New Edition: Updated to 2018 Exam Design Standards

GEOTECHNICAL

E-Book 80 solved problems for Depth Exam (Evening Session)

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Presented by PE Civil Exam

PE Civil Exam 80– Geotechnical Questions & Answers (pdf Format)
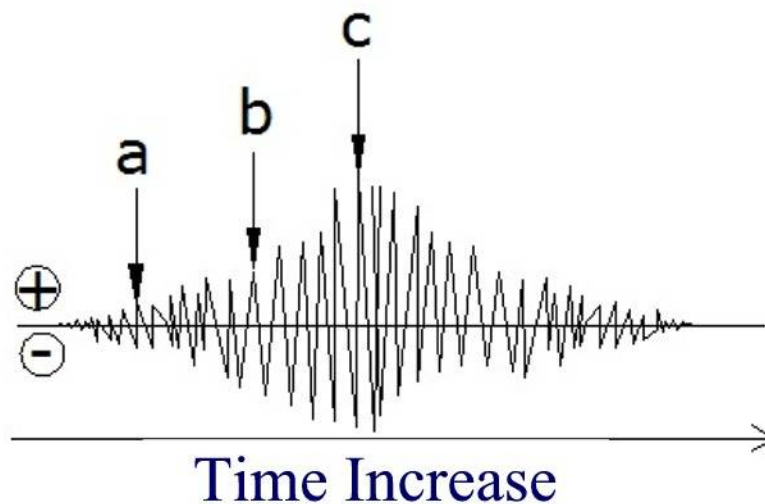For Depth Exam (Evening Session)

PE Civil Depth Exam (Evening Session): This practice exam contains 80-Geotechnical questions, and answers each set from all Geotechnical & Soil Foundation Engineering:

4.   **PROBLEM** (Geophysics)

In the following diagram, which waves arrive at the interval labeled at c?

a. S-wave
b. P-wave
c. Rayleigh wave
d. surface wave

4.   SOLUTION:

At **a** P-waves arrival, this type of seismic wave that compresses, and expands the ground.
At **b** S-waves arrival, this type of seismic wave that moves the ground up to down, and side to side.
At **c** waves arrive, this type of seismic wave come to surface that forms when P-waves, and S-waves reach Earth's surface.

The Correct Answer is: (d)

58. PROBLEM (Cofferdams)

A square cofferdam is 50 ft on each side, and it has placed in the lake to permit dry construction of a bridge pier. The coffer dam consists of two square sheets pile enclosure. The inner enclosure separated on all sides from the outer one by 6 ft. The bottom of the lake is practically impermeable. The space between sheet pile has filled with soil that showed a permeability of 0.035 ft/day in a laboratory test. Assuming the sheet pile was not water tight, and the lake surface was 20 ft above the lake bottom. How much water per day is to be pumped from the excavation to keep the cofferdam dry?
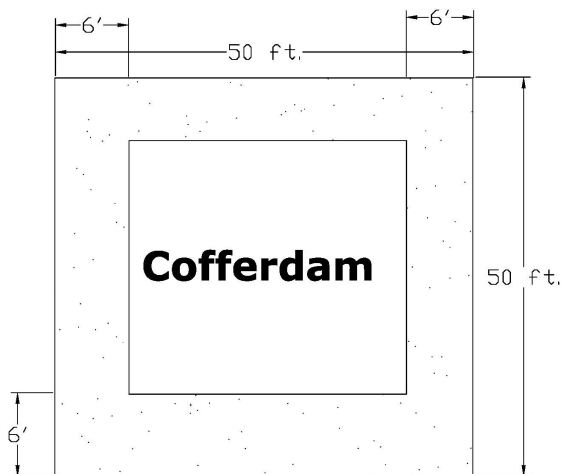
a   Q =1645.00 gal/day
b   Q =2653.00 gal/day
c   Q =678.00 gal/day
d.   Q =177.00 gal/day

58.   SOLUTION:

Coefficient of permeability,   k = 0.035 ft /day
Seepage Surface area,

$$A=(50-12) \times 4 \times 20 = 3040 \text{ ft}^2$$
$$H = 20 \text{ ft}$$
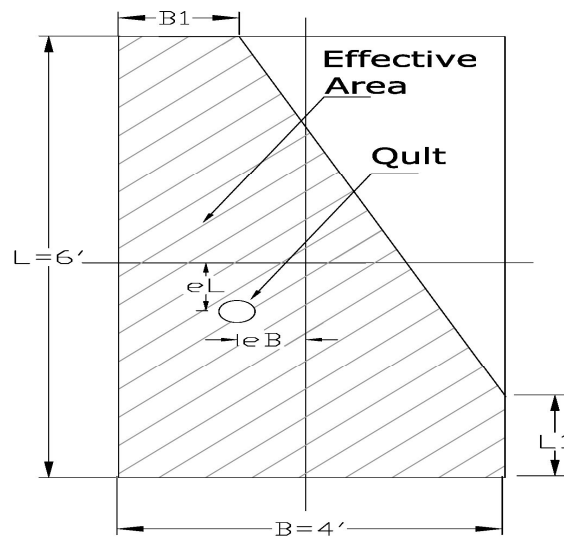$$L = 6 \text{ft}$$
$$i = H/L = 20/6 = 3.33$$
$$Q = VA = KiA = .035 \times 3.33 \times 3040 = 354.66 \text{ ft}^3/\text{day}$$
$$Q = 354.66 \times 7.48 = 2652.90 \text{ gal/day} \quad (1 \text{ ft}^3 = 7.48 \text{ gal})$$

The Correct Answer is: (b)

64.   PROBLEM (Bearing Capacity)

Determine the ultimate load of a rectangular footing 6'x 4' with eccentric shown in Figure where, Soil Unit Weight, γ= 118 lb/ft³, Ultimate Bearing Capacity, q'_u=2000 lb/ft², eB=.5', eL=.75', L1=1.0', and B1=0.68'.

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a 15.0 Kip
b 48.0 Kip
c 28.0 Kip
d 31.0 Kip

63.   SOLUTION:

Where, eL/L=.75/6= 0.125< 1/6, eB/B=.5/4= 0.125<1/6;
Therefore,
A'=L1B+1/2{(B+B1)(L−L1)}=1 x 4+1/2{(4+.68)(6−1)}= 15.700 ft²
q'_u=2000 lb/ft²
Q_{ult}= A'x q'_u= 15.7 x 2000=31400.00 =31.4 Kip

The Correct Answer is: (d)

X. Deep Foundations (ASD or LRFD) : Number of Questions **10**

A. Single-element axial capacity (e.g., driven pile, drilled shaft, micropile, helical screw piles, auger cast piles)

B. Lateral load, and deformation analysis

C. Single-element settlement

D. Down drag

E. Group effects (e.g., axial capacity, settlement, lateral deflection)

F. Installation methods/hammer selection

G. Pile dynamics (e.g., wave equation, high-strain dynamic testing, signal matching)

H. Pile, and drilled-shaft load testing

I. Integrity testing methods (e.g., low-strain impact integrity testing, ultrasonic cross-hole testing, coring, thermal integrity testing)

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71.   PROBLEM (Single-element axial capacity)

A 16 in diameter concrete pile is driven 40 ft into soft clay. Where, C=900 psf., and friction coefficient, α=0.80. Determine the Ultimate pile capacity.

   a 132.00 Kip
   b 107.00 Kip
   c 190.00 Kip
   d 120.00 Kip

71.   SOLUTION:
    C=900 psf., D=16", L=40 ft, α=0.80, A_{tip} =π/4(16/12)^2=1.40 ft^2
    Q_{ult}= Q_{tip} + $Q_{friction}$
    Q_{tip} =9CA_{tip}=9 x 900 x 1.40=11304.00 # =11.30 Kip
    $Q_{friction}$ = αC$A_{surface}$=0.80 x 900 x (πDL)
    $Q_{friction}$ =0.80 x 900 x (3.14 x 16/12 x 40)= 120576.00# =120.58 Kip
    Q_{ult}= Q_{tip} + $Q_{friction}$ =11.30+120.58=131.88 Kip
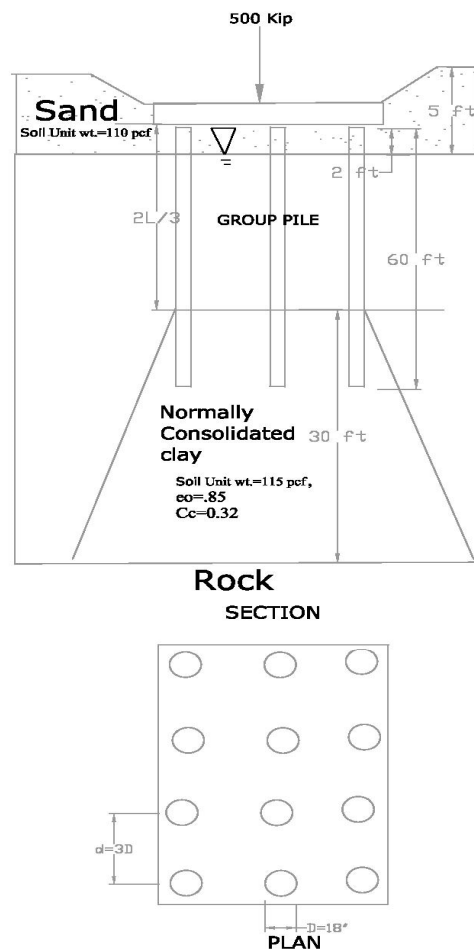
   The Correct Answer is: (a)

80.   PROBLEM (Pile Group Settlement)

Determine the consolidation settlement in the clay layer of the pile group. Each pile has an 18-inch diameter, and 60 ft long as shown in the Figure.

a   0.40 ft
b   0.60 ft
c   0.90 ft
d   1.10 ft

80. SOLUTION:

Where, Qg=500Kip, n1=4, n2=3, d=3D, D=18"=1.5', Cc=0.32, e0=.85

d=3 x 1.5=4.5 ft

Lg=(n1-1)d+2(D/2)=(4-1)4.5+2(1.5/2)=15

Bg=(n2-1)d+2(D/2)=(3-1)4.5+2(1.5/2)=10.5

H1=30

Z=H1/2=30/2=15 ft

$\Delta\delta'$=Qg/(Lg+z)(Bg+z)=500/(15+15)(10.5+15)=0.65 Kip/ft^2

∴ δ'=5 x110+(40-2+30/2)(115-62.4)

=550+(38+15)x52.5=3332.5 lb/ ft^2=3.33 Kip/ft^2

ΔS={CcH1/(1+e0)}log[(δ'+$\Delta\delta'$)/ δ']

∴ Settlement,

ΔS={0.32 x 30/(1+.85)}log[(3.33+0.65)/3.33]=5.19 x 0.08=0.40 ft

The Correct Answer is: (a)