

**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 Transportation PM exam** are presented here. The design standards applicable to the Transportation 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–TRANSPORTATION Depth Exam Specifications

Effective Beginning with the April 2010 Examinations

A competent transportation engineer should have a basic knowledge in drainage, soils, and pavement design. Culvert design and pavement design are knowledges that have not been tested previously under the current Civil exam specifications. **Beginning with the April 2010 exam, Section V of the Transportation module has been broadened to permit testing in these important transportation knowledges.**

	Approximate Percentage of Examination
I. Traffic Analysis	22.5%
A. Traffic capacity studies	
B. Traffic signals	
C. Speed studies	
D. Intersection analysis	
E. Traffic volume studies	
F. Sight distance evaluation	
G. Traffic control devices	
H. Pedestrian facilities	
I. Driver behavior and/or performance	
II. Geometric Design	30%
A. Horizontal curves	
B. Vertical curves	
C. Sight distance	
D. Superelevation	
E. Vertical and/or horizontal clearances	
F. Acceleration and deceleration	
G. Intersections and/or interchanges	
III. Transportation Planning	7.5%
A. Optimization and/or cost analysis (e.g., transportation route A or transportation route B)	
B. Traffic impact studies	
C. Capacity analysis (future conditions)	
IV. Traffic Safety	15%
A. Roadside clearance analysis	
B. Conflict analysis	
C. Work zone safety	
D. Accident analysis	
V. Other Topics	25%
A. Hydraulics	
1. Culvert design	
2. Open channel – subcritical and supercritical flow	
B. Hydrology	
1. Hydrograph development and synthetic hydrographs	
C. Engineering properties of soils and materials (e.g., index properties, identification of types of soils, suitable or unsuitable soil, boring logs)	

- D. Soil mechanics analysis (e.g., soil behavior, soil classification, soil compaction)
- E. Engineering economics
 - 1. Value engineering and costing
- F. Construction operations and methods (e.g., erosion control measures, excavation/embankment)
- G. Pavement structures (e.g., flexible and rigid pavement design)

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 as examples of kinds of knowledge are not exclusive or exhaustive categories.
3. Each depth (PM) exam contains 40 multiple-choice questions. Examinee chooses **one** depth exam and works all questions in the depth exam chosen.
4. Score results are combined with breadth exam results for final score.

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

Effective Beginning with the October 2008 Examinations

ABBREVIATION	DESIGN STANDARD TITLE
AASHTO	<i>A Policy on Geometric Design of Highways and Streets</i> , 2004 edition (5th edition), American Association of State Highway & Transportation Officials, Washington, DC.
AASHTO	<i>Roadside Design Guide</i> , 3rd edition with 2006 Chapter 6 Update, American Association of State Highway & Transportation Officials, Washington, DC.
HCM ¹	<i>Highway Capacity Manual (HCM 2000)</i> , 2000 edition, Transportation Research Board—National Research Council, Washington, DC.
MUTCD ²	<i>Manual on Uniform Traffic Control Devices</i> , 2003, U.S. Department of Transportation—Federal Highway Administration, Washington, DC.
PCA	<i>Design and Control of Concrete Mixtures</i> , 2002, 14th edition, Portland Cement Association, Skokie, IL.
ITE	<i>Traffic Engineering Handbook</i> , 1999, 5th edition, Institute of Transportation Engineers, Washington, DC.

Notes

1. Including all changes adopted through October 1, 2006.
2. Including Revision 1, dated November 2004; and Revision 2, dated December 2007.