

Real Estate Journal

THE LARGEST BUSINESS PUBLICATION OF ITS KIND IN THE NATION

The structural engineer's role in the adaptive re-use, renovation and rehab of existing buildings

tg Structural Engineer



By Thomas Heger,
DM Berg
Consultants, P.C.

With the skyrocketing prices of building materials, shrinking open parcels of land and strict zoning regulations, developers are turning to conversion of older buildings into modern day structures with all the amenities and space requirements of a new building.

The developers envision a diamond in the rough scenario and expect big savings in construction costs by reusing the main structural elements and shell of the building. However, a structural engineer experienced in building renovations can see through the haze and will caution the developer as to the many polishing steps that the existing building may need to go through to become that "diamond" they expect. Some of these steps may add significant design and construction costs to the budget. Many times throughout the project the old phrase "they don't build'em like they use to and thank God they don't" will be uttered from the structural engineer's mouth.

When a developer is contemplating recycling an existing building, a structural engineer experienced in building renovation and rehabilitation should be brought into the project at the early planning stages. An early structural feasibility study should be performed to quickly identify any

structural cost implications that may arise. Many current building codes dedicate a chapter for the requirements for the repair, alteration and change of use of existing buildings. The basic structural requirement within these chapters is that all buildings must exhibit some form of lateral force resisting system to resist some level of wind and seismic load. This stems from our modern day knowledge of the effect seismic forces have on the structural components within the building. If the renovation scope includes modification to the existing architectural layout of the existing building, then the existing structural elements (walls, columns, footings and framing) may suffice for the new use and for lateral load resistance. Thus the structural upgrade construction costs will be minimal. However, if the scope includes adding floors on top of the building and/or removal of interior masonry walls, framing, columns and other major structural elements, then the design and construction costs to replace or supplement the existing gravity and lateral load resisting systems can quickly spiral out of control. When major renovations to the structure are necessary, construction costs for temporary shoring, bracing and underpinning must also be considered.

In renovation and rehabilitation projects, it is important to meticulously evaluate the existing structural elements through a due-diligence study. The study can properly identify any budget-busting structural deficiencies or the new code required structural upgrades that need to be performed to make the project feasible. Also, in order for the structural engineer to produce an accurate set of

construction documents so the developers can get a good estimate of all the construction costs without exposing themselves to large change orders during construction, the developers and architects must remember to budget additional consulting fees for the following work not typically seen for a new building design. The additional consulting fees may be, but not limited to the following scope of services:

- Extensive structural field investigation and condition survey;
- Contractor's assistance for selective demolition to remove finishes to expose the existing structural elements;
- A comprehensive due diligence report;
- Existing material testing to determine design strengths and properties of various materials; and
- Geotechnical consultant to help determine existing foundation systems, soil bearing capacities and seismic design coefficients.

Once the architect designs the program requirements for the building, the structural engineer will begin to add some creative analysis and design. As with most renovation/rehabilitation projects, some level of seismic upgrades are usually required to increase the lateral load resisting system. Typically this involves strengthening of masonry walls or adding supplemental steel bracing, steel moment frames or sometimes wood shear walls. Also included are the requirements to strengthen the foundation supporting the new lateral load resisting system. This work of course has to be kept as unobtrusive as possible to stay within the confines of the archi-

tectural layouts. Fortunately, the structural engineer armed with today's current material technologies and construction methods, has a well stocked bag of tricks to accomplish the structural strengthening. A few of these methods may include high strength steel, epoxy anchors and bolting, carbon fiber-reinforced plastic (CFRP) plate or wraps, external post-tensioning, polymer based mortars, applying a layer of reinforced shotcrete to existing unreinforced masonry walls, epoxy injection resin for strengthening concrete and wood, and a variety of drilled-in foundation pile systems.

Again, by investing time and money and the early participation from a qualified structural engineer with a strong portfolio of renovation projects, all structural cost impacts can be tabled near the start of the project. Then the developer can make an informed decision on the economic feasibility of the building rehabilitation. Here at DM Berg Consultants, P.C. we have been involved with many renovation/rehabilitation projects such as conversion of old mill building complexes to residential, churches to residential, and retail to medical offices to name a few. New building design can always be interesting and challenging, but we have discovered that renovation/rehabilitation projects can be just as challenging, presenting unique structural solutions that require both knowledge and imagination, which in the end, we find extremely gratifying.

Thomas Heger, P.E. is president of DM Berg Consultants, P.C., Needham, Mass.