Assignment 7

Q1

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# Program to Determine the bearing capacity of soil with water table
# Input values
BulkDensity = float(input("Enter the value of Bulk Density of soil (kN/m^3): "))
SatDensity = float(input("Enter the value of Saturated Density of soil (kN/m^3): "))
WaterDensity = float(input("Enter the unit Weight of Water (kN/m^3): "))
Df = float(input("Enter the value of depth of footing Df (m): "))
Dw = float(input("Enter the value of water table above footing level Dw (m): "))
# Handle potential empty input for Dw1
while True:
dw1_input = input("Enter the value of Water table below the level of footing Dw1 (m): ")
try:
Dw1 = float(dw1_input)
break # Exit the loop if conversion is successful
except ValueError:
print("Invalid input. Please enter a valid number for Dw1.")
B = float(input("Enter the value of width of footing B (m): "))
Nq = float(input("Enter the value of Nq: "))
N = float(input("Enter the value of N (bearing capacity factor): "))
# Submerged density
SubDensity = SatDensity - WaterDensity
print("Submerged Weight of soil is:", SubDensity)
# ---------------- CASE A ----------------
print("\nCASE A: Water table at ground surface")
qu = (SubDensity * Df * Nq) + (0.5 * B * SubDensity * N)
print("The value of ultimate bearing capacity of soil is:", qu)
Rw = 0.5 + 0.5 * (Dw / B)
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print("The value of Rw is:", Rw)
Rw1 = 0.5 + 0.5 * (Dw1 / B)
print("The value of Rw1 is:", Rw1)
qu = (BulkDensity * Df * Nq * Rw) + (0.5 * B * BulkDensity * N * Rw1)
print("The approximate value of ultimate bearing capacity is:", qu)
# ---------------- CASE B ----------------
print("\nCASE B: Water table at base of footing")
qu = (BulkDensity * Df * Nq) + (0.5 * B * SubDensity * N)
print("The value of ultimate bearing capacity is:", qu)
Rw = 0.5 + 0.5 * (Dw / B)
print("The value of Rw is:", Rw)
Rw1 = 0.5 + 0.5 * (Dw1 / B)
print("The value of Rw1 is:", Rw1)
qu = (BulkDensity * Df * Nq * Rw) + (0.5 * B * BulkDensity * N * Rw1)
print("The approximate value of ultimate bearing capacity is:", qu)
# ---------------- CASE C ----------------
print("\nCASE C: Water table below base of footing")
while True:
x_input = input("Enter the value of depth of water below footing (x in m): ")
try:
x = float(x_input)
break
except ValueError:
print("Invalid input. Please enter a valid number for x.")
qu = (BulkDensity * Df * Nq) + (0.5 * B * ((BulkDensity * x) + (SubDensity * (B - x))) * N)
print("The value of ultimate bearing capacity is:", qu)
Rw = 0.5 + 0.5 * (Dw / B)
print("The value of Rw is:", Rw)
Rw1 = 0.5 + 0.5 * (Dw1 / B)
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print("The value of Rw1 is:", Rw1)
qu = (BulkDensity * Df * Nq * Rw) + (0.5 * B * BulkDensity * N * Rw1)
print("The approximate value of ultimate bearing capacity is:", qu)
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output-

Enter the value of Bulk Density of soil (kN/m^3): 18

Enter the value of Saturated Density of soil (kN/m^3): 20

Enter the unit Weight of Water (kN/m^3): 10

Enter the value of depth of footing Df (m): 2

Enter the value of water table above footing level Dw (m): 0

Enter the value of Water table below the level of footing Dw1 (m): 0

Enter the value of width of footing B (m): 3

Enter the value of Nq: 33

Enter the value of N (bearing capacity factor): 34

Submerged Weight of soil is: 10.0

CASE A: Water table at ground surface

The value of ultimate bearing capacity of soil is: 1170.0

The value of Rw is: 0.5

The value of Rw1 is: 0.5

The approximate value of ultimate bearing capacity is: 1053.0

CASE B: Water table at base of footing

The value of ultimate bearing capacity is: 1698.0

The value of Rw is: 0.5

The value of Rw1 is: 0.5

The approximate value of ultimate bearing capacity is: 1053.0

CASE C: Water table below base of footing

Enter the value of depth of water below footing (x in m): 1

The value of ultimate bearing capacity is: 3126.0

The value of Rw is: 0.5

The value of Rw1 is: 0.5

The approximate value of ultimate bearing capacity is: 1053.0

Q2

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# To find the ultimate load carrying capacity of pile
UCS = float(input("Enter the value of UCS of soil:"))
Cu = UCS / 2
B = float(input("Enter the value of dimension of pile:"))
L = float(input("Enter the length of pile:"))
Alpha = float(input("Enter the value of adhesion factor:"))
Nc = float(input("The value of Nc: "))
Ab = B * B
print("The Base area of footing is:", Ab)
As = 4 * B * L
print("The value of cohesion of soil is:", Cu)
Qpu = Cu * Nc * Ab
print("Qpu:", Qpu)
Qf = Alpha * Cu * As
print("Qf:", Qf)
Qu = Qpu + Qf
print("The value of load carrying capacity of pile is (Qu):", Qu)
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output-

Enter the value of UCS of soil:75

Enter the value of dimension of pile:0.45

Enter the length of pile:15

Enter the value of adhesion factor:0.8

The value of Nc: 9

The Base area of footing is: 0.2025

The value of cohesion of soil is: 37.5

Qpu: 68.34375

Qf: 810.0

The value of load carrying capacity of pile is (Qu): 878.34375

Q3

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# Program 3: To Determine the bearing capacity of soil with water table (multiple cases)
BulkDensity = float(input("Enter the value of Bulk Density of soil:"))
SatDensity = float(input("Enter the value of Saturated Density of soil:"))
WaterDensity = float(input("Enter the unit Weight of Water:"))
Df = float(input("Enter the value of depth of footing:"))
B = float(input("Enter the value of width of footing:"))
Nq = float(input("Enter the value of Nq:"))
N_Gamma = float(input("Enter the value of N gamma (N):"))
SubDensity = SatDensity - WaterDensity
print("Submerged Weight of soil is:", SubDensity)
M = int(input("Number of data values of Water table above footing level: "))
N = int(input("Number of data values of Water table below footing level: "))
Dw = []
Dw1 = []
for i in range(1, M+1):
Depth_Dw = float(input("Enter the value of water table above footing level measured w.r.t. ground (Dw): "))
Dw.append(Depth_Dw)
Rw = 0.5 + 0.5 * (Depth_Dw / B)
print("The value of Rw is:", Rw)
for j in range(1, N+1):
Depth_Dw1 = float(input("Enter the value of water table below footing level measured w.r.t. ground (Dw1): "))
Dw1.append(Depth_Dw1)
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Rw1 = 0.5 + 0.5 * (Depth_Dw1 / B)

print("The value of Rw1 is:", Rw1)

qu = (BulkDensity * Df * Nq * Rw) + (0.5 * 0.8 * B * BulkDensity * N_Gamma * Rw1)

print("qu: ", qu, "kN/m^2")
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output-

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Enter the value of Bulk Density of soil:18
Enter the value of Saturated Density of soil:20
Enter the unit Weight of Water:10
Enter the value of depth of footing:2
Enter the value of width of footing:3
Enter the value of Nq:33
Enter the value of N gamma (N):34
Submerged Weight of soil is: 10.0
Number of data values of Water table above footing level: 3
Number of data values of Water table below footing level: 3
Enter the value of water table above footing level measured w.r.t. ground (Dw): 0
The value of Rw is: 0.5
Enter the value of water table above footing level measured w.r.t. ground (Dw): 1
The value of Rw is: 0.6666666666666666
Enter the value of water table above footing level measured w.r.t. ground (Dw): 2
The value of Rw is: 0.8333333333333333
Enter the value of water table below footing level measured w.r.t. ground (Dw1): 0
The value of Rw1 is: 0.5
Enter the value of water table below footing level measured w.r.t. ground (Dw1): 0
The value of Rw1 is: 0.5
Enter the value of water table below footing level measured w.r.t. ground (Dw1): 1
The value of Rw1 is: 0.6666666666666666
qu:  1479.6 kN/m^2
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