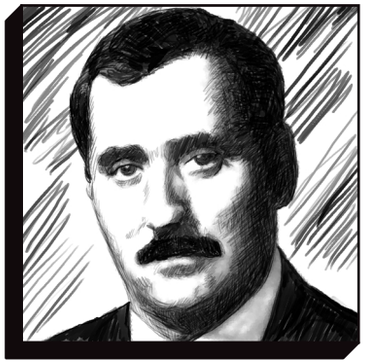

Fire Protection

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Twenty-First Century Fire Protection Concepts: Area Limitations?

It's the 21st century. America put a man on the moon more than three decades ago. Advances in science, medicine and other fields have been nothing short of spectacular in recent years, thanks to our technology, but one of the fields that still seems mired in the past is fire protection.

Most of the fire protection provided in buildings today is mandated by building codes. Building codes in their present form were developed in the early 1900s. While the codes we presently use in the United States are far more sophisticated than the codes used in the early 1900s, many fire protection provisions contained in our two newest model building codes, the *International Building Code* (IBC) and *NFPA Building Code* (NFPA 5000), still lack an engineering basis. To put it in other terms, many provisions in our two newest building codes are still based upon the opinions of "experts" in the field, rather than on statistics and scientific-based research studies. Given the costs associated with complying with the fire protection requirements contained in codes, and the advanced state of American society in general, it seems rather odd that Americans would tolerate the use of opinion as a basis for writing fire safety regulations which govern the building construction industry.

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Some of the most glaring examples of "opinion-based" provisions contained in building codes are the "allowable area" limitations contained in the *IBC* and NFPA 5000. For discussion purposes, let's take a look at the allowable area provisions contained in the *International Building Code*.

The first edition of the *International Building Code*, the 2000 edition, was based on the model building codes developed by the three regional model building groups, the International Conference of Building Officials (ICBO), the Southern Building Code Congress, International (SBCCI) and Building Officials and Code Administrators, International (BOCAI). Each of these three model building codes contained a different area limitations table. Rather than adopt any one of the area limitations tables already in use, the first edition of the *IBC* contains a new area limitations table.

It seems obvious that one of the first questions that should be asked by anyone interested in the engineering basis for code provisions is whether the introduction of a new area limitations table in the *IBC* is an admission that the area limitations tables contained in each of the three regional model codes was "flawed." Another obvious question to ask is whether the area limitations table contained in the *IBC* is actually a technological improvement on the previous area limitation tables or whether the new area limitation table is just different. In other words, is there really an engineering basis for each area limitations entry in the table *or* is the new table just the "opinion" of another committee of "experts"? Looking at the area limitations table contained in the *IBC* and seeing that each of the entries neatly ends in "00" (in other words, rounded to the hundreds of square feet) suggests that a less than rigorous engineering approach may have been used to develop the table.

Exceptions permitted

In addition to the area limitations table, each of the regional model codes contains provisions for modifications to the area limitations table to allow larger buildings in the case where a building is surrounded by open space, which can be used to facilitate fire department operations, and/or the building is protected by a sprinkler system. The area increases allowed for these two conditions vary with each of the regional model codes. Allowances for increases in the area limitations table for these conditions are also permitted in the *IBC*. In general, the maximum allowed area increase for open space in the *IBC* is limited to 75 percent (of the area allowed in the area limitations table), while the maximum allowed area increase for sprinkler protection is 200 percent (of the area allowed in the area limitations table).

It seems logical that buildings of the same construction type should be permitted to be larger (in floor area) if the building is surrounded by open space, which facilitates fire department operations, but what exactly is the relationship

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Is the new area limitations table actually a technological improvement on previous area limitation tables, or is it just different?

between increased floor area and the percentage of building perimeter which faces open space? Are there research studies that address this question? If there are, I haven't seen them. Assuming that this topic hasn't been addressed by research studies, just where did the 75 percent limitation on the open space increase come from? Another example of a consensus of "expert" opinion, rather than an objective engineering basis?

An increase in the allowed floor area for a building of a particular construction type when sprinkler protection is provided also seems logical. The only question is just how much of an area increase is warranted? We know that, if the sprinkler system is properly designed, and the protection is properly maintained, the sprinkler system will control any fire that occurs in the building. Given that, is a 200 percent increase in floor area a reasonable limitation on the increase allowed when sprinkler protection is provided or should a much larger increase in floor area be permitted? Again, the question should be asked just how the area increase for the installation of a sprinkler system was determined, through a consensus of experts on a committee or is there an actual engineering basis?

The committee responsible for drafting the height/area limitations for the *NFPA Building Code* in essence agreed that the area limitations contained in other building codes was an archaic concept and drafts of NFPA 5000 did not include an area limitations table similar to the table found in the *IBC*. In lieu of including an area limitations table, NFPA 5000 simply required that non-sprinklered buildings be divided by one-hour construction into compartments not exceeding 12,000 square feet in area. An increase in compartment size to 100,000 square feet was permitted in buildings protected throughout by a sprinkler system.

The basis for requiring that non-sprinklered buildings be divided into 12,000 square foot compartments was that the "average" fire department has the capability of applying 1,000 gallons of water per minute (gpm) on a fire and that 1,000 gpm is an adequate water supply to control a fire in a compartment which is 100,000 cubic feet in volume. Assuming a ceiling height of 8 feet, applying 1,000 gpm to a fire is adequate to control a fire in a compartment which is roughly 12,000 square feet in floor area. The link to the compartment area limitations for sprinklered buildings was based on studies in Britain; however, the basis for this limitation appears to be a bit more tenuous.

While the compartment size limitation included in drafts of the NFPA 5000 had an engineering basis, this approach proved to be too novel and the National Fire Protection Association (NFPA) eventually capitulated to criticism and included a "standard" area limitation table in NFPA 5000. In other words, the NFPA abandoned an engineering approach to building area limitations in favor of an area limitations concept which had its origins in the early 1900s.

From a fire engineering standpoint, can we do better than the *International Building Code* and NFPA 5000? I would certainly hope so, but, in order to make progress we will need to abandon some of the early 20th century myths on which our current 21st century codes are based. Both the ICC and the NFPA should insist on a sound engineering basis, not only for new code change proposals, but also for every fire safety provision that is already in the code. Of course, that means that the people writing the code will need to be well versed in fire engineering. It is obvious from our current crop of codes that simply being a code official doesn't mean that one has sufficient fire engineering knowledge to determine what actually belongs in the code. □

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