PE
civil engineering
construction
practice exam
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About NCEES
The National Council of Examiners for Engineering and Surveying (NCEES) is a nonprofit organization made up of engineering and surveying licensing boards from all U.S. states and territories. Since its founding in 1920, NCEES has been committed to advancing licensure for engineers and surveyors in order to protect the health, safety, and welfare of the American public.

NCEES helps its member licensing boards carry out their duties to regulate the professions of engineering and surveying. It develops best-practice models for state licensure laws and regulations and promotes uniformity among the states. It develops and administers the exams used for engineering and surveying licensure throughout the country. It also provides services to help licensed engineers and surveyors practice their professions in other U.S. states and territories.

Updates on exam content and procedures
Visit us at ncees.org/exams for updates on everything exam-related, including specifications, exam-day policies, scoring, and corrections to published exam preparation materials. This is also where you will register for the exam and find additional steps you should follow in your state to be approved for the exam.

Exam-day schedule
Be sure to arrive at the exam site on time. Late-arriving examinees will not be allowed into the exam room once the proctor has begun to read the exam script. The report time for the exam will be printed on your Exam Authorization. Normally, you will be given 1 hour between morning and afternoon sessions.

Admission to the exam site
To be admitted to the exam, you must bring two items: (1) your Exam Authorization and (2) a current, signed, government-issued identification.

Examinee Guide
The NCEES Examinee Guide is the official guide to policies and procedures for all NCEES exams. All examinees are required to read this document before starting the exam registration process. You can download it at ncees.org/exams. It is your responsibility to make sure that you have the current version.

NCEES exams are administered in either a computer-based format or a pencil-and-paper format. Each method of administration has specific rules. This guide describes the rules for each exam format. Refer to the appropriate section for your exam.

Scoring and reporting
NCEES typically releases exam results to its member licensing boards 8–10 weeks after the exam. Depending on your state, you will be notified of your exam result online through your MyNCEES account or via postal mail from your state licensing board. Detailed information on the scoring process can be found at ncees.org/exams.

Staying connected
To keep up to date with NCEES announcements, events, and activities, connect with us on your preferred social media network.
CIVIL AM PRACTICE EXAM
101. A 227-ft length of canal is to be lined with concrete for erosion control. With 12% allowance for waste and overexcavation, the volume (yd\(^3\)) of concrete that must be delivered is most nearly:

(A) 234  
(B) 280  
(C) 292  
(D) 327

102. Based on the straight-line method of depreciation, the book value at the end of the 8th year for a track loader having an initial cost of $75,000, and a salvage value of $10,000 at the end of its expected life of 10 years is most nearly:

(A) $10,000  
(B) $15,000  
(C) $23,000  
(D) $48,750

103. The budgeted labor amount for an excavation task is $4,000. The hourly labor cost is $50 per worker, and the workday is 8 hours. Two workers are assigned to excavate the material. The time (days) available for the workers to complete this task is most nearly:

(A) 3  
(B) 4  
(C) 5  
(D) 12.5
104. A CPM arrow diagram is shown below. Nine activities have been estimated with durations ranging from 5 to 35 days. The minimum time (days) required to finish the project is most nearly:

(A) 40  
(B) 42  
(C) 45  
(D) 50

105. A bridge is to be jacked up to replace its bearings. The design requires a hydraulic ram with a minimum capacity of 1,000 kN (kilonewtons). The hydraulic rams that are available are rated in tons (2,000 lb/ton). The minimum size (tons) ram to use is most nearly:

(A) 1,110  
(B) 250  
(C) 150  
(D) 100
501. A segment of interstate highway requires the construction of an embankment of 500,000 yd$^3$. The embankment fill is to be compacted to a minimum of 90% of Modified Proctor maximum dry density.

A source of suitable borrow has been located for construction of the embankment. Assume that there is no soil loss in transporting the soil from the borrow pit to the embankment.

The following data apply:

- Dry unit weight of soil in borrow pit: 113.0 pc当地
- Moisture content in borrow pit: 16.0%
- Specific gravity of the soil particles: 2.65
- Modified Proctor optimum moisture content: 13.0%
- Modified Proctor maximum dry density: 120.0 pc当地

Assuming each truck holds 5.0 yd$^3$ and the void ratio of the soil is 1.30 during transport, the minimum number of truckloads of soil from the borrow pit that are required to construct the embankment is most nearly:

(A) 100,000
(B) 150,000
(C) 200,000
(D) 250,000

502. The figure shows a survey grid for a borrow pit excavation. The number at each grid intersection is the depth of cut at that location. The total excavation volume (yd$^3$) is most nearly:

(A) 41
(B) 61
(C) 184
(D) 246
503. The curve shown in the figure has a radius \( R = 200 \text{ ft} \), and the mid-ordinate \( M = 12.8 \text{ ft} \). The length (ft) of the curve is most nearly:

(A) 143.9
(B) 140.8
(C) 75.2
(D) 71.9

504. Referring to the grade profile and mass diagram for a roadway construction project, which of the following is/are true?

I. The job is balanced (i.e., equal cut and fill).
II. Section B–D represents a fill operation.
III. Station D represents a transition point between cut and fill.

(A) I only
(B) II only
(C) III only
(D) II and III only

Horizontal length of side slope = \(14 \times \frac{3}{2} = 21.0\) ft

Slope length = \(\sqrt{(14)^2 + (21)^2} = 25.24\) ft

Cross-sectional area of lining = \(\left[(2 \times 25.24) + 9\right] \frac{7}{12} = 34.70\) ft\(^2\)

Volume of lining = \(\frac{(34.70 \times 227)}{27} = 291.7\) yd\(^3\)

Delivered volume = \(291.7\) yd\(^3\) \times 1.12 = 327 yd\(^3\) (waste)

**THE CORRECT ANSWER IS: (D)**


\[D = \frac{$75,000 - $10,000}{10} = $6,500\]

Book value after 8 years = \($75,000 - (8)($6,500) = $23,000\)

**THE CORRECT ANSWER IS: (C)**


Crew cost = \(2($50/hr) = $100/hr\)

Days allowed = \(\frac{$4,000}{(8\text{ hr/day})($100/hr)} = 5\text{ days}\)

**THE CORRECT ANSWER IS: (C)**


Activities: \(7 + 4 + 5\)

Days: \(30 + 10 + 10 = 50\text{ days}\)

**THE CORRECT ANSWER IS: (D)**

\[ 1,000 \text{ kN} = 1,000 \text{ kN} \times \frac{1 \text{ ton}}{8.896444 \text{ kN}} = 112.4 \text{ tons} \]

150 tons > 112.4 tons

**THE CORRECT ANSWER IS: (C)**


\[
\tan(x) = \frac{40}{30} \quad x = 53.13^\circ
\]

\[
\cos(53.13^\circ) \times 100 \text{ ft} = 60 \text{ ft}
\]

60 ft – 35 ft = 25 ft

**THE CORRECT ANSWER IS: (B)**


\[
w = (20 \text{ lb/ft}^2)(8 \text{ ft}) = 160 \text{ lb/vertical ft per brace location}
\]

\[
\sum M_x = 0
\]

\[
\sum M_y = (160 \text{ lb/ft})(16 \text{ ft})(16 \text{ ft/2}) - 10 \text{ ft} (R_x) = 0
\]

\[
R_x = 2,048 \text{ lb}
\]

Axial load in brace = \( \frac{(2,048)\sqrt{2}}{1} = 2,896 \text{ lb} \)

**THE CORRECT ANSWER IS: (C)**

Density of embankment fill, $\gamma_{\text{dry}} = (0.90)(120.0 \text{pcf}) = 108.0 \text{pcf}$

Total weight of dry soil required:

$$W_{\text{total}} = (500,000 \text{ yd}^3)(27 \text{ ft}^3/\text{yd}^3)(108.0 \text{pcf}) = 1.458 \times 10^9 \text{ lb}$$

Dry unit weight of soil in the truck:

$$\gamma_{\text{dry}} = G_s \gamma_w/(1 + e) = (2.65)(62.4 \text{pcf})/(1+1.30) = 71.9 \text{pcf}$$

Truck capacity:

$$W_{\text{truck}} = (5.0 \text{ yd}^3)(27 \text{ ft}^3/\text{yd}^3)(71.9 \text{pcf}) = 9,700 \text{ lb/truck}$$

Therefore, the minimum number of trucks required is:

$$N = W_{\text{total}}/W_{\text{truck}} = 1.458 \times 10^9 / 9,700 = 150,000 \text{ trucks}$$

**THE CORRECT ANSWER IS: (B)**


$$V = \left( \frac{1.0 + 0.5 + 1.5 + 1.5}{4} + \frac{0.5 + 0.0 + 1.0 + 1.5}{4} + \frac{1.5 + 1.5 + 2.0 + 2.0}{4} + \frac{1.5 + 1.0 + 1.5 + 2.0}{4} \right)$$

$$+ \left( \frac{1.0 + 0.0 + 0.3 + 1.5}{4} + \frac{2.0 + 2.0 + 2.5 + 3.0}{4} + \frac{2.0 + 1.5 + 1.5 + 2.5}{4} \right)$$

$$+ \left( \frac{1.5 + 0.3 + 0.7 + 1.5}{4} \right)(10 \times 15)$$

$$= \left( \frac{4.5 + 3.0 + 7.0 + 6.0 + 2.8 + 9.5 + 7.5 + 4.0}{4} \right)(10 \times 15)$$

$$= \frac{44.3}{4}(150)$$

$$= 1,661 \text{ ft}^3$$

$$= 61.5 \text{ yd}^3$$

**THE CORRECT ANSWER IS: (B)**
CONSTRUCTION PM SOLUTIONS


\[ M = R \left( 1 - \cos \frac{\Delta}{2} \right) \]

\[ 12.8 \text{ ft} = 200 \text{ ft} \left( 1 - \cos \frac{\Delta}{2} \right) \]

\[ \Delta = 41.22^\circ \]

\[ L = 2\pi R \frac{\Delta}{360^\circ} \]

\[ = 2\pi(200 \text{ ft}) \left( \frac{41.22^\circ}{360^\circ} \right) \]

\[ = 143.88 \text{ ft} \]

THE CORRECT ANSWER IS: (A)


B is the turning point where the job goes from excavation to a fill operation. D is the point where it goes back to excavation. Therefore, B–D is the fill operation (Statement II), and D is a transition point (Statement III). Statements II and III are true.

THE CORRECT ANSWER IS: (D)


Both shrink and swell can be estimated. Shrink is the relationship between the in-place (bank) and compacted states. Dry density in-place can be estimated from tests on rings. Compacted dry density can be estimated from ASTM D698. Swell can be estimated from gradation (soil type).

THE CORRECT ANSWER IS: (B)