

Designer's Guide to **EMERGING TECHNOLOGIES** *in Fire Rated Glazing Systems*



Clear Fire Resistive Butt-Glazed Wall



Fire Resistive Blast Wall



Fire Resistive Floor



Fire Resistive Curtain Wall with Dynamic Testing

INNOVATION *is the engine of business success*



See **SAFTI FIRST's** Innovation Timeline

Whether it's the development of a brand-new product, a more efficient process, or a novel way of serving customers, innovation helps distinguish a company from its competitors while raising the bar for everyone. Innovation has always been the driving force for SAFTI *FIRST* ever since we introduced the first clear, fire resistive glazing to the U.S. market in the late 1970s, which ushered in several other firsts in the fire rated glass and framing industry.

To keep the innovative spirit alive, we've invested time and resources in building the **necessary infrastructure** to develop and test our ideas in order to bring new, U.S.-made fire rated glass and framing products to the marketplace. These new products are a culmination of a lot of time and resources spent on research, development

and testing, and a direct response to the needs and demands of architects and glazing contractors. This is consistent with our company's mission statement:

"Our mission is to produce appealing architectural products that protect people while providing our customers with expert information, economical solutions, and unlimited inspiration."

We are excited to share these new developments in this interactive resource guide. In the first article, we show how today's fire rated glazing systems go beyond combining fire protection and vision. The second article discusses fire rated glass used in exterior applications. The third article demonstrates how fire rated glass and framing products can contribute to LEED v4 and in achieving overall sustainable design goals.

We hope that you find the information in this resource guide to be useful, and to inspire you to create elegant, inviting, and safe spaces with today's advanced fire rated glazing products. If you have any questions or require any assistance, please do not hesitate to call us toll-free at 888.653.3333 or visit us online at www.safti.com.

Sincerely,

William O'Keeffe
President & CEO

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Achieving Sustainable Design with Today's Fire Rated Glass Systems



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Multi-tasking Fire Rated Systems

FULFILL UNIQUE DESIGN & PERFORMANCE REQUIREMENTS

Channing Swanson, AIA, LEED AP, principal at Neumann Monson Architects in Des Moines, Iowa, says that “architects are always interested in breaking boundaries and doing more with less,” and he is not the only one. Designers have always been known to push the envelope on what’s possible, which in turn pushes building product manufacturers to constantly innovate and introduce new products to satisfy unique applications.

Fire rated glass is no exception. When clear fire resistive glass that outperformed wired glass was introduced in the early 1980s, it was revolutionary. Three decades later, fire rated glass has evolved into a multi-tasking building product that combines vision and fire protection with various performance and aesthetic requirements. To name a few:

1 Fire Resistive and Security Rated Glass: Blast, Ballistic, and Forced Entry

Fire rated glass can also be combined with security glazing to form a single assembly that protects against fire, bullets, blast, and forced entry. In the past, the fire rated system, which was usually wired glass, was placed alongside the ballistic, blast, or security rated system—which meant two different manufacturers and two separate installations. Today, designers can have a single, multi-functioning system provided by one manufacturer that is tested and listed to do the job that is required.

2 Fire Resistive and Hurricane Rated Glass

Today’s fire resistive glazing systems can meet the highest hurricane code standards without the need for expensive shutters or duplicative fire- and impact-safe windows or curtain walls. Designers now have the ability to use one glazing product that enhances aesthetics and natural light while meeting strict codes and insurance limits. Today’s fire resistive and hurricane rated systems

CASE STUDY SPOTLIGHT

Florida Condos Install Fire and Hurricane Rated Glass Wall Assemblies

CASE STUDY SPOTLIGHTS

Fire Resistive Blast and Ballistic Glass Walls in High Security Facilities

Fire Rated Security Glass at Plaquemines Parish Detention Center

have complete **Florida Product Approval Numbers**, **Texas Product Approval Numbers**, and **UL certifications**. There is also a need for fire resistive and hurricane rated systems in Florida, Texas, and even New York and New Jersey now after the devastating effects of Hurricane Sandy.

3 Fire Resistive and Decorative Art Glass

Decorative art glass has been used for many years to either tell a story or beautify any space, as seen in stained glass windows in churches and historical buildings, to name a few. Now, decorative glass can be combined with fire rated glass to bring a unique design element to any space where fire ratings are required. This can include stained glass, patterned glass, textured glass, colored glass, digitally printed glass, and even glass embedded with LEDs designed to display high-impact visuals.



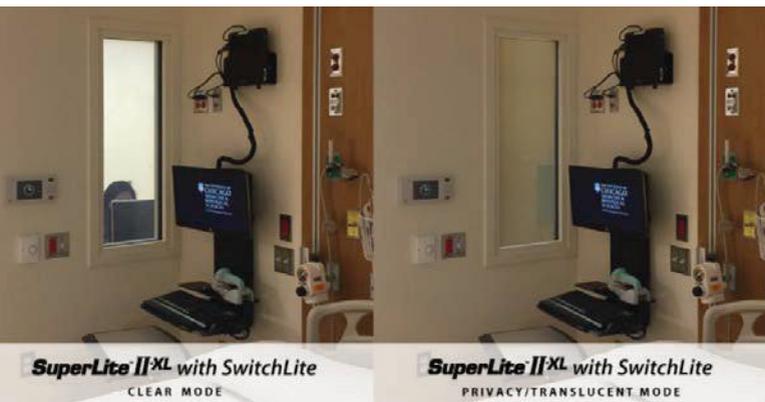
▲ 2-Hour Fire Resistive Blast Rated Wall by SAFTI FIRST



▲ 2-Hour Fire Resistive Stairwell Enclosure with Digitally Printed Glass by SAFTI FIRST

4 Fire Resistive Transparent Butt-Glazed Walls
 Designers can now achieve truly transparent fire resistive glass walls up to two hours without vertical mullions or spacers using fire resistive multilaminates like **SuperLite II-XLM**. This product meets ASTM E-119 up to two hours with a hose stream test, and is impact safety rated to the maximum safety standard CPSC Cat. II. SuperLite II-XLM is available in large sizes and can be used in all fire rated 20/45/60/90/120 minute applications, including clear butt-glazed walls for maximum vision and transparency.

5 Fire Resistive Switchable Privacy Glass
 There are instances where the same spaces that use glass in windows, doors, or walls for vision and transparency also have a need or desire for privacy. Before, the only solution was to use curtains or external window blinds to block views when needed. This can be a problem in hospitals, laboratories, clean room, etc., because curtains and exterior blinds tend to accumulate and trap dust and other allergens. Introducing glass with integrated blinds solved this issue of accumulating dust and allergens, but it doesn't exactly have the high-tech look.



▲ SuperLite II-XL 45 with SwithLite by SAFTI FIRST

CASE STUDY SPOTLIGHT

Fire Rated, Digitally Printed Glass Brings Whimsical and Reliable Protection at Children's Hospital

Today, architects can combine vision, privacy, convenience, cleanliness, and high-tech design while meeting fire rated code requirements with fire resistive switchable privacy glass. This technology is being widely used in medical and dental facilities, laboratories, offices, manufacturing facilities, mixed-use residential/commercial buildings, schools, and much more.

6 Fire Resistive Floor Systems

The latest innovation in fire resistive glazing technology is in the development of fire resistive floors. Traditionally, concrete is used in between floors for fire resistance. The development of fire resistive floors with a non-slip walkable surface enables light to penetrate further into the building while meeting all the required fire rated requirements. The **GPX FireFloor** system is tested to ASTM E-119 and has the largest tested and listed individual glass panel sizes at 82-³/₈-inch by 85-³/₁₆-inch fully supported and 67-⁷/₈-inch by 70-³/₁₆-inch butt-glazed.

Unlike other fire rated floors available today, the GPX FireFloor system is designed with no airspace between the fire rated glass and walkable surface to eliminate condensation issues. It is a single glass unit comprised of custom SuperLite II-XL combined with a tempered laminated walking surface and a structural steel framing grid. Both the glass unit and structural framing grid are manufactured and provided by SAFTI FIRST.

For more case studies that demonstrate fire rated glass in unique applications, [CLICK HERE](#).

CASE STUDY SPOTLIGHT

Fire Rated Switchable Glass Provides Privacy and Fire Protection at the University of Chicago Medical Center

Fire Rated Glazing in the Building Envelope: **WHAT ARCHITECTS NEED TO KNOW**

Fire rated glass is typically used in interior applications to protect people and property in the event of fire. It does this in two ways—by compartmentalizing the fire to prevent it from spreading to other areas and by protecting paths of egress so building occupants can safely exit the building.

The bigger news, however, is the fact that there has been a steady increase of fire rated glass being used in the building envelope. Today, we see exterior fire rated glazing going beyond punched openings and into fully engineered curtain wall systems that can perform like the rest of the building envelope and even match the aesthetic of adjacent non-rated systems.

Here are most common code and performance requirements that architects should consider when specifying exterior fire rated glazing systems.

1 Lot Line Requirements

Fire rated glazing fulfills the designer's goals of having unobstructed views, natural light, and code compliance in situations where buildings are adjacent to or in close proximity to lot lines. New York City is probably one of the areas where this happens the most. Amidst all this confusion, the NYC Building Department issued **Buildings Bulletin 2015-017** to clarify the code requirements for lot line openings.

Whether it's New York City, Boston, Chicago, San Francisco, or any other densely populated city, an exterior wall may or may not be allowed to have openings depending on the fire separation distance. When allowed, the codes distinguish between openings that are "protected" (fire protective doors, windows, shutters) and "unprotected" (no fire rating).



▲ *The Kensington in Boston incorporates a 60-minute fire resistive curtain wall adjacent to the non-rated systems.*

CLICK HERE to download the **Consultant's Guide to New York City Building Bulletin 2015-17 & Fire Rated Exterior Openings**



▲ *Kromrey Middle School in Madison, Wis., has a 60-minute fire resistive curtain wall that can withstand dramatic weather conditions.*

Table **705.8 in the 2012 and 2015 IBC** lay out the percentage of protected and unprotected openings and size limits allowed in exterior walls. Fire protective glass tested to NFPA 252/257, such as ceramics and wired glass, is either limited in size or prohibited altogether, depending on the fire separation distance. Generally speaking, as the fire separation distance increases, the allowable opening area and the percentage of allowable fire protective openings increases.

However, these limitations do not apply to fire resistive glazing tested to ASTM E-119. Designers can still use glazing—as long as it is fire resistive—in areas where exterior openings are not permitted or limited in size per

IBC Table 705.8. Fire resistive glazing materials have been tested to the more stringent performance requirements of ASTM E119, which requires any temperature rise to be less than 250 degrees Fahrenheit above ambient temperature on the non-fire side. Designers can use fire resistive glazing to exceed the opening protection limits that restrict the use of fire protective glazing in fire doors and windows. By using fire resistive glazing, designers don't have to sacrifice expansive clear views and abundant natural light in order to meet code requirements.

2 Dynamic Curtain Wall Testing

All materials used in the exterior skin are expected to prevent air and water from entering the building. Static curtain wall testing performed in a chamber is one way to determine a product's ability to perform. However, the information gathered from this test is limited, which is why dynamic curtain wall testing is preferred by owners, architects, and building envelope consultants. Dynamic curtain wall testing is designed to duplicate real world

CLICK HERE to learn about the difference between fire protective versus fire resistive glazing.

conditions. As a result, it is much more stringent and difficult to pass, but it is a more reliable indicator.

Such was the case when SAFTI *FIRST* was asked to supply a fire resistive curtain wall for **The Kensington**, a mixed-use residential building in Boston. The west-facing elevation was in close proximity to the property line, prompting the building official to require part of the curtain wall to meet ASTM E-119 for 60 minutes, as well as pass the rigorous dynamic testing prescribed by Curtain Wall Design and Consulting (CDC), the firm hired by the architect to ensure that the building was air and water tight. Architectural Testing Inc. (ATI) and independent laboratory tested the **GPX Curtain Wall** system to ASTM E284-04 (Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors), ASTM E331-00 (Standard Test Method for Metal Curtain Walls by Uniform Static Air Pressure Difference) and AAMA 501.1-05 (Standard Test Method for Metal Curtain Walls for Water Penetration Using Dynamic Pressure). The GPX Curtain Wall system passed all of these tests, providing designers with documented performance of the system being air and watertight.

In addition to air and water testing, the GPX Curtain Wall system was also tested to and successfully passed AAMA 501.4-09 (Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts), ASTM E330-02 (Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference), Interstory Vertical Displacement Test, Thermal Cycling, and Condensation Evaluation.

3 Thermal Performance

Occupant comfort is another consideration when selecting glazing products for the building envelope. While glass gives the benefit of natural daylight, controlling heat and glare are important considerations as well. SAFTI *FIRST*'s **SuperLite** glass products can easily incorporate low-e or any energy performance glazing to achieve the required thermal performance—even in extreme weather conditions.

CASE STUDY SPOTLIGHT

Fire Rated Curtain Wall Performance in Dramatic Weather Conditions

CASE STUDY SPOTLIGHT

Boston Building Protects Property Line with Fire Resistive Curtain Wall

As far as extreme environments go, Wisconsin has some of the most dramatic in North America. During the winter months, temperatures regularly dip well below freezing, and it is not uncommon to see conditions reach -10 degrees Fahrenheit without taking wind chill factors into account. In the summer months, however, the temperatures can reach up to 90 degrees Fahrenheit with significant humidity levels for extended periods of time.

Given these dramatic weather conditions, the materials chosen for the building envelope should not only protect building occupants from the elements, but ensure their comfort as well. In the case of **Kromrey Middle School** in Middleton, Wis., they had to account for fire resistance as well.

Part of the additions and remodel at Kromrey Middle School included a dramatic, light-filled glass entrance almost 30 feet high that combined transparent high performance low-e glass panels and opaque decorative panels in a clear anodized aluminum curtain wall frame. Because of the glazing structure's proximity to the surrounding building, it was determined that the assembly had to meet ASTM E-119 for 60 minutes in order to meet code requirements.

To meet the code and design requirements, SAFTI *FIRST* provided SuperLite II-XL 60 with PPG Starphire Ultra-Clear insulated with Guardian SNX62-27 clear tempered for the transparent panels. For the opaque panels, SAFTI *FIRST* provided a custom fire resistive wood veneer panel insulated with a clear anodized panel on the interior side. For the framing SAFTI *FIRST* provided GPX Curtain Wall Framing with uniform sightlines and clear anodized finish.

Do you have a current or upcoming project that may require fire rated glazing?

CLICK HERE to contact your local SAFTI *FIRST* architectural representative.

LEED® v4:

ACHIEVING SUSTAINABLE DESIGN WITH TODAY'S FIRE RATED GLASS SYSTEMS

The LEED (Leadership in Energy and Environmental Design) green building certification program is continually evolving. It was first released in 2004, and the current version, LEED v4, was announced in 2013. This version has many changes from the previous version (LEED 2009), particularly in the category of Materials and Resources (MR). In fact, the majority of the MR credits are completely new, replacing the LEED 2009 credits on material attributes (e.g., recycled content) with new credits focused on building product transparency and reporting. A comparison of the old and new MR credits is shown in Table 2. Note: Credits in LEED v4 are not identified by number.

Credits in the LEED program are focused on assessing the building as a whole. For example, in many of the MR credits, a certain percentage, by cost, of the total value of permanently installed building products in the project must meet criteria. In other cases, a certain number of building products must meet the criteria. As a result, no single product or material alone can earn LEED credit

points; rather, it is that building products can contribute toward earning LEED points on a project.

Fire Rated Glass Systems and Applicable LEED v4 Credits

Energy & Atmosphere

Within this category there is one prerequisite and one credit, both related to energy use, that SAFTI *FIRST* products can contribute toward. An energy-efficient building envelope is a key component in sustainable building design. Achieving an energy-efficient building envelope includes consideration of both the insulating value of materials as well as potential solar impacts.

- *Prerequisite—Minimum Energy Performance:* SAFTI *FIRST* products can be part of a strategy to help achieve the required energy performance because SuperLite products have the option of being insulated and having low-e or energy performance glazing.

TABLE 2: Comparison of Materials and Resources Credits in LEED v4 versus LEED 2009

Credit	LEED v4	Points	Credit	LEED 2009	Points
Prerequisite	Storage and Collection of Recyclables	Required	Prerequisite 1	Storage and Collection of Recyclables	Required
Prerequisite	Construction and Demolition Waste Management Planning	Required	N/A		
Credit	Building Life-Cycle Impact Reduction	up to 5	Credit 1 Credit 2	Building Reuse Materials Reuse	1 to 4 1 to 2
Credit	BPDO ^a – Environmental Product Declarations	1 to 2	New credit; does include preferences for materials source within 100 miles.		
Credit	BPDO ^a – Sourcing of Raw Materials	1 to 2	Credit 4 Credit 5 Credit 6 Credit 7		1 to 2 1 to 2 1 1
Credit	BPDO ^a – Material Ingredients	1 to 2	New credit; does include preferences for materials source within 100 miles.		
Credit	Construction and Demolition Waste Management	1 to 2	Credit 2	Construction Waste Management	1 to 2

FIGURE 1: LEED v4 BD+C: NC Points by Category

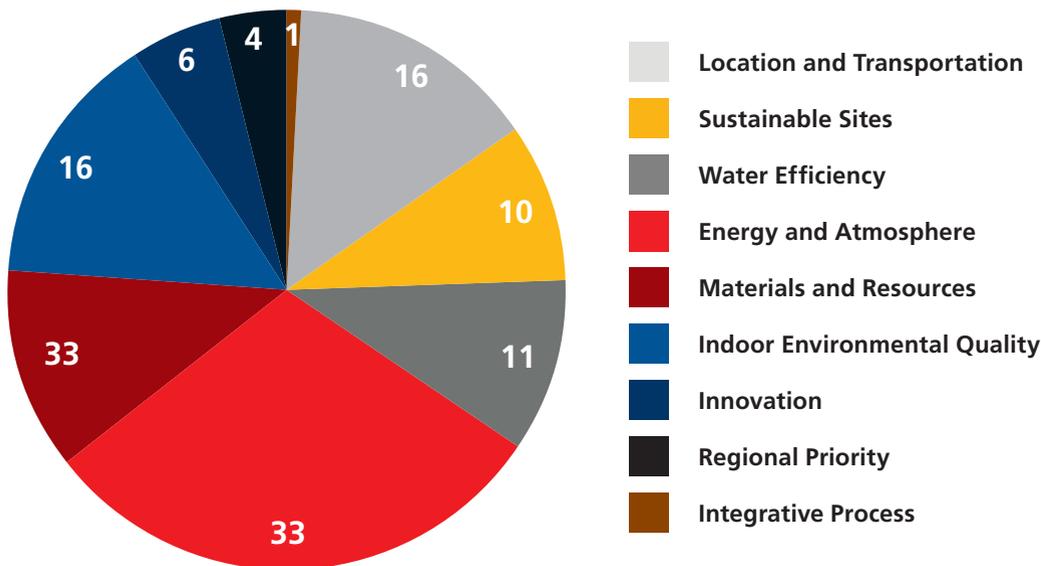


Figure 1 shows the points in each of the various credit categories in LEED v4. Note that credits previously found in the Sustainable Sites category in LEED 2009 are now divided between Sustainable Sites and Location and Transportation in LEED v4. The points needed for each level of certification are shown in Figure 2. The more “green” the building, the higher number of points earned.

■ **Credit—Optimize Energy Performance:** SAFTI *FIRST* products can be used as part of strategies, including energy performance glazing and passive solar designs, to further reduce the amount of energy consumed by the building. SuperLite II-XL and GPX Framing assemblies have been tested for U-Factor, Solar Heat Gain Coefficient, and Condensation Resistance. In addition, because this credit also includes interior lighting energy demands, using fire rated glass can help maximize light penetration, even from artificial lighting, by providing light transmittance in areas where opaque walls are the norm.

Materials & Resources

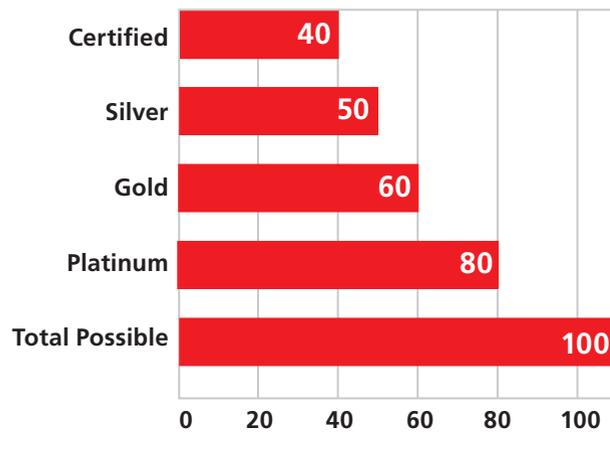
SAFTI *FIRST* has several products that meet the new product information disclosures criteria found in LEED v4. These and other credits within MR that relate to SAFTI *FIRST* products are described in the following paragraphs.

■ **Credit—Building Product Disclosure and Optimization—Sourcing of Raw Materials:** Option 2: Leadership Extraction Practices of this credit awards a point for using materials that contain recycled

content or those that follow other responsible extraction criteria for at least 25 percent, by cost, of the total value of permanently installed products. The credit evaluates all building materials on the project. Metal portions of SAFTI *FIRST* glass framing systems contain recycled content that can contribute. Steel used in the GPX framing system contains approximately 30 percent by weight pre-consumer recycled content. Aluminum used in the GPX framing system contains approximately 25 percent by weight pre-consumer recycled content. However, their total contribution relative to other materials on a project may not be significant.

■ **Credit—Building Product Disclosure and Optimization—Material Ingredients:** There are three options worth one point each. All three options require documentation of the raw material ingredients for building products. Option 1 awards 1/20 of one point for each product used having a Health Product Declaration (HPD) or other compliant ingredient report. HPD v2.0 reports are available for SAFTI *FIRST*'s SuperLite fire rated glass and GPX

FIGURE 2: LEED v4 Certification Levels



fire rated framing products. Option 2 awards one point if 25 percent, by cost, of the total value of permanently installed products in the project can document material ingredient optimization using one of the specified certifications, including Cradle to Cradle (C2C) certification. PYRAN® Platinum product C2C Silver Certification counts toward achievement of this credit.

- **Credit—Construction and Demolition Waste Management:** This credit awards points based on construction waste diverted from the landfill and, new in LEED v4, for reduction in total waste material if total waste generated is no more than 2.5 pounds-per-square foot of building floor area. Since SAFTI *FIRST* products are supplied to the construction site in the exact quantities needed they typically have no waste and therefore can contribute to the construction waste avoidance option. Should a product be damaged in transit, both the glass and the metal framing systems can be recycled. Products are delivered on wood pallets or in shipping boxes made from recycled materials and this packaging can be recycled.

Indoor Environmental Quality

This category addresses both indoor air quality and other aspects of indoor comfort.

- **Credit—Low-Emitting Materials:** This credit strives to minimize the amount of volatile organic compounds (VOC) in the indoor air of the building.

New in LEED v4 is the recognition of products that are considered inherently non-emitting materials such as glass and metals without further testing. SAFTI *FIRST* glass and metal framing used as interior walls or flooring eliminates a possible source of VOCs from the indoor environment. Other green building programs, such as the IGCC, have also recognized glass and metal products as inherently non-emitting materials.

- **Credit—Daylight; Credit—Views:** In LEED v4 these are two separate credits, one awarding points for providing daylighting, the other for providing views to the outdoors. Glass can be an integral part of a strategy to provide both daylight and views while still providing sound control, security, and privacy. SAFTI *FIRST* fire rated glass products provide benefits of daylighting as well as light access in areas not normally glazed, such as stairwells.
- **Credit—Acoustic Performance:** Acoustic comfort is another important element in sustainable designs. This new credit in LEED v4 includes requirements for sound transmission, background noise, and other criteria as a function of the occupancy of the building. High Sound Transmission Class (STC) values provide superior acoustic insulation. In the case of LEED-Schools, there is an additional minimum prerequisite for Acoustic Performance. Schools must meet the Sound Transmission Class (STC) requirements of ANSI Standard S12.60-2010, Acoustical Performance Criteria, Design Requirements and Guidelines for Schools, and windows must have an STC rating of at least 35.

The STC values for SAFTI *FIRST* glass products range from 28 to 33 for SuperLite I, I-XL, I-W, and PYRAN Platinum F products, and range from 40 to 44 for SuperLite X-90, SuperLite II-XL, and PYRAN Platinum L products. The SuperLite glass products can be customized to achieve higher STC ratings as needed. SuperLite II-XL products also have Outdoor-Indoor Transmission Class (OITC) values that range from 37 to 40. SuperLite II-XL can also be customized to achieve higher OITC ratings as needed.

For more information on how SAFTI *FIRST* products meet LEED v4 and sustainable design principles, download SAFTI *FIRST*'s LEED v4 brochure and scorecard [here](#).