

**Vertical Forces (Gravity/Other) and Incidental Lateral Component of the
 Structural Engineering BREADTH Exam Specifications**

Effective Beginning with the April 2011 Examinations

- The 4-hour **Vertical Forces (Gravity/Other) and Incidental Lateral** breadth examination is offered on Friday morning and focuses on gravity loads. It contains 40 multiple-choice questions.
- The exam uses the US Customary System (USCS) of units.
- The exam is developed with questions that will require a variety of approaches and methodologies, including design, analysis, and application.
- The knowledge areas specified as examples of kinds of knowledge are not exclusive or exhaustive categories.
- Score results are combined with depth exam results for final score of this component.

| | Approximate Number of Questions |
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| I. Analysis of Structures | 12 |
| A. Loads | 4 |
| 1. Dead | |
| 2. Live | |
| 3. Snow, including drifting | |
| 4. Moving (e.g., vehicular, pedestrian, crane) | |
| 5. Thermal | |
| 6. Shrinkage and creep | |
| 7. Impact (e.g., vehicular, crane, and elevator) | |
| 8. Settlement | |
| 9. Ponding | |
| 10. Fluid | |
| 11. Ice | |
| 12. Static earth pressure | |
| 13. Hydrostatic | |
| 14. Hydraulics (e.g., stream flow, wave action, scour, flood) | |
| B. Methods | 8 |
| 1. Statics (e.g., determinate, location of forces and moments, free-body diagrams) | |
| 2. Shear and moment diagrams | |
| 3. Code coefficients and tables | |
| 4. Computer-generated structural analysis techniques (e.g., modeling, interpreting, and verifying results) | |
| 5. Simplified analysis methods (e.g., influence lines, portal frame method/cantilever method) | |
| 6. Indeterminate analysis methods (e.g., deflection compatibility) | |

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| II. Design and Details of Structures | 26 |
| A. General Structural Considerations | 3 |
| 1. Material properties and standards | |
| 2. Load combinations | |
| 3. Serviceability requirements | |
| (a) Deflection | |
| (b) Camber | |
| (c) Vibration | |
| 4. Fatigue (for AASHTO concrete and steel) | |
| 5. Bearings | |
| 6. Expansion joints | |
| 7. Corrosion | |
| B. Structural Systems Integration | 1 |
| 1. Specifications, quality controls and coordination with other disciplines | |
| 2. Constructability | |
| 3. Construction sequencing | |
| 4. Strengthening existing systems: reinforcing methods | |
| C. Structural Steel | 5 |
| 1. Tension members | |
| 2. Columns and compression members | |
| 3. Base plates | |
| 4. Beams | |
| 5. Plate girders—straight | |
| 6. Plate girders—curved | |
| 7. Trusses | |
| 8. Beam-columns | |
| 9. Connections—welded | |
| 10. Connections—bolted | |
| 11. Moment connections | |
| 12. Weld design | |
| 13. Composite steel design | |
| 14. Relief angle (e.g., masonry support angle, facade support angle) | |
| 15. Bridge piers | |
| 16. Bridge cross-frame diaphragms | |
| D. Light Gage/Cold-Formed Steel | 1 |
| 1. Framing | |
| 2. Connections | |
| 3. Web crippling | |
| E. Concrete | 5 |
| 1. Flexural members (e.g., beams, joists, bridge decks, and slabs) | |
| 2. Design for shear | |
| 3. Columns and compression members | |
| 4. Two-way slab systems | |
| 5. Pre-tensioned concrete | |
| 6. Post-tensioned concrete | |

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| 7. Attachment of elements and anchorage to concrete (e.g., inserts, attachment plates, dowels) | |
| 8. Bridge piers | |
| 9. Crack control | |
| 10. Composite design | |
| 11. Slab-on-grade | |
| F. Wood | 4 |
| 1. Sawn beams | |
| 2. Glue-laminated beams | |
| 3. Engineered lumber | |
| 4. Columns | |
| 5. Bearing walls | |
| 6. Trusses | |
| 7. Bolted, nailed, and screwed connections | |
| G. Masonry | 3 |
| 1. Flexural members | |
| 2. Compression members | |
| 3. Bearing walls | |
| 4. Detailing (e.g., crack control, deflection, masonry openings) | |
| H. Foundations and Retaining Structures | 4 |
| 1. Use of design pressure coefficients (e.g., active, passive, at rest, bearing, coefficient of friction, cohesion) | |
| 2. Selection of foundation systems (e.g., based on geotechnical information, boring logs, settlement, and groundwater table) | |
| 3. Overturning, sliding and bearing | |
| 4. Combined footings/mat foundations | |
| 5. Piles (concrete, steel, timber) | |
| 6. Drilled shafts/drilled piers/caissons | |
| 7. Gravity walls | |
| 8. Anchored walls | |
| 9. Cantilever walls | |
| 10. Basement walls for buildings | |
| 11. Effect of adjacent loads | |
| 12. Use of modulus of sub-grade reaction | |
| III. Construction Administration | 2 |
| A. Procedures for Mitigating Nonconforming Work | |
| B. Inspection Methods | |

STRUCTURAL ENGINEERING Design Standards¹

These standards apply to the Vertical and Lateral components of the Structural Engineering exam.

Effective Beginning with the April 2017 Examinations

Revisions are shown in red.

| ABBREVIATION | DESIGN STANDARD TITLE |
|---------------------|--|
| AASHTO | <i>AASHTO LRFD Bridge Design Specifications, 7th edition, American Association of State Highway & Transportation Officials, Washington, DC.</i> |
| IBC | <i>International Building Code, 2012 edition (without supplements), International Code Council, Falls Church, VA.</i> |
| ASCE 7 | <i>Minimum Design Loads for Buildings and Other Structures, 3rd printing, 2010, American Society of Civil Engineers, Reston, VA.</i> |
| ACI 318 | <i>Building Code Requirements for Structural Concrete, 2011, American Concrete Institute, Farmington Hills, MI.</i> |
| AISC | <i>Steel Construction Manual, 14th edition, American Institute of Steel Construction, Inc., Chicago, IL.</i> |
| AISC | <i>Seismic Design Manual, 2nd edition, American Institute of Steel Construction, Inc., Chicago, IL.</i> |
| AISI | <i>North American Specification for the Design of Cold-Formed Steel Structural Members, 2007 edition with Supplement No. 2 (2010), American Iron and Steel Institute, Washington, DC.</i> |
| NDS | <i>National Design Specification for Wood Construction ASD/LRFD, 2012 edition & National Design Specification Supplement, Design Values for Wood Construction, 2012 edition, American Forest & Paper Association, Washington, DC.</i> |
| NDS | <i>Special Design Provisions for Wind and Seismic with Commentary, 2008 edition, American Forest & Paper Association, Washington, DC.</i> |
| PCI | <i>PCI Design Handbook: Precast and Prestressed Concrete, 7th edition, 2010, Precast/Prestressed Concrete Institute, Chicago, IL.</i> |
| TMS 402/602 | <i>Building Code Requirements and Specifications for Masonry Structures (and related commentaries), 2011; The Masonry Society, Boulder, CO; American Concrete Institute, Detroit, MI; and Structural Engineering Institute of the American Society of Civil Engineers, Reston, VA.</i> |

Notes

1. Solutions to exam questions that reference a standard of practice are scored based on this list. Solutions based on other editions or standards will **not** receive credit. All questions use the US Customary System (USCS) of units.