NCEES

NCEES-PE-Civil-Structural

NCEES - PE Civil Engineering: Structural

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Question: 1

In a design scenario, an engineer is creating a combined footing for two columns spaced 15 feet apart, with loads of 100 kips and 150 kips, respectively. If the footing extends 3 feet on both sides, what is the total width of the combined footing?

A. 10 feet
B. 12 feet
C. 15 feet
D. 18 feet

Answer: D

Explanation:
The total width of the combined footing is the distance between the columns plus the extensions on both sides. Therefore, total width = 15 ft + 3 ft + 3 ft = 18 ft.

Question: 2

In a deep foundation design, a structural engineer is specifying drilled shafts. If the shafts have a diameter of 2 feet and the design load on each shaft is 120 kips, what is the minimum embedment depth required if the ultimate bearing capacity of the soil is 25 ksf?

A. 5 feet
B. 6 feet
C. 7 feet
D. 8 feet

Answer: A

Explanation:
q
EXPLANATION[$$ The required area of each shaft is A = P =
2
image
image
120 kips = 4: 8 ft2. The area of a shaft is A = π (2)
= π ft2 ≈
25 ksf 2
3:14 ft2. Therefore, the minimum embedment depth is
image
π ft2

4:8 ft2 ≈ 1: 53 ft.

Question: 3

In a deep foundation design, a structural engineer is considering drilled shafts to support a bridge. If the shafts are 4 feet in diameter and the design load on each shaft is 300 kips, what is the minimum required length of the shaft if the ultimate bearing capacity of the soil is 20 ksf?

A. 10 feet
B. 12 feet
C. 15 feet
D. 18 feet

Answer: B

Explanation:
q
EXPLANATION[$$ The required area of each shaft is A = P =
2
image
image
300 kips = 15 ft2. The area of a shaft is A = π (4)
= 12.57 ft2.
20 ksf
2
15 ft2
image
Therefore, the minimum length required is 12.57 ft2
≈ 1: 19 ft.

Question: 4

A structural engineer is tasked with designing a shallow footing to support a column with a load of 250 kips. The soil has a bearing capacity of 5 ksf.
What is the minimum required area for the footing to ensure safety against bearing failure?

A. 30 ft²
B. 40 ft²
C. 50 ft²
D. 60 ft²

Answer: B

Explanation:
q

EXPLANATION[$$ The required area A is calculated using A = P , where P is the load and q is the bearing capacity. Thus, A =
5 ksf
250kips = 50 ft2.

Question: 5

In a retaining wall design, an engineer needs to calculate the factor of safety against sliding. If the wall has a weight of 70 kips, the horizontal earth pressure is 25 kips, and the friction coefficient between the base and the soil is 0.4, what is the factor of safety against sliding?

A. 1.5
B. 2.0
C. 2.5
D. 3.0

Answer: B

Explanation:
The factor of safety FS is calculated using FS =
image
P
W , where W is the weight of the wall and P = H · μ. Thus,
FS = = 7: 0.
70 kips 25 kips·0.4

Question: 6

A structural engineer is designing a slab-on-grade foundation for a retail store. If the store is expected to impose a load of 150 kips per column and the slab is to be 6 inches thick, what is the required thickness of the slab if the soil has a bearing capacity of 4 ksf?

A. 4 inches
B. 6 inches
C. 8 inches
D. 10 inches

Answer: B

Explanation:
The load per column divided by the bearing
150kips 2
capacity gives the required area. Therefore, 4 ksf
= 37.5 ft .
The thickness of the slab is designed to be 6 inches, which is acceptable.

Question: 7

A structural engineer is designing a mat foundation for a building with an estimated total load of 800 kips. If the mat is to be 12 inches thick and the soil has a bearing capacity of 8 ksf, what is the minimum area required for the mat foundation?

A. 100 ft²
B. 120 ft²
C. 160 ft²
D. 200 ft²

Answer: C

Explanation:
q
EXPLANATION[$$ The required area A can be calculated as A = P .
8 ksf
Thus, A = 800kips
= 100 ft2.

Question: 8

A retaining wall is designed to retain soil with a height of 10 feet. If the wall has a base width of 4 feet and the soil has a unit weight of 120 pcf, what is the total lateral earth pressure acting on the wall at the base due to the retained soil?

A. 1,200 lbs
B. 1,440 lbs
C. 1,600 lbs
D. 1,800 lbs

Answer: B

Explanation:
The lateral earth pressure P at the base of the
1 2 1
wall can be calculated using P = 2 γh
120 pcf × (10 ft)2 = 6000 lbs.
. Thus, P = 2 ×

Question: 9

In a deep foundation project, a structural engineer is designing a pile foundation for a building. If each pile is to carry a load of 90 kips and the allowable axial capacity of each pile is 15 kips, how many piles are necessary to support the load?

A. 5
B. 6
C. 7
D. 8

Answer: D

Explanation:
The number of piles required is calculated as
90 kips
Number of piles = 15 kips/pile
= 6 piles.
However, to ensure
safety, it is prudent to use 8 piles.

Question: 10

A structural engineer is analyzing a pier designed to resist lateral loads. If the pier has a diameter of 3 feet and the lateral load acting on it is 40 kips, what is the maximum bending moment in the pier assuming it behaves as a fixed-end beam with a length of 12 feet?

A. 160 ft-kips
B. 180 ft-kips
C. 200 ft-kips
D. 240 ft-kips

Answer: C

Explanation:
The bending moment M at the fixed end of a beam subjected to a lateral load P is given by $M = P \times L$.
Thus, $M = 40 \text{ kips} \times 12 \text{ ft} = 480 \text{ ft-kips}$.

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