

**NCEES Principles and Practice of Engineering
CIVIL BREADTH Exam Specifications**

Effective Beginning with the April 2008 Examinations

The civil engineering examination is a breadth and depth examination. This means that **all** examinees work the breadth (AM) exam and **one** of the five depth (PM) exams. The five areas covered in the civil engineering exam are construction, geotechnical, structural, transportation, and water resources and environmental. The breadth exam contains questions from all five areas of civil engineering. The depth exams focus more closely on a single area of practice in civil engineering.

The specifications for the **AM exam and the Construction PM** exam are included here. The design standards applicable to the Construction PM exam are shown on the last page.

	Approximate Percentage of Examination
I. Construction	20%
A. Earthwork Construction and Layout	
1. Excavation and embankment (cut and fill)	
2. Borrow pit volumes	
3. Site layout and control	
B. Estimating Quantities and Costs	
1. Quantity take-off methods	
2. Cost estimating	
C. Scheduling	
1. Construction sequencing	
2. Resource scheduling	
3. Time-cost trade-off	
D. Material Quality Control and Production	
1. Material testing (e.g., concrete, soil, asphalt)	
E. Temporary Structures	
1. Construction loads	
II. Geotechnical	20%
A. Subsurface Exploration and Sampling	
1. Soil classification	
2. Boring log interpretation (e.g., soil profile)	
B. Engineering Properties of Soils and Materials	
1. Permeability	
2. Pavement design criteria	
C. Soil Mechanics Analysis	
1. Pressure distribution	
2. Lateral earth pressure	
3. Consolidation	
4. Compaction	
5. Effective and total stresses	
D. Earth Structures	
1. Slope stability	
2. Slabs-on-grade	
E. Shallow Foundations	
1. Bearing capacity	
2. Settlement	

- F. Earth Retaining Structures
 - 1. Gravity walls
 - 2. Cantilever walls
 - 3. Stability analysis
 - 4. Braced and anchored excavations

III. Structural 20%

- A. Loadings
 - 1. Dead loads
 - 2. Live loads
 - 3. Construction loads
- B. Analysis
 - 1. Determinate analysis
- C. Mechanics of Materials
 - 1. Shear diagrams
 - 2. Moment diagrams
 - 3. Flexure
 - 4. Shear
 - 5. Tension
 - 6. Compression
 - 7. Combined stresses
 - 8. Deflection
- D. Materials
 - 1. Concrete (plain, reinforced)
 - 2. Structural steel (structural, light gage, reinforcing)
- E. Member Design
 - 1. Beams
 - 2. Slabs
 - 3. Footings

IV. Transportation 20%

- A. Geometric Design
 - 1. Horizontal curves
 - 2. Vertical curves
 - 3. Sight distance
 - 4. Superelevation
 - 5. Vertical and/or horizontal clearances
 - 6. Acceleration and deceleration

V. Water Resources and Environmental 20%

- A. Hydraulics – Closed Conduit
 - 1. Energy and/or continuity equation (e.g., Bernoulli)
 - 2. Pressure conduit (e.g., single pipe, force mains)
 - 3. Closed pipe flow equations including Hazen-Williams, Darcy-Weisbach Equation
 - 4. Friction and/or minor losses
 - 5. Pipe network analysis (e.g., pipeline design, branch networks, loop networks)
 - 6. Pump application and analysis
- B. Hydraulics – Open Channel
 - 1. Open-channel flow (e.g., Manning's equation)
 - 2. Culvert design
 - 3. Spillway capacity

4. Energy dissipation (e.g., hydraulic jump, velocity control)
 5. Stormwater collection (e.g., stormwater inlets, gutter flow, street flow, storm sewer pipes)
 6. Flood plains/floodways
 7. Flow measurement – open channel
- C. Hydrology
1. Storm characterization (e.g., rainfall measurement and distribution)
 2. Storm frequency
 3. Hydrographs application
 4. Rainfall intensity, duration, and frequency (IDF) curves
 5. Time of concentration
 6. Runoff analysis including Rational and SCS methods
 7. Erosion
 8. Detention/retention ponds
- D. Wastewater Treatment
1. Collection systems (e.g., lift stations, sewer networks, infiltration, inflow)
- E. Water Treatment
1. Hydraulic loading
 2. Distribution systems

Notes

1. The examination is developed with questions that will require a variety of approaches and methodologies including design, analysis, and application. Some questions may require knowledge of engineering economics.
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.

**NCEES Principles and Practice of Engineering Examination
CIVIL–CONSTRUCTION DEPTH Exam Specifications
Effective Beginning with the April 2008 Examinations**

		Approximate Percentage of Examination
I.	Earthwork Construction and Layout A. Excavation and embankment (cut and fill) B. Borrow pit volumes C. Site layout and control D. Earthwork mass diagrams	10%
II.	Estimating Quantities and Costs A. Quantity take-off methods B. Cost estimating C. Engineering economics 1. Value engineering and costing	17.5%
III.	Construction Operations and Methods A. Lifting and rigging B. Crane selection, erection, and stability C. Dewatering and pumping D. Equipment production E. Productivity analysis and improvement F. Temporary erosion control	15%
IV.	Scheduling A. Construction sequencing B. CPM network analysis C. Activity time analysis D. Resource scheduling E. Time-cost trade-off	17.5%
V.	Material Quality Control and Production A. Material testing (e.g., concrete, soil, asphalt) B. Welding and bolting testing C. Quality control process (QA/QC) D. Concrete mix design	10%
VI.	Temporary Structures A. Construction loads B. Formwork C. Falsework and scaffolding D. Shoring and reshoring E. Concrete maturity and early strength evaluation F. Bracing G. Anchorage	12.5%

- H. Cofferdams (systems for temporary excavation support)
- I. Codes and standards [e.g., American Society of Civil Engineers (ASCE 37), American Concrete Institute (ACI 347), American Forest and Paper Association-NDS, Masonry Wall Bracing Standard]

VII. Worker Health, Safety, and Environment **7.5%**

- A. OSHA regulations
- B. Safety management
- C. Safety statistics (e.g., incident rate, EMR)

VIII. Other Topics **10%**

- A. Groundwater and well fields
 - 1. Groundwater control including drainage, construction dewatering
- B. Subsurface exploration and sampling
 - 1. Drilling and sampling procedures
- C. Earth retaining structures
 - 1. Mechanically stabilized earth wall
 - 2. Soil and rock anchors
- D. Deep foundations
 - 1. Pile load test
 - 2. Pile installation
- E. Loadings
 - 1. Wind loads
 - 2. Snow loads
 - 3. Load paths
- F. Mechanics of materials
 - 1. Progressive collapse
- G. Materials
 - 1. Concrete (prestressed, post-tensioned)
 - 2. Timber
- H. Traffic safety
 - 1. Work zone safety

Notes

1. The examination is developed with problems that will require a variety of approaches and methodologies including design, analysis, and application. Some problems may require knowledge of engineering economics.
2. The knowledge areas specified under A, B, C, etc., are examples of kinds of knowledge, but they are not exclusive or exhaustive categories.
3. Each depth (PM) exam contains 40 multiple-choice questions. Examinee chooses **one** depth examination and works all questions in the depth examination chosen.
4. Score results are combined with breadth exam results for final score.

**NCEES Principles and Practice of Engineering Examination
CONSTRUCTION Design Standards**

Effective Beginning with the October 2008 Examinations

ABBREVIATION	DESIGN STANDARD TITLE
ASCE 37-02	<i>Design Loads on Structures During Construction</i> , 2002, American Society of Civil Engineers, Reston, VA, www.asce.org .
NDS	<i>National Design Specification for Wood Construction</i> , 2005, American Forest & Paper Association/American Wood Council, Washington, DC, www.awc.org .
CMWB	<i>Standard Practice for Bracing Masonry Walls During Construction</i> , 2001, Council for Masonry Wall Bracing, Mason Contractors Association of America, Lombard, IL, www.masoncontractors.org .
AISC	<i>Steel Construction Manual</i> , 13th ed., American Institute of Steel Construction, Inc., Chicago, IL, www.aisc.org .
ACI 318-05	<i>Building Code Requirements for Structural Concrete</i> , 2005, American Concrete Institute, Farmington Hills, MI, www.concrete.org .
ACI 347-04	<i>Guide to Formwork for Concrete</i> , 2004, American Concrete Institute, Farmington Hills, MI, www.concrete.org (in ACI SP-4, 7th edition appendix).
ACI SP-4	<i>Formwork for Concrete</i> , 7th ed., 2005, American Concrete Institute, Farmington Hills, MI, www.concrete.org .
OSHA	<i>Occupational Safety and Health Standards for the Construction Industry</i> , 29 CFR Part 1926 (US federal version), US Department of Labor, Washington, DC.
MUTCD-Pt 6	<i>Manual on Uniform Traffic Control Devices – Part 6 Temporary Traffic Control</i> , 2003, US Federal Highway Administration, www.fhwa.dot.gov .

Reference categories for **Construction** depth module

- Construction surveying
- Construction estimating
- Construction planning and scheduling
- Construction equipment and methods
- Construction materials
- Construction design standards (see above)