



## Engineering Sciences Section – 2005

### C28 Forensic-Engineering Anthropology: Defining Acceptable Practice in Building Design and Construction

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After attending this presentation, attendees will learn to use historical documents to document the diffusion of and changes acceptable construction practice over time.

This presentation will impact the forensic community and/or humanity by demonstrating how in the past, most practitioners defined "acceptable building practice" in an ad hoc manner. This presentation will give practitioners a tool to make such acceptable-building-practice determinations in a rigorous, defensible manner.

Over time and for a number of reasons, the very way that buildings have been (and are) built has changed—evolved—because of new construction materials, land-use practices, and so forth. One important reason that building-design and -construction practice evolves is to enhance building safety and accessibility. While year-to-year changes are, to say the least, generally slight, one can see obvious change when one compares a current building with one -built generations ago.

In general, unless explicit exception is taken in the law, building design and construction practices are *grand fathered*. That is, if a specific feature of a building (let's call it a widget) would have been permitted by on-point code or by acceptable practice at the time the building had been designed (assuming the feature was a part of the original construction) or built (assuming there was no explicit design or that the widget had been the result of a building modification), that widget would be permitted to remain without change even though current code or, in the absence of on-point code, acceptable practice) would forbid the widget if built today. On the other hand, widgets that are in violation of code or acceptable practice at the time of design or construction, as the case may be, are not grand fathered into acceptability, the passage of time can not confer acceptability to defective construction. The reason for grandfathering is simple, without grand fathering, the building stock of the country might have to be heavily modified—or bulldozed—each time a new edition of the code came out. Because this is simply impractical, a lack of grandfathering would place tremendous pressure on code-development organizations to *not* revise the code. Grandfathering, in other words, encourages progress in building construction, the use of new construction materials, and building safety.

A brief example of grandfathering is in order. Handrail height is presently governed by code: the handrail must be between 34 and 38 inches (measured vertically) above the step nosing. In the past, before the mid 1980s, handrail height was, by custom and often by code, required to be between 30 and 34 inches. A building built in, say, 1975, would not, because of grandfathering, be required to move its 30-inch-high handrails to conform to current code.<sup>1</sup>

Because old construction built to acceptable practice is grand fathered, but that which is built in violation of acceptable practice is not, forensicengineering practitioners must frequently determine what would be considered acceptable building design and construction practice in past eras. Understanding what constitutes acceptable practice in recent times can be discerned from review of applicable building codes, which are, to a large extent, a written manifestation of past acceptable practice.<sup>2</sup> To determine what would be acceptable construction practice in a given era is often no small task. How would one, for example, determine what constituted acceptable handrail and step dimensions and stair uniformity for a building built in an area that did not have a building code at the time the building had been built?

One cannot credibly discuss from direct experience the building practice of the time before one is a practicing engineer or architect. One cannot discuss from experience the building practice from the time before one's birth. This brief paper takes the position that acceptable practice can be 'reverse engineered' by study of building codes, construction textbooks, and similar treatises that were written in or before the era of interest. Early codes were promulgated to promote fire safety, building materials and construction methods, as well as design to facilitate quick building egress was mandated. Early codes, construction texts, and handbooks did not attempt to build to any utopian ideal; rather, they determined what was acceptable and memorialized that subset from what already existed out in the real world. In addition, the existence of model codes (codes published for the purpose of serving as exemplars to be adopted in whole or in part by municipalities) promotes textual uniformity in the code-adoption process. No town exists in a vacuum. People travel from town to town, and building architects, contractors, and journeymen get exposed to the construction around them. Thus, what constitutes acceptable practice will diffuse—and become more uniform—geographically over time.

The examples that will be discussed concern how to determine what constituted acceptable practice for the construction of original staircases in 1950's residential construction in suburban northern New



## Engineering Sciences Section – 2005

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Jersey. In each case, code is non-existent or not on point.<sup>3</sup> A study of building codes for the fifty years prior to the era of the building construction indicates that the hazards that were at issue in the examples were known about for generations prior to the construction of the residences. Specifically, riser and tread dimensions, stair-to-stair uniformity, handrail details, guard details, and landing configurations had all evolved in the first half of the twentieth century to the point where it can be convincingly demonstrated that the examples' construction can be shown to violate acceptable building practice for the era in which the buildings were built.

Among the many codes that will be discussed are the ordinances of the City of Plainfield (1902), the New York City Building Code (1908, 1916, and 1938), The Uniform Building Code (1927), The National Board of Fire Underwriters (1922 and 1931), and the Building Code of the City of Philadelphia (1949), as well as codes from smaller cities and towns.

### **Sources of references will be discussed.**

1. We will not address here the question of widgets defective at construction but gaining acceptability because of changes in code over time. (Looking at this example, think of a building built in 1975 with 38-inch-high handrails.) This author would not attempt to make the case that the 1975-era 38-inch-high handrails, in violation when the building had been built, were today defective.
2. Building codes evolve over time for a number of reasons: first, the changes in construction practice that comes about through construction evolution; secondly, research (the handrail-height change discussed above stems from research accomplished by Brian Maki of the University of Toronto in the 1980s.); and thirdly, by legislative technology forcing, e.g., the push to make buildings more energy efficient.
3. By not on point, reference is made to a situation where a code exists but does not cover the issues of interest. In the one of the examples, the town had a building code, but that code was silent with respect to stairs.

### **Building Code, Acceptable Practice, Grandfathering**