



DESIGNATED STRUCTURAL ENGINEER PROGRAM BC CODES AND PRACTICES EXAM

GUIDELINE TO THE BC CODES & PRACTICES EXAM

Updated September 2009

Objectives of the BC Codes and Practices Exam:

The BC Codes and Practices Examination is intended for Professional Engineers who are ready to confirm that they have the necessary skills and experience to take full responsibility for the structural design of Part 3 building structures in accordance with Part 4 Structural requirements, and for the management of the structural design in accordance with the applicable laws and practices in British Columbia.

The exam covers some of the key aspects of the structural design of buildings that are required to be completed to Part 4 of the 2006 BC Building Code. Seismic design and practice specific to British Columbia is emphasized on the exam. The exam also covers structural design aspects of the primary specific materials; steel, concrete, timber and masonry.

It is expected that candidates show competence in Part 4 requirements, including structural engineering design and analysis with an emphasis on seismic requirements. Competence in the specific design requirements of at least two of the materials sections from steel, concrete, wood, and masonry must also be demonstrated. Candidates must choose two or more material exam sections out of the four to write the exam.

BC Codes and Practices Exam

This document is intended to provide guidance to those preparing for the exam and to the authors of the exam. The guideline is not represented as a complete coverage of all possible topics. Questions may cover any aspects that may reasonably be expected to form a part of the practice of structural design for buildings in British Columbia. Specific requirements of the City of Vancouver By-Law No. 9419 2007 will not be tested.

What to Expect

Exam candidates should expect a wide variety of questions with a strong emphasis, approximately 50 percent of the exam, on questions related to seismic analysis and design. Experienced candidates who are very familiar with the structural analysis and design of buildings as the Engineer of Record are expected to have sufficient time to complete the exam. Less experienced candidates or experienced candidates not regularly completing detailed structural analysis and design may find the time limitation a challenge. Questions will vary in degree of difficulty and vary in the anticipated time to complete. The exam committee follows a guideline of 1/3 simple, 1/3

medium, and 1/3 hard questions. Some questions will not require calculations. Few of the questions are expected to require extensive calculations. Although, more than one question may relate to a described problem or aspect of building design, each question will be independent with answers not reliant on a correct answer to a previous question.

The exam committee strives to provide a balance of degree of difficulty and time requirements within each section of the exam. They also select questions that cover the broad range of scope of practice that may be encountered by a Struct.Eng. in BC. Exam questions that test specific types of structures will be limited. Questions on specialized structural topics such as post-tensioned concrete or cable structures will be avoided on the exam.

Note: Consistent with the 2006 BC Building Code and current material codes, all questions and answers are formatted in Metric Units only. See Sections E, F, G, and H for the Edition of each material code utilized for the exam.

Preparation Suggestions for Candidates

Candidates must clearly understand that the exam is intended to test Structural Engineers who are currently and actively completing structural analysis and structural design of buildings to Part 4 requirements. All candidates should ensure they have complete familiarity and understanding of all aspects of Part 4 of the 2006 BC Building Code.

Candidates must select at least two primary materials for which they wish to be tested. Although candidates may write the exam for more than two sections, the exam committee believes most candidates will not benefit from this approach. Candidates are encouraged to study both the selected material codes and ensure that they have recent experience in applying the code requirements.

Previous candidates have found a benefit to study and challenge each other in small groups of colleagues.

Format of the BC Codes and Practices Exam

The exam will be open book and open notes. The time allotted for the exam is 6 hours (two – three hour sittings). The exam will consist primarily of, but not limited to, multiple-choice questions with four choices.

The exam is divided into 8 sections, **A** through **H**. Where reference is made to the *National Building Code of Canada* (NBCC) or its commentaries, it is assumed that the 2005 Edition applies and that actual applications are to be in conformance with the *British Columbia Building Code 2006* (BCBC 2006). The NBCC is referred to because code development and discussion, and public comment, are in the context of the NBCC, hence it is a rich source for understanding principles used in the codes as they are introduced.

The first three-hour session of the examination will cover sections A-D and the second three-hour session will cover sections E-H. Candidates must submit their results at the end of each three-hour session. In the second half of the examination, the candidate is only required to attempt any two of the four sections. At the discretion of the candidate, he/she can elect to attempt more than two sections on material codes in the afternoon session. All attempted sections will be marked. However, only the best two sections will be counted for the results of the examination.

Marking

The marking distributions for each section are as follows:

First three-hour session:

A. 2006 BCBC Administrative requirements	10%
B. Load Provisions	25%
C. Basic Seismicity and Seismic Principles	50%
D. Basics of Mechanics and Structural Behaviour, Building System, and Integrity	15%
Total Mark: (total of sections A,B,C,D)	100%

Second three-hour session:

E. Concrete Code	50%
F. Structural Steel Code	50%
G. Timber Code	50%
H. Masonry Code	50%
Total Mark: (any 2 sections from E,F,G,H)	100%

It is required that a successful candidate shall score a minimum average of approximately 70% in each of the first three-hour session and second three-hour session to pass the examination. Successful candidates must pass each of the Morning and Afternoon session, and if either the Morning or Afternoon session is not passed, only that session needs to be re-written.

The BC Codes & Practices Exam is reviewed carefully by members of the Exam Committee. Their responsibilities include review of the exam objectives, its contents and the distribution of questions regarding type and degree of difficulty. The Committee revises the exam as necessary to provide for new material, test validity, and to incorporate feedback wherever necessary. In the process of post exam analysis, questions may be discarded, anomalies may be identified in the marking of the exam and appropriate adjustments are made in the interest of fairness to all candidates. Marking of the exam is closely reviewed, double-checked and adjusted where necessary before final results are

posted. If questions are discarded the Exam Committee ensures that candidates are not adversely affected.

A. 2006 BCBC Administrative Requirements

This section will examine candidates' understandings of basic administrative requirements of Municipal codes, BC Building Code 2006. and APEGBC Guidelines. Note that Administration requirements specific to the City of Vancouver Building By-Law No. 9419 2007 will not be tested.

1. Defined Terms
2. Administrative requirements (e.g. parts 2,3,4 and 9 of BCBC and the relationship to local codes)
3. Letters of Assurance and Field Reviews
4. Guidelines for Structural Engineering Services for Building Projects of APEGBC
5. Responsibilities of the Struct.Eng.

B. Load Provisions

This section examines the understanding of the loading and load combination requirements of the B.C. Building Code 2006, Part 4, including an understanding of the background to the code provisions contained in the Commentaries to NBCC 2005.

1. Knowledge of the principles of Limit States Design
 - serviceability
 - strength and stability
 - performance factors and load factors, reliability index
 - factored load effects
 - companion loads
 - load combinations
2. Dead Loads
 - load analysis, tributary areas
 - self weight
 - load allowances for undetermined items, partitions, and utilities
3. Live Loads
 - use and occupancy
 - pattern loads, concentrated load
 - load reductions
4. Snow, Ice, and Rain Loads
5. Wind Load
 - exposure
 - internal and external loads
 - directional loads

C. Seismic Principles

The principles to be examined include the requirements of the BCBC 2006, the background material in NBCC 2005 Commentary J, in the context of fundamental principles, tasks, and knowledge in BC practice of seismic design, analysis, evaluation, and retrofit of buildings.

1. Seismology
 - earthquake characteristics and terminology
 - tectonic situation affecting British Columbia
 - earthquake magnitude, intensities, and related probability measures
 - accelerographs, ground acceleration and velocity, response spectra
 - geotechnical influences
2. Dynamics
 - Structural irregularities
 - basics of dynamics
 - relationship of sdof and mdof models to real structures
 - period, damping, mode shapes
3. Performance Goals
 - seismic design philosophy of the NBCC
 - capacity design principles
4. Seismic Analysis and Design
 - the principle of Ductility
 - the principle of Capacity Design
 - Part 4 provisions of the NBCC for seismic design and analysis
 - basics of mdof dynamic analysis
 - distribution of forces in lateral load resisting systems including torsion effects
 - internal forces in irregular systems, vertical and plan irregularities
 - attachments, parts and portions
 - anchorage requirements for non-structural elements
6. Seismic Behaviour of Building Systems
 - performance and limitations of systems and elements with varying degrees of ductility
7. Building details for seismic design
 - diaphragm/wall connections and collector struts
 - footing ties
 - wall anchoring
 - connection designs
8. Geotechnical and Foundation Issues
 - Site Class, liquefaction, slope stability, settlement
9. Basics of probability dealing with return periods, expectation, and variance

D. Basics of Mechanics and Structural Behaviour and Building System and Integrity – Strength and Serviceability

This section will test the skills of the candidates in applying basics of Mechanics and structural behaviour, and will examine the candidate's understanding of areas in building system behaviour.

1. Mechanics and Analysis
 - analysis and behavior of statically determinate and indeterminate structures
 - analysis of simple frames
 - analysis of simple trusses or arches
 - deflections
 - basic torsion analysis
 - P-delta analysis of simple column frames
 - stability analysis of beam and columns
2. Structural Behavior
 - elastic and inelastic behaviour of materials
3. Deflection and compatibility of varying systems

E. Concrete Code (approximately 50% on Seismic)

This section examines understanding of the principles and application of the latest edition of Concrete Materials and Methods of Concrete Construction, CAN/CSA A 23.3 - 04.

F. Structural Steel Codes (approximately 50% on Seismic)

This section examines understanding of the principles and application of the latest edition of Limit States Design of Steel Structures CAN /CSA S16 – 01 (including Supplement CAN/CSA-S16S1-05and CSA S16-01 UPDATE NO.3 DATED AUGUST 2006)

G. Timber Code (approximately 50% on Seismic)

This section examines understanding of the principles and application of the latest edition of Engineering Design in Wood, CAN/CSA 086 – 01 (including Supplement CAN/CSA-0861-05).

H. Masonry Code (approximately 50% on Seismic)

This section examines the principles and application of the latest edition of the Canadian Masonry Codes, Design of Masonry Structures, CAN/CSA S304.1 – 04 and Masonry Construction for Buildings CAN/CSA A371-04.