

New Edition: Updated to 2015 Exam Design Standards

PE Civil Exam

Morning Session



E-book 120 solved problems for morning session

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2015 PE Exam Standard Specification

PE Civil Exam E-Book120-Mix Questions & Answers (pdf Format)
For Breath Exam (Morning Session)

Breadth Exam (morning session): These practice exams are contained 120 mixed questions and answers of five civil engineering areas. The five covered areas are construction, geotechnical, structural, transportation, and water resources & environment.

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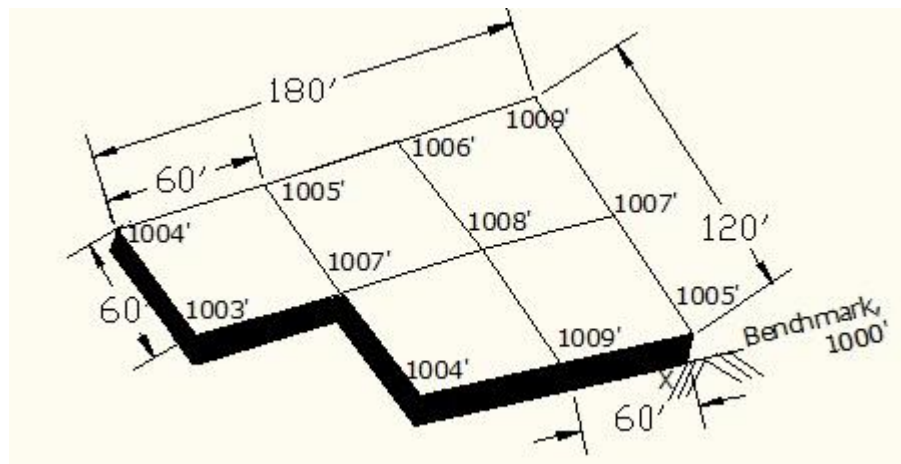
Total Number of Problems = 120

I. Project Planning: Number of Questions-12

- A. Quantity take-off methods
- B. Cost estimating
- C. Project schedules
- D. Activity identification and sequencing

1. PROBLEM (Quantity take-off methods)

A borrow pit contour elevation has been shown in the figure; it has to be cut. What is the average volume cut from the borrow pit?



- a. $V=8330 \text{ yd}^3$
- b. $V=5660 \text{ yd}^3$
- c. $V=7530 \text{ yd}^3$
- d. $V=4400 \text{ yd}^3$

1. SOLUTION:

$$\text{Volume, } V = \sum [h(i,j)n] \times [A/(4 \times 27)]$$

$h(i,j)$ = Height in ft above a datum surface at row i & column j

n = Number of corners, A = Area of grid in ft^2

Area of each grid, $A = 60 \times 60 = 3600 \text{ ft}^2$

$$V = [(\text{Height from BM} \times \text{No. of corners} + \dots)] \times [A/(4 \times 27)]$$

$$V = [(4 \times 1 + 5 \times 2 + 6 \times 2 + 9 \times 1 + 7 \times 2 + 5 \times 1 + 9 \times 2 + 8 \times 4 + 4 \times 1 + 7 \times 3 + 3 \times 1)] \times [(3600)/(4 \times 27)]$$

$$= 132 \times [(3600)/(4 \times 27)] = 4400 \text{ yd}^3$$

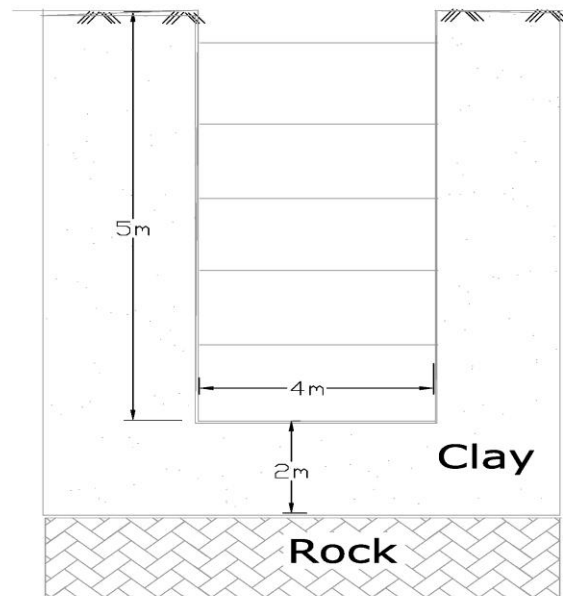
Total Volume of Borrow pit, $V = 4400 \text{ yd}^3$

The Correct Answer is: (d)

20. **PROBLEM** (Temporary structures and facilities)

Determine the Factor of Safety against heave a braced cut in clay soil shown in Figure. Where, Length of braced cut, $L=15\text{m}$, $\gamma=16\text{ kN/m}^3$, $N_c=5.14$, $\Phi_1'=0^\circ$ and $c=40\text{ kN/m}^2$.

- a 6.0
- b 4.0
- c 3.0
- d 5.0



20. **SOLUTION:**

$L=15\text{m}$, $B=4\text{m}$, $\gamma=16\text{ kN/m}^3$, $N_c=5.14$, $c=40\text{ kN/m}^2$ and $\Phi_1'=0^\circ$

$B/\sqrt{2}=4/\sqrt{2}=2.828 > T=2\text{m}$

Or, $T=2\text{m} < B/\sqrt{2}=2.828$

Hence, $B'=T=2\text{m}$ and $B''=\sqrt{2}B'=2.828$ and surcharge, $q=0.0$

$F.S.=[N_c c\{(1+0.2B''/L)\}+cH/B']/(\gamma H+q)$,

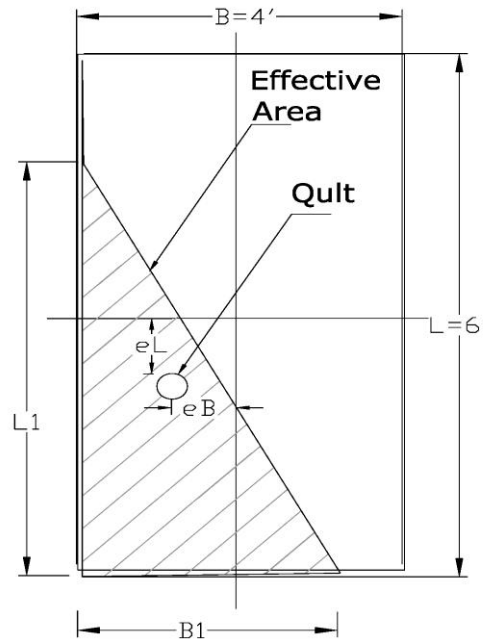
$F.S.=[5.14 \times 40\{(1+0.2 \times 2.83/15)\}+40 \times 5/2]/(16 \times 5+0.0)$

$F.S.=3.917$

The Correct Answer is: (b)

33. PROBLEM (Bearing Capacity)

Determine the ultimate load of a rectangular footing 6' x 4' with eccentric as shown in the Figure. Where, the Soil Unit Weight, $\gamma = 118 \text{ lb/ft}^3$, Ultimate Bearing Capacity, $q'_u = 3000 \text{ lb/ft}^2$, $e_B = 1.5'$ and $e_L = 1.75'$.



- a 12.0 Kip
- b 48.0 Kip
- c 17.0 Kip
- d 31.0 Kip

33. SOLUTION:

Where, $e_L/L = 1.75/6 = 0.292 > 1/6$, and $e_B/B = 1.5/4 = 0.375 > 1/6$;

Therefore,

$$B_1 = B(1.5 - 3e_B/B) = 4[(1.5 - (3 \times 1.5/4))] = 1.5 \text{ ft}$$

$$L_1 = L(1.5 - 3e_L/L) = 6[(1.5 - (3 \times 1.75/6))] = 3.750 \text{ ft}$$

$$\text{Effective Area, } A' = 1/2(L_1 B_1) = 1/2(1.5 \times 3.750) = 5.62 \text{ ft}^2$$

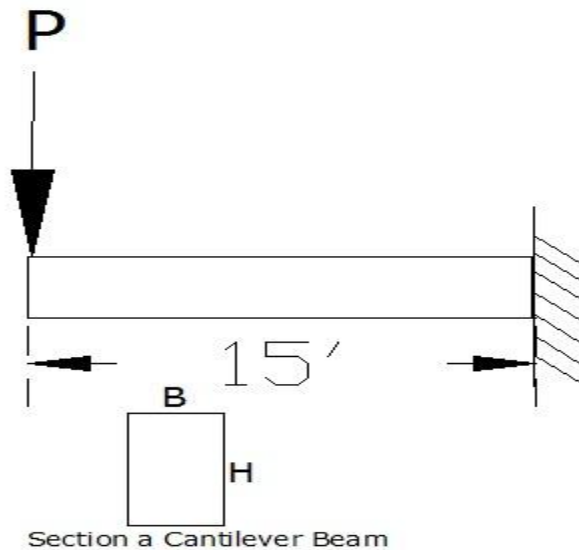
$$q'_u = 3000 \text{ lb/ft}^2$$

$$\therefore Q_{ult} = A' \times q'_u = 5.62 \times 3000 = 16848 = 16.85 \text{ Kip}$$

Correct Solution is (c)

49. PROBLEM (Deflection)

Determined the deflection of the referring rectangular beam. A 20 Kips point load "P" is acted at its free end. Where, concrete strength 3000 psi, cross-section of beam 10" x 16".



- a. -1.60 in
- b. -2.50 in
- c. -3.64 in
- d. -5.2 in

49. SOLUTION:

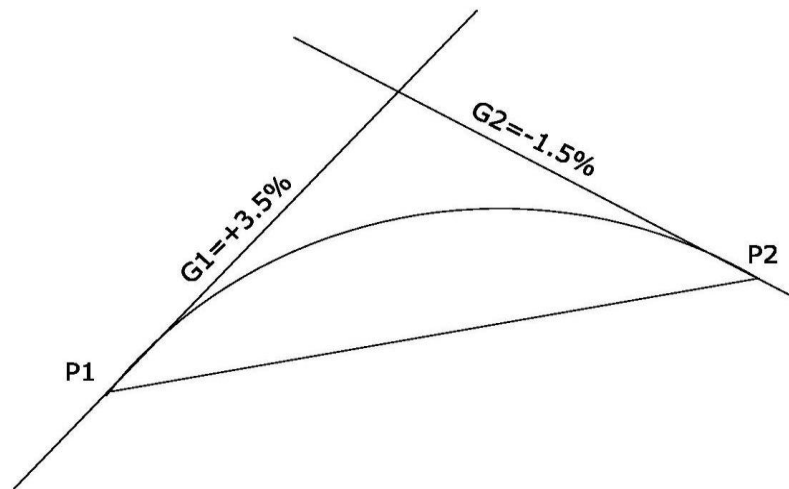
Where, $P=20$ Kip, $L=15$ ft, $B=10$ ", $H=16$ " and
 $E=57000\sqrt{f_c'}=57000\sqrt{3000}=3122018$ psi/1000=3122 Ksi
 Moment of inertia, $I=BH^3/12=10 \times 16^3/12=3413$ in⁴
 Deflection at the tip, $\delta_{max}=-PL^3/3EI$
 $\delta_{max}=-20 \times (15 \times 12)^3/[3(3122 \times 3413)]=-3.64$ in

The sign is negative, because the deflection is downward.

The Correct Answer is: (c)

83. PROBLEM (Basic vertical curve elements)

A vertical curve has required for ascending 3.5% and descending -1.5% grade, the design speed is 55 mph & the stopping sight distance is $S=495$ ft. Calculate the length of the vertical curve required for stopping sight distance.



- a. 558.00 ft
- b. 458.00 ft
- c. 528.00ft
- d. 568.00 ft

83. SOLUTION:

$$A = G_2 - G_1 = -1.5\% - (+3.5\%) = -5\% = 5\%$$

Assume $S > L$, $S = 495$ ft

$$L = 2S - 2158/A = 2 \times 495 - 2158/5 = 558.4 \text{ ft}$$

And

$L > S$,

$$L = AS^2/2158 = 5 \times 495^2/2158 = 567.71 \text{ ft is the correct length.}$$

The Correct Answer is: (d)

120. PROBLEM (Safety)

According to **OSHA**, which of the following should be considered for the maximum deflection of a platform when loaded?

- a. The platform may not deflect more than $1/60$ of the span.
- b. The platform may not deflect more than $1/50$ of the span.
- c. The platform may not deflect more than $1/40$ of the span.
- d. The platform may not deflect more than $1/30$ of the span.

120. SOLUTION:

The platform may not deflect more than $1/60$ of the span.

The Correct Answer is: (a)