

# Sales Engineering Technical Paper Series

## Seismic Bracing Requirements in New York City

The topic of seismic bracing has recently created a stir among architects, engineers, and contractors dealing with renovation and new construction projects in metropolitan New York City. This paper summarizes some of the current and upcoming seismic matters in NYC.

### Current NYC Building Code

The current version of the NYC Building code is based on the Uniform Building Code, (UBC), and has not been significantly changed since 1968. Since then, numerous changes, or amendments, have been added resulting in the bulky, 700-page codebook! Within these pages there are general construction requirements as well as provisions for seismic bracing. However, the problem is that the seismic requirements are not being specified and/or enforced 100% of the time on projects. Some job specifications have a very detailed seismic bracing section, while others skip over it. Other times, the sole responsibility for seismic bracing design and installation is given to the contractor.

Two important terms in the code are *essential facilities* and *exemptions*. Essential facilities are defined as, "...those structures which are necessary for emergency operations subsequent to a natural disaster." In general, electrical and mechanical services in any essential facility require bracing unless certain exemptions are applicable. One of the most popular exemptions is for suspended conduit, mechanical piping, and ductwork; if the hanger rod is 12 inches or less, bracing is not required.

As for calculations, the current NYC Building Code's Seismic Force Level equation for non-structural components is:

$$F_p = Z I_p C_p W_p$$

Where:

$F_p$  = Seismic Force Level

$Z$  = Seismic Zone Factor

$I_p$  = Importance Factor (aka: Occupancy Factor)

$C_p$  = Horizontal Force Factor

$W_p$  = Operating weight of equipment

$F_p$ : This value governs the amount of bracing necessary for a component. It will be expressed in terms of "g", or the gravitational weight, i.e., 0.15g or 1.0g.

$Z$ : This factor is based on the zone, or geographic area, that a project is located. All areas within the jurisdiction

of the NYC Building Code are assigned,  $Z=0.15$ ; per Reference Standard RS 9-6 of the NYC Building Code.

**FYI:** Metropolitan New York City is located in Seismic Zone 2

$I_p$ : The Importance Factor depends on if the building/structure is considered an "essential facility." Examples of these are hospitals, fire stations, communications centers, etc. For essential facilities,  $I_p=1.5$ , all other facilities,  $I_p=1.0$ .

$C_p$ : The Horizontal Force Factor depends on the component being braced. Table No. 23-P in Reference Standard RS 9-6, shows that the value can be 0.75 or 2.0 depending on if the component is part of the structure, is a non-structural component, hanging, or is supported from underneath.

$W_p$ : This factor stays constant and is also known as "g", or the gravitational weight.

### Model Code

Not only is there a mass quantity of pages in the current code, but the language is complicated and confusing. Even though attempts have been made to ease the understanding of the code, it still receives much skepticism and ill feelings. Mayor Bloomberg realized this and created an advisory committee to review and recommend a building code that a brand new NYC Building Code would be modeled after.

Two options were given to the advisory committee; International Code Council's; International Building Code 2000, (2000 IBC), and the National Fire Protection Association 5000, (NFPA 5000). After numerous months of reviewing language, content, complexity, accessibility to users, and the overall ease of adaptability for the city, the committee selected the 2000 IBC to be used as the model building code for the next version of the NYC Building Code.

### New Model Building Code: 2000 IBC

As of November 2004, forty-four states and Washington D.C. have adopted the IBC in some capacity - including New York state. With NYC's adoption of the IBC as a model code, the city will be using an accepted, readily accessible, and easy to use code. Other benefits of using this code are easily accessible updates and the overall organization of the code.

Like the *current* NYC Building Code, the upcoming version will probably NOT follow the model building code word-for-word. Obviously the 2000 IBC is a very

thorough model code, but the NYC Building Authority will likely define their own constants for calculations and set their own exemptions. This should prove to be very helpful upon code adoption for those making the calculations for seismic design since fewer assumptions are necessary.

As for the seismic force level equation, the NYC Building Code Authority will most likely modify the equation to better suit the high-density structures of the city. The actual Seismic Force Level equation from the 2000 IBC is as follows;

$$F_p = \frac{0.4a_p S_{DS} I_p}{R_p} \left( 1 + 2 \frac{z}{h} \right) W_p$$

Obviously, there are more variables in this equation than the current version. However, some of the variables are dependant on others, and others will become constants for Metro-NYC. At present, the projected release date for the new NYC Building Code is January 2006.

### **General Requirements for NYC**

Regardless of current or future code requirements, some of the same general rules apply. The most important is that a Structural Professional Engineer, (PE), must review the seismic bracing requirements, design details, and installation of mechanical, electrical, and HVAC systems. The PE's review will include his/her stamp showing that all the necessary calculations have been made and will show that the bracing requirements for that specific project have been met.

Projects like courthouses, MTA, NYCSCA (schools), hospitals, communications centers, etc., will require bracing. Federally funded projects sometimes even have their own job specification above and beyond that of the building code. Regardless of how detailed the project specification, the designer and contractor must adhere to its seismic requirements or may suffer financial ramifications such as no payment for the job or even back charges from the owner.

The northeast United States is not known for having frequent earthquakes. However, bracing to protect against them is becoming a standard requirement in this region. Some jurisdictions have always had seismic bracing requirements, but have not always enforced them. The NYC Building Authority's upcoming requirements for this bracing should be looked at as a safety measure - not an economic burden. Be sure to monitor the city's websites to keep up to date on the enforcement date, exemptions, and inclusions of the new NYC Building Code coming in 2006.