Sustainability Through Fire-rated Glass

by Jeff Griffiths, CSI

Photo courtesy SaftiFirst

A BASIC FIRE CONTAINMENT DESIGN STRATEGY IS COMPARTMENTALIZATION, WHICH APPLIES TO ENERGY CONSERVATION AS WELL. CONTROLLING AIR MIGRATION AND CIRCULATION, ALONG WITH MAINTAINING PROPER PRESSURIZATION OF BUILDING SPACES—INCLUDING STAIRWELLS AND ELEVATOR SHAFTS—ARE COMMON GOALS OF FIRE CONTAINMENT AND ENERGY EFFICIENCY. HOWEVER, THE DESIRE FOR LARGE, OPEN SPACES, AND THE GENEROUS USE OF GLASS FAÇADES FOR THE SAKE OF NATURAL DAYLIGHTING AND A REDUCTION IN ARTIFICIAL INTERIOR LIGHTING, CAN BE AT ODDS WITH THE NEED FOR AIRTIGHT INTERIORS AND MULTIPLE LEVELS OF FIRE CONTAINMENT.

Which goal is more important and which best serves the need for sustainability: natural daylighting or fire containment? Fire-rated glass technology makes both goals attainable. These glazing products are increasingly contributing to the enhancement of interior spaces and the more efficient use of resources by allowing daylight to extend deeper into the building. Interior walls can now become quite literally transparent. Gone are the days of traditional wired glass limited to a 0.8-m^2 (9-sf) area due to its fragile nature. Today's wired glass must provide both fire and safety glazing protection, no matter what the size.

Wire-free fire-rated glazing—such as specialty tempered float glass and architectural ceramics—is designed to contain smoke and flames while providing critical egress protection during the first 20 to 45 minutes

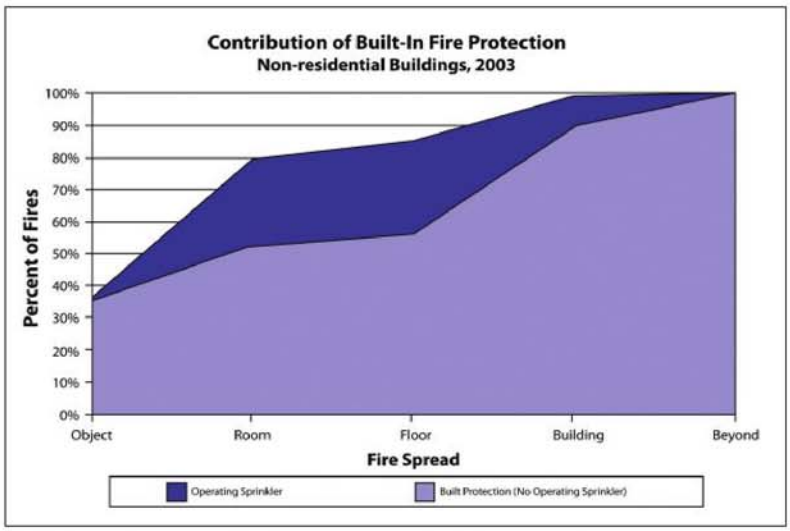
of the fire's outbreak. These products are categorized as fire-protective since they do not resist the spread of radiant heat, which seriously threatens lives and quickly leads to the combustion of surrounding building materials as the fire remains unchecked.

Fire-resistive glass and framing systems perform at the same level as masonry and drywall assemblies, blocking the spread of radiant heat for up to two hours with the added benefits of enhanced visibility and lighting. Additionally, these systems provide around-the-clock fire protection without any concern for possible deteriorating mechanisms, operational malfunction, interruption of water or electrical resources, and a myriad of other potential mishaps that render sprinkler systems useless. Despite the onslaught of self-serving small-scale studies that hope to quell concerns, one must recognize that sprinkler systems always pose the potential for failure.

The need for passive protection

Prompted by the debate over passive versus active fire protection, a 2006 study conducted by independent research company Tridata attempted to understand the most effective means of preventing fire spread by analyzing real-world results to determine the value of passive versus active fire prevention and containment systems.

The findings were based on an evaluation of 2003 data from the National Fire Incident Reporting System (NFIRS) fire incident data. NFIRS is a voluntary data



Built-in protection—also known as passive fire protection—ensures property and life safety by preventing most of the fire spread.

Image courtesy Tridata

Fire-rated decorative art glass was used at the Baylor Orthopedic Spine Hospital in Arlington, Texas, for beauty, safety, and privacy.

Photo courtesy Meltdown Glass

At Weill Cornell Medical College in New York City, the architect wanted an exterior curtain wall system with large glass lites wrapping around the building. However, this area leads into a parking garage, which needed to be fire-rated. To achieve the desired transparency, and meet the building code requirements, a two-hour fire-resistive curtain wall was installed.

Photos courtesy SaftiFirst

This two-hour fire-resistive protection stairwell at the Reid Hospital (Richmond, Indiana) meets ASTM E 119/UL 263/NFPA 251, *Standard Test Method for Fire Tests of Building Construction and Materials*.

collection system administered by the U. S. Fire Administration (USFA) and represents the most comprehensive set of fire data available. Analysis of such data to assess the effectiveness of active detection and suppression systems is not new—NFIRS data has been somewhat routinely used to this end. However, using this information to assess the effectiveness of passive fire protection—meaning 'integral building systems'—is a new approach.

According to the Tridata report:

NFIRS data has led to major improvements in our quantitative understanding of the fire problem in the United States. In 2003, over 15,000 fire departments in all 50 states submitted data to NFIRS. Each year of NFIRS data contains between 600,000 and 900,000 records, each representing a separate fire report. This makes NFIRS the largest fire database in the world and the best set of fire data and fire department incident summary data available worldwide.[1]

In fire engineering terms, fire spread and any related containment is a generally accepted measurement of fire control success. Measurements based on monetary loss can skew the perception of success because figures can vary widely due to building type and contents. The Tridata research team analyzed fire spread for both residential and non-residential buildings. In their effort to arrive at a baseline for passive fire protection, they reviewed fire spread in properties with no automatic suppression system or where such a system was installed but did not function.

Data for suppression systems that either failed or did not function for whatever reason was included because it is equivalent to not having a system at all. Fire spread information based on the traditional split between properties with active suppression systems installed and those without was also studied.

The researchers discovered in more than 50 percent of non-residential properties, and in 60 percent of residential properties, fire spread was limited to the room of fire origin. Depending on building use, this proportion can rise to over 85 percent (*i.e.* 87 percent in educational properties and 90 percent in healthcare-related properties). Without the benefit of additional active systems, the combination of pre-2003 building construction, design, fire load, and fire department response resulted in significant containment. The study confirms that while passive fire protection is not the only reason for this containment, it is a critical component of an overall fire protection system. The addition of an active suppression system,

To enable natural light to penetrate further into Pomona College (California), clear, fire-rated walls were supplied. The system meets ASTM E 119/UL 263/NFPA 251 requirements for a two-hour stairwell enclosure.

The first ever fire- and hurricane-rated assembly for the Las Olas Beach Club and Condominium, a luxurious multi-family residence in Ft. Lauderdale, Florida, was successfully tested. The architect wanted to design the units with as much glazing as possible to ensure views of the surrounding area, but the codes required the assembly to provide protection again fires and windstorms. Fire- and hurricane-rated assemblies were supplied for the 76 window/wall systems rated up to 60 minutes for the individual units and 120-minute fire- and hurricane-rated assemblies for the lobby area. Blue-green tint was also applied to the glass as a decorative element.

along with the rapid response of firefighters, enhances the performance of fire-rated materials and assemblies in saving lives and valuable resources.

Conserve the past to sustain the future

According to Richard Licht, technical director for the Alliance for Fire and Smoke Containment and Control (AFSCC), the three national model building codes—*Uniform Building Code* (*UBC*), *National Building Code* (*NBC*), and *Standard Building Code* (*SBC*)—have, over the past 30 years, provided increasing incentives for installing automatic fire sprinkler systems. This has been done by offering numerous sprinkler trade-offs, allowing for less use of fire-resistant components. These components help control fire spread, limit damage to a burning building and surrounding structures, and allow enough time for occupants to escape and firefighters to do their work before the building collapses.[2]

"The relatively good record in commercial construction is due largely to the conservatism of the previous two decades in the fire safety design of buildings, with both active and passive measures being incorporated in the designs, even to the point of identifying the practice as 'redundant,'" explained Licht. "This approach has borne good results to date, but with present-day code changes, that trend is not likely to continue. As a practice, designers do not generally specify beyond

Due to property line requirements, all 182 openings in all 32 floors of the south facing elevation of San Diego's Sapphire Towers needed to be fire-rated. To meet the design, code, and energy performance requirements of the project, National Fenestration Rating Council (NFRC)-certified assemblies were supplied.

'minimum standards,' and the new minimums are considerably lower than the allowable minimums of the last decades."

Licht raises a concern the increasing number of sprinkler trade-offs actually pose a threat to buildings constructed according to these relaxed standards. Fire, whether arson or accidental, is a threat to the building. The Tridata study confirms how passive fire protection is actually the foundation of any fire protection strategy. Reliance on this protection contributed to preserving a significant portion of existing buildings constructed in accordance with a far more balanced compartmentalization strategy that takes advantage of both passive and active fire resistance.

This prayer and reflection area at UC Davis Surgery and Emergency Services Pavilion (California) is protected by 60-minute fire-rated decorative art glass. The segmented wall assembly meets ASTM E 119/UL 263/NFPA 251.

Patrice Frey, director of sustainability research for the National Trust for Historic Preservation, points out the U.S. Energy Information Agency (EIA) has suggested facilities built between 1920 and 2000 are less energy-efficient than buildings constructed before and after. Further, in 1999 the federal General Services Administration (GSA) found that utility spaces—including stairwells and elevator shafts—are common goals of fire containment and energy efficiency. However, the desire for large open spaces and the generous use of glass façades for the sake of natural daylighting and a reduction in artificial lighting can be at odds with the need for airtight interiors and multiple levels of fire containment. Which goal is more important and which best serves the need for sustainability?

ADDITIONAL **INFORMATION**

Author

Jeff Griffiths, CSI, is the director of business development for SaftiFirst. With over 25 years of experience within the glass and glazing industry, he has worked with both sloped and vertical glazing systems incorporating wood, aluminum, and steel structural components along with various glass products. From 1985 to 1992, Griffiths oversaw the manufacturing of SaftiFirst's earliest generation of fire-resistive glazing systems. He currently serves on Glass Association of North America's (GANA's) Fire-rated Glazing Council Educational Committee, Window and Door Manufacturers' (WDMA's) Interior Products Code Committee, and the American National Standards Institute (ANSI) Z9.1 Test Standard Committee. Griffiths can be reached via e-mail at jeffg@safti.com.

Abstract

Compartmentalization is a fire containment design strategy applied throughout the building industry. It applies to energy conservation as well. Controlling air migration and circulation, along with maintaining proper pressurization of building

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The framing system at CSU Fullerton Recreation Center (California), matched the non-rated systems used in the building's exterior, providing the uniform, seamless look the architect desired.

costs for historic buildings were 27 percent less than for more modern buildings, according to its buildings inventory.

Both Licht and Frey are concerned with learning from the past to preserve what has worked and avoid what has not. Their combined message raises the concern that the industry may be ignoring the inherent value of demonstrated building performance with regard to energy conservation and life safety. The conventional honeycomb design of compartmentalized multi-story commercial and institutional buildings has contributed to their longevity and, in numerous cases, justifies enhancing their existence.

The National Trust for Historic Preservation asserts it takes about 65 years to recoup the 'embodied energy' that goes into constructing an existing building when it is replaced by a comparable one that is energy-efficient by today's standards. Since an enormous amount of carbon emissions come from building construction and operation, reusing and improving the energy efficiency of older, historic buildings is an essential part of a sustainable future.

Code changes

The newly revised 2012 *International Building Code* (*IBC*) modifies two tables (*i.e.* 716.5 and 716.6) to help clarify the applications for fire-rated glazing and those instances that require fire-resistance-rated glazing versus fire-protection-rated glazing. The tables now show the required fire rating and any size limitations for door vision panels, sidelites and transoms, and fire windows. The tables also present required fire ratings for wall assemblies. These changes make it easier than ever to properly specify fire-rated glazing and framing systems while confidently contributing to energy conservation and the sustainability of resources.

These revisions should help dispel the misconception fire rating durations (*i.e.* 20, 45, 60, 90,120, and 180 minutes) advertised by some fire-rated glass manufacturers are all one needs to know when specifying the right glass for any given application. Fire-protective products like wired glass, specialty tempered float glass, and architectural ceramics have limited use due to code restrictions. They serve a valuable purpose, but do not protect against the destructive spread of radiant heat. On the other hand, fire-resistive glazing systems provide absolute transparency for every application up to two hours.

Conclusion

Preservation and conservation within the construction industry starts with strategies that minimize the loss of embodied energy. A trip through any major metropolitan area points out the realization that the industry cannot afford to throw away architectural resources. The philosophy of sustainability forces one to question how to make more of what one has. Fire-rated glass technology, and the development of other advanced fire-resistant building materials, contribute to both today's and tomorrow's sustainability by protecting the architectural environmental assets. **CS**