PRIEST & ASSOCIATES
CONSULTING, LLC

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FIRESIDE

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FROM OUR VIEW

We are pleased to present the second edition of our FIRESIDE Newsletter. We hope you find it useful and informative. As always, we stand ready to receive comments and suggestions of ways we might improve its content.

All of us at PAC would like to take this opportunity to wish everyone a prosperous 2013

PAC has been granted status as an **Approved Testing Organization** with the California State Fire Marshall's Office (CSFM) Building and Materials Listing (BML) program. An approved testing organization is any person, firm, corporation or association equipped or having access to facilities which are equipped to perform tests in accordance with the California State Fire Marshal's testing procedures. PAC is recognized as a TYPE C1 agency**,** qualified to conduct or supervise designated tests and examinations and who may utilize the facilities of other firms for the necessary testing equipment. PAC's listing covers flamespread, fire resistance, roof fire classification and all California Building Code Wildland Urban Interface (WUI) tests referenced in CBC Chapter 7A.

Industry Alerts!

Proposed AC450 (Field-applied Intumescent Coatings to Wood I-joists) – See a discussion of this proposed AC in The Code Corner.

Photovoltaic Panel Systems – As previously reported, the 2012 IBC and IRC now include specific language requiring rooftop mounted- and building integrated- photovoltaic panel systems to be consistent with the fire classification requirements for roof covering materials. This is discussed further in the section on ICC Code Development.

Proposed Revisions to AC14 (Prefabricated Wood I-joists) - Revisions submitted by an Industry task group are proposed to Appendix A of AC14 to provide for specific procedures for the determination of durability, mechanical property degradation and corrosion effects of factory-applied fire protective paints, coatings and treatments to wood I-joists. See article in The Code Corner.

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THE CODE CORNER

The ICC ES Evaluation Committee is constantly considering changes in existing Acceptance Criteria, or the development of new ones. Some highlights of this activity are mentioned below.

Proposed AC450 (Field-applied Intumescent Coatings to Wood I-joists)

Priest & Associates (Howard Stacy) has been involved in the submittal of a proposed Acceptance Criteria for Intumescent Fire-resistant Coatings Field-applied to Prefabricated Wood I-Joists (Subject AC450). The proposal was submitted to ICC ES and posted for a 30-day public comment period under the "alternate criteria process" on December 3. Comments on the draft criteria will be posted on the ICC-ES web site for consideration in preparing a revised draft of the criteria, which will be presented at the February 2013 Evaluation Committee hearing.

The proposed AC establishes evaluation and acceptance requirements for intumescent fire-resistant coatings field-applied to prefabricated wood I-joists. The criteria is limited to the application of a coating to I-joists in new construction utilized for fire protection of floors where recognition is sought for establishment of equivalent fire performance to 2x10 solid sawn wood joists under Exception 4 to Section R501.3 of the 2012 IRC. The application of the fire-resistant coating is limited to interior assemblies and must occur once the structure is dried-in, having a sustained humidity of less than 80%. This proposal is based on performance criteria established in AC14 "Acceptance Criteria for Prefabricated Wood I-joists" under Section A4.4 Fire Protection of Floors, with two key exceptions: 1) AC14 provides only for factory-application of coatings/treatments for the fire protection of the I-joist framing members, and 2) AC14 provides for a more rigorous set of durability requirements, owing to the potential for weather exposure and handling between the point of manufacture and construction.

Proposed Revisions to AC14 (Prefabricated Wood I-joists)

Revisions submitted by an Industry task group are proposed to Appendix A of AC14 to provide for specific procedures for the determination of durability, mechanical property degradation and corrosion effects of factory-applied fire protective paints, coatings and treatments to wood I-joists.

A key element for discussion in the Industry proposal involves the durability evaluation of the fire protection materials. This evaluation involves the application of the coating to one side of 4 ft. x 4 ft. samples of web stock, exposure of specimens to three environmental exposure conditions (moisture cycling with a 72 hour water spray, a three cycle freeze thaw regimen involving 24 hour water submersion followed by freezing at -20°F for 24 hours, and a 2000 hour UV exposure). Conditioned specimens and a control group of unconditioned specimens are exposed to a uniform heat flux of 50kW/m² using the radiant panel configuration described in ASTM E1623 (commonly referred to as the 'ICAL' apparatus) and the burn-through time is assessed. Burn-through times for the conditioned specimens must be within 90% of the time recorded for the unconditioned specimens.

These revisions will be posted in early January for public comment, with consideration of comments to be held during the February 2013 hearings in Birmingham.

ICC Code Development

Photovoltaic Panel Systems – As previously reported, the 2012 IBC and IRC now include specific language requiring rooftop mounted- and building integrated- photovoltaic panel systems to match the required fire rating of the roof. The changes are found in three sections of the 2012 IBC and two sections of the 2012 IRC:

- IBC Section 1505—Fire Classification,
- IBC Section 1507 and IRC Section R905—Requirements for Roof Coverings, and
- IBC Section 1509 and IRC Section M2302—Rooftop Structures.

Issues of importance include:

- The requirements are different for BIPV systems and rack-mounted PV systems.
- Without an adequate PV system fire classification test, Section 1509.7.2 of the IBC may be impossible to use for jurisdictional enforcement.

The current version of UL 1703 does not address the fire classification of an assembly of PV modules installed over fire rated roofing systems. In an effort to rectify this, the UL 1703 Standards Technical Panel has made extensive revisions to the UL 1703 standard which have recently undergone review by a broad range of stakeholders.

A presentation on the revisions to UL 1703 was recently made by UL to ASTM Subcommittee E5.14 on Exterior Fire Exposures during the December 2012 ASTM E5 committee meetings, and the possibility of moving toward the development of a new ASTM standard on fire classification of photovoltaic modules was favorably discussed.
A proposal to introduce ASTM E2768 "Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials (30 min Tunnel Test)" into Section 2303.2 of the 2015 International Building Code covering the fire test requirements for Fire-retardant-treated wood (FRTW) was defeated over concerns relating to the definition of "significant progressive combustion". ASTM E2768 was developed for the purposes of standardizing the so-called "extended (30 minute) E84" which has been used for decades for the characterization of FRTW. The standard defines "progressive combustion" as the limitation on the progression of the flame front beyond 10-1/2 feet from the centerline of the burner. Opponents to the proposal argued successfully that "progressive combustion" is different from the flame front limitation, and is not addressed by the standard. Efforts to resolve this are underway in ASTM E5.

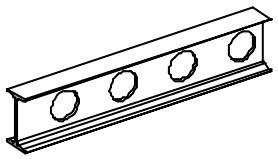
ASTM E2726/E2726M – 12 *"Standard Test Method for Evaluating the Fire-Test-Response of Deck Structures to Burning Brands"* was recently voted into existence by the ASTM E5 membership during the December 2012 meeting. This method determines the fire-test-response characteristics of deck structures attached to or in close proximity to primary structures, and was developed to provide a consensus standard with California Wildland Interface decking regulatory issues in mind. The standard is based on California State Fire Marshal Test Method 12-7A-4.

THE STANDARDS BOX

ISO Fire Standards Update

The ISO TC92/Subcommittee 2 (on Fire Containment) working groups are developing new fire tests continuously. One which has been worked on for several years and is finally being published, is ISO 834 parts 10 & 11 on evaluating the fire resistance contribution to structural steel items of protective coatings such as intumescent sprays, as reported in our previous newsletter.

However, it has become apparent that the increasing use of structural steel elements with web openings, either round, oval or square, are introducing variables into the equation that do not exist with sold flange elements. For one thing, the hottest portion of the elements tend to exist along the centerline of the flange, between the openings.



Typical Beam with Web Openings

Designers and engineers are fond of these types of structural elements because they reduce weight and supply numerous channels for cables, pipes and other items to pass through. However, the method used to load these items during a fire resistance test (and indeed, in a field application) must be carefully considered. Beams with web openings can fail in one of many ways, several of which are unique to this type of element:

- Vertical Shear
- Bending
- Web Post Buckling - occurs when the web separating two openings is unable to transfer the required horizontal shear force and the shear stress is greater than the shear strength of the web.
- Web Post Horizontal Shear – often occurs on slender web posts between closely spaced openings.
- Vierendeel Bending - the mechanism by which shear is transferred across the web opening and causes bending in the top and bottom, left and right, parts of the beam surrounding the opening.

Loading should always be as uniform as possible, to avoid web post failure, and the ratios of opening diameter and spacing to web height must be considered carefully.

The ISO standard for evaluating structural elements with web openings is at the beginning stages now, and work will begin in earnest shortly.

ACROSS THE PONDS

EUROPE/MIDDLE EAST/ASIA (EMEA)

For years, Authorities Having Jurisdiction in the various Emirates making up the United Arab Emirates (UAE) have accepted a blend of British and North American test and code requirements. Now, the trend is more towards North American standards, and adoption of the International Building Code. As a consequence, manufacturers, architects and engineers are shifting their emphasis in this direction, and relying increasingly on Certification Programs to verify that products and construction assemblies meet code requirements.

The advantage of a Certification Program, is that it consists of a third party verification that the product or assembly which was tested and met the qualification requirements is continuing to be manufactured to a high quality level and that the product is not changing over time. To accomplish this, the Certifying Agency performs routine audits of the manufacturing facility. Even in the field, the product can be easily identified as being under a Certification Program, because it will be clearly labeled with the Certifier's name and the properties for which the product is labeled.

HOW IT WORKS

Heat Release Measurements in Fire Tests by Javier Trevino

In fire testing, Heat Release Rate is defined as the amount of heat produced by a burning object during a specified time interval. Heat from a fire is generally composed of a convective plume (Hot Smoke) and a radiative component (Infrared radiation from the actual fire). In 1982, the Oxygen Depletion Method was developed and is still in use today. Prior to 1982, various schemes were used to estimate the heat release rate of fires.

- **Mass Loss Method -** Measure the mass loss rate (kg/s) of the burning item, multiply this by the effective heat of combustion (MJ/kg) and an efficiency factor.
- **Substitution Method -** Burn the item of interest and pass the hot gases through a collection stack with thermocouples and compare to a second burn using a gas of known HRR to replicate the temperature curve.
- **Heat Balance Engineering -** After conducting a burn in a strategically instrumented room (thermocouples), a complex set of heat balance equations can then be used to estimate the HRR of the burning item(s).
- **Oxygen Consumption Method -** The procedure involves burning the item of interest under a collection hood connected to a blower.
- **Single Thermocouple Correlation -** It has been found (Trevino) that a single thermocouple correctly positioned in the ASTM Room (8 ft x 12 ft x 8 ft high) can be used to estimate HRR to near flashover levels. It was discovered that this thermocouple follows the HRR curve shape very precisely. A

correlation formula can be used to estimate the HRR for a variety of HRR curves (single peak, double peak, monotonically increasing, steady state etc.). Although this technique seems a step back in technology compared to Oxygen Depletion Calorimetry, it provides users a simplified method of estimating HRR with simple instruments once the correlation function is developed. Today, Trevino and other researchers are working out the details and will publish their findings in the near future.

To request an electronic copy of Javier's full paper on the *History of Heat Release Measurements in Fire Tests* be sent to you, click on HRR@priestassociates.com.

DID YOU KNOW?

Priest & Associates Consulting (PAC) are experts in automation and control. PAC has refurbished and upgraded four Steiner Tunnels with custom Labview software and improved instrumentation and has refurbished two older Cone Calorimeters (Stanton Redcroft and Darkstar Research) with modern data acquisition, upgraded instrumentation and custom Labview software. PAC has designed and helped commission a Full Scale Vertical ASTM E119 furnace and NFPA 285 ISMA apparatus, and an ASTM E1623 ICAL apparatus. PAC can help you get your old fire test equipment back up and running, or design new equipment to replace older equipment. We can help select replacement instrumentation (such as electronic replacement of pneumatic Moore Controller for Steiner tunnels), or write custom software for tunnels, cones, furnaces, heat release rate hoods, and any other fire test equipment. If your test equipment is not calibrating properly, we can help troubleshoot and solve your problem. With upwards of 70 years of hands on experience, we have seen it all and can help you with your fire testing equipment needs.