



National Research Council  
Canada

Conseil national de recherches  
Canada

Canadian Commission  
on Building and Fire  
Codes

Commission canadienne des  
codes du bâtiment et de  
prévention des incendies

Ottawa, Canada  
K1A 0R6

**NRC-CMRC**

May 27, 1996

BFC-6089

John Kenward  
Chief Executive Officer  
Canadian Home Builder's Association  
150 Laurier Avenue W., Suite 200  
Ottawa, ON  
K1P 5J4

Dear Sir/Madam:

The Strategic Plan of the Canadian Commission on Building and Fire Codes (CCBFC) recommends that the National Model Building and Fire Codes be restructured around an objective-based framework.

A Task Group has been set up by the CCBFC to help plan a transition to the new form of the National Code Documents. The commission, through its Task Group on Objective-Based Codes, wishes to ensure that the needs and concerns of all code users are addressed. As one step in this process, the Task Group is requesting your comments upon the current understanding in three areas:

1. **Needs That Must Be Addressed in the Transition to Objective-Based Codes and supported after they are introduced into Legislation**
2. **Principles for Building and Fire Codes**
3. **Scope of the National Model Code Documents**

Please find attached to this letter a copy of a survey covering these issues and in addition a paper describing the current understanding of the advantages, principles and implications of Objective-Based Codes.

It would be very much appreciated if you or one of your associates would complete and return the survey form by Fax or mail to the Commission by June 10th.

With many thanks for your cooperation on this task.

Yours sincerely,

Luc Saint-Martin  
Secretary, Canadian Commission on Building and Fire Codes  
Tel: (613) 993-9960

fax: (613) 952-4040

e-mail: [stmartin@nrc.lan.irc.ca](mailto:stmartin@nrc.lan.irc.ca)

Canada



## **Objective Based Codes**

### **User Needs and Expectations**

The Strategic Plan of the Canadian Commission on Building and Fire Codes (CCBFC) recommends that the National Model Building and Fire Codes be restructured around an objective-based framework. A paper describing the current understanding of the advantages, principles and implications of this approach is attached.

A CCBFC Task Group is studying this transition and wishes to ensure that the needs and concerns of all code users are addressed. As one step in this process, the Task Group is requesting your comments upon the current understanding in three areas:

- 1. Needs That Must Be Addressed in the Transition to Objective-Based Codes and supported after they are introduced into Legislation**
- 2. Principles for Building and Fire Codes**
- 3. Scope of the National Model Code Documents**

The following is a set of unordered lists reflecting the Task Group's current discussions on each of the three areas. Your comments with regard to each of these areas are requested. It is recognized that these are not totally exhaustive lists and the Task Group have made provision for you to indicate, in some cases for individual documents, areas which you feel may have been omitted or areas which you feel should not be addressed.

The Task Group are requesting that you review each of these lists and return them with your comments by June 10th 1996 to:

CCBFC Task Group on Objective-Based Codes  
C/O Canadian Codes Centre (OBC Survey),  
National Research Council,  
Building M-24, Montreal Road,  
Ottawa, Ontario K1A 0R6  
CANADA

or by Fax to (613) 952 4040

or Email your responses to Codes@nrc.ca

## **Needs That Must Be Addressed in the Transition to Objective-Based Codes and Addressed before they are introduced into Legislation**

### **The Need:**

- to ensure that there is national consensus that objective-based codes are the right solution for the country's building and fire regulatory framework
- to ensure all affected parties are involved in the transition process
- for mechanisms to verify new acceptable solutions
- for education and training programs
- to account for concerns over liability of designers, enforcers and builders
- to address legislative issues in the adoption and enactment process
- for a gradual, evolutionary introduction
- for design, application and enforcement tools and models
- to specify performance-based solutions where appropriate
- to retain the substantive body existing code provisions as acceptable performance.

### **Suggest other needs**

- The need for/to \_\_\_\_\_
- The need for/to \_\_\_\_\_
- The need for/to \_\_\_\_\_
- The need for/to \_\_\_\_\_

## 2. Principles for Building and Fire Codes

### Building and Fire Codes should:

- be able to be adopted throughout the country
- be easily understood
- be easy to update
- be flexible in application
- facilitate consistency of interpretation
- facilitate innovation
- have a clarity of intent
- have a well defined scope
- include only verifiable requirements
- be based upon appropriate current technology
- result in an appropriate level of risk for all situations
- be written in plain language
- consider cost effectiveness of requirements

### Suggest other principles

- \_\_\_\_\_

- \_\_\_\_\_

- \_\_\_\_\_

- \_\_\_\_\_

### 3. Scope of the National Model Code Documents

**Note:** The National Model Codes are a set of minimum technical requirements developed by the CCBFC with the assistance of NRC. These are offered for adoption to provinces, territories and municipalities, who have jurisdiction over building and fire regulations, with the goal of national uniformity. Administrative and enforcement issues are the responsibility of the adopting authority and are not normally included in these model documents.

#### The National Model Codes Must:

- address health and safety of the public
- address property protection
- address barrier free design
- apply to all buildings
- address durability issues related to health and safety
- address protection of emergency responders
- address safety at construction and demolition sites
- address protection against break and enter (Building Code)
- address the construction process (Building Code)
- address building maintenance and operation (Fire Code)
- address hazards external to buildings (Fire Code)
- address emergency planning (Fire Code)

#### Suggest other scope items

- \_\_\_\_\_

- \_\_\_\_\_

- \_\_\_\_\_

- \_\_\_\_\_

## Respondent Information

Please indicate below, in terms of yourself or your organization, your relationship to the code so that we are able to place your response in the context of your professional, or other relationship to the code documents.

Name \_\_\_\_\_

Company Name \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ Province \_\_\_\_\_

Postal Code \_\_\_\_\_

Tel: \_\_\_\_\_ Fax: \_\_\_\_\_

Please check (✓) one:

- |  |  |
|--|--|
| <input type="checkbox"/> Building Official               | <input type="checkbox"/> Emergency Services            |
| <input type="checkbox"/> Architects                      | <input type="checkbox"/> Owner/Developer               |
| <input type="checkbox"/> Engineer                        | <input type="checkbox"/> Student/Educator              |
| <input type="checkbox"/> Builder/Contractor              | <input type="checkbox"/> Product manufacturer/Supplier |
| <input type="checkbox"/> Municipal/Provincial Government | <input type="checkbox"/> Federal Government            |
| <input type="checkbox"/> Standards Organization          | <input type="checkbox"/> Private Citizen               |

Other specialization: \_\_\_\_\_







National Research  
Council Canada

Conseil national  
de recherches Canada

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# ***NRC-CNRC***

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## ***Objective-Based Codes: A New Approach for Canada***

**construction**



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# Objective-Based Codes: A New Approach for Canada

## Introduction

Preparation of the Strategic Plan of the Canadian Commission on Building and Fire Codes (CCBFC) identified several fundamental attributes that building and fire codes should contain to ensure their applicability and utility in future years. These included:

- greater flexibility in application,
- improved clarity of requirements,
- reduced complexity,
- greater ease of use,
- reduced need for change,
- easier application to renovation,
- more responsiveness to innovation,
- greater clarity of intent and consistency in scope.

Discussion on how to achieve these features and examination of international trends in building regulation indicated that a code structure which provides a clear statement of the intent of every provision would go a long way towards satisfying these needs.

Initially, the concept of performance codes was seen as the best path to pursue. It soon emerged, however, that codes containing only performance requirements would not be achievable until a great deal of technical research and development was undertaken to establish appropriate and verifiable levels of performance. Verification and computational tools and models would also be necessary in order for designers and building and fire officials to apply such codes. As well, it was argued, some code requirements do not lend themselves to a performance-based solution and are better left as prescriptive or specification-type statements.

A more logical and flexible approach was developed, that of codes organized around a framework which clearly states the intent

(objective) of each code requirement and then relates each of these objectives to higher, and subsequently top level, objectives of the code document. Accompanying each requirement would be one or more acceptable solutions. Acceptable solutions could be either performance- or prescriptive-based. In some cases both kinds of solutions, performance and prescriptive, may be available to address a specific requirement within the code.

An advantage of this approach, for countries such as Canada with a building regulatory system that works well, is that it would allow for the continued use of the existing codes. With some reorganization, the current codes would continue to be applicable as "acceptable solutions." The focus on future code development would then be on the identification of additional "acceptable solutions."

This paper describes how the National Model Codes could be transformed into an objective-based framework. It is intended as a working document of a CCBFC Task Group studying the issue, and will be amended and updated as developments unfold.

## A New Framework

The objective-based framework as presently envisaged by IRC's Canadian Codes Centre would essentially consist of a number of basic components:

- 1 a set of objectives of ever-increasing specificity;
- 2 mandatory requirements with specific links to objectives; and
- 3 "acceptable solutions" and "approved documents" linked to the requirements in the second component.

This paper also outlines a possible development plan by which the first component, an objectives structure based on the 1995 codes, would be prepared as an interim

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## Objective-Based Codes

step in 1997-98. The reorganization of the code to include all three components would be targeted for 2001.

Although the term "performance code" is not used, the objective-based code framework will encourage the development of performance-based requirements, which could be contained in Components 2 or 3, based on need and the availability of the required knowledge. Work on developing performance-based requirements and related application tools could therefore proceed independently of the development of the objective-based framework.

Prescriptive requirements, such as those contained within the existing code documents, will always be part of the framework, although it is hoped that these will, with time, eventually become the basis of Component 3.

### What are Objective-Based Codes?

They are codes whose requirements are based upon explicitly stated objectives. These objectives are stated in terms of a clear and logical hierarchy. The hierarchy starts with a number of key objectives related to fundamental issues such as health and safety. These objectives essentially define the scope of the code. More specific objectives are then expressed under each of these general objectives, for example:

safeguard people from injury caused by structural failure; safeguard people from injury or illness when evacuating buildings during a fire.

These are then followed by a set of specific objectives or functional requirements, for example:

"buildings shall be provided with safeguards against fire spread so that occupants have time to escape to a place of safety without being overcome by the effects of fire...."

The final element in this hierarchy is a statement about how the performance will be verified. This statement, referred to as a "functional requirement" (see figure 1), will be expressed in terms of performance where the knowledge or tools are actually available to verify the performance. In other cases, it will be a prescriptive solution the same as or similar to those in the current codes.

The establishment of "acceptable solutions" to meet the requirements of an objective may be stated in both prescriptive and performance terms. In general, there will be a prescriptive "acceptable solution" for each requirement based upon those in the existing codes and an alternative performance "acceptable solution" will be available where appropriate. The prescriptive solutions would generally follow the existing format within the current code documents, where the materials and process are clearly defined. In the case of the performance-based solution, these would be expressed in terms of the performance that the solution must deliver. In some cases, a number of alternative "acceptable solutions" may satisfy an objective. Designers and others would be free to use any one of these solutions to meet the requirements of the code.

### What is a "Performance Requirement?"

Most code writers and users have little difficulty agreeing that a requirement that the exterior walls on the first story of a two-storey dwelling unit be constructed of 38-by 89-mm wood studs at 400 mm centres is a "prescriptive" requirement. But what about a requirement that enclosed parking garages be ventilated at a rate of 3.9 L/s-m<sup>2</sup>? Is this a "prescriptive" requirement or a "performance" requirement?

Performance requirements are generally perceived to be requirements stated in a way that allows flexibility in the choice of

**Objective-Based Structure**

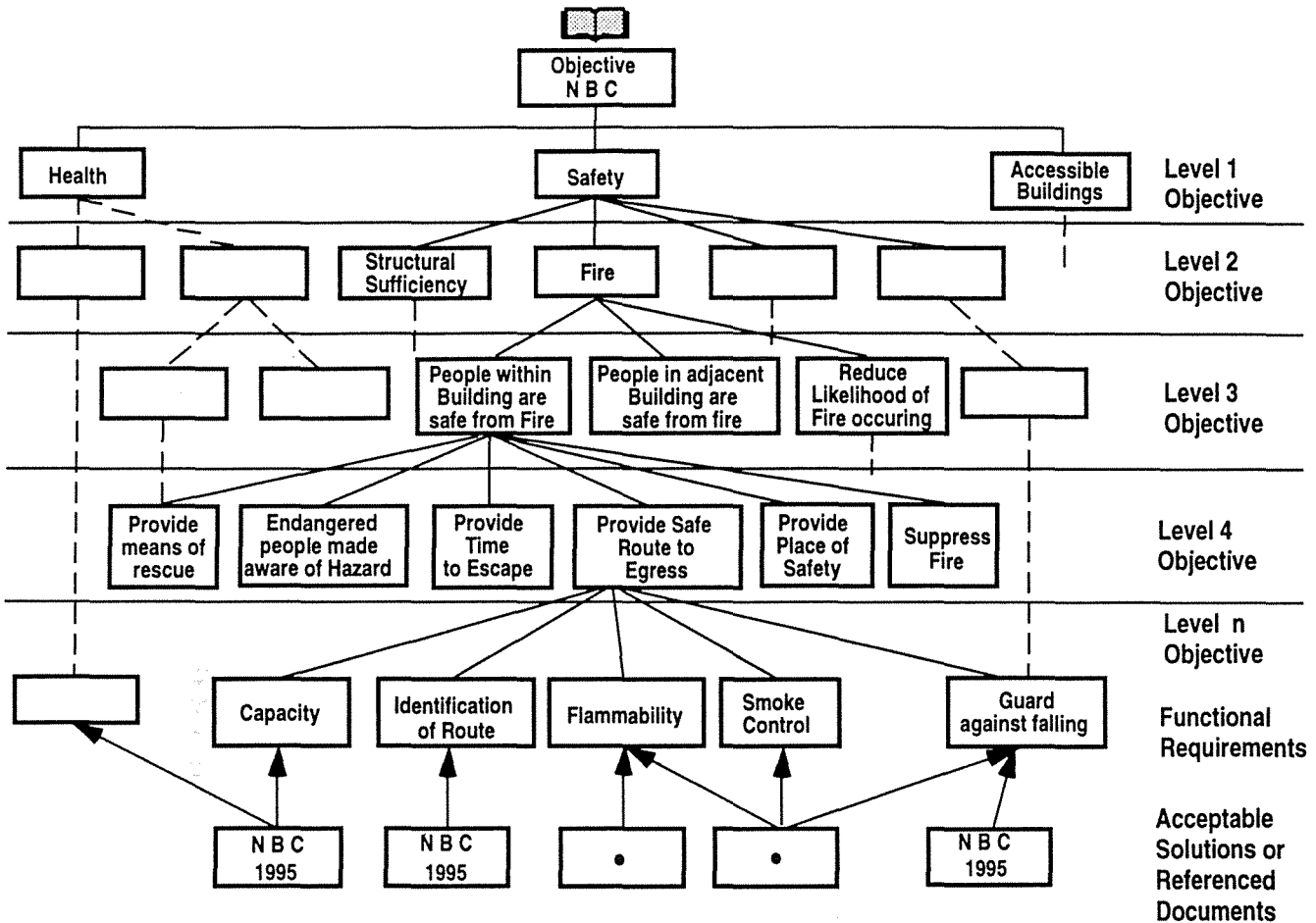


Figure 1.

solutions. As stated above, the ventilation requirement allows less flexibility than if the requirement had been to limit carbon monoxide concentration to not more than 100 ppm. On the other hand, it offers more flexibility than requiring the installation of x centrifugal fans with no more than y m of ducting. To someone used to prescriptive requirements, a requirement that allows freedom to choose the means of achieving a specified level of ventilation would seem like a performance requirement.

In fact, once one moves even a small step away from purely prescriptive requirements, language becomes inadequate to indicate accurately in a single phrase where on the “performance – prescriptive

spectrum” a requirement lies. This is why the terms “performance requirement” and “performance code” can cause a great deal of confusion – they can mean different things to different people.

**Why do We Need Objective-Based Codes?**

**Complexity of Existing Codes**

The structure of most existing codes is not as clear as it could be. A lack of clarity exists both in the logical structure of the document and language structure. Providing a restructured document based on a set of clearly defined objectives will simplify

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## **Objective-Based Codes**

the process of understanding the code contents and provide for a more uniform interpretation of the codes. Clear and easy-to-understand codes can significantly reduce the costs associated with code compliance.

### **Clarity of Intent**

Stating the objectives of the code explicitly will facilitate code users' understanding of the intent of specific articles within the code. This will better enable the users to comply with the requirements or offer alternative solutions that are able to meet the intent. Lack of clarity often results in a broad range of interpretation. This detracts from the objective of providing uniformly applied codes for Canada.

### **Innovative Designs**

The codes have always provided individuals with the flexibility to use alternative solutions that meet the intent of the code. Use of this flexibility, though, has been made difficult by the lack of clarity as to what those intents are. This can stifle innovative design. A clear statement of intent associated with each of the code requirements will go some way towards rectifying this problem.

### **Regulatory Reform and Globalization**

In Canada, as is the case worldwide, there is a general trend toward expressing regulations in terms of the performance of the solution rather than by prescribing the approach to be taken. As this global trend continues, the adoption of an objective-based code approach would facilitate the introduction of a greater number of performance criteria into our existing codes. This could eventually result in a "dual path" approach, where there would be a choice between meeting performance criteria within the code or adopting one of a set of recognized "acceptable solutions" based

upon the prescriptive requirements within the current code documents.

By providing a clear indication of the intent and performance requirements that a product must meet, Canadian regulations will make it easier for exporters of Canadian products to convince other countries of the level of performance that can be expected of the product. Work is underway with a number of international collaborators, within the framework of the conseil international du bâtiment (CIB), to learn from the experiences of others who have moved or are moving toward the adoption of performance-based codes.

### **Concerns with Adopting an Objective-Based Approach**

#### **Difficulties with Enforcement**

A move to increased use of performance criteria, with no compensating changes, would likely increase the level of technical sophistication required of building officials and other code users. Some parts of the current code require a level of technical expertise beyond that found in many rural communities. Although an objective-based code provides enforcement personnel with a well-structured document and clear guidance to the intent of articles (in the form of clearly stated objectives), users will still require a basic level of technical knowledge to understand the guidance provided. The proposed approach, with training initiatives and "acceptable solutions," seeks to reduce this difficulty as much as possible. Nevertheless, the new approach may cause some jurisdictions to place increased reliance on certificates of compliance.

#### **Verification of Performance**

It is clear that when a designer proposes a performance-based solution, some jurisdictions will experience difficulties in estab-

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## **Objective-Based Codes**

lishing that a design meets a specified performance criterion. In many cases, it would not just be a question of the time and cost involved in verification but may require access to appropriate verification tools and expertise. There are a number of ways in which verification can and has been dealt with in these situations. Certification of designs by registered professionals is already being used for many designs; so is the evaluation of products by such organizations as the Canadian Construction Materials Centre. It is also envisaged that computer-based design tools and models would be developed to aid both the designer and regulator.

### ***Implicit Performance Expectations***

Existing code requirements often mandate the use of a specific solution for a task (e.g., the use of concrete or masonry for a firewall), but the solution also implicitly addresses other performance aspects which, in the existing codes, are not expressed or obvious (e.g., inherent fire resistance of wood floor joists in houses). With the development of the objective-based codes, it should be possible to identify all functional requirements that need to be met. In many cases, a specific solution may simultaneously satisfy a number of functional requirements, but in each case, the intent of the requirements will be clear. Such an approach will further facilitate the development of innovative solutions and products.

### **The Transition**

#### ***Objectives and Restructuring***

Although the current code documents are mainly concerned with health and life safety, over the years a number of other issues have become part of the documents. All objectives need to be identified clearly and explicitly. The demand from some authorities for the inclusion of other related objectives (energy, environmental,

etc.) as part of the codes could be addressed through the provision of "progeny" documents that address these objectives directly.

All of these codes would include an increased emphasis on the provision of performance requirements. In addition, for each existing code, a document detailing the objective structure (Objective Code Structure) down to the level of functional requirements would be developed.

As a step toward the introduction of a set of new re-structured and objective-based code documents in the year 2001, a set of interim support documents will be developed based upon the content of the existing (1995) codes. These supporting documents, currently targeted for the year 1997-98, would clearly outline the objectives within the current (1995) codes, define an objective structure for each code, and link existing code requirements to these objectives. The explication of this structure would provide the basis for an informed decision, through a process of public review, on which objectives should be continued to be addressed in the 2001 codes.

#### ***Possible Adoption Options***

The full objective-based code could offer several options for adoption by authorities having jurisdiction. In one option, authorities could choose to adopt the detailed Objective-Based Code Structure document as their code and reference the 2001 documents as a set of "approved solutions." In a second option, the authorities could adopt the updated 2001 documents as their code and use the detailed Objective-Based Code Structure documents as a guidance document. A final option would be for the authority to enact both documents (2001 and the Objective Code Structure) so that together they form the legal code.

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## **Objective-Based Codes**

This multi-option approach would enable the individual territories, provinces and municipalities to choose the approach with which they feel most comfortable. The advantage of the first option is that the use of a referenced “acceptable solutions” document would enable the system to be more responsive to evolving technology without requiring new legislation to effect its referencing. This is the current situation with regard to standards which are referenced documents within the existing codes, where only the references to them are updated annually.

To support innovation, a system would also be put in place to recognize alternative “acceptable solutions” as new technologies and products become available. This approach would facilitate the adoption of performance criteria and at the same time enable a simpler, predominantly prescriptive, path to be available.

From a legislative point of view, this would allow for greater stability as the code objectives would be relatively stable and change little over time. As new technology and products evolve, the establishment and recognition of new “acceptable solutions” can be incorporated in the codes without any further legislative actions. In this way, it is possible to be more responsive to the needs of the industry.

### **Support Systems**

Adoption of this approach can only be successful if a full set of systems are put in place to support the full range of code users. These range from educational resources, computer-based support tools, and appropriate administrative services (product evaluations, recognition and adoption of “acceptable solutions,” etc.).

Some computer-based support tools are already in existence in such areas as structural design. There are also a number of tools available which will provide support in

the area of energy modeling, which will be able to support the new energy codes. In the area of fire, a number of tools are available and more are becoming available. These fire related tools include systems such as FiRECAM, which is currently being developed and applied at the National Fire Laboratory.

The provision of educational resources has been identified as a critical and high priority area in the move to objective-based codes. Work will be undertaken with a broad range of organizations in helping them develop appropriate educational resources to enable them to serve the needs of their own communities.

### **The Transition Process**

Developing the new code and objective structures will require extensive consultation with all involved parties. The Strategic Plan of the Canadian Commission on Building and Fire Codes (CCBFC) has already outlined this approach as one of its top priorities. IRC is currently working with several countries in harmonizing and refining the strategy for implementing this approach. Many of the existing code committees, developed around the existing codes documents, will have to be re-structured along the lines of specific code objectives.

### **Summary**

Adopting the objective-based codes approach will provide codes users with clearly stated guidance on why a specific requirement exists (the objective that it is addressing). Such a system will provide a level of guidance on interpretation that, in the past, has not been available.

The adoption of the proposed approach will provide greater flexibility for designers, builders, and manufacturers to produce innovative designs. At the same time, by clarifying the basic code structure and by providing clearly specified “acceptable



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## **Objective-Based Codes**

solutions," the cost and effort associated with code-related compliance will be significantly reduced.

### **Further Information Sources**

Documents have been developed to further explain the background to the move to objective-based codes. These are now available via the Internet at our Web site. The background to the CCBFC Strategic Plan can be found at:

<http://www.irc.nrc.ca/ccbfc/>

and details of the CCBFC's Task Group on Objective-Based Codes, along with their working documents, can be found at:

<http://www.irc.nrc.ca/ccbfc/tgs/obc/>

If you have any questions relating to the move to Objective-Based Codes you can contact the Canadian Codes Centre at:  
Phone: (613) 993-9960  
Fax: (613) 952-4040  
email: [codes@nrc.ca](mailto:codes@nrc.ca)

### **Sample Glossary of Terms**

#### *Objective-based Code*

A code with a structure based on a hierarchy of objectives and sub-objectives.

#### *Objective*

A statement of the outcome that compliance with a code or part thereof is expected to achieve.

#### *Sub-objective*

One of a group of related objectives, the satisfaction of which contributes to satisfying a related higher level objective.

#### *Functional Requirement*

A detailed sub-objective at the highest level in the hierarchy at which the objective can be expressed in quantitative terms.

#### *Approved Solution*

An expression of one or more means deemed to satisfy a functional requirement or higher level objective. Such expression may be in the form of a prescriptive solution or a performance solution.

#### *Prescriptive Solution*

A specific statement of building elements (materials, components, assemblies, systems or equipment) that can be used and/or procedures that can be carried out to satisfy the terms of a functional requirement.

#### *Performance Solution*

A statement of the level of performance that a building element (material, component, assembly, system or equipment) or procedure must provide to satisfy the terms of a functional requirement. A performance solution specifies the aspect of the element's performance that is being established, the methods that are used to measure performance and the criteria that are used to evaluate success or failure.

Ottawa, February 1996

