Civil Engineer Examination

Seismic Principles Test Plan

Effective January 2018

Definition of Seismic Principles

Seismic Principles is defined as the fundamental principles, tasks and knowledges underlying those activities involved in the California practice of seismic design, seismic analysis or seismic evaluation of new and existing civil engineering projects such as:

- Buildings
- Non-buildings structures
- Non-structural components, equipment and lifelines

This area of practice is structured into six primary content areas:

I. Seismic Data and Seismic Design Criteria (10%)
II. Seismic Characteristics of Engineered System (15%)
III. Seismic Forces: Building Structures (28%)
IV. Seismic Forces: Non-Building Structures, Components, and Equipment (12%)
V. Seismic Analysis Procedures (25 %)
VI. Seismic Detailing and Construction Quality Control (10%)

(**NOTE**: As used throughout this test plan, the term **applicable code** refers to the **current adopted California Building Code.)**

BPELSG Civil Engineering: Seismic Principles (CSP) Test Plan-2017	
	Percentage of Questions on the Exam
I. Seismic Data and Seismic Design Criteria **Professional Activities:** **1. Practice in accordance to laws, codes and standards governing seismic design.** **2. Identify design performance requirements for a project.** **3. Determine site-related coefficients.** **4. Determine effects of site characteristics on a structure.** **5. Determine Seismic Design Category.**	**10%**
Test questions on these professional activities may include one or more of the following:	
A. Geologic seismic hazards and geotechnical data that affect design, including liquefaction and site classification	
B. Site-related seismic coefficients	
C. Natural period of the structure and the expected period of the seismic ground motion	
D. The seismic design philosophy of the applicable code	
E. Applicable laws, regulations and codes for civil engineering seismic design and construction	
F. Seismic Design Categories	
G. Building Risk Categories	
H. Seismic importance factors	
II. Seismic Characteristics of Engineered System **Professional Activities:** **1. Select appropriate seismic force-resisting systems for new or existing structures.** **2. Identify effects of structural characteristics on seismic design/performance.** **3. Evaluate vulnerability of structures with previous poor seismic performance.** **4. Evaluate post-earthquake structural safety.** **5. Determine methods for improving seismic performance of existing structures.**	**15%**
Test questions on these professional activities may include one or more of the following:	
A. The different structural systems and their design parameters	
B. Limitations of different structural systems	
C. Requirements for structures with horizontal irregularities (e.g., torsional response, re-entrant corners, out-of-plane offset)	
D. Requirements for structures with vertical irregularities (e.g., vertical discontinuities, offsets, soft stories)	
E. Drift and P-Delta effects	
F. Effects of ductility and damping on seismic performance	
G. Effects of redundancy on seismic performance	

H. Anchorage and stability in existing unreinforced masonry (URM) bearing wall buildings	
I. Weak connections in precast concrete structures	
J. Punching shear failures in cast-in-place concrete structures	
K. Diaphragm to wall connection failures in tilt-up and masonry buildings	
L. Buckling or brittle connections in steel braced frame structures	
M. Welded connection failures in steel moment frames	
N. Assessment and identification of post-earthquake damage and risk	
O. Methods to improve seismic performance and the effects on existing structures	
P. Methods and effects of adding stiffness to protect brittle elements	
Q. Methods and effects of improving ductility of brittle elements	
R. Methods and effects of strengthening connections in structural elements	
III. Seismic Forces: Building Structures **Professional Activities:** **1. Determine structural characteristics required to calculate seismic design forces.** **2. Determine seismic design forces for structures.** **3. Perform vertical distribution of seismic forces for structures.** **4. Determine seismic diaphragm forces.** **5. Determine seismic forces for structural elements.**	**28%**
Test questions on these professional activities may include one or more of the following:	
A. Mass and stiffness	
B. Methods to determine the structure's fundamental period	
C. Selection of seismic factors and coefficients required for design	
D. Static force procedures and formulas	
E. Structural system seismic coefficient application	
F. Design base shear	
G. Vertical force distribution	
H. Design seismic forces on diaphragms	
I. Design seismic forces on structural elements	
J. Out-of-plane seismic forces on structural elements	
K. Design lateral force formulas	
IV. Seismic Forces: Non-Building Structures, Components, and Equipment **Professional Activities:** **1. Determine seismic forces for non-structural building components and equipment.** **2. Determine seismic forces for non-building structures.**	**12%**
Test questions on these professional activities may include one or more of the following:	
A. Mass and stiffness	
B. Methods to determine the structure's fundamental period	

C. Selection of seismic factors and coefficients required for design	
D. Static force procedures and formulas	
E. Design base shear	
F. Application of seismic factors and coefficients for design of non-building structures	
G. Application of seismic factors and coefficients for design of non-building components and equipment	
H. Design lateral force formulas	
V. Seismic Analysis Procedures **Professional Activities:** **1. Perform analysis of seismic force resisting systems.** **2. Perform the distribution of seismic forces to structural elements.** **3. Perform the seismic analysis of diaphragms (e.g., rigid and flexible).**	**25%**
Test questions on these professional activities may include one or more of the following:	
A. Applicable load combinations	
B. Distribution of internal and external forces	
C. Application of deflection and drift requirements	
D. Diaphragm force distribution to structural elements (e.g., chord forces, drag forces and diaphragm shear)	
E. Methods used to calculate rigidities of structural elements	
F. Distribution of seismic forces based on rigidity	
G. Assumptions controlling the analysis for rigid diaphragms	
H. Methods to determine centers of rigidity and mass	
I. Torsional moment requirements in rigid diaphragms	
J. Assumptions controlling the analysis of flexible diaphragms	
K. Sub-diaphragm analysis.	
VI. Seismic Detailing and Construction Quality Control **Professional Activities:** **1. Identify the detailing requirements that are critical for seismic performance (e.g., load path, wall anchorage, chord and collector).** **2. Recognize need for construction quality control of the seismic design aspects of the project (e.g., testing, special inspection and observation requirements).**	**10%**
Test questions on these professional activities may include one or more of the following:	
A. Seismic detailing and inherent seismic performance characteristics for steel	
B. Seismic detailing and inherent seismic performance characteristics for concrete	
C. Seismic detailing and inherent seismic performance characteristics for masonry	
D. Seismic detailing and inherent seismic performance characteristics for wood	
E. Deformation compatibility requirements for structural and non-structural elements	

F. Required building separation and setback	
G. Requirements for ties and continuity, collectors and drags	
H. Requirements for anchorage of concrete and masonry walls	
I. Seismic materials testing requirements	
J. Seismic special inspection requirements	
K. Seismic structural observation requirements	