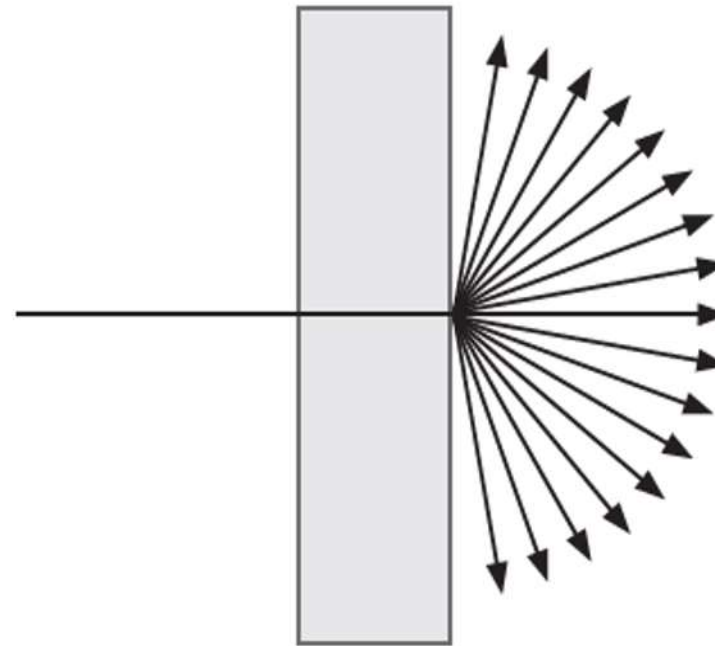
** Acid-etched glass may be laminated in the same manner as unetched glass providing that the laminate is applied to the unetched surface.*

LIGHT DIFFUSION

Un-etched Glass
Direct Light



Acid-etched Glass
Diffuse Transmittance & Haze



LIGHT DIFFUSION PROPERTIES

Test/Standard: ASTM D1003-13

Acid-etched Finish	Glass Substrate	Thickness mm (in)	Total Luminous Transmittance	Diffuse Transmittance	Haze
Opaque	Clear	6mm (1/4")	82.5%	75.09%	90.73%
Velour	Clear	6mm (1/4")	88.44%	79.00%	89.30%
Satin	Clear	6mm (1/4")	72.75%	32.66%	44.89%
Satinlite	Clear	6mm (1/4")	75.41%	9.73%	12.90%

Total Luminous Transmittance is the ratio of transmitted light to the incident light and is influenced by absorption and reflection properties.

Diffuse Transmittance is the portion of light that is scattered or diffused by the glass surface.

Haze is the percentage of light which in passing through deviates from the incident beam greater than 2.5 degrees on average. Haze is equal to the diffuse transmittance divided by the total luminous transmittance.

LIGHT DIFFUSION

- Enhanced natural light dispersion into the building interior
- Glowing and diffusion effects of artificial light (light boxes, backlit panels)

APPLICATION





H & M Store – Toronto, ON
Insulated Glass Unit – 8mm Starphire Ultra-Clear™ Opaque Surface #1, 2, 3 & 4



H & M Store – Toronto, ON
Insulated Glass Unit – 8mm Starphire Ultra-Clear™ Opaque Surface #1, 2, 3 & 4



NYU Langone Medical Center – New York, NY
12mm Starphire Ultra-Clear™ Glass Velour 2 Faces Tempered



NYU Langone Medical Center – New York, NY
12mm Starphire Ultra-Clear™ Glass Velour 2 Faces Tempered

SURFACE RESISTANCE

Test/Standard		Select acid-etched glass products	Float glass	Unit of Measure
Resistance to Wear	ASTM-C501	198 to 215	183.29	Abrasive Wear Index (Ix)
Resistance to Staining	ASTM-C1378	A	A	Classification
Scratch Hardness	MOHs	5 to 7	5,5	Out of a possible 10

Applications

- Surface 1 applications
- High traffic areas such as storefronts
- Railings and balustrades
- Structural glass façade
- Shelters
- Walkways



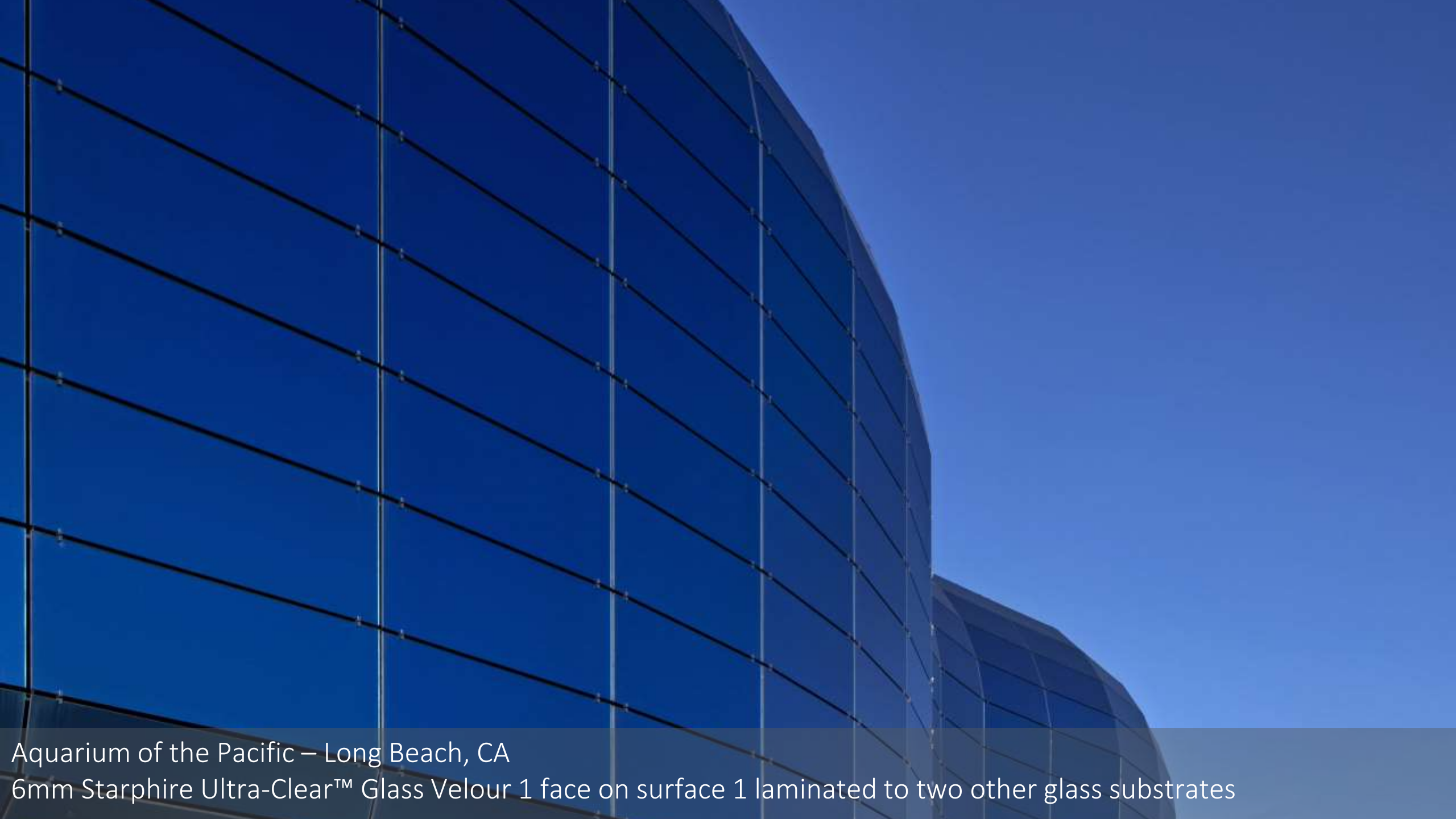
National Institute of Scientific Research (INRS) - Laval, QC
Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Satin Surface #1, Solarban® 60 Surface #3



National Institute of Scientific Research (INRS) - Laval, QC
Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Satin Surface #1, Solarban® 60 Surface #3



Aquarium of the Pacific – Long Beach, CA
6mm Starphire Ultra-Clear™ Glass Velour 1 face on surface 1 laminated to two other glass substrates



Aquarium of the Pacific – Long Beach, CA
6mm Starphire Ultra-Clear™ Glass Velour 1 face on surface 1 laminated to two other glass substrates

ACID-ETCHED GLASS
EXTERIOR GLAZING SYSTEMS



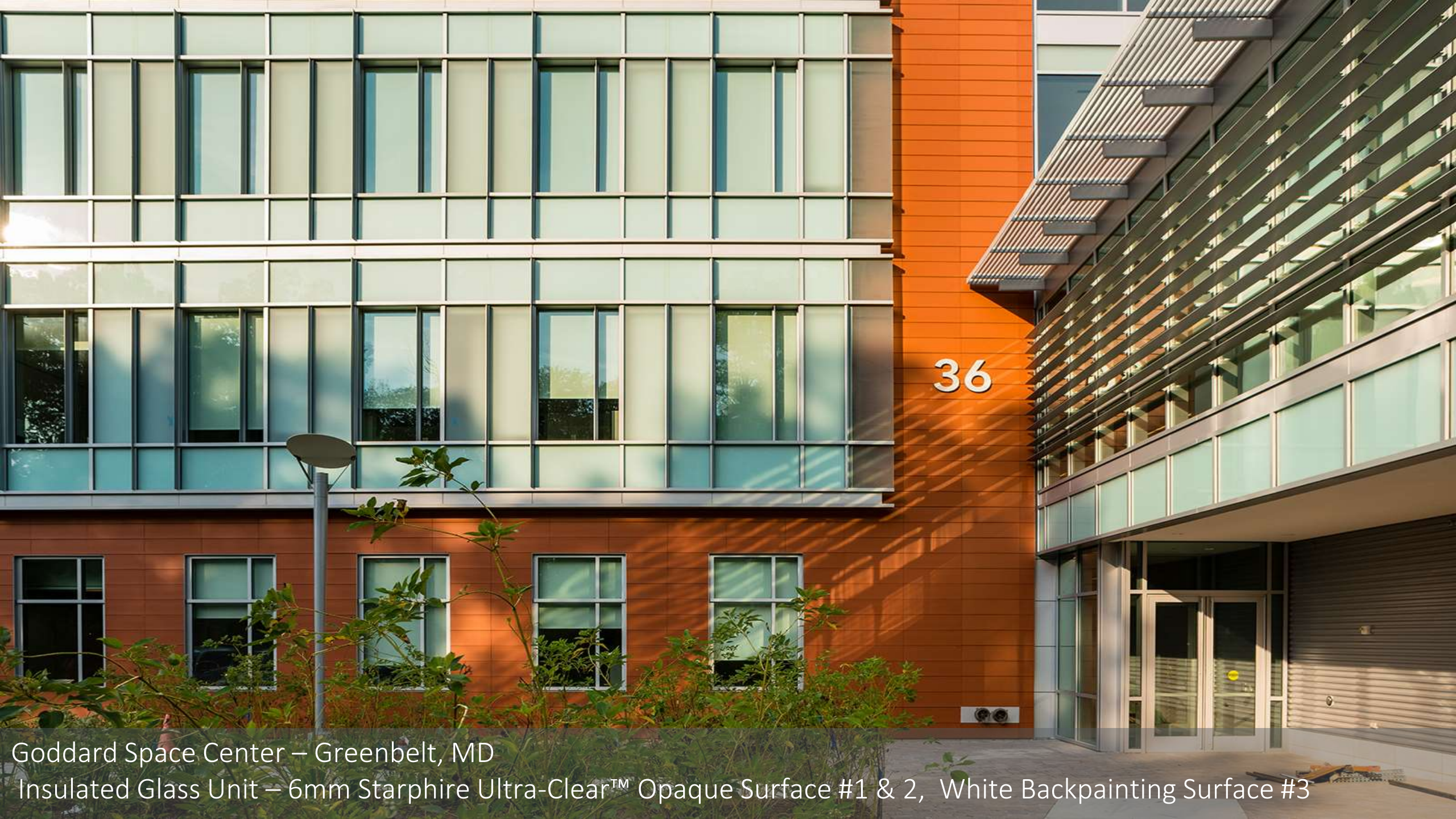
ACID-ETCHED GLASS

APPROPRIATE CONCEALMENT

- Use an Opaque etch finish on one or two surfaces
- Harmonize the look of spandrel units with vision areas
- Applications
 - Spandrel
 - Structural glass façade



Goddard Space Center – Greenbelt, MD
Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Opaque Surface #1 & 2, White Backpainting Surface #3



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Goddard Space Center – Greenbelt, MD
Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Opaque Surface #1 & 2, White Backpainting Surface #3



University of Iowa Health Care - Iowa City, IA
Insulated Glass Unit – 6mm Clear Glass Velour Surface #3, SunGuard SN62 Surface #2

PRIVACY WITH UNRESTRICTED LIGHT FLOW

Visible Light Transmittance Monolithic Glass

	6mm Clear	6mm Starphire
Un-etched glass	89.0%	91.0%
Satinlite acid-etched glass	88.0%	90.0%
Satin acid-etched glass	89.0%	90.0%
Velour acid-etched glass	91.0%	92.0%
Opaque acid-etched glass	91.0%	93.0%

VISIBLE LIGHT TRANSMITTANCE

Visible Light Transmittance

Description	VLT
6mm clear glass with acid-etched - full surface	91%
6mm clear glass with acid-etched - 35% pattern coverage	91%
6mm clear glass with grey frit - 20% coverage	72%
6mm clear glass with grey frit - 40% coverage	55%



ABB Canada Campus – Montreal, QC
Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Opaque Surface #2



ABB Canada Campus – Montreal, QC
Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Opaque Surface #2



Johnson

VOLVO

Johnson
Volvo Cars
Durham

WELCOME

Johnson Volvo - Durham, NC
6mm Starphire Ultra-Clear™ Velour Surface #1



Johnson Volvo - Durham, NC
6mm Starphire Ultra-Clear™ Velour Surface #1

ENHANCED COLOR RENDERING

Use a light etch surface to reduce reflection and enhance the color integrated in the glazing system

Applications

- IGU with a ceramic paint on the back surface of the glass
- Laminate with colored interlayer

ACID-ETCHED GLASS





Diana Center Barnard College – New York, NY
Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Glass Velour Surface #1, Terracotta Ceramic Paint Surface #2,
Tempered , Solarban® 60 Surface #3



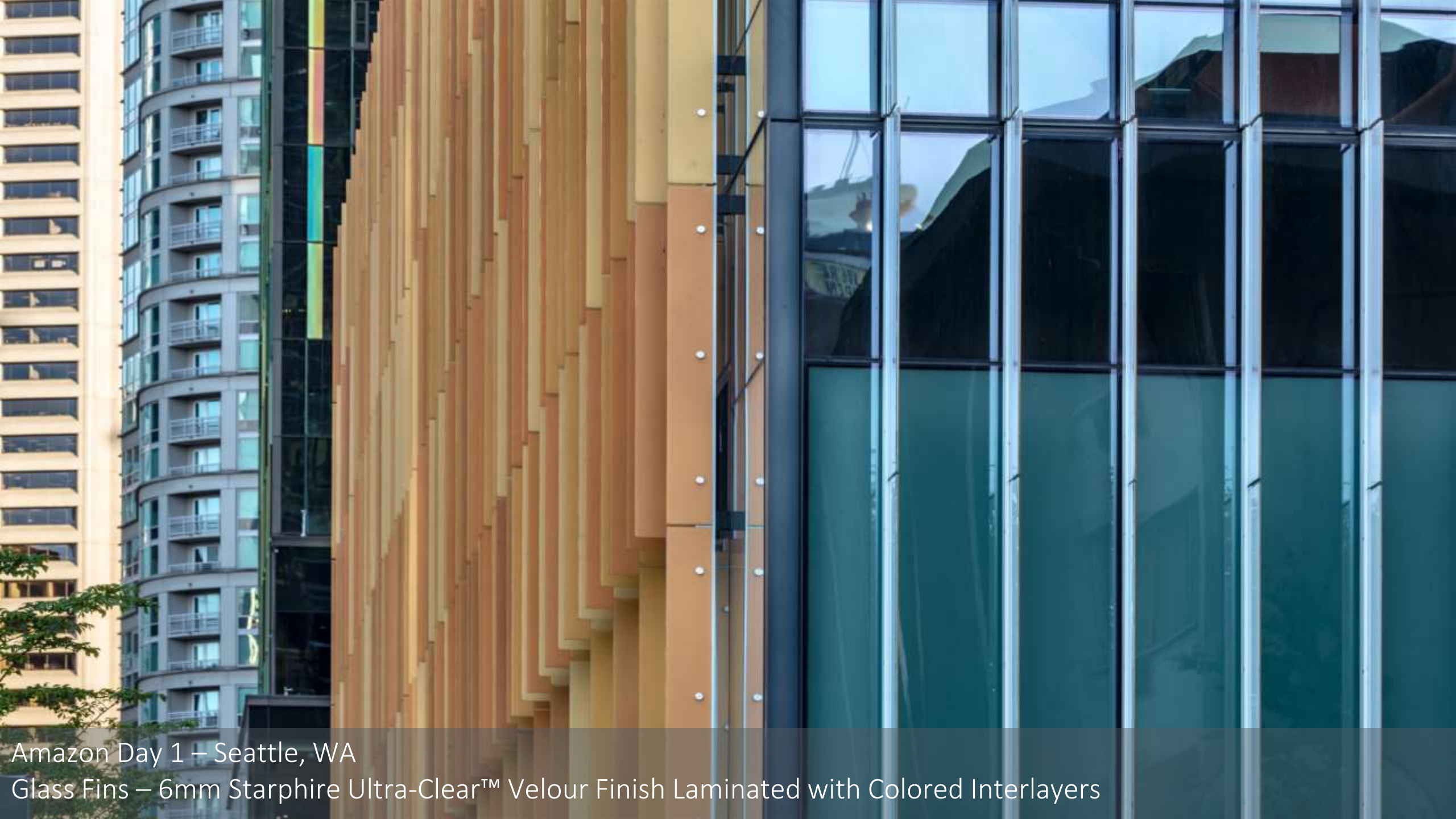
579 5th Avenue – New York, NY
6mm Starphire Ultra-Clear™ Opaque 1 Face Laminated + White Interlayer



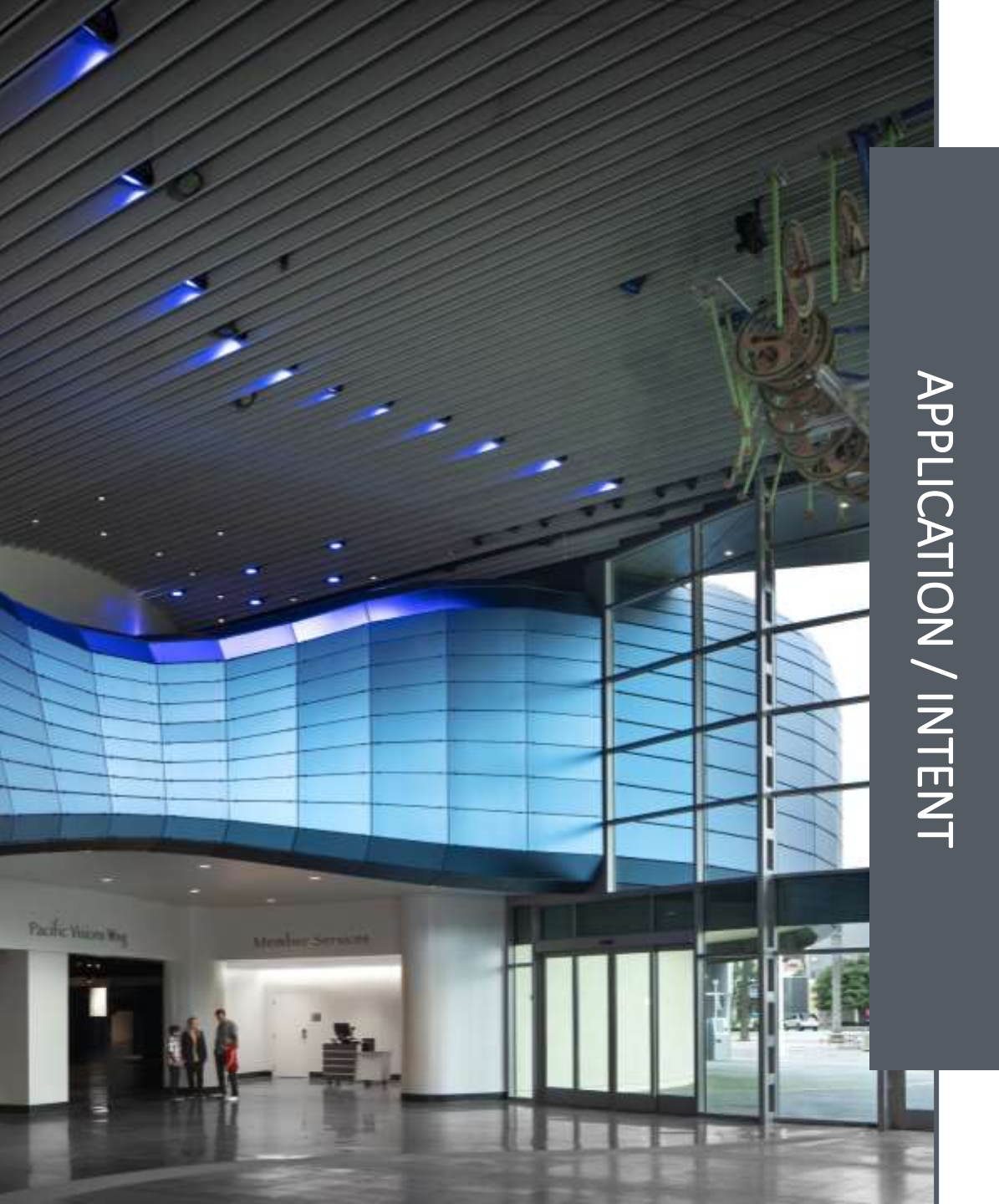


Amazon Day 1 – Seattle, WA

Glass Fins – 6mm Starphire Ultra-Clear™ Velour Finish Laminated with Colored Interlayers



Amazon Day 1 – Seattle, WA
Glass Fins – 6mm Starphire Ultra-Clear™ Velour Finish Laminated with Colored Interlayers



APPLICATION / INTENT

DESIGN & MODULATION

- Add a design element to the glass envelope of the building
- Create a modulation effect on the building façade
- Reduce glare



Oakland University – Rochester, MI
Insulated Glass Unit – Mix of Clear Glass Satin, Velour and Opaque Surface #3, Low-e coating Surface #2



Oakland University – Rochester, MI
Insulated Glass Unit – Mix of Clear Glass Satin, Velour and Opaque Surface #3, Low-e coating Surface #2



CUPE Building – Ottawa, ON
Insulated Glass Unit – 6mm Clear & Blue Glass Satin Surface #3, Solarban® 60 Surface #2



CUPE Building – Ottawa, ON
Insulated Glass Unit – 6mm Clear & Blue Glass Satin Surface #3, Solarban® 60 Surface #2



University of Pennsylvania – Philadelphia, PA
Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Nuance Custom Velour Stripes Surface #1



University of Pennsylvania – Philadelphia, PA
Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Nuance Custom Velour Stripes Surface #1



Maurice Richard Arena – Montreal, QC
6mm clear glass Satinlite on surface 1 with 6mm grey glass Pilkington Mirropane™ on surface 3 backpainted in grey
on surface 4

BIRD COLLISION DETERRENCE

- Bird friendly building façade
- Railings & balustrades
- Exterior walls
- Wind and sound barriers
- Shelters

APPLICATIONS



BIRD COLLISION DETERRENCE

BIRD DETERRENCE PERFORMANCE		
Test Method	Product	Threat Factor (*)
Tunnel Test - American Bird Conservancy	AviProtek® Pattern 211 Position 1 - Monolithic	23
Tunnel Test - American Bird Conservancy	AviProtek® Pattern 213 Position 1 - Monolithic	29.8
Tunnel Test - American Bird Conservancy	AviProtek® Pattern 214 Position 1 - Monolithic	30
Field Experiment - Dr. Daniel Klem, Acopian Center for Ornithology, Muhlenberg College, PA	AviProtek® Pattern 213 Position 1 - Double-glazed unit	5
Field Experiment - Dr. Daniel Klem, Acopian Center for Ornithology, Muhlenberg College, PA	AviProtek® T Position 1 - Double-glazed unit	31
(*) % of times birds will not avoid collision		



City of Seattle's Cedar River Municipal Watershed – North Bend, WA
Insulated Glass Unit – 6mm clear glass AviProtek® pattern 221 Surface #1, Solarban® 70XL Surface #3

The image shows a bright, modern interior space, likely a community center or a public building. The most prominent feature is a large wall of floor-to-ceiling windows with dark frames, offering a clear view of a lush green park with many trees. The ceiling is made of horizontal wooden slats and features several large, circular, illuminated pendant lights. In the foreground, there is a long, dark wooden table with chairs. To the left, a woman is standing at a counter, possibly a kitchen or service area. To the right, a staircase with a metal railing leads to an upper level. The overall atmosphere is bright and airy, with natural light streaming in from the windows.

City of Seattle's Cedar River Municipal Watershed – North Bend, WA
Insulated Glass Unit – 6mm clear glass AviProtek® pattern 221 Surface #1, Solarban® 70XL Surface #3



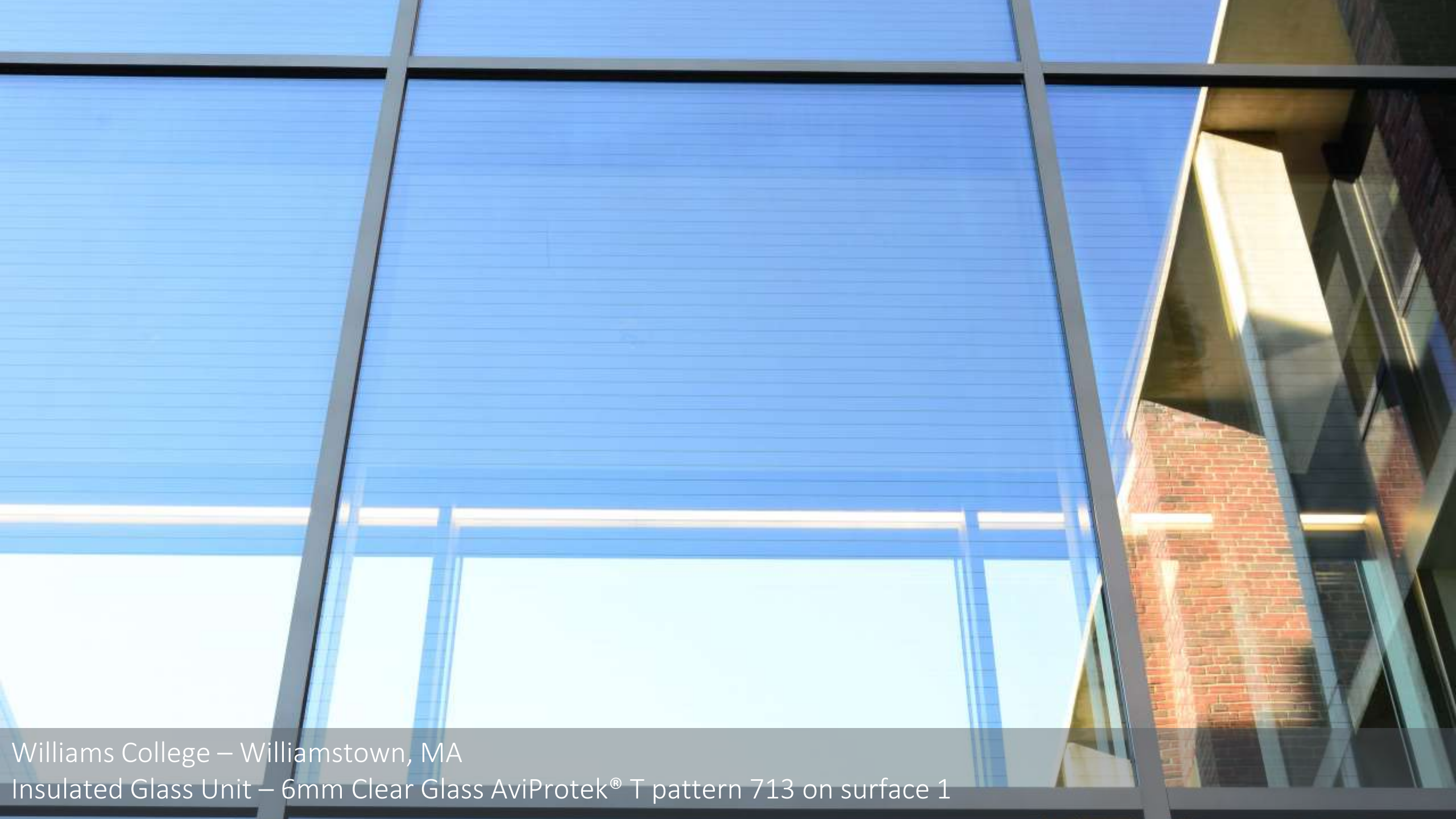
The Boulevard Club – Toronto, ON
Insulated Glass Unit – 6mm Clear Glass AviProtek® E pattern 216, Solarban® 60 Surface #2



The Boulevard Club – Toronto, ON
Insulated Glass Unit – 6mm Clear Glass AviProtek® E pattern 216, Solarban® 60 Surface #2



Williams College – Williamstown, MA
Insulated Glass Unit – 6mm Clear Glass AviProtek® T pattern 713 on surface 1



Williams College – Williamstown, MA
Insulated Glass Unit – 6mm Clear Glass AviProtek® T pattern 713 on surface 1

SLIP RESISTANCE FOR WALKWAY APPLICATIONS

Test/Standard		Pattern 406	Pattern 407	Force
Procedure Dynamic Coefficient of Friction (DCOF)	ANSI A137.1-2012 Section 9.6	0,67	0,66	0,56

According to the ANSI A137.1 standard for ceramic tile:

"Unless otherwise specified, tiles suitable for level interior spaces expected to be walked upon when wet shall have a (minimum) wet DCOF of 0.42 ..."



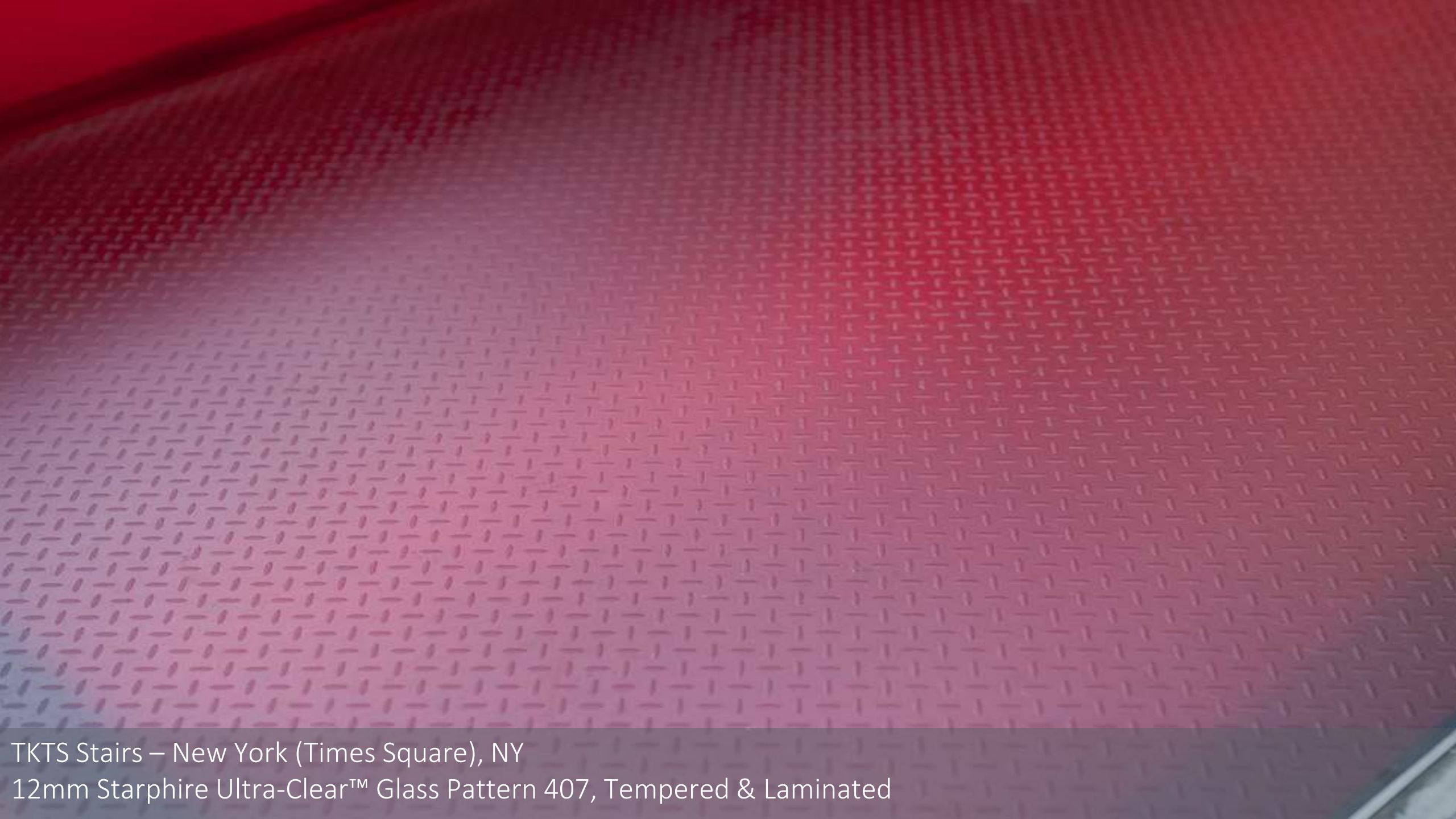
APPLICATIONS

SLIP RESISTANCE FOR WALKWAY APPLICATIONS

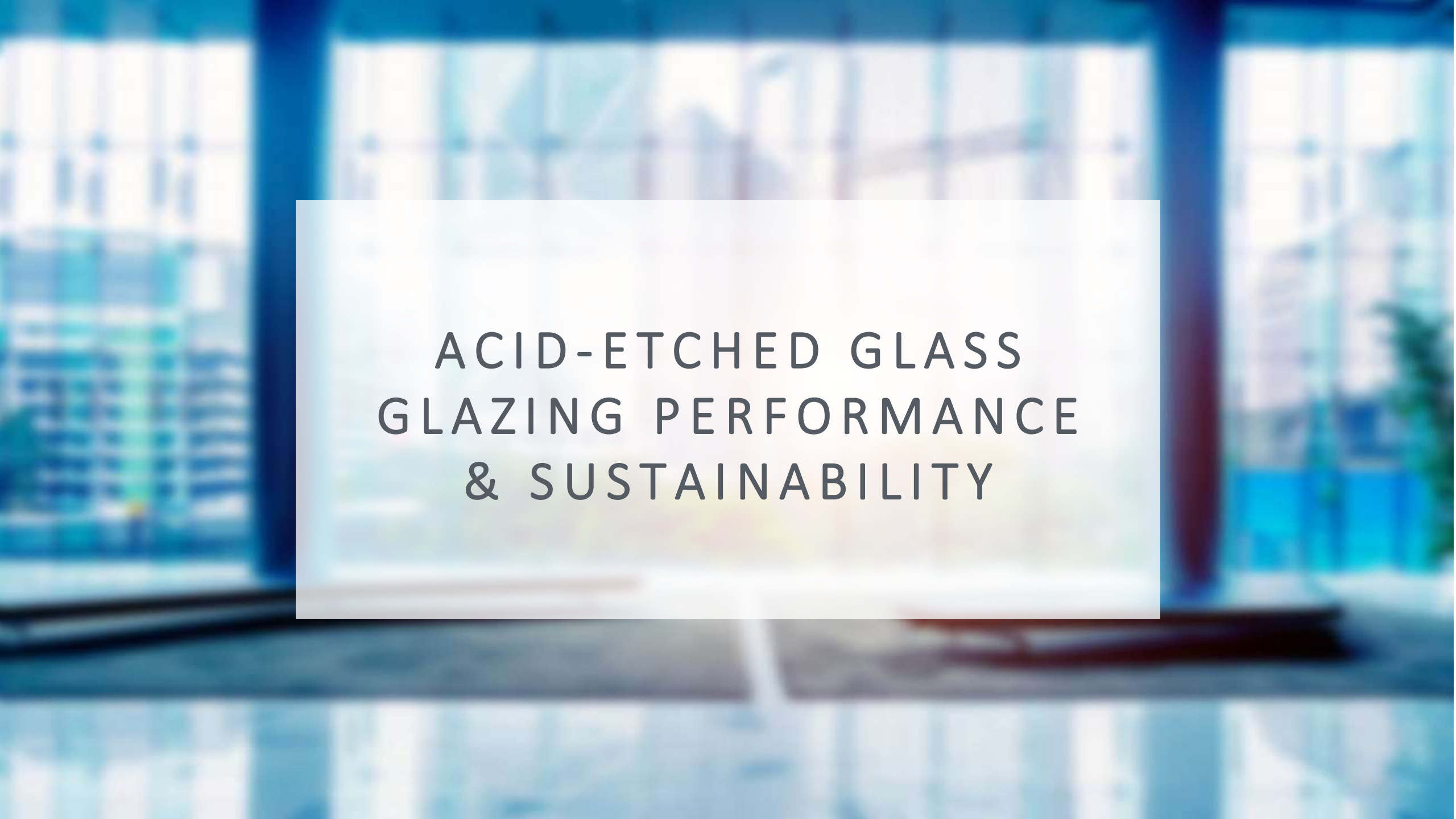
- Walkways
- Stair treads



TKTS Stairs – New York (Times Square), NY
12mm Starphire Ultra-Clear™ Glass Pattern 407, Tempered & Laminated



TKTS Stairs – New York (Times Square), NY
12mm Starphire Ultra-Clear™ Glass Pattern 407, Tempered & Laminated

A blurred background image showing a cityscape with various buildings and structures, viewed through a window. The image is out of focus, emphasizing the text overlay.

ACID-ETCHED GLASS GLAZING PERFORMANCE & SUSTAINABILITY

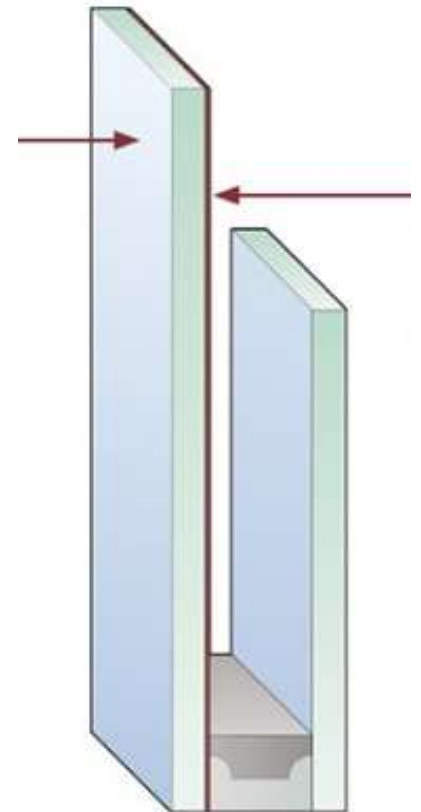
INTEGRATION IN INSULATED GLASS UNITS

Acid etching can be used on any surface within an IGU, including those exposed to weather conditions on # 1

Integration must take into account the surface(s) on which a Low-E coating is required

Acid etching can be applied to position 1 with a Low-E coating on position 2

Decision is based on design and functional intents



INTEGRATION IN INSULATED GLASS UNITS

Glass Performance Data

One-Inch Insulating Glass without Acid-etched Glass			U-Value (Btu/h-ft ² -F)		SHGC ⁴
Glass 1	Space	Glass 2	Winter	Summer	
6mm clear SB70XL (2)	1/2" air	6mm clear	0.280	0.260	0.270
One-Inch Insulating Glass with Acid-etched Glass			U-Value (Btu/h-ft ² -F)		SHGC ⁴
Glass 1	Space	Glass 2	Winter	Summer	
6mm clear Opaque (1) SB70XL (2)	1/2" air	6mm clear	0.280	0.260	0.276
6mm clear Velour (1) SB70XL (2)	1/2" air	6mm clear	0.280	0.260	0.281
6mm clear Satin (1) SB70XL (2)	1/2" air	6mm clear	0.280	0.260	0.274
6mm clear Satinlite (1) SB70XL (2)	1/2" air	6mm clear	0.280	0.260	0.275

Data is similar with acid-etched glass in position #3

INTEGRATION IN INSULATED GLASS UNITS

Glass Performance Data One-Inch Insulating Glass with Bird-Friendly Glass

With Invisible Markers on Surface 1			U-Value (Btu/h-ft ² -F)		SHGC ⁴
Glass 1	Space	Glass 2	Winter	Summer	
6mm clear Aviprotek T (1)	1/2" air	6mm clear Solarban 60 (3)	0,29	0,27	0,43
6mm clear Aviprotek T (1)	1/2" air	6mm clear Solarban 70XL (3)	0,28	0,27	0,35
6mm clear Aviprotek T (1)	1/2" air	6mm clear Solarban 90 (3)	0,29	0,27	0,31

RELEVANCE OF ACID-ETCHED GLASS & MIRROR PRODUCTS TO LEED®

- Building Product Disclosure and Optimization
Environmental Product Declaration (EPD)
(1 point)

Report describing a product's potential environmental impacts, according to the life cycle assessment criteria and in conformity with ISO protocol 14025.

- Building Product Disclosure and Optimization - Material Ingredients
Health Product Declaration® (HPD®)
(1 point)

A declaration that includes a complete list of a product's ingredients and their associated effects on health.

RELEVANCE OF ACID-ETCHED GLASS & MIRROR PRODUCTS TO LEED®

- Low-Emitting Materials
 - Product Category Calculation (1-3 points)
 - Glass is a non-emitting source
- Daylight
 - Design to maximize daylight (1-3 points)
- Pilot Credit 55 – Bird Collision Deterrence (1 point)

The background of the image features architectural sketches on a light-colored surface. At the top, there are several small, repetitive line drawings of a building facade. Below these, a larger sketch shows a building with a blue-tinted glass facade and a green circular area representing a tree or garden. Several markers are scattered across the sketches: a blue marker on the left, a grey marker with a blue cap in the bottom left, and two grey markers with black and green caps in the bottom right.

ACID-ETCHED GLASS SPECIFICATIONS

SUMMARY ANALYSIS

- Does not restrict light flow
- Surface does not degrade
- Surface does not discolor
- Visual appearance is uniform and consistent
- Does not reduce the structural strength of the glass
- No significant impact on solar performance

PROPERTIES



KEY ACID-ETCHED GLASS SPECIFICATIONS

- Validate glass specifications at the design development stage
 - Surface finish
 - Substrate
 - Size
 - Thickness
- Surfaces to etch
- Glass performance properties
- Gloss tolerance of the etch finish
- Warranty on etched surface degradation

KEY PROPERTIES of ACID-ETCHED GLASS

in EXTERIOR APPLICATIONS

Test/Standard		6mm clear with Selected Acid-etch Finish	6mm clear unetched
Visible Light Transmittance	Lab test	91.00%	89.00%
Light Diffusion (Haze)	ASTM D1003-13	90.73%	0.00%
Resistance to Wear (Abrasive wear index)	ASTM-C501	210	183.29
Resistance to Staining	ASTM-C1378	A	A
Scratch Hardness	MOHs	5	5.5
Strength	6mm Tempered with selected etch		6mm Tempered unetched
	Etched surface in Tension	Unetched surface in Tension	
Modulous of rupture / ASTM C-158			
Max Load (pounds)	357	351	338
Flexural Strength	1.07	1.05	1
Modulous of Rupture (psi)	28720	28370	26720

DESIGN DEVELOPMENT PROCESS

- Involve the acid-glass manufacturer in the early stages
- Validation
 - Product Availability
 - Constructability
 - Fabrication
 - Budget
 - Samples
 - Testing

This concludes The American Institute of Architects Continuing Education Systems Course

WALKER

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