



## **ENCOURAGING RENOVATION: APPROACHES TO UPGRADING EXISTING BUILDINGS**

Out of the thousands of pages that make up the 2007 Ohio Building Code and its referenced standards, there are only 15 pages in Chapter 34 that provide code requirements for renovating existing buildings. Trying to develop code requirements for renovating existing buildings is complex. Materials, construction methods, code implementation at the time of construction, and deterioration of a building vary significantly depending upon age and location. In addition to the technical challenges in creating a standard code document that effectively accounts for these variables, there are philosophical questions about the level of safety and reliability the public should expect from a renovated building.

Consideration of the above is too much to squeeze into the 15 pages of Chapter 34. Chapter 34 takes a cleaner and more conservative approach by providing a set of triggers, which if exceeded, require an existing building to meet current structural code requirements for new buildings.

Chapter 34 can make renovation of existing buildings prohibitively expensive when adhered to and enforced. It is difficult to avoid the triggers of Chapter 34, and it is often not economically feasible to take a building designed before we considered earthquake loading in our designs, and make it meet current structural code requirements. Faced with costs of complying with Chapter 34, owners of existing buildings are not likely to upgrade. They may choose to invest elsewhere, or leave their buildings unimproved, which leads to the further deterioration of the building and eventually their abandonment and demolition.

### **The Need for Alternatives:**

The triggers in Chapter 34 can be extremely punitive. Any change that increases the seismic load on an individual *element* by more than 10% (or reduces the capacity of an element by more than 10%) requires the *entire seismic force resisting system* to conform to the requirements of a new structure.

Taken literally, a new rooftop unit which could locally increase the seismic force on a supporting element by 10%, would require the entire building to meet current structural code requirements.

There are other rehabilitation standards which are not formally adopted by the 2007 Ohio Building Code, such as the International Existing Building Code (IEBC), ASCE-31 (Seismic Evaluation of Existing Buildings), and ASCE-41 (Seismic Rehabilitation of Existing Buildings). These documents provide some flexibility and attempt to better address various existing building conditions.

The IEBC, in most cases, does not require that the entire seismic force resisting system conform to current structural code requirements. It presents a tiered approach to building renovations with varying levels of requirements depending upon the scope of the renovation. Even significant renovations permit analyzing and designing the structure for seismic forces less than required for new structures.

There are some specific instances when dealing with existing buildings where the upgrade provisions of Chapter 34 are not required.

- 1) **Building Alterations Initiated for the Purpose of Increasing its Strength or Stiffness:** Nobody wants to provide any barriers to addressing a structural deficiency. If an owner voluntarily chooses to make structural upgrades, this typically would not trigger a code requirement that would force them to bring their entire building up to current code requirements. There are several situations where small improvements to a building can significantly improve its reliability, even if those improvements don't approach current code requirements.
- 2) **Change of Occupancy:** Changes in occupancy can also trigger code required upgrades. However, in lower seismic regions, such as the entire state of Ohio, structural upgrades are not



required by code unless the building is changing to an occupancy category IV structure such as hospitals, fire and police stations, emergency shelters, etc.

- 3) **Historic Buildings:** Historic buildings may also be repaired, restored, altered, added onto, even moved as long as, when the work has been completed, they are judged by the building official to not constitute a distinct life safety hazard.

Steven Schaefer Associates has been successful in working with local building departments to permit the use of alternate building standards. Our experience with existing buildings and other rehabilitation standards allow us to solve challenges while still providing safe and compliant solutions. In pursuit of this, Steven Schaefer Associates Project Engineer Marshall Carman, has been petitioning the Ohio Board of Building Standards to include language in the building code that gives structural engineers clear alternatives to some of the punitive requirements of Chapter 34, in the hope that this will encourage, rather than discourage, the reuse and improvements of existing buildings.

#### Sidebar #1 Residential Upgrade

A client wanted to upgrade the structural integrity and energy efficiency of a university campus multi-residential building constructed in 1963, before local building codes addressed seismic loads. Strict compliance with Chapter 34 would have prohibited the structural and architectural improvements they hoped to implement. We recommended a site-specific Response Spectrum Analysis. Our client selected the specific life-safety and event-specific criteria they wanted to meet, we identified exactly what would have to be done in order to meet those criteria, and were able to meet the owner's objectives and save them tens of millions of dollars in the process.

#### Sidebar #2 Conversion

This conversion of five row houses into a single structure will serve as a community for homeless individuals. The 120-year-old, building will contain more than 40 single residences, connected by common corridors on each floor with new stairwells at each end and a new community area on the first floor. Under Chapter 34, the owner would be required to add vertical reinforcement to all the brick walls in order to meet today's seismic load requirements. But to do so would make the cost of conversion prohibitive. To save the project and put this group of inner-city buildings to a very worthwhile use, we worked with the City Plan Examiner, who allowed us to use the IEBC as our compliance standard rather than Chapter 34.

#### Sidebar #3 Upgrade of a School

We were asked to upgrade a school building consisting of three separate wings surrounding a center courtyard constructed in 1972. The 1970 Edition of the Ohio Building Code, in force at the time of construction, did not address seismic forces. In addition, the structure did not appear to have been designed to resist the required wind loads. Had we been required to upgrade the school according to Chapter 34 of the IBC, the project would not have been feasible. Our solution was to design a retrofit scheme, which significantly improved the safety of the occupants, by following ASCE-41. Even though ASCE 41 has not been adopted by the Ohio Board of Building Standards as a code document, the local building department accepted it as an acceptable procedure for analyzing and designing a retrofit scheme for this building.