



Structural Engineering: Expansion of existing buildings in N.Y.C.: Structural challenges and solutions

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In New York City, a property with unused development rights represents an untapped revenue source. However, the task of expanding an existing building - especially an older building - is fraught with challenges. The design of building enlargements must balance the ambitions of property owners with the need to maintain the safety of existing buildings.

The undertaking is further complicated by the fact that the chapter of the New York City Building Code that governs modifications to existing buildings - Chapter 34 - is completely blank. The Department of Building (DOB) is in the process of adopting a modern existing building code, but that undertaking is difficult in a city with a diverse set of vested interests, and an even more diverse set of building types. In the interim, professionals designing building enlargements are largely forced to rely on their judgment and on an assortment of reference documents, including local laws and technical notes published by the DOB.

Property owners with unused development rights looking to expand their buildings should be aware of one DOB publication in particular, TPPN #4/99. In general, this document stipulates that if an expansion to an existing building requires the construction of new foundations (or strengthening of existing ones), and if the expansion increases the weight of the original building by more than about 20%, then the entire building must be upgraded to withstand earthquake forces. These thresholds are often referred to as "seismic triggers."

Although outdated (and somewhat less restrictive than in other cities), the logic behind these requirements makes sense. New York City sits in a region of moderate seismicity, meaning medium-size earthquakes are possible. Because heavier buildings are subjected to larger forces during earthquakes, it is reasonable to impose earthquake requirements for buildings that are undergoing substantial enlargements.

Unfortunately, upgrading an older existing building to be earthquake-resistant can be extremely expensive and disruptive. In most instances, it is prudent to limit the scope of the expansion such that the seismic retrofit requirements are not triggered. Therefore, when considering an expansion to an existing building, it is important to get an experienced professional team involved from the outset. A seasoned structural engineer, working with an architect, can help to create a structurally sound addition that maximizes useable s/f, while minimizing the need for costly reinforcement work.

The following is a partial list of strategies a knowledgeable team might utilize in the design of a cost-effective building expansion in New York City:

- * Minimize the weight of the new construction. Since the seismic triggers are primarily weight-based, using lightweight materials for the new construction is key. Avoid using masonry and concrete whenever possible; instead opt for light-gage steel framing or wood. Lightweight construction materials can also allow you to support the expansion without needing to reinforce existing structural

members;

* Reduce the weight of the existing construction. Demolishing the heaviest portions of the existing structure can reduce the overall weight of the renovated building and help you to avoid seismic upgrades. For example, tearing down the top floor of an existing masonry building may be enough to offset the weight of three added stories of new lightweight construction;

* Build out, not up. This is often impossible given the building density in New York City, but adding mezzanines and balconies on the lower floors (as opposed to additional stories above the roof) can be effective in maximizing useable space without triggering seismic upgrades;

* Find out where you have excess structural capacity. To avoid costly reinforcement work, it's often worthwhile to spend the money upfront to investigate the capacity of existing structural members. Oftentimes existing masonry walls will have excess capacity, while existing columns and beams will not. An experienced structural engineer can identify the members with excess capacity and then use those members to support the weight of the addition.

* Isolate. Expansions of any size can preclude the need for seismic upgrades if the new construction is isolated from the existing building. The logistics of accomplishing this can be tricky, especially for vertical expansions, but often it is the best option for sizeable additions; and

* Tear down and rebuild. For large vertical expansions (increases of square footage greater than about 20%), the cheapest option may be to tear down and rebuild.

Of course, designing a cost-conscious expansion is more involved than just following a checklist. Other complicating circumstances can and will occur. For example, expansions to historic buildings cannot alter the building's appearance from the street and need to receive approval from the Landmarks Preservation Commission.

But property owners should not be deterred. A team of experienced professionals can design an expansion that maximizes useable s/f, minimizes the need for budget-busting reinforcement work, all while maintaining the safety of the building.

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