Concrete Masonry and Fire Safety

...A Lesson in Apples and Oranges

The concrete masonry industry has long been a proponent of using non- combustible materials for both general construction and for fire-rated wall assemblies.

Why?

The obvious reason is that concrete masonry walls are non-combustible. In other words, they will not burn, have never burned in the past, and will never burn in the future. However, there are many other fire related benefits to non-combustible construction that are often overlooked by designers and the model building codes. I would like to share them so that you can fully understand and appreciate concrete masonry's long-standing practice and passion for promoting non-combustible construction.

This industry is fueled by the fact that **NOT ALL FIRE-RATED WALLS ARE EQUAL**. That's right! Even though many wall assemblies have identical fire ratings, the current ASTM test method, ASTM E119 "Standard Methods of Fire Tests of Building Construction and Materials", creates an **apples to oranges** comparison between many wall systems. Let me explain. If one digs into the details of E119, you will realize that this standardized test method, used for decades, allows TWO walls to be tested! In fact, using two walls is the preferred method in E119 and is used by many material manufacturers. Those of us that produce non-combustible wall materials are *"allowed"* to use the OPTIONAL method that relies upon only one wall to pass the test. This begs the question, "How many real-life buildings have duplicate fire walls?" The answer is "NONE". Firefighters and building occupants do not have the luxury, as we do in the lab, of having duplicate fire walls.

WHY DO SOME MATERIALS NEED TWO TEST WALL SPECIMENS TO PASS E119?

E119 has three criteria that determine a wall's fire rating. Two relate to heat transfer and the third relates to structural stability. The structural stability of a test wall is determined by spraying a stream of water from a hose on a tested wall immediately after it has been subjected to fire. Hence, it is called the "hose stream test". Many walls perform well on the heat transfer criteria generated by the fire, but they don't perform well during the hose stream test... in fact, they often fall apart. A fire wall's structural stability is the paramount concern. If a fire wall falls down, or is breached by an explosion or falling building debris, or simply erodes due to heat effects, then **what good is it**?

More credit should be given to non-combustible, structurally stable walls that perform very well on the hose stream test. The heat transfer criteria is the *only* limiting factor in non-combustible walls when establishing their fire ratings. The temperature rise on the non-fire exposed side of a test wall and many non-combustible walls eventually reach this limit, which qualifies as a test failure. **Yes the non-combustible wall may get very hot, BUT it will NEVER burn, will NEVER allow the fire to spread, and ALWAYS performs very well under the hose stream test.** Unfortunately, non-combustible walls get practically no credit for being structurally stable in either ASTM E119 (or in the model building codes). The fact that ASTM E119 has created an apples to oranges comparison for fire rated wall assemblies is unlikely to change, but is certainly something that designers need to know.

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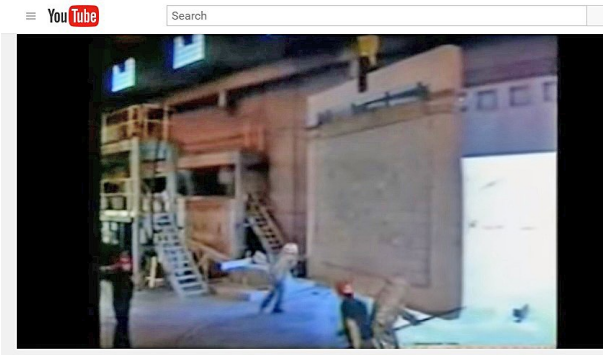
The **apples** to **oranges** comparison can be carried one step further when considering the fact that ASTM E119 does not record, nor evaluate, the **amount of fuel** that is required to heat/burn a test wall. Non-combustible walls require much more fuel than some other wall systems. Hence they have even more built-in fire resistance. Plus, when one uses a second test wall for the hose stream evaluation, the second wall is heated by fire for only **one half** of its intended fire rating or **only one hour, whichever is less**.



See the result of an ASTM E119 Fire Test in this video >

The apples and oranges situation in ASTM E119 is the first strike against non-combustible wall assemblies. **Another strike** is our model building codes. Balanced fire safety design relies upon three items, **DETECTION, SUPPRESSION** (fire sprinklers) and **CONTAINMENT**. Over the years, more and more emphasis has been placed on the first two items for a variety of reasons, including: 1) strong building code lobbying efforts by detection and suppression interests and 2) the general public's perception that if a fire is successfully detected, sprinklers will deliver water to the fire and will extinguish the fire. **The assumption that sprinklers successfully extinguish fires 100% of the time is simply not true. All three elements are ABSOLUTELY crucial**.

Unfortunately, non-combustible fire-rated containment walls are becoming more and more scarce with each passing building code cycle (including Illinois' adoption of the IBC) and detection and suppression are beginning to define balanced design.

The only problem with this reliance is that BOTH detection and suppression systems are ACTIVE systems; they need water, electricity, regular maintenance and have been recalled by their manufacturers, etc... By their very nature of being ACTIVE they cannot, and are not, 100% reliable. On the other hand, containment walls, by their very nature of being PASSIVE, are 100% RELIABLE and have never been recalled due to an electrical or mechanical defect, or been rendered ineffective by an angry tenant or a creative and determined arsonist.

Hence, our dilemma is, "Why are we (the design community and building code developers) placing more and more emphasis on active fire safety features rather than inherently reliable passive fire safety features?"

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Kevin Cavanaugh is currently chairman of NCMA's Com-Check Task Group. He is past chair of ACI Cmte. 122 on Energy Conservation and NCMA's Fire Safety Task Group and was appointed to the WI Multi-Family Dwelling Code Council (by the Governor of WI.)

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