STATE BUILDING CODE INTERPRETATION NO. I-21-01

June 25, 2001

The following is offered in response to your letter to me dated June 13, 2001 in which you seek a formal interpretation of the structural provisions of the 1999 State Building Code.

Question: If a structural component has been loaded or stressed beyond its design capacities, would this constitute a "failure" or code violation?

Answer: While the determination of a structural failure is more of an engineering judgment than a code issue, the loading of a structural component of a building or structure subject to the requirements of the 1999 State Building Code beyond its design capabilities does constitute a violation of the code. The section of the code that has been violated depends on the circumstances surrounding the over-loading. For the purposes of this explanation, I will refer to the BOCA National Building Code/1996 portion of the 1999 State Building Code, but the information presented is equally applicable to buildings constructed utilizing the 1995 CABO One and Two Family Dwelling Code.

If a structural member such as a floor joist supporting a living room in a single-family residence is properly designed to support the required 40 pound per square foot live load, and the floor joist is properly installed, but at some subsequent time the joist is subject to overloading based upon a change of use or occupancy of the space, then sections 3402.5 and 1614.0 have been violated, because the code requires that the structural system of an existing building must be capable of supporting the loads applicable to the new use or occupancy.

If, on the other hand, the structural component is initially not designed to support the required design live load based on the proposed occupancy, (using the above example, for instance, if the single-family residential living room floor joist were designed for a 20 pound per square foot live load), a violation of section 1606.0 has occurred, because the design live load is not the greatest load produced by the intended occupancy.

A third scenario might be that the floor joist was properly designed, but a field substitution of a joist of smaller size, greater spacing or lesser design strength was made. In this instance, not only are the structural provisions of the code violated, but there is also a violation of section 111.3, which requires compliance with the approved construction documents for which the permit has been issued.

Due to the numerous factors of safety inherent in the structural design process, one rarely sees actual structural "failure" where a structural member breaks and

collapses, especially in “stick-built” wood frame construction. Nevertheless, it is possible for a structural member to remain intact and still not be code-compliant. The determination that a structural member has exceeded its designed capacity can be made in a variety of ways. Among others, if any of the following occurs, the structural member is in violation of the code:

1) When the member as it is used exceeds the allowable bending stress for the material involved.
2) When the actual deflection of the member exceeds the allowable deflection.
3) When the allowable horizontal shear stress has been exceeded.
4) When the member exerts excessive bearing stress on the bearing points.

Again, when the building official suspects that a structural violation has occurred, it is prudent to enlist the services of a licensed professional engineer specializing in structural design to evaluate the structural conditions and make the determination if the member has indeed “failed”.