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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 contain 120 mixed questions and answers of five civil engineering areas. The five covered areas are construction, geotechnical, structural, transportation, and water resources & environment.

Total Number of Problems =120

I. Project Planning: Number of Questions-12

A. Quantity take-off methods

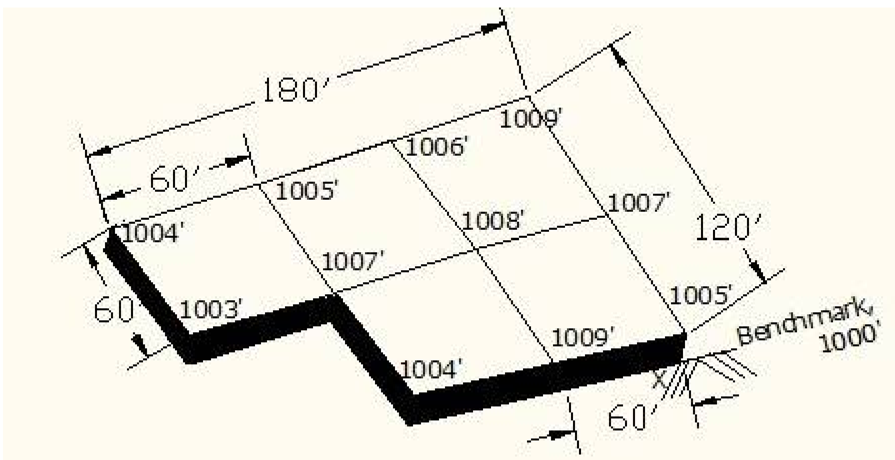
B. Cost estimating

C. Project schedules

D. Activity identification and sequencing

1. PROBLEM (Quantity take-off methods**)**

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



a. $V = 8330$ yd³

b. $V = 5660$ yd³

c. $V = 7530$ yd³

d. $V = 4400$ yd³

1. SOLUTION:

Volume, $V=\Sigma[h(i,j)n]x[A/(4x27)]$

$h(i,j)$= 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=60x60=3600 ft^2

V=[(Height from BMxNo. of corners+.....)] x [(A/(4x27)]

V=[(4x1+5x2+6x2+9x1+7x2+5x1+9x2+8x4+4x1+7x3+3x1)] x [(3600/(4x27)]

=132x [(3600/(4x27)]=4400 yd^3

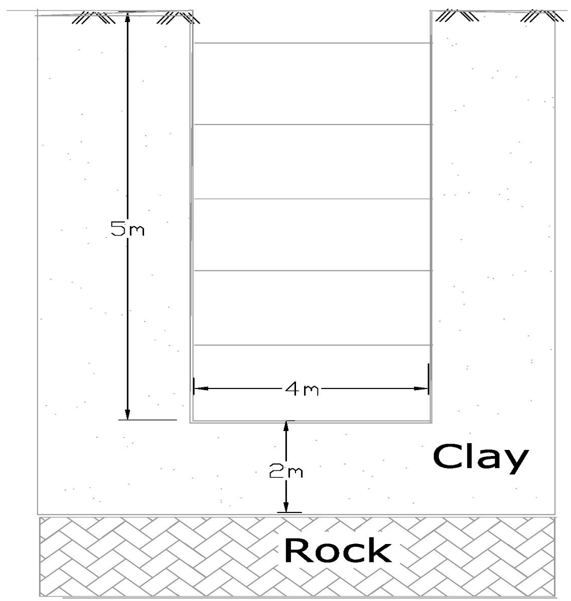
Total Volume of Borrow pit, V=4400 yd^3

The Correct Answer is: (d)

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

Determine the Factor of Safety for a braced cut in clay soil shown in Figure. Where, Length of braced cut, L=15m, Clay soil, $\gamma = 16\ kN/m^3$, Nc=5.14, $\Phi_1' = 0^o$ and $c=40\ kN/m^2$.

a 6.0
b 4.0
c 3.0
d 5.0



20. **SOLUTION:**

L=15m, B=4m, $\gamma = 16\ kN/m^3$, Nc=5.14, $c=40\ kN/m^2$ and $\Phi_1' = 0^o$

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

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

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

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

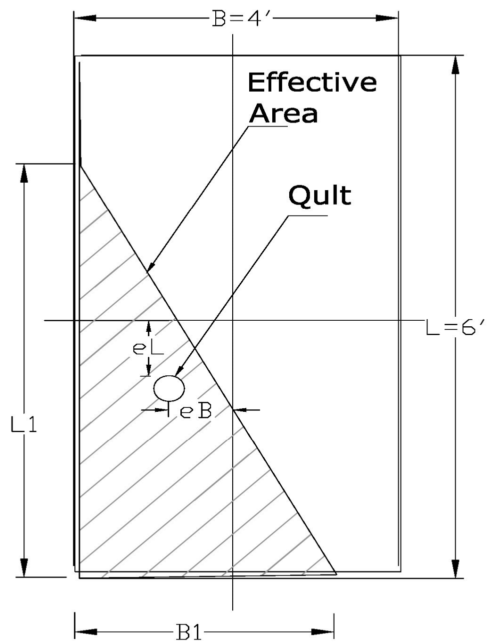
$F.S = [5.14 \times 40\{(1+0.2 \times 2.83/15)\} + 40 \times 5/2] / (16 \times 5 + 0.0)$

$F.S = 3.917$

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, $\gamma = 118\ lb/ft^3$, Ultimate Bearing Capacity, $q'_u = 3000\ lb/ft^2$, eB=1.5' and eL=1.75'.



a 12.5 Kip

b 48.5 Kip

c 8.5 Kip

d 31.0 Kip

33. SOLUTION:

Where, eL/L=1.75/6= 0.292> 1/6, and eB/B=1.5/4= 0.375>1/6;
Therefore,

B1=B(1.5-3eB/B)= 4[(1.5-(3 x 1.5/4)]= 1.5 ft

L1=L(1.5-3eL/L)= 6[(1.5-(3 x 1.75/6)]= 3.750 ft

Effective Area, A'=1/2(L1B1)=1/2 (1.5 x 3.750)= 2.81 ft^2

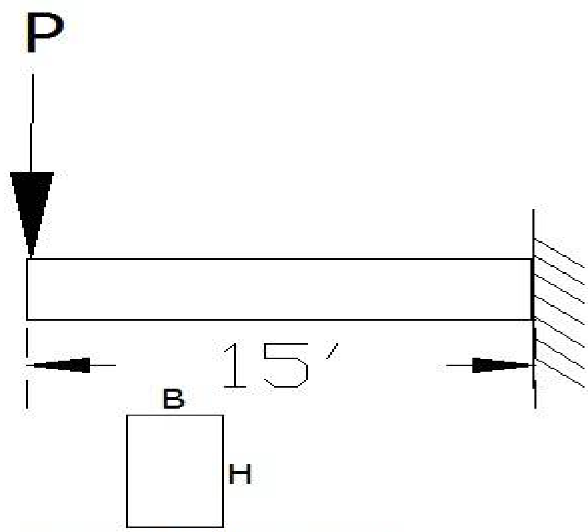
$q'_u = 3000\ lb/ft^2$

$\therefore\ Q_{ult} = A' \times q'_u = 2.81 \times 3000 = 8430 = 8.43$ Kip

Correct Solution is (c)

49. PROBLEM (Deflection**)**

Determine the deflection of the rectangular beam shown in the figure. A 20 Kips point load "P" is applied at its free end. Consider, concrete strength 3000 psi, cross-section of beam 10" x 16".



Section a Cantilever Beam

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

49. SOLUTION:

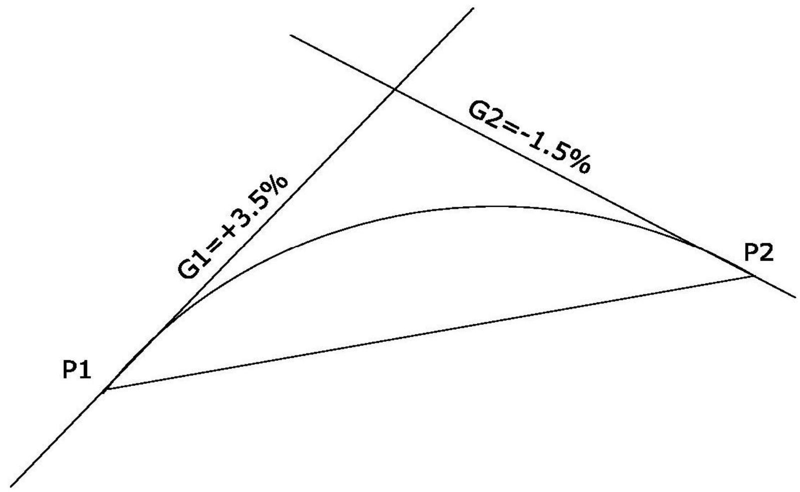
Where, P=20 Kip, L=15 ft, B=10", H=16" and
$E=57000\sqrt{fc'}=57000\sqrt{3000}=3122018$ psi/1000=3122 Ksi
Moment of inertia, $I=BH^3/12= 10x16^3/12=3413$ in^4
Deflection at the tip, $\partial max=-PL^3/3EI$
$\partial max =-20x(15x12)^3/[3(3122x3413)]=-3.64$ in

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=G2-G1= -1. 5% –(+3.5%)= -5%=5%
Assume S>L, S=495 ft
L=2S-2158/A=2 x 495-2158/ 5= 558.4 ft
And
L>S,
$L=AS^2/2158=5 \times 495^2/2158=$ 567.71 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)