

# Examination Information for Candidates

## October 2010 Structural Engineer Seismic Examination

### Introduction

The mission of the Board for Professional Engineers and Land Surveyors (the Board) is to safeguard the life, health, property, and welfare of the public by regulating the practice of professional engineering and land surveying. The Board accomplishes this mission by setting forth examination standards to reliably determine those applicants who are competent to provide safe services to the public.

Applicants for licensure as a Structural Engineer must hold a current and valid California license as a Civil Engineer and pass the California Structural Engineer Seismic Examination (CSESE) **and** the National Council of Examiners for Engineering and Surveying (NCEES) Structural II Examination to use the title “Structural Engineer” in California. For information on NCEES visit [www.ncees.org](http://www.ncees.org).

### Examination Description

The CSESE is a one-day 8-hour examination. The examination comprises approximately 60 multiple-choice questions and three design/essay-type questions. Candidates will be allotted four hours to complete the multiple-choice section (a.m. session) and four hours to complete the design section (p.m. session).

The subject matter of the CSESE relates to the seismic principles and practice of structural engineering. Candidates are tested on elements of current structural engineering practice as dictated by an occupational analysis. The candidate’s knowledge of structural engineering principles, method of solving the problems, and reasoning ability as demonstrated in the candidate’s solutions for design problems will be tested. Candidates should develop solutions with calculations, findings, and statements arranged in a professional, organized, and legible manner. Solutions that simply present the results of the calculations or printouts from a programmable calculator are not sufficient. Credit will **only** be given for complete calculations and methodologies provided for each problem requirement. If tables or charts are used, the reference must be specified.

Candidates are provided individual solution booklets for each design problem. Each design solution must be clearly identified with problem number and the candidate’s examination identification number on each page. Credit will **only** be given for sketches that are completed in the specified solution booklets.

Candidates multiple-choice responses must be entered on the machine scoreable answer sheet (scantron). Multiple-choice answers marked in the test booklet rather than the scantron sheet will not be graded and additional time will not be allowed to transfer the answers to the scantron. Calculations needed to solve a multiple-choice item **must** be performed in the multiple-choice test booklet but the calculations will **not** be graded.

## **Examination Description Continued**

The specific content of the examination is reflected in the California Structural Engineer Seismic Examination Test Plan ([www.pels.ca.gov/applicants/sese\\_testplan.pdf](http://www.pels.ca.gov/applicants/sese_testplan.pdf)) which was completed in December 2003 and revised in March 2008 to reflect the adoption of the 2007 California Building Code.

All candidates will be required to demonstrate knowledge of the 2007 California Building Code (CBC). **Portions of the design and multiple-choice questions will cover all four common construction materials—steel, concrete, wood, and masonry. Therefore, it is recommended that candidates bring all references to all examination sections.**

**INSTRUCTIONS SPECIFIC TO ALLOWABLE STRESS DESIGN (ASD) AND LOAD AND RESISTANCE FACTOR DESIGN (LRFD):** For the October 2010 examination, all concrete and steel problems on the CSESE will require the LRFD (strength design) method. All wood problems will require the ASD method. Masonry problems will designate whether the ASD or LRFD (strength design) method will be required. No credit will be given if the problems are solved using the incorrect method. If the ASD method is required, no credit will be given if the problems are solved using the LRFD method. If the LRFD method is required, no credit will be given if the problems are solved using the ASD method.

## **Reference Materials**

The entire examination is open book. A list of references required for the 2010 CSESE is provided in ([www.pels.ca.gov/applicants/sese\\_refs\\_10.pdf](http://www.pels.ca.gov/applicants/sese_refs_10.pdf)).

## **Review Courses**

The Board does not endorse any review course or material provided as study aides. If you are interested in obtaining information on review courses, we suggest you contact your local university or professional engineering society.

## **Grading Process for Design/Essay Questions**

Candidates are provided individual solution booklets for each design problem. Design problems are solved through calculations, written answers, and graphic presentations completed by the candidate in the designated solution booklet. Each design solution completed by a candidate is graded independently by at least two licensed Structural Engineers. Discrepancies between the two graders findings are resolved through further grading by a third engineer.

Graders are trained to apply explicitly established scoring criteria and performance standards for each design problem and solution. The scoring criteria and grading plans are developed by licensed Structural Engineers in conjunction with the development of the design items. The grading plans, like the items, are based on the current test plan. Points are assigned to the

problem and to the grading elements within problems according to their weight as designated by the test plan. The predetermined point values are awarded for each grading element correctly addressed in a candidate's solution. Partial credit for a grading element is not allowed.

To maximize method points, candidates must show all work, including all formulas and calculations when specified and cite references where specified. Reference must include title, author, edition/date, section, page and figure number, if applicable. Acceptable references are those included on the 2010 California Structural Engineer Seismic Examination Reference List, legal statutes or published material relating to the practice of California structural engineering. Class notes, tapes or other unaccredited, unpublished materials are **not** acceptable citations.

Some problems may require a specified number of answers. Candidates must provide **only** the number of answers required. Any answers provided beyond the number required will **not** be graded. To maximize answer points, avoid duplication in the answers. To obtain credit, candidates must also provide explanations/justifications for each answer when requested.

### **Grading Process for Multiple Choice Questions**

Candidates use a machine-scorable answer sheet (scantron) to record their answers to the multiple-choice items of the examination, which is then scanned for scoring. Candidates do not receive credit for a question if they marked more than one answer, if they do not mark an answer, or if they mark an incorrect answer. After initial scoring, any question that does not meet statistical criteria, or that is found to have a content problem, may be deleted. In the event of deletion, the point value of the deleted question either becomes zero for all candidates or points will be awarded to all candidates. In this way, no candidate's score is affected by a deleted question.

### **Final Results**

The cumulative total of points awarded for a candidate's performance on the multiple-choice and design portions of the examination is the basis for determining if the candidate has achieved the minimum passing score.

Examination results are mailed to the candidates approximately fifteen weeks after the examination. Results will not be given out by phone. Duplicate results will be mailed ten days after the results have been released. You may also check the Board web site for updated information.

### **Examination Appeals**

Candidates who fail the examination and are **within 15% of the passing score** may appeal their performance on **design problems only**. Multiple-choice items may not be appealed. Candidates must review their examination to appeal their results.

# *Examination Development Information*

## **Introduction**

The Board collaborates with licensed Structural Engineers with content expertise and examination development experience in the development of an examination which meets the highest standards for examination construction and which is a reliable measure of structural engineering practice.

Throughout the entire cycle of examination development and grading, numerous licensed Structural Engineers review the examination. This exposure helps to ensure the validity and reliability of the examination and the discovery of any flaws that may exist in an examination before it is administered. The following is an overview of the examination development process.

## **Examination Test Plan**

The test plan for a licensing examination is the vital link between the test and professional practice. It defines the content of the examination by identifying the subject-matter areas to be covered and by establishing the relative emphasis each content area should be given. Test plans are developed based upon the results of a job or occupational analysis. Typically, an occupational analysis is conducted every five to seven years and test plans are updated accordingly to ensure that they reflect actual tasks performed by licensed Structural Engineers.

In 2003, an occupational analysis was conducted for Structural Engineers. A committee consisting of a diverse group of California-licensed Structural Engineers developed a survey consisting of statements describing the tasks and knowledges related to competent entry-level structural engineering practice with seismic emphasis. This survey was distributed to 1600 California licensed Structural Engineers residing throughout the state. The survey respondents' ratings were analyzed and used to develop the Structural Engineer Seismic Examination Test Plan ([link](#)). The first examination developed under the new test plan was administered in October 2004. In March 2008, the Test Plan was revised to include any changes necessary due to the adoption of the 2007 California Building Code.

## **Examination Development Process**

An Examination Development Committee, consisting of California Licensed Structural Engineers, annually develops the CSESE. Members of the committee, or Subject Matter Experts (SMEs), are chosen based on geographical location, areas of expertise, working environment, and other factors that make the committee a diverse representation of structural engineering throughout California.

### **Examination Development Conference**

The Examination Development Committee convenes to review the test plan and construct each new examination. Through the review of performance data for previously used items, the committee develops new items and selects and revises items from the existing item bank for

inclusion in the new examination. Grading plans are developed or revised for use in scoring the examination.

### **Examination Review Conference**

The Examination Development Committee reconvenes as a group to review and refine items selected and developed for the new examination.

### **Field Testing/Board Review**

Newly licensed Structural Engineers are recruited to take a draft version of the newly constructed examination under simulated test conditions. After completing each item, the field testers answer a set of questions about each item's clarity, difficulty, importance, and the time needed to answer. The field testers then complete a questionnaire about the overall examination content. This includes any subject areas that should have been covered but were not, any areas that were covered but were unnecessary, overemphasized, or redundant, adequacy of time, and comparison in content depth, breadth and difficulty with the Structural Engineer Examination that they passed. This critical phase of examination review process may reveal ambiguities in the wording of an item, elicit an acceptable alternate response, disclose unanticipated response patterns, or address time issues. Any of these may require further refinement of the item before the examination is finalized.

### **Setting a Pass/Fail Standard**

Because each examination is considered independent of any previous administration and levels of examination difficulty may vary, the Board adopts a criterion-referenced passing score. A criterion-referenced passing score applies minimum standards for competent practice to all candidates regardless of the form of the examination administered.

A group of licensed Structural Engineers representing the demographic diversity of the structural engineering profession convenes after the examination is administered and graded to determine the pass/fail standard for the examination.

In general, a modified Angoff method is used for the multiple-choice questions and a pass/fail method for the design questions. The Angoff procedure requires the Structural Engineers (judges) to estimate the proportion of borderline candidates who would answer each item correctly. The pass/fail standard for the examination is obtained by averaging all of the judges' ratings. The overall pass/fail standard is obtained by summing the results for each test section (multiple-choice and design). The same modified Angoff and pass/fail methods are used for the NCEES Structural I and II examinations.

The pass/fail standard is established to distinguish between those candidates whose performance equals or betters the requirement for minimum acceptable competence in the area of structural engineering. The concept of "minimum acceptable competence" is defined at each standard setting meeting to ensure that participants have a common frame of reference for assessing minimum competence for the entry-level structural engineer.

## Levels of Item Complexity

There are four (4) levels of thought processes that can be applied in constructing test items. They are, in order of increasing level of complexity: knowledge, comprehension, application, and analysis. A description of each level follows:

**Knowledge-Level Requirements:** Knowledge-level items require that candidates remember information that they have previously learned. The key feature of this type of item is that the candidates need only recall information and indicate the correct choice. Because professional practice entails much more than the memory of information, it is recommended that items be developed to test competencies above this level.

**Comprehension-Level Requirements:** Comprehension-level items require the candidate to demonstrate an understanding of information. This can be done by requiring the candidate to identify a concept or a principle that is presented in the item by an indirect or implicit means, or by requiring the candidate to elaborate in his or her own words on the similarities, differences, and implications for practice with respect to a number of concepts or principles.

**Application-Level Requirements:** The application-level of testing goes another level beyond a candidate's ability to use knowledge in a given situation. It tests the candidate's ability to understand information and to demonstrate the correct use of this understanding in various situations.

**Analysis-Level Requirements:** Analysis-level items require the candidate to critically evaluate information, to identify and weigh the strengths and weaknesses of procedures, to interpret technical data and derive a conclusion, and entails an assessment of the implications of actions including the consideration of contingencies for failures or complications.

Candidates are required to demonstrate comprehension, to apply their knowledge, and to analyze situations whenever possible. Every effort is made to develop practice-related test problems at the higher cognitive levels (comprehension, application, and analysis) and to limit the number of knowledge-based items.