Ontario Association of Architects

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OBC - Importance Category and Seismic Restraint

Summary

The Ontario Building Code (OBC) requires all buildings be assigned an Importance Category of 'Low', 'Normal', 'High' or 'Post-disaster'. The Importance Category is necessary for seismic design, but can at times be overlooked because, by default, all buildings are considered 'Normal' unless designated otherwise. The Importance Category should be included as part of the code data matrix in building permit application submissions.

This Practice Tip describes aspects of seismic restraint and the Importance Category that must be taken into account in the design of buildings. The design requirements are mostly structural, but there are architectural, mechanical, and electrical requirements and implications to appropriately incorporate them into the design.

If the Importance Category and the provisions for seismic design and restraint are not taken into account at the early design stages, then the revisions needed to comply with the code requirements can be difficult and costly.

Understanding the changes to seismic design in the 2024 Ontario Building Code should include a review of terminology (e.g. seismic hazard index is replaced by seismic category), consideration of the accuracy and detail of site information provided by the owner, and considerations for non-structural components. Site properties are now obtained through the online 2020 National Building Code of Canada Seismic Hazard Tool. OBC Supplementary Standard SB-1 is now only used to provide seismic data for the prescriptive requirements of Part 9. For Part 9 buildings, a new section addresses lateral resistance to wind and earthquake loads, assessment of the site conditions, and the permitted design paths for code compliant structural design.

Background

Seismic design is a critical factor for buildings designated to be available after an earthquake for emergency responders, treating victims, communications, and housing the displaced. Some areas of Ontario; the Ottawa and St. Lawrence valleys for example, are among the highest seismically sensitive areas in North America.

Three things certificate of practice holders should be aware of related to seismic design are:

1) the Importance Category and the correlated earthquake importance factor of the structure (I_E);
2) the Site Class (assigned by a geotechnical engineer following soil tests); and
3) the Seismic Category, which indicates the severity and risk of seismic hazard.

Importance Categories

The OBC requires all buildings be assigned an Importance Category of 'Low', 'Normal', 'High' or Post-disaster. The 'Post-disaster' category applies to buildings such as hospitals, police facilities, and telephone exchanges that need to remain operational following a disaster. The 'High' category is for buildings that are likely to become a shelter or collecting point, such as schools.

Although the requirement for the Importance Category resides in "Part 4 – Structural Design" of the OBC, the determination of Importance Category relates to the use and occupancy of the building. This has traditionally under the purview of the holder and owner, rather than the structural engineer. To appropriately assign the Importance Category, professional judgment should be used and discussions with the owner, structural engineer, and authorities having jurisdiction (AHJs) may be needed.

The following descriptions of the Importance Categories are in reference to OBC Table 4.1.2.1

Low

Possible examples of the 'Low' Importance Category are *low human occupancy* buildings (i.e. farm buildings), with 1 person or less per 40 m^2 of floor area and *low-hazard industrial occupancy* (i.e. Group F, Division 3 warehouses), where structural failure causing damage to materials or equipment does not present a direct threat to human life.

It is important for the authorities having jurisdiction to be aware of when the 'Low' Importance Category is being assigned, since it enables relaxations of some code requirements. In some cases, this relaxation is inappropriate. For example, an equestrian riding facility, that also has provision for permanent or temporary grandstands, is an Assembly Occupancy use and should not be categorized as a 'Low' Importance Category.

Normal

All buildings, unless the building meets the criteria for 'Low', 'High' or 'Post-disaster'.

High

The 'High' Importance Category applies to schools, community centers, and industrial or storage facilities having hazardous or toxic materials. This category is not limited to the specific facilities noted. It might also apply to a college, sports facility, arena, or large place of worship. The OBC uses the phrase "a building that provides a greater degree of safety to human life". It should be noted that this is not the OBC defined term '*Post-disaster' building,* but a lower Importance Category, which requires professional judgment in order to assign a category.

Post-disaster

A *Post-disaster building* is defined in the OBC and means a building "necessary for the provision of essential services to the general public in the event of a disaster", and includes:

- hospitals, emergency treatment facilities, and blood banks;
- telephone exchanges;
- power generating stations and electrical substations;
- control centres for natural gas distribution;
- control centres for air, land, and marine transportation;
- public water treatment and storage facilities;
- water and sewage pumping stations;
- sewage treatment facilities;
- emergency response facilities;
- fire, rescue and police stations;
- storage facilities for vehicles or boats used for fire, rescue, and police purposes; and
- communications facilities, including radio and television stations.

The list covers a broad range of buildings. Questions may arise for some facilities that are not specifically listed, such as: wind turbines, private versus public bus terminal or airport, a private clinic, or a nonemergency treatment facility – places not likely considered essential to provision of services to the public in a disaster. Discussion with the owner, structural engineer, and AHJs may be required in order to appropriately assign the Importance Category for such uses.

Site Class (Table 4.1.8.4.B)

A Site Class (designated by the letters A to F), relative to substrate type (e.g. rock, hard, or soft soil), is not one of the factors needed for calculating the Seismic Category. It is assigned by a geotechnical engineer following soil tests. A shear wave velocity test may be required by the geotechnical engineers to assign a Site Class more accurately than can be ascertained without the test. The shear wave test would be an additional cost over simple borehole analysis, but may save the project considerable construction cost (i.e. due to test result values, the engineer may be able to assign a Site Class with less stringent requirements). Additionally,

site stability should be evaluated based on site-specific soil properties to account for the potential of slope displacement in the design of the structure and its foundations.

Without an understanding of the underlying geologic structure, the Site Class of adjacent properties cannot be used as a guide to the Site Class of any other property. Similarly, one portion of a site may be different from another portion. As with bore holes, the number and location of shear wave velocity tests is a matter of professional judgement.

The Seismic Category

While the structural design of the building involves complex seismic restraint calculations, a reasonably simple selection process is used to determine the seismic category.

The seismic category is selected after calculating the values for I_E S(T) where:

I_E	importance factor for earthquake loads and effects (refer to OBC Table 4.1.8.5.-A);
S(T)	5% damped spectral response acceleration, for periods T=0.2, T=-.5, and T=1.0, (refer to NBCC Seismic Hazard Tool results for any specific site).

With these calculated values, the Seismic Category is selected based on where they fit within the range of values for each category (refer to OBC Table 4.1.8.5.-B).

If the seismic category is determined to be SC1 or SC2, the building is not a *post-disaster building*, it is not seismically isolated, and does not have supplemental energy dissipation system, there is no requirement to restrain architectural elements like suspended ceilings, parapets, ornamentations, masonry veneer connectors, etc., nor to restrain mechanical and electrical systems and equipment for that building (refer to OBC 4.1.8.18).

Part 9 Buildings

Schools, community centres, other assembly occupancies, and 'F1' group high hazard industrial (i.e. all 'High' Importance Category buildings) are excluded from design under OBC Part 9, but some '*Post-disaster' buildings* can fall within the acceptable application of Part 9. All buildings that fall under the definition of *'Post-disaster' building* must be designed to OBC Part 4 (refer to OBC Div. A, 1.1.2.2.(2)).

Part 9 also has some individual sections and clauses related to seismic design and restraint, such as masonry reinforcement or the restraint of water heaters, based on seismic spectral response acceleration for the location of the building (refer to OBC 9.20.1.2 and 9.20.15).

Bracing for earthquake and wind loads must be evaluated for Part 9 buildings (refer to OBC 9.23.13 and Table A-9.23.13). Low to moderate, high, and extreme wind and seismic forces have prescriptive design and construction requirements. Otherwise, Part 4 design or good engineering practice, such as that provided in CWC 2014 "Engineering Guide for Wood Frame Construction", is required for the design of bracing for earthquake and wind loads.

Renovations

For renovation projects, a soils report and determination of Site Class by a geotechnical engineer may not be available. With some exceptions, OBC seismic design requirements are not applicable to renovation projects.

OBC, Div. B, Section 11.5 deals with *compliance alternatives (C.A.)*, a term defined as "a substitute for a requirement in another Part of Division B that is listed in Part 10 or 11 of Division B and "*C.A."* has a corresponding meaning.", (refer to OBC Div. A, 1.4.1.2.(1)(c)).

Various *C.A.'s* are listed in Tables 11.5.1.1.A. to 11.5.1.1.F, corresponding to occupancies A, B, C, D, E, and F respectively. *C.A.'s* No. A83, B85, C94, DE84, and F85 all state that the requirements under Div. B, 4.1.8. Earthquake Loads and Effects do not apply, i.e., the seismic design requirements of the OBC do not apply to renovations.

Having said this, since seismic requirements are in Div. B, Part 4 of the Code, the application of the *C.A.* is somewhat restricted because Div. B, 11.5.1.1.(1) allows *C.A.'s* to be substituted for requirements found in

Parts 3, 4, 6, or 8 only if the Chief Building Official's (CBO's) approval is obtained. Note that Div. B, 11.5.1.1.(2) allows *C.A.'s* to be substituted for Part 9 and 12 requirements without having to seek the CBO's approval.

It is expected that building officials would generally accept that seismic design requirements for a renovation would not apply, but anticipate that a code based explanation may be requested by building officials.

Building Code Data Matrix (Refer to Practice Tip PT.03)

The OAA template for the 2024 Building Code Data Matrix includes a section for recording the assigned Importance Category and the seismic hazard category calculation results. This information should be included as part of building permit applications. If the Importance Category is not identified on the drawings, the determination and designation of a classification may not be clear because in accordance with the OBC, the 'Normal' category applies, unless another category has been explicitly assigned.

Suggested Procedures

1. Become familiar with Importance Categories, seismic design requirements, non-structural component requirements, and alternative seismic design options (such as seismic isolation and supplemental energy dissipation).
2. In the building code review process, determine if the Importance Category of the building is 'Low', 'Normal', 'High', or 'Post-disaster'. Discuss with the client, then confirm and document.
3. In cases where the classification is not clear, discuss with the building department. Document the discussions and, most importantly, any decisions and agreements.
4. A geotechnical report should be provided by the owner. The report should include the Site Class and the factors for the seismic category calculations. This information should appear on structural engineering drawings.
5. Determine if the seismic category meets the thresholds discussed above and what set of seismic restraints for non-structural elements are required.
6. Include the Importance Category and seismic category information in a building code data matrix on the drawings.
7. When responsible for the coordination of consultants, distribute the information to all consultants so that they can interpret the applicable OBC requirements and provide appropriate seismic design and restraints where required.
8. Become familiar with the types of structural irregularities described in OBC Table 4.1.8.6., and when applicable, consider the architectural form and interior spaces in relation to the structural irregularities.

References

Practice Tip PT.03 – Building Code Data Matrices

2024 Building Code, Part 4 – Structural Design

2024 Building Code, Part 9 – Housing and Small Buildings

NBCC Seismic Hazard Tool