Objective-based building codes come to Ontario

By Bernard Ennis, P.Eng.

Moving towards an objective-based standard for future versions of the *Ontario Building Code* from the current prescriptive standard represents a fundamental shift. An objective-based code, however, will allow greater flexibility–and in turn greater innovation–while continuing to protect the public.

The *Ontario Building Code* (OBC) is the pivotal document for the building industry in this province. It contains construction standards that a large body of experts has concluded are best practices for dealing with potential building deterioration and failure, as well as with the many causes of death, injury and illness that may occur in buildings. For over 30 years, the provincial government, through the municipalities, has regulated construction by enforcing compliance with these standards. However, with the upcoming publication of the latest building code, a new approach to building design will be introduced to Ontario.

Following a strategic planning project in 1995, the Canadian Commission on Building and Fire Codes (see sidebar "How building codes are developed," p. 54) decided to adopt an objective-based format for future model codes. By adopting this format, the commission intends to make the national model codes more flexible, especially concerning innovation, while keeping codes as similar as possible to those with which building industry practitioners are familiar.

Purpose of building codes

Building codes are a compilation of design solutions that address certain well-recognized objectives of safety, health and accessibility. These solutions have been found either by research performed by the National Research Council, or through experience of past failures, to achieve these objectives. The code either sets the design criteria, such as roof and floor loadings, that designers must use or stipulates specific prescriptive design requirements.

Currently, building codes are a mixture of these prescriptive and performance standards. Performance standards quantitatively stipulate minimum performance criteria for a building component. For example, the OBC requires that crane runway rails shall be designed to resist a lateral force applied parallel to the top of the rail equal to at least 10 per cent of the maximum wheel loads of the crane. How this is achieved is left to the discretion of the designer. Compliance with the code can be demonstrated through engineering analysis, or determined by testing the component.

Prescriptive standards identify specific requirements of the construction, such as items that must be included in the building, or ways in which the work must be done. Generally, prescriptive standards refer to features of the construction that can be found by inspection. For example, OBC clause 6.2.3.2.1(6) stipulates that trunk supply ducts shall not be nailed directly to wood members. Compliance with that code requirement can be easily detected by observation. Prescriptive standards are useful because they are easy to understand and follow. Unfortunately, they are also inflexible, which can stifle innovation.

Why objective codes?

Although the requirements in existing codes grew out of specific objectives, they are not stated and have not always been obvious. Consequently, there is a lack of understanding in the industry about the underlying rationale for the solutions presented in the code. The move to an objective-based format is intended to make designers aware of the purpose for each statement in the code.

The other problem with the existing code is its resistance to innovation and special situations. Designers and their clients occasionally have plans to deal with unique circumstances that are hampered by the restrictive requirements specified in the building code. Sometimes, industry is capable of providing a novel product or system that cannot be used in a building because it fails to comply. Therefore, while it is important that building codes articulate the minimum safety or other requirements acceptable to our society, they should also seek to support the market. To do this, they must allow designers to meet objectives in ways not envisioned by the drafters of the regulations.

Innovation was not prohibited by past codes. The Ontario building and fire codes have always contained equivalency provisions that permitted the use of materials, equipment, systems, and methods of design or construction procedures not specifically prescribed. Designers could devise solutions that were different from what the code prescribed, as long as they could prove that these solutions would work just as well. A municipal building official could approve an equivalent pursuant to section 2.7 of the existing OBC. Requests for approval of equivalency could also be made to the Building Materials Evaluation Commission (BMEC), a regulatory agency authorized under the *Building Code Act* (BCA) to examine and rule on the acceptability of materials,

systems and building designs intended for construction. The applicant had to demonstrate to the BMEC that the alternative design solution provided a level of performance equal to or better than required by the codes. However, the process was time-consuming, costly and not worth pursuing in most situations. Usually, the applicant would have to have the materials, systems or a mockup of the construction tested by an accredited laboratory to demonstrate the alternative would achieve the level of performance that would be achieved by conforming with the requirements of the building code. The results would then be reviewed by the BMEC, which ruled on whether the alternative solution could be used.

This system works well for manufacturers interested in having new products approved. However, it is less practical for considering design configurations, engineered systems or other solutions dealing with unique situations. Since the new code requires only that the designer demonstrate that the alternative meets the objectives of the new code, it provides a more flexible approach that still ensures public interest concerns have primacy over those of the constructor.

Under an objective-based code, a material, system or design that differs from acceptable solutions will be treated as an alternative solution. The process used to evaluate alternative solutions will be similar to that used under the current equivalency provisions. Either a municipal building department or BMEC may authorize an equivalent. Designers will still be responsible for demonstrating that a new approach achieves the same result as the acceptable solution set out in the codes. However, the new codes' focus on objectives and functional statements, rather than prescriptions, is intended to make the evaluation process much easier.

Sponsors of the change to objective-based building codes say they will make it easier to determine whether a new product, building technique, or engineered design solution will satisfy the regulator's intentions, enabling designers to innovate more easily and with greater certainty that innovations will be accepted–even though the code's objectives are essentially unchanged. The change will not affect the current permit processes, or the way in which engineers, architects and other designers work.

What are objective-based codes?

Ontario's next building and fire codes will be based on the new model code developed jointly by the National Research Council and the Canadian provinces and territories. They will be organized quite differently from previous codes. The new code will have three major sections: Division A, Division B and Division C.

Division A sets out the objectives the code addresses and the functional requirements solutions must satisfy. Division A's prime purpose is to state as clearly as possible what it is that society seeks to achieve with the code.

Part 2 of Division A provides the objectives of the code, divided into seven groupings: Safety (OS), Health (OH), Accessibility (OA), Fire and Structural Protection of Buildings (OP), Resource Conservation (OR), Environmental Integrity (OE), and Conservation of Buildings (OC). The first five major objectives have several sub-objectives, most of them listing at least one specific risk a designer must address (see Example).

Part 3 of Division A lists more than 50 functional statements that describe the purpose of design solutions complying with the code requirements. These functions are generic and do not explain how to achieve a provision's aim. Functional statements are prefaced by an alphanumeric identifier. For example:

- F05–To retard the effects of fire on emergency egress facilities;
- F34–To resist or discourage unwanted access or entry;
- F53–To maintain appropriate indoor/outdoor pressure differences.

Division B will look familiar to practitioners already working in the building industry as it closely follows the organizational structure of the current code.

The major difference in this division is the introduction of a table identifying the objectives and functional statements applicable to every sentence in the code. Since every provision within the code will be tied to at least one specific objective, it will be easier to understand why a particular provision exists. For example, clause 6.2.3.11.1 in the *National Building Code* (NBC) stipulates that "in ventilating systems that exhaust air to the outdoors, provision shall be made for admission of a supply of makeup air in sufficient quantity so that the operation of the exhaust system and other exhaust equipment or combustion equipment is not adversely affected." The clause defines the acceptable solution. If a designer is not interested in considering an alternative solution, the design must include the provision stipulated in this clause (i.e. a makeup air supply). If a designer intends to provide an alternative design solution, the first step is to consult the table. Here,

Example of Objectives and Sub-objectives

OS1 Fire Safety

An objective of this code is to limit the probability that, as a result of the design or construction of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to fire. The risks of injury due to fire addressed in this Code are those caused by:

OS1.1–fire or explosion occurring

OS1.2–fire or explosion impacting areas beyond its point of origin

OS1.3–collapse of physical elements due to a fire or explosion

OS1.4–fire safety systems failing to function as expected

OS1.5–persons being delayed in or impeded from moving to a safe place during a fire emergency

the designer will find the following objectives and functional statements for this acceptable solution: F44, F81–OS3.4; F50, F81–OH1.1.

This indicates there are two objectives associated with this acceptable solution. The first, OS3.4, indicates the solution is meant to deal with risks due to exposure to hazardous substances. The second objective, OH1.1, indicates the solution is to deal with risks due to indoor conditions caused by inadequate indoor air quality. The functional statements associated with each of these objectives describe how each of these objectives is met. For example, F44 states that the purpose of the design solution is "to limit the spread of hazardous substances beyond their point of release." Under the new code, a designer can propose a design solution other than the prescribed exhaust and makeup air system, if the alternative can be shown to achieve the purpose described by F44.

Effect of new codes on practice

The new design flexibility offered by objective-based codes is only for those who wish to use it. Many users have no need to introduce innovative alternatives. For their designs, they will use the Division B acceptable solutions, which are essentially the same prescriptive code provisions found in earlier editions of the OBC.

But the introduction of objective-based codes has raised many questions about how this change might affect both PEO and practitioners. One immediately apparent concern for PEO is its effect on professional standards. Must professional engineers investigate and use alternative solutions? Will a client be able to lodge a complaint against a professional engineer who does not suggest or prepare alternative solutions, especially if the client believes that an alternative solution might have reduced the capital cost of a project? Since there will be a database of alternative solutions, will it be necessary for professional engineers to keep current on alternative solutions just as they are expected to keep current on codes and standards?

PEO is also concerned that permit drawings using alternative engineering solutions will be reviewed by building department personnel. Generally, these people are not professional engineers; however, they will be required to review and make judgments on alternatives that are the product of the practice of professional engineering. PEO is investigating whether this activity would be a violation of the *Professional Engineers Act*. If it is, PEO will have to consider whether to enforce against building officials who make rulings on alternative solutions, or whether PEO should press each municipality to hire or retain professional engineers for this purpose. Alternatively, could PEO force municipalities to implement an owner-paid peer review requirement for all alternative solutions?

Despite opportunities to innovate provided by the upcoming building code, municipalities will decide whether an alternative solution can be used. It is possible that municipalities might reject alternative solutions on grounds unrelated to technical merit. For instance, they might be reluctant to approve alternative proposals due to concerns about municipal liability, cost of conducting reviews, or lack of technical competence within a building department. Some municipalities might decide to charge excessive amounts to review and approve alternatives. If that happens, clients might require professional engineers to redesign, or to bear review costs. Professional engineers should become aware of the policy regarding alternative solutions within each municipality before committing to a design.

Many professional engineers complain the building code stifles their ability to provide the best possible service to their clients. The introduction of objective-based codes is an attempt to overcome this problem. The new codes are intended to promote a better understanding of what that code is trying to achieve. They should prove most useful when a designer wishes to do something different from the acceptable solutions, and needs to know what an alternative solution must accomplish to satisfy the requirements of the OBC.

How building codes are developed

Although building regulation is a provincial/territorial responsibility, the provinces and territories have recognized that developing and using a national "model" building code is more efficient, comprehensive and consistent than each jurisdiction proceeding on its own. The model code has no legal status; each province or territory must implement the model code by incorporating it into building regulations legislated in that jurisdiction for it to have any effect. The model code can, if necessary, be adapted to particular provincial or territorial policy decisions, or such local circumstances as the existence of permafrost.

Creation of the model codes is the function of the Canadian Commission on Building and Fire Codes (CCBFC). This organization develops and maintains six of Canada's model construction and fire codes and oversees the work of several standing committees, special purpose committees, and task groups. CCBFC members are selected from across Canada and appointed by the National Research Council (NRC). Commission members are drawn from a variety of interest groups throughout the construction and related industries. Professional engineers sitting on these committees hold positions as researchers, designers, contractors, building officials, provincial and federal civil servants, and representatives of equipment and material suppliers. Their role is to provide input and comment on technical matters relating to the construction of buildings and building systems.

The Canadian Codes Centre of the National Research Council's Institute for Research in Construction (IRC) conducts research to develop and apply new technologies for design, construction, and operation of durable, energy-efficient and cost-effective building systems. These technologies address both new construction, and repair or renovation, for all types of buildings and some concrete structures. Professional engineers wanting to keep abreast of code developments should subscribe to the *CodeNews* bulletins published by the Ministry of Municipal Affairs and Housing. You may sign up for this Internet-based newsletter by visiting www.codenews.ca.

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