

- Methods for predicting the effectiveness of SFRM insulation as a function of its properties, the application characteristics, and the duration and intensity of the fire.
- Methods for predicting service life performance of SFRM under in-service conditions.

Affected Standards: AIA MasterSpec and AWCI Standard 12 for field inspection and conformance criteria; ASTM standards for SFRM performance criteria and test methods. *Model Building Codes:* The standards should be adopted in model building codes by mandatory reference to, or incorporation of, the latest edition of the standard. (See Recommendation 10 for more on this issue.)

Recommendation 7. NIST recommends the adoption and use of the “structural frame” approach to fire resistance ratings. This approach requires that structural members—such as girders, beams, trusses and spandrels having direct connection to the columns, and bracing members designed to carry gravity loads—be fire protected to the same fire resistance rating as columns. This approach is currently required by the International Building Code (IBC), one of the model codes, and is in the process of adoption by NFPA 5000, the other model code. This requirement ensures consistency in the fire protection provided to all of the structural elements that contribute to overall structural stability.³³ State and local jurisdictions should adopt and enforce this requirement.

9.2.3 Group 3. New Methods for Fire Resistant Design of Structures

The procedures and practices used in the fire resistant design of structures should be enhanced by requiring an objective that uncontrolled fires result in burnout without partial or global (total) collapse. Performance-based methods are an alternative to prescriptive design methods. This effort should include the development and evaluation of new fire-resistive coating materials and technologies and evaluation of the fire performance of conventional and high-performance structural materials.

Recommendation 8. NIST recommends that the fire resistance of structures be enhanced by requiring a performance objective that uncontrolled building fires result in burnout without partial or global (total) collapse. Such a provision should recognize that sprinklers could be compromised, nonoperational, or nonexistent. Current methods for determining the fire resistance rating of structural assemblies do not explicitly specify a performance objective. The rating resulting from current test methods indicates that the assembly (component or subsystem) continued to support its superimposed load (simulating a maximum load condition) during the test exposure without collapse. *Model Building Codes:* This recommendation should be included into the national model codes as an objective and adopted as an integral part of fire resistance design for structures. The issue of non-operational sprinklers could be addressed using the existing concept of Design Scenario 8 of NFPA 5000, where such compromise is assumed and the result is required to be acceptable to the Authority Having Jurisdiction. *Affected Standards:* ASCE-7, AISC Specifications, ACI 318, and ASCE/SFPE 29.

Recommendation 9. NIST recommends the development of: (1) performance-based standards and code provisions, as an alternative to current prescriptive design methods, to enable the design and retrofit of structures to resist real building fire conditions, including their ability to achieve the performance objective of burnout without structural or local floor collapse; and (2) the tools, guidelines, and test methods necessary to evaluate the fire performance of the

³³ Had this requirement been adopted by the 1968 New York City building code, the WTC floor system, including its connections, would have had the 3 hour rating required for the columns since the floors braced the columns.