A Professional Corporation

Technical Bulletin

FROM SPEIGHT, MARSHALL & FRANCIS, P.C.

Structural Engineering - Special Inspections
January 2004
Bulletin No. XXII

On a regular basis, we plan to distribute these informational leaflets about crucial - but often ambiguous - structural engineering topics. With the knowledge of our featured subjects, our goal is to help our clients improve their profitability while reducing their liability. We suggest distributing a copy of our technical bulletins throughout your office and keeping them on hand for quick reference.

New Code Requirements SHAKE UP Structural Design

Introduction:

Effective October 1, 2003, the Commonwealth of Virginia adopted the 2003 edition of its Uniform Statewide Building Code. The main difference between the 2003 USBC and its predecessor, the 2000 USBC, is their associated building codes. The 2000 USBC uses the 1996 edition of the BOCA National Building Code. The 2003 USBC uses the 2000 edition of the IBC.

IBC 2000 is considerably more stringent in its seismic (earthquake) design requirements than BOCA 1996. This means areas of Virginia previously exempt from a complete seismic analysis now require complete analysis, design, and detailing consideration. The additional design considerations mean more work on the part of the structural engineer to assure the building can resist the code-prescribed seismic criteria.

IBC vs. BOCA Seismic Design Provisions:

Originally, seismic design was based solely on location. The country was split into seismic zones focusing on earthquake ground motion in a given region. Because public safety is a primary code objective, BOCA moved from using seismic zones to Seismic Performance Categories, which were based on both location and hazard exposure (building occupancy and use). The IBC has taken site classification a step further by using Seismic Design Categories. The SDC is based on location, occupancy, and site soil characteristics. Because soil characteristics directly impact the Seismic Design Category, soils reports become invaluable. In the past, general approximations of the soil properties could be made, but now we will depend on the geotechnical engineer to provide site-specific properties. As site classification becomes more specific, the seismic analysis requirements change. In the Hampton Roads area of Virginia, wind loads typically govern structural design under BOCA guidelines. Due to the type of soils located in the Hampton Roads area, seismic design is more likely to govern because of IBC's criteria. However, even if wind governs under IBC, special seismic detailing will still be required.

A Real Life Example:

Our firm is presently designing a 5-story office building in Virginia Beach. Under the 1996 BOCA, the building was classified as a Seismic Hazard Exposure Group I and assigned to Seismic Performance Category A. According to BOCA Section 1610.3.5.1, *"regular or irregular buildings assigned to Category A are not required to be analyzed for seismic forces for the building as a whole."* The main windforce vertical resisting systems (braced bays) act as the seismic resisting system automatically, thus satisfying the seismic code requirements.

Under IBC, the same Group I building would be in Seismic Design Category B. The required analysis procedure to use for seismic design of the office building is the "equivalent lateral-force procedure", as described in IBC Section 1617.4. One of the main design considerations of the equivalent lateral-force procedure is base shear, which is the force produced at the base of the building during an earthquake. Under BOCA, the design base shear for this building is 109.1 kips, while under IBC it is 152.7 kips, an approximate increase of 40%. In other words, the building must be designed to resist around 40% more seismic load than BOCA requires. By default in Hampton Roads, BOCA allowed the main windforce vertical resisting system to resist the seismic forces. IBC requires that both wind and seismic loads be calculated and the building be designed for the case yielding the higher load. In this example, the base wind shear determined by BOCA criteria is 241.4 kips and the IBC base wind shear is 213 kips, a 13% decrease in wind load under the new criteria. However, the base wind shear is still higher than the base seismic shear, so wind load will govern the design under either code. Though wind loads governed in this example, seismic loads will likely govern for a building such as a parking garage, with similar weight but with less exposure to wind.

LEGEND

BOCA	Building Officials and Code Administrators
IBC	International Building Code
SBC	Standard Building Code
SDC	Seismic Design Category
SPC	Seismic Performance Category
UBC	Uniform Building Code
USBC	Uniform Statewide Building Code

Effects on Structural Scope of Work:

Because a more detailed seismic design is now required for all buildings, there will be a significant increase in the amount of detailing and calculations that go into the typical structural design. Buildings will cost more as a result of more intense structural detailing requirements. Further, geotechnical reports will have to provide significantly more information, obtained through more advanced testing.

Additional Information:

The International Conference of Building Officials created IBC by combining BOCA, SBC and UBC. As of January 1, 2004, it has been adopted by 44 of 50 states and by the Department of Defense. For the most updated list of IBC adoptions by state, please visit the International Code Council website - www.iccsafe.org/cs/adoptions/adoption.html

For more information on the differences between IBC and other model codes, please refer to the following articles:

Ghosh, S.K., "New Model Codes and Seismic Design", Concrete International, Vol. 23 No. 7, July 2001.

Henry, John R., "Seismic Design Category", Structural Engineer, February 2002.

SPEIGHT, MARSHALL & FRANCIS, P.C.
2125 McComas Way, Suite 103
Virginia Beach, Virginia 23456
email: a-team@smandf.com

(757) 427-1020
(757) 427-5919