The Debate Continues – Why Fire Safety Should Never Be Sacrificed

In October of 2003 a major U.S. manufacturer of sprinkler heads and fire equipment accessories sought to demonstrate how a solely active fire suppression system could replace the need for passive fire-rated systems. They constructed six test assemblies comprised of three 1/4" tempered glass panels butt glazed together to form a 13'-0 wide by 14'-0 tall wall attached to the face of Underwriters Laboratories' test furnace. Each test assembly used either their vertical pendant or sidewall window sprinkler spaced at various distances from the face of the glass. The furnace temperature settings followed the time/temperature curve established by the ASTM E119 test standard. Temperature probes were placed at various locations on the non-fire side glass surface for monitoring purposes. Based on the results, the sprinklers seemed to do away with the need for passive fire protection by relying solely on water dispensed at 20 gpm.

The sprinkler manufacturer's next step was to share their test results with code officials and the construction community. They submitted the test documentation to the ICC Evaluation Service (ICC-ES) for review. This resulted in evaluation report ESR-2397 and the 2007 issuance of AC385 – Acceptance Criteria for Special-purpose Sprinkler Heads Used with Fixed Glazed Assemblies to Provide a Fire-resistance Rated Wall Assembly. It was the first time a modified ASTM E119 test was conducted and seemingly passed while relying solely on an active suppression system. The proposed ICC-ES acceptance criteria stated that, "Because the sprinkler heads are used to limit the rate of heat transfer through the glazing, the ASTM E119 test method and test assembly are modified to take into account the sprinkler heads and their discharge." This was the first glazing assembly ever deemed a fire-resistive wall based on modified standard test criteria.

On May 4, 2011, the ICC-ES Evaluation Committee invited interested parties to submit comments on three proposed revisions to AC385 due to opposition that immediately emerged and resulted in proposed code change FS4-09/10 which prohibited the use of any active fire suppression system being used in conjunction with ASTM E119 or ANSI/UL 263 test criteria. The following was added to the 2012 International Building Code (IBC) as a result of this successful code adoption:

703.4 Automatic sprinklers. Under the prescriptive fire resistance requirements of the International Building Code, the fire resistance rating of a building element, component or assembly shall be established without the use of automatic sprinklers or any other fire suppression system being incorporated as part of the assembly tested in accordance with the fire exposure, procedures, and acceptance criteria specified in ASTM E119 or UL 263. However, this section shall not prohibit or limit the duties and powers of the building official allowed by **Section 104.10 and 104.11.**

On June 3, 2011, the ICC-ES Evaluation Committee issued a memo announcing that they had withdrawn AC385 from use and revoked the underlying evaluation report (ESR-2397). Undeterred by the setback, proponents of this degradation of fire safety renewed their efforts.

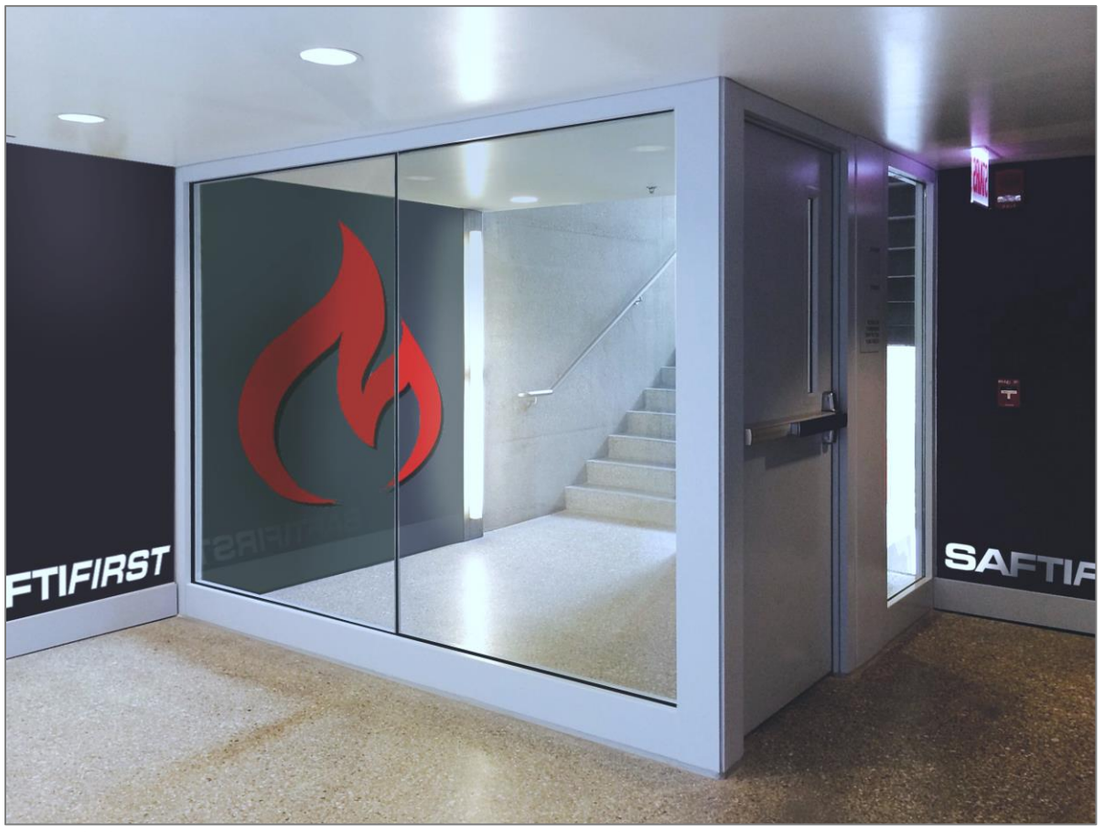
In August of 2012, the sprinkler manufacturer urged the ICC-ES Evaluation Committee to revisit the issue. At this point, the committee invited public comments on the reinstatement of AC385. The central theme among those respondents supportive of reinstatement focused on the IBC code sections that address alternative materials, design and methods of construction. For example, David Collins (FAIA, NCARB) contended that, "AIA believes that very existence of AC385 is directly derived from the authority granted to the code official authority through Sections 703.3 and 104.11 of the 2012 IBC. Alternative methods and materials has been a strong element of virtually every model building code and survive today to assist the entire industry to be able to respond to the evolution of systems."

The sentiments of the AIA were echoed by two prominent engineers employed by Arup USA Inc., Matthew Johann and Ray Grill. They claimed that, "The assembly supported by ESR-2397 provides design freedom to architects and code consultants and has been utilized to help maintain the design vision for several of our projects. Our typical applications involve the separation of adjacent occupancies when there is a need or desire to include glazing to promote an open feel or to support a given operation."

However, Section 104.10 of the 2012 IBC clearly addresses that a waiver of code requirements is to be considered "Wherever there are practical difficulties involved in carrying out the provisions of this code, the building official shall have the authority to grant modifications for individual cases, upon application of the owner or owner's representative, provided the building official shall first find that special individual reason makes the strict letter of this code impractical and the modification is in compliance with the intent and purpose of this code and that such modification does not lessen health, accessibility, life and fire safety, or structural requirements." It would be helpful to know what typical practical

difficulties exist that would justify the implementation of AC385 given that fire-rated glazing and framing systems are readily available, less costly, and fully code compliant. Neither supportive submittal mentioned any specific practical difficulty being overcome by virtue of AC385.

Is it the AIA's contention that today's fire-rated glazing systems inhibit the evolution of construction practices? How so? These systems certainly have come a long way from the 1296 square inch limitation of wired glass in hollow metal frames. Today's systems offer metal or wood finishes that cover the spectrum, provide access to wire-free clear views along corridors and throughout the building, and incorporate high-performance component make-ups for increased security, sound attenuation, and energy savings. These systems also offer a variety of sightlines or virtually no sightlines at all through the use of structural glazing. These numerous options provide the freedom "to promote an open feel." The difficulty here is that neither ESR-2397 nor AC385 clearly define what conditions or practical restrictions would prompt the use of this alternate means of construction. The manufacturers of fire-rated glazing systems would certainly want to know if such problems exist.



Today's fire rated glass systems provide access to wire-free clear views and reliable 24/7 protection without the need for and cost of an additional dedicated sprinkler system requiring regular inspection and long-term maintenance. These systems also offer a variety of sightlines or virtually no sightlines at all through the use of structural glazing. These numerous options provide the freedom "to promote an open feel."

Like most decisions related to construction materials, cost could be one contributing factor. Much like sprinkler systems, fire-rated glazing systems are not inexpensive. But given their 24-hour effectiveness combined with the numerous aesthetic and environmental benefits derived within the interior and on the exterior of a building, fully code compliant fire-rated glazing is cost effective. Sprinkler systems are not infallible. Although, much like passive fire-rated assemblies of all types, they do play an important role in the widely accepted strategy of balanced fire protection that's inherently enforced by building codes throughout the world. Passive and active fire protection systems each have their strengths and weaknesses. Most importantly, the critical factors in measuring the overall value of any fire protection strategy are reliability and effectiveness.

The National Fire Protection Association's (NFPA) recent study, U.S. Experience With Sprinklers, lists the percentages of occurrences where wet and dry pipe sprinklers operated as intended in reported structure fires from 2003 to 2007. For wet pipe systems, reliability ranges from 75% to 99% depending on the type of occupancy. For dry pipe systems, reliability ranges from 43% to 100%. As for effectiveness, the report's author, John R. Hall Jr., points out that, "A disadvantage of measuring automatic extinguishing equipment effectiveness by judgments made in incident reports is the ambiguity and subjectivity of the criterion of "effective," which has never been precisely defined, let alone supported by an operational assessment protocol that could be executed consistently by different

people." Mr. Hall suggests that effectiveness "should be measured relative to the design objectives for a particular system." So in the case of the alternate glazing system covered by AC385, its potential effectiveness is entirely dependent on 100% sprinkler reliability since the performance values of compartmentation and radiant heat protection have been compromised by having a non-rated glass and framing assembly at its core.

In their submittal supporting the reinstatement of AC385, Matthew Johann and Ray Grill contend that, "There is no history of failure associated with this type of assembly, and no evidence that it provides a reduced level of fire and life safety as compared to a solid, fully-passive fire-rated barrier when designed and installed in accordance with ESR-2397 and applicable standards." Their belief in ESR-2397 and the stipulated alternative method of construction hinges on limited empirical data and overlooks research that confirms sprinkler systems do fail to operate and can be ineffective. One has only to refer to any of the NFPA annual large-loss fire reports to learn that numerous fire disasters include buildings where sprinkler systems were present. Their contention that reliance on AC385 has never resulted in a disaster seems to rely solely on blind faith.

Mr. Hall's report also lists all of the typical reasons sprinklers fail. They fall into the following basic categories:

Failure to maintain operational status. System shut-off caused 53% of failures.
Failure to meet current building hazards and requirements. Building occupancies and configurations change over time, out-growing the original sprinkler design and capacity.
Failure due to direct and indirect defects. Aging building systems and surrounding infrastructure, especially water supply systems, can contribute to the gradual decline and eventual failure in sprinkler effectiveness.
These potential failures are always present. The reality is that buildings are not static nor are they perfect. So on February 10, 2015, the ICC-ES Evaluation Committee modified AC385 to insure fire safety and a secure means of egress by adopting the following:

5.1.11 The assemblies evaluated are not permitted to be used in lieu of firewalls. Where the assemblies are used as an alternative to fire barriers for exit-passage ways, horizontal exits, or exit enclosures, the fire area in which the assembly is located shall be fully sprinklered in accordance with IBC Section 903.3.1. The water supply duration for sprinklers, where used, shall be not less than the fire resistance rating that would have been required for a fire barrier. In addition, the registered design professional shall provide the code official with documentation in accordance with IBC Section 104.10 for a code modification or Section 104.11 for an alternative method of construction that addresses any anticipated impact on the functionality of the means of egress.