LIGHT CONTROL

REAGAN NATIONAL AIRPORT'S NEW SECURITY CHECKPOINT BUILDINGS WILL HAVE VARIABLE-OPACITY GLASS CURTAIN WALLS. CARROLL MCCORMICK REPORTS.

Balancing the desire for natural light with the need to control the heat load in buildings that have glass curtain walls usually entails the use of shades and brute force air conditioning. Another option is to use a laminated glass system that can be controlled to adjust the amount of solar heat gain inside the building.

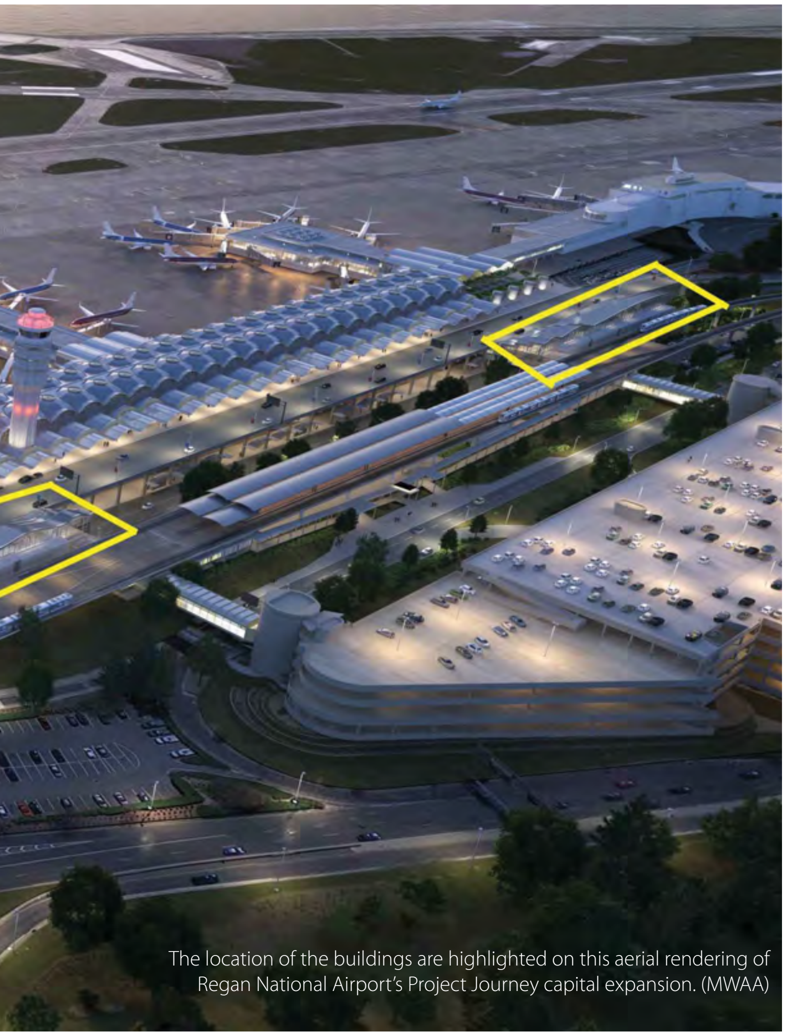
One such product is called electrochromic glass, which responds to the application of a small electrical current. It can be made to go from fully transparent to as much as 99% opaque as required.

For its two new security checkpoint buildings, the Metropolitan Washington Airports Authority (MWAA) chose this route with an electrochromic system called SageGlass smart glass. It is manufactured by Faribault, Minnesota-based SageGlass, a business unit of the Paris-based building products conglomerate Saint-Gobain.

The MWAA is implementing new sustainability standards in all of its facilities and this is one of the first large-scale applications. The glazing was changed from standard glass to the electrochromic system during the design process as part its sustainability goals, according to MWAA.

The new checkpoint buildings are being built at either end of Reagan National Airport's Terminal B/C. Pelli Clarke Pelli Architects designed the

Extensive glass curtain walls provide natural lighting of the new checkpoint building interiors. (MWAA)



The location of the buildings are highlighted on this aerial rendering of Regan National Airport's Project Journey capital expansion. (MWAA)

1,000,000sq ft (93,000m^2), 1,650ft (503m)-long steel and glass concourse, which opened in 1997. The additions are part of a larger, US$1 billion capital scheme called Project Journey; the other main component of which is the construction of a new north concourse to replace the 14 outdoor gates at the north end of Terminal B/C.

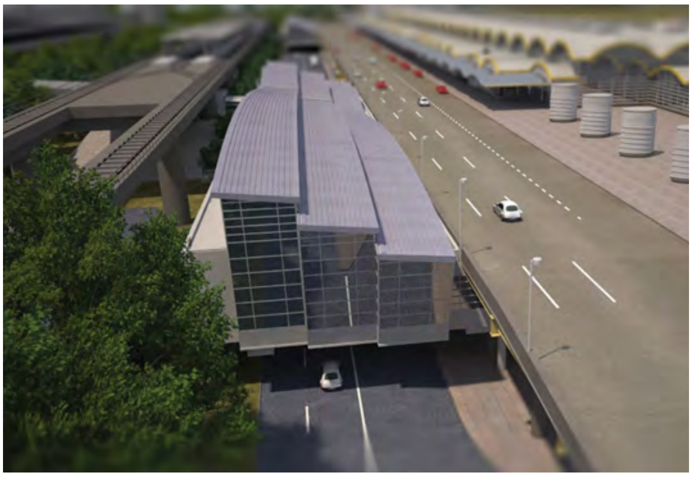
The structures will consolidate the three existing TSA checkpoints into just two, that will be located at each of the piers in Terminal B/C. This will turn the entire Terminal B/C into a post-security screening area. They will also increase the number of checkpoint lanes from 20 to 28, "... expediting the screening process and creating a seamless, free-flowing environment between the three existing Terminal B/C piers and the new north concourse. The resulting connectivity is designed to provide passengers an improved post-security experience – alleviating gate area congestion while expanding access to a variety of shopping and dining options," MWAA explains.

Each checkpoint building will be 375ft (114.3m) long and 150ft (45.7m) wide with a height of 65ft (19.8m) for the highest point of the three-stepped roof. They are mirror images of each other. A dramatic architectural feature is the use of glass curtain walls on three sides of each building, paying homage to the terminal, which was designed by César Pelli. Chad Menge, principal architect, MWAA, explained: "Pelli used a lot of glass in the design of DCA Terminal B/C – 1993 was right at the beginning of the development of LEED; his design applied natural light strategies before they were codified."

The panes in the new security checkpoint buildings are 96in (243.8cm) wide. Their height decreases from 44in (111.8cm) at the base of the curtain walls to 20in (50.8cm) at the top.

Such a large amount of glass poses a challenge: How to reduce the heat load on warm days and control glare. The traditional solution is well known, if not elegant. "If you want a lot of light you have to do a lot of cooling," Mr Menge said. Additionally, with ordinary glazing, something such as mechanical shades and/or frit – ceramic dots or some other pattern cooked onto the glass surface – is necessary.

But SageGlass smart glass changes all of that. While its up-front cost is higher, the life cycle expense associated with the typical glazing used in a curtain wall system would outpace it, Mr Menge explained. "If we didn't use electrochromic glass, we would have to spend money on electromechanical shades or frit, [and more on] and larger sized mechanical systems, yearly energy consumption



A model of one of the new checkpoint buildings, straddling the road behind Terminal B/C. (MWAA) and maintenance. We did the modelling to study the impact of the electrochromic glass on the mechanical systems loads, to verify that we could reduce the size of the mechanical systems. We are focused on three things: Providing natural light for the travelling passengers, energy efficiency to minimise energy costs, and controlling glare for the operators of the TSA checkpoints."

Since the opacity of the glass panels can be controlled individually or by zone, selectively reducing glare is straightforward. "The TSA equipment is located where there is a lot of glass, and we want to reduce glare to create a nice working environment for the TSA screeners. You can group the panels in different ways. Say, two or three rows of windows reduce glare for the TSA staff that you can control separately," said Mr Menge.

Electrochromic glass is one of several technologies under the generic heading of smart glass or switchable glass. Others include thermochromic and polymer-dispersed liquid-crystal glass. Probably the most familiar type is the photochromic glass used in eyeglasses, which darkens automatically outdoors.

Jordan Doria, SageGlass' senior marketing manager explained how it works. "Fundamentally what we do is electrically control the tint of the glass, the amount of visible light passing through it – up to 99%. At the same time, you block the solar heat and the UV, but primarily our customers are interested in blocking the visible light and heat to enhance occupant comfort and save money on lighting and HVAC bills.

"[The tint] is controlled with voltage. It takes a couple watts to cause typical insulating glass units to change, then a trickle charge to hold it." The energy required to tint 1,500sq ft (139.6m^2) of glass over the course of a typical day takes about the same amount of power as a 60-watt bulb."

This ability to control the amount of opacity is an important way to meet MWAA's design and operating goals. It wants lots of natural light, wants to control glare, and also wants to control the heat load; ie, less in the summer and more in the winter. Mr Menge noted: "For our situation we are going to tie its use in with our building management system – the overarching control of lighting, heating, cooling. We want not only to adjust the heating and cooling of the space but integrate with the [use of the] LEDs we have inside the building. As we go on, we will fine tune that system."

SageGlass smart glass has a bluish hue when tinted, as seen from the inside of the building. When un-tinted it looks like typical architectural glass. The colour was taken into account when making finish material selections. Mr Menge added: "We did study its effect on the material selections for the checkpoints; for example, the terrazzo and stone panels. We didn't want any detrimental effects to the finishes."

The use of electrochromic glass is a first for MWAA, Mr Menge said and concluded: "It is exciting. We take our responsibility to passengers and people that use Reagan National Airport seriously. We are excited to be using this technology and to be looking to the future. We always want to be environmentally responsible and incorporate sustainability goals at the airport. We haven't made the decision whether to go for LEED, but we strive to apply sustainability principles and ideas in the buildings we make."

View of SageGlass smart glass at the Minneapolis-St Paul International Airport. The tinting can be controlled at will. (SageGlass)