DM Berg Consultants, P.C.

Spring 2002

Brookline Village Lofts Building A
Brookline, Massachusetts

DM BERG CONSULTANTS, P.C. is a structural engineering firm providing services for both public and private-sector clientele. Our business focus is:

- Building designs for new construction
- Analyses, forensics, and report writing
- Rehabilitation and restoration for existing buildings and parking structures
- Envelope and weatherproofing designs for new and existing building roofing and cladding systems

Project Types

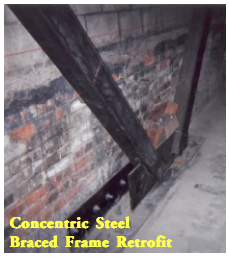
Assembly
Civic
Commercial
Educational
Healthcare
Hospitality
Industrial
Institutional
Parking Garages
Residential
Retail
Specialty

DM Berg Consultants, P.C.
570 Hillside Avenue
Needham, MA 02494
Tel: 781 444 5156
Fax: 781 444 5157
www.dmberg.com

Navigating the Mysteries of Chapter 34 in the MSBC, 6th Edition

by Matthew H. Johnson, P.E.
Project Manager

The Massachusetts State Building Code, 6th Edition (780 CMR), Chapter 34 outlines the requirements for the Repair, Alteration, and Change of Use of Existing Buildings. At first glance, this section of 780 CMR seems bloated and circuitous in its references. However, after some study, the requirements and the intent of the chapter become clear.


Concentric Steel Braced Frame Retrofit

Buildings prior to the 1975 edition of 780 CMR were not required to be designed for seismic forces. Wind loading, in some form, has always been present as a design requirement. In the early days of construction, today's familiar Type 3 or 4 construction predominated [as is visible throughout New England]. In most cases, the building weight alone was enough to resist the maximum wind gusts and minor earthquakes that are common during the life cycle of a structure.

However, as the engineering and geological community has learned more about tectonic plates and the forces caused by earthquakes, seismicity has begun to dominate many design discussions and requirements. Additionally, as manufacturing technologies have changed, many old mill buildings or classic structures were left for naught as newer, state of the art facilities, sensitive to the noise, air quality, vibration, and machinery of today's factory have replaced them.


Concentric Steel Braced Frame Retrofit

Whether through New Englanders history of strong construction or just plain luck, many of these great old buildings have survived and are finding new life through adaptive reuse. Chapter 34 has been created as a map for the Repair, Alteration, and Change of Use for these and other old buildings.

One of the underlying requirements of Chapter 34 is that all buildings in some form must have a lateral force resisting system. In many cases this could be existing, un-reinforced masonry walls, or for some newer buildings, steel braced or moment resisting frames. In many simple repair or restoration cases, the design forces are only due to the effects of wind associated with Exposure A; the lowest pressure zone.

However, depending on the level of alteration or if there is an increase in the area and/or weight of the building, seismic force analysis may be required. Weight must be carefully calculated because the additions of roof top mechanical units or the addition of concrete to floors and/or roofs for leveling or acoustics increase the weight of a building enough to require design for seismic forces. Additionally, any change to a building's existing lateral force resisting system will require the replacement of the lost strength and stiffness of the removed element if the building is not in conformance with CMR 780.

Chapter 34 also places premiums on the new use for the structure. For apartment or residence retrofits in old mill buildings, the permanent nature of the occupants requires a higher level of compliance with the code for new construction. While seismic design is not always required to fully comply with the new code, provisions of Chapter 34 require a level of safety be developed that generally requires reinforcing the existing structure for lateral force loading.

Additions may be the most ambiguous section of Chapter 34. If an alteration is not structurally separated through the use of an expansion joint, the existing building will have to meet some level of conformity with the new code, possibly full compliance, depending on the size and weight of the addition. However, if an addition is constructed vertically from the existing building, there can usually be no expansion joint. Since the new addition, like any new construction, must comply fully with the code for new construction, so must the building supporting the addition. This can be especially taxing architecturally when placing a new lateral system in the often confined spaces of turn-of-the-century construction.

As a final note, make sure that during the due diligence phase of a pre-purchase agreement you budget for and consult with your structural engineer. Understanding the cost impact of an adaptive re-use project involves more than just the potential tenants and market rate for your project. Some use groups and types of construction can no longer co-exist without budget-busting structural retrofits. ■

Project Highlight . . . . . *Staff Profile*

BROOKLINE VILLAGE LOFTS
Brookline, Massachusetts
by William H. Barry, P.E., Project Manager


Photo by DMBC

Building C

Brookline Village Lofts
Brookline, Massachusetts

Architect:
CYMA2, Inc.

General Contractor:
M. O'Connor Contracting

Total Estimated Cost:
$6,000,000

Total Square Footage:
36,000

Brookline Village Lofts is a luxury condominium complex comprised of 21 residences contained within four individual buildings designated as Building A - 3 units; Building B - 3 units; Building C - 14 units; and Building D - one unit.

Buildings B and C are constructed above a 41 tandem space below grade parking garage. To minimize the height of the garage and the amount of excavation, the roof of the parking garage is composed of 18½ inch deep concrete beams and one-way concrete joists supporting a 4½ inch thick slab. The concrete garage roof also proved to be the best system to accommodate the smaller unrelated footprints of the supported structures.

All three new buildings (A, B, and C) are of wood framed construction utilizing many engineered wood beams and some steel framing to achieve the complex interior layouts desired by the developer. The smaller Building B utilizes a steel brace frame at one side to compensate for the lack of shear wall panels. The larger Building C was constructed with exposed Douglas Fir beams and posts for a "loft" look. To accommodate the many windows on the street side elevations of this building, two 3-story steel moment frames straddling the large bay windows were required. Building D is the only portion of the original building on the site to be saved. This was done to maintain the retaining wall supporting the neighboring property. The interior of this space was subdivided vertically to create a split level living space and utilized 5½ inch deep LVL joists to create the shallowest structure depth possible. ■

WILLIAM H. BARRY, P.E.
PROJECT MANAGER

Mr. Barry has been with DMBC for seven years. Bill has gained experience working on a range of projects including all types of structural systems in the design of entirely new buildings as well as additions and renovations of existing buildings.

Bill has had a significant role in expanding the firm's design and document standards for wood frame buildings. He has also been involved in many of the firm's temporary construction support systems for construction equipment, with special emphasis on crane supports. Bill was the designer of the steel framed crane runway system utilized by the steel erector at the Lafayette Corporate Center addition in downtown Boston.

Bill received his Master and Bachelor of Science Degrees in Civil Engineering from Worcester Polytechnic Institute. He is currently registered in Massachusetts.

As part of the educational outreach program for the PBS series "Building Big", Bill taught after school study students about structural behavior at the West Roxbury Public Library. In his spare time, Bill enjoys hiking, model railroading, and reading.

In addition to the Brookline Village Lofts project featured to the left, Mr. Barry has been the lead engineer on the following projects:

Boylston Place at Chestnut Hill - Chestnut Hill, MA
Architect: DiGiorgio and Associates, Inc.
Southwood Square – Stamford, CT
Architect: Russell, Scott, Steedle & Capone Architects
St. John of God – Brighton, MA
Architect: The Architectural Team, Inc. ■

Technical Note by Radu D. Urma, P.E., S.E., Associate

Large companies are continually diversifying their products, for obvious business reasons. The construction industry follows this trend so the designers should take advantage of it. Two examples are as follows:

1. "Hilti" is known for its fastening products, especially anchors to concrete, cmu, brick, etc., but they expanded with powder actuated fastening systems and metal deck attachment systems. They also developed a special shear connector called X-HVB for use in composite steel beam construction, compared to the traditional 3/4 inch diameter welded headed stud, its shear strength is higher and the attachment is mechanical - no electrical power source is required.
2. "Simpson" is known for its wood construction connectors. They expanded with mechanical anchors for concrete, cmu, brick and drywall, and acrylic and epoxy adhesives for threaded rod anchors or rebar dowels into the above materials. They also developed connectors for lightgauge steel construction. In some cases, these new products may be more efficient than similar ones by other companies. For example, the expansion anchors "Wedge-All" by Simpson or "KwikBolt II" by Hilti cover the same field; however for a certain application one or the other may be more efficient.

The **Boston Association of Structural Engineers** (BASE) has published a commentary for the structural portions of Chapter 34. This is available at the BASE website at: **www.engineers.org/base/base.html.**

Follow along in our future newsletters as we break down seismic design in Massachusetts. Articles include seismic upgrades and hazard mitigation as required by Chapter 34 of the MSBC (feature article); and seismic bracing of cmu walls (Summer 2002). To read past articles, visit www.dmberg.com and click on **Company** subcategory **News**.

DMBC, P.C. strives to create a working atmosphere where, through mutual cooperation and respect amongst staff and clients, the process of designing structures can be carried out with efficiency for all concerned including owners, developers, other clients, and end users.