



Non-Combustible Concrete Construction

A key to saving lives and reducing property damage.

In a typical year, fire departments are called to more than 1.7 million fires, one every 18 seconds. Over 80,000 are in apartments, 2,000 in hotels and motels, and 740 in dormitories. These structure fires cause more than \$9 billion in property damage each year, about half in residential properties.

More importantly, fire kills... more Americans than all natural disasters combined. Every year, more than 4,000 people, one every 130 minutes, die in fires, about 85% in homes.

Many of these deaths and much of this property damage can be prevented. The key is balanced design, combining the judicious use of sprinklers plus non-combustible concrete construction.

Balanced Design: The Smart Choice for Safety

Recent building code revisions have resulted in a reduction of the use of passive fire protection design systems, such as compartmentalization, in favor of active fire protection systems, such as sprinklers. Sprinklers, while often effective, have not been fully quantified for their reliability, and may fail at crucial periods. **However, one study does show that sprinkler systems could fail on an alarming 30% of the time.*** "Sprinkler trade-offs," the concept of exchanging established passive fire containment code provisions for active protection such as fire sprinklers, in the building codes have weakened fire protection requirements. In reaction to these building and fire code sprinkler tradeoffs, the concept of balanced design has been advanced and has gained popularity. Balanced design re-established the importance of passive design, including compartmentalization, in combination with active design, to deliver a more comprehensive fire protection system.

Active Fire Protection: Fire protection systems that must be activated to perform, such as sprinklers and smoke detectors.

Passive Fire Protection: Fire resistance provided by elements that inherently resist fire, such as non-combustible precast concrete, concrete and masonry block.

Balanced Design: A Combination of active and passive building elements, as well as the concept of compartmentalization, which greatly enhances fire protection at a minimum cost.

Active Fire Protection + Passive Fire Protection = Balanced Design

*Read the full report at <http://www.cfsc.org/ReliabilityofSprinklerSystemsRJJan2006.html>

The approach to defining balanced design should involve an arrangement or relation of the various fire protection features and systems to achieve an acceptable level of safety. The concept of considering multiple safeguards is contained in NFPA 101®, Life Safety Code®1, as follows:

4.5.1 Multiple Safeguards

The design of every building or structure intended for human occupancy shall be such that reliance for safety to life does not depend solely on any single safeguard. An additional safeguard(s) shall be provided for life safety in case any single safeguard is ineffective due to inappropriate human actions or system failure.

(Source: Koffel, B. "A Methodology to Analyze the Concept of Balanced Design", Fire Protection Engineering, Spring 2006.)

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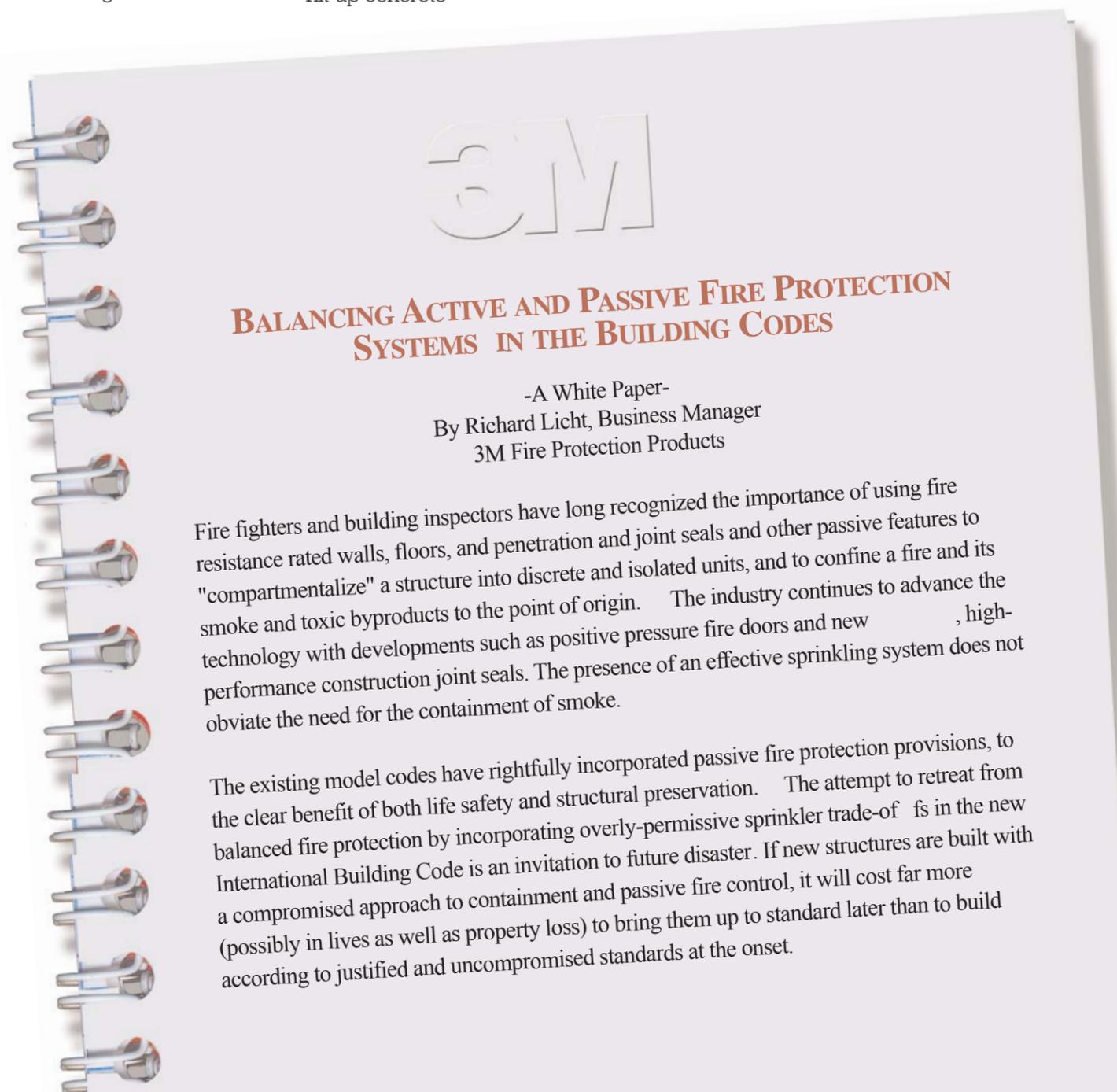
Concrete is a 2000 year young building technology. Continual advances in concrete material science and design have delivered new engineered concrete solutions for sustainability, durability and value. There's Non-combustible construction solution for every need

- Cast-in-place concrete
- Concrete masonry
- Insulating concrete forms
- Post-tensioned concrete
- Precast concrete
- Tilt-up concrete

Non-combustible concrete construction delivers for building owners...

Passive fire resistance is just one of concrete's many attractive benefits. Concrete also delivers

- Lower operating costs
- Lower insurance costs
- Lower maintenance costs
- Lower energy costs



BALANCING ACTIVE AND PASSIVE FIRE PROTECTION SYSTEMS IN THE BUILDING CODES

-A White Paper-
By Richard Licht, Business Manager
3M Fire Protection Products

Fire fighters and building inspectors have long recognized the importance of using fire resistance rated walls, floors, and penetration and joint seals and other passive features to "compartmentalize" a structure into discrete and isolated units, and to confine a fire and its smoke and toxic byproducts to the point of origin. The industry continues to advance the technology with developments such as positive pressure fire doors and new performance construction joint seals. The presence of an effective sprinkling system does not obviate the need for the containment of smoke.

The existing model codes have rightfully incorporated passive fire protection provisions, to the clear benefit of both life safety and structural preservation. The attempt to retreat from balanced fire protection by incorporating overly-permissive sprinkler trade-offs in the new International Building Code is an invitation to future disaster. If new structures are built with a compromised approach to containment and passive fire control, it will cost far more (possibly in lives as well as property loss) to bring them up to standard later than to build according to justified and uncompromised standards at the onset.

- Speed of construction
- Lowest life-cycle costs
- Higher appreciation
- Proven performance
- Resistant to seismic and high wind damage

...and occupants

- Fire safe non-combustible construction
- Does not burn
- Does not produce smoke, fumes or gases
- Does not add fuel to the fire
- Provides minimum two-hour separation between units
- Serves passively for the life of the building
- Lower insurance costs
- Needs no testing or inspection
- Superior acoustic qualities
- Security for occupants and contents

...and communities.

- Lower risk and exposure for the fire service
- More efficient use of fire services
- Construction does not add fuel load
- Fire is contained
- Adjacent units are protected
- Structural collapse is unlikely
- Community recognized for its fire safe construction
- Provides a stable tax base for the community
- Attracts long term investors to the community
- Provides redundant fire protection



Non-Combustible Concrete Construction is Cool

It has long been the opinion of legislators, code-officials, and design professionals that non-combustible concrete construction solutions are more costly than other alternatives such as gypsum fire walls with sprinklers.

Due to the perception of elevated cost, the acceptance of a balanced design approach incorporating both passive and active protection systems has met with resistance. The design of a comparative study was undertaken by the Fire Safe Construction Advisory Council to accurately document the perceived increased cost associated with the use of balanced design in a typical multi-family residential building.

The building model chosen for the project was a 4 story multi-family residential structure encompassing approximately 25,000 gross square feet of building area per floor. Based on the proposed target building types, it was decided that to better evaluate the relative construction costs, two different floor layouts would be used. The first model is a building comprised exclusively of single bedroom dwelling units. The second model is assembled using a typical mix of one and two bedroom dwelling units.

The building construction types, designed using the provisions of the 2003 International Building Code, included:

- Conventional wood framing with wood floor system (Type V-B Construction)
- Conventional wood framing with wood floor system (Type V-A Construction)
- Light gauge steel framing with cast-in-place concrete floor system on metal form deck

- Insulated concrete form exterior walls with interior bearing walls constructed of concrete masonry units and precast concrete floor system
- Load bearing concrete masonry with precast concrete floor system
- Load-bearing concrete masonry with cast-in-place concrete floor system
- Precast concrete walls with precast concrete floor system
- Insulated concrete form walls with precast concrete floor system
- Insulated concrete form walls with cast-inplace concrete floor system

The study provides the relative cost as a comparison to wood frame as a baseline of 100%, indicating increases or decreases relative to the baseline. Cost percentages shown below are examples of those provided by the complete study.

Concrete and Masonry Systems are Cost Effective Compared to Wood Frame

Location	Relative Cost of Concrete and Masonry	
	One Bedroom Scheme	Mixed Bedroom Scheme
Framingham, MA	5 % more	1 % more
Harrisburg, PA	5 % more	2 % more
Towson, MD	3 % more	3 % less

The Alliance for Concrete Codes and Standards (ACCS) supports the concept of balanced design in the building codes. Many communities around the country have adopted amendments to the model building code to promote balanced design. ACCS and its members have been instrumental in advancing these changes and can support the effort to promote balanced design in your community.

Contact ACCS today for more information on balanced design and non-combustible concrete construction and support for building code changes in your area.

The Alliance for Concrete Codes and Standards is a coalition of concrete organizations committed to enhancing building codes and standards to improve life safety, property protection, and welfare of the general public.