

# National Council of Examiners for Engineering and Surveying

## Principles and Practice of Engineering Lateral Forces (Wind/Earthquake) Component of the Structural BREADTH Exam

Effective Beginning with the April 2011 Examination

The 4-hour **Lateral Forces (Wind/Earthquake)** breadth examination is offered on Saturday morning and focuses on wind/earthquake loads.

	<b>Approximate Percentage of Examination</b>
<b>I. Analysis of Structures</b>	<b>37%</b>
A. Lateral Forces	10%
1. Wind	
2. Horizontal seismic	
3. Vertical seismic	
4. Dynamic earth pressure	
B. Lateral Force Distribution	22%
1. Statics (e.g., determinate and indeterminate, location of forces and moments, free-body diagrams)	
2. Seismic design categories (C and lower)	
3. Seismic design categories (D and higher)	
4. Seismic static force procedures	
5. Seismic dynamic force procedures	
6. Configuration of a structural system to resist effects of horizontal torsional moments	
7. Relative rigidity force distribution	
8. Horizontal/plan and vertical irregularities	
9. Flexible diaphragms	
10. Rigid diaphragms	
11. Simplified wind	
12. Wind analytic procedures	
13. Wind components and cladding	
14. Main wind force resisting systems	
C. Methods	5%
1. Computer-generated structural analysis techniques (e.g., modeling, interpreting, and verifying results)	
2. Simplified analysis methods (e.g., influence lines, portal frame method/cantilever method)	
<b>II. Design and Detailing of Structures</b>	<b>60%</b>
A. General Structural Considerations	7.5%
1. Load combinations	
2. Serviceability requirements: building drift	
3. Anchorage of a structural system to resist uplift and sliding forces	

	<b>Approximate Percentage of Examination</b>
4. Components, attachments, and cladding	
5. Redundancy factors	
6. Overstrength	
7. Ductility requirements	
8. Abutment/pier seat width	
B. Structural Systems Integration	5%
1. Structural systems to resist effects of lateral forces	
2. Constructability	
3. Strengthening existing systems: seismic retrofit	
a. Details	
b. System compatibility	
C. Structural Steel	10%
1. Ordinary moment frames	
2. Intermediate moment-resisting frames	
3. Special moment-resisting frames	
4. Bracing	
5. Ordinary concentric braced frames	
6. Special concentric braced frames	
7. Eccentric braced frames	
8. Bridge piers	
D. Light Gage/Cold-Formed Steel	2.5%
1. Metal deck diaphragms	
2. Light-framed wall systems (e.g., shearwall systems)	
E. Concrete	12.5%
1. Ordinary or intermediate shear walls	
2. Special shear walls	
3. Ordinary or intermediate moment-resisting frames	
4. Special moment-resisting frames	
5. Diaphragms	
6. Reinforcement details (e.g., ductile detailing, anchorage)	
7. Bridge piers	
8. Tilt-up construction	
F. Wood	7.5%
1. Shear walls	
2. Plywood diaphragms (e.g., drag struts, chords)	
3. Plywood sub-diaphragms	
G. Masonry	7.5%
1. Flexural-compression members	
2. Slender walls	
3. Ordinary or intermediate shear walls	
4. Special shear walls	
5. Anchorage for walls (e.g., out-of-plane)	
6. Attachment of elements to masonry	

	<b>Approximate Percentage of Examination</b>
H. Foundations and Retaining Structures	7.5%
1. Spread footings	
2. Piles (concrete, steel, timber)	
3. Drilled shafts/drilled piers/caissons	
<b>III. Construction Administration</b>	<b>3%</b>
A. Structural observation	

**Notes**

1. The examination is developed with questions that will require a variety of approaches and methodologies including design, analysis, and application.
2. The knowledge areas specified under 1, 2, 3, etc., are examples of kinds of knowledge, but they are not exclusive or exhaustive categories.
3. The breadth (AM) exam contains 40 multiple-choice questions. Examinee works all questions.
4. Score results are combined with depth exam results for final score of this component.