User Manual

CIVILAB 2023

BEARING CAPACITY

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How to use CiviLab to calculate the bearing capacity from results of laboratory tests?

I- NF P 94 261 (Eurocode 7)

I-1- Test Data:

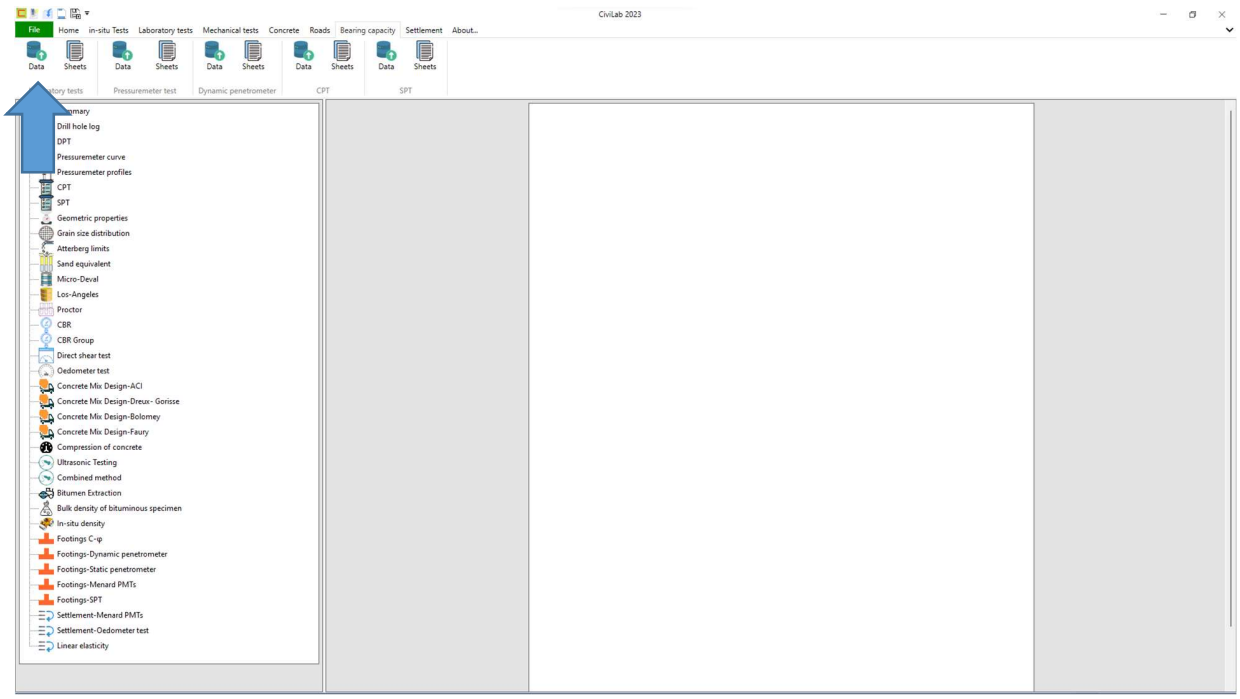
Click on the "Data" button in the “Laboratory Tests” panel, then input:

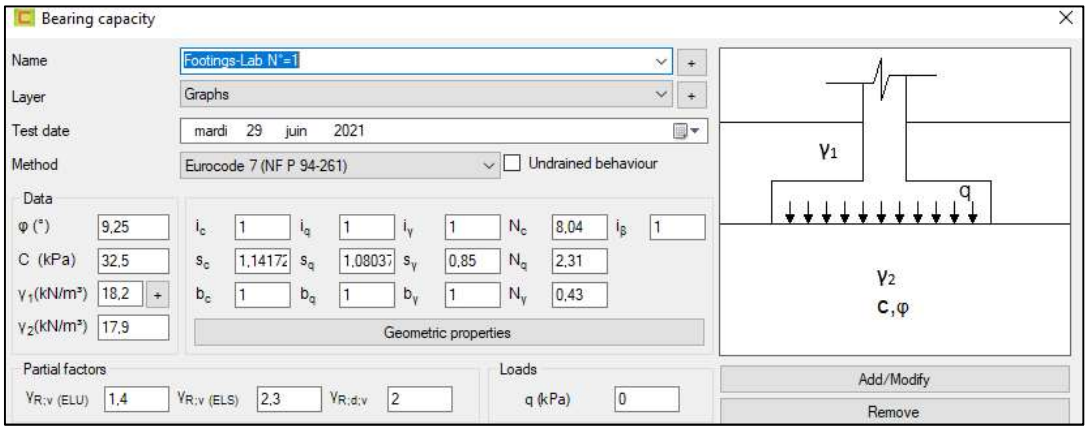
- The test name;
- Select the test date;
- Select the layer;
- The standard (NF P 94 261)
- For undrained conditions, check the corresponding box
- c' et ϕ' or c_u
- The density of the soil above and below the base of the footing (γ1, γ2)
- Load value q
- The value of the partial factor allowing the calculation of the lift at ULS ($\gamma_{R;\, v(ULS)}$) (PS: the value proposed by CiviLab is that recommended by standard NF P 94 261).
- The value of the partial factor allowing the calculation of the lift at SLS ($\gamma_{R;\, v\,(SLS)}$) (PS: the value proposed by CiviLab is that recommended by standard NF P 94 261)
- The model coefficient associated with the calculation method used ($\gamma_{R;\, d;\, v}$) (PS: the value proposed by CiviLab is that recommended by standard NF P 94 261)
- Click on the "Geometric properties" button then:
  - Select the footing type
  - Enter the data of the geometric shape of the footing (B, L, D)
  - Enter the depth of the water table (if the water table is unknown enter the value 9999)
  - If the base of the footing is inclined, enter the angle value

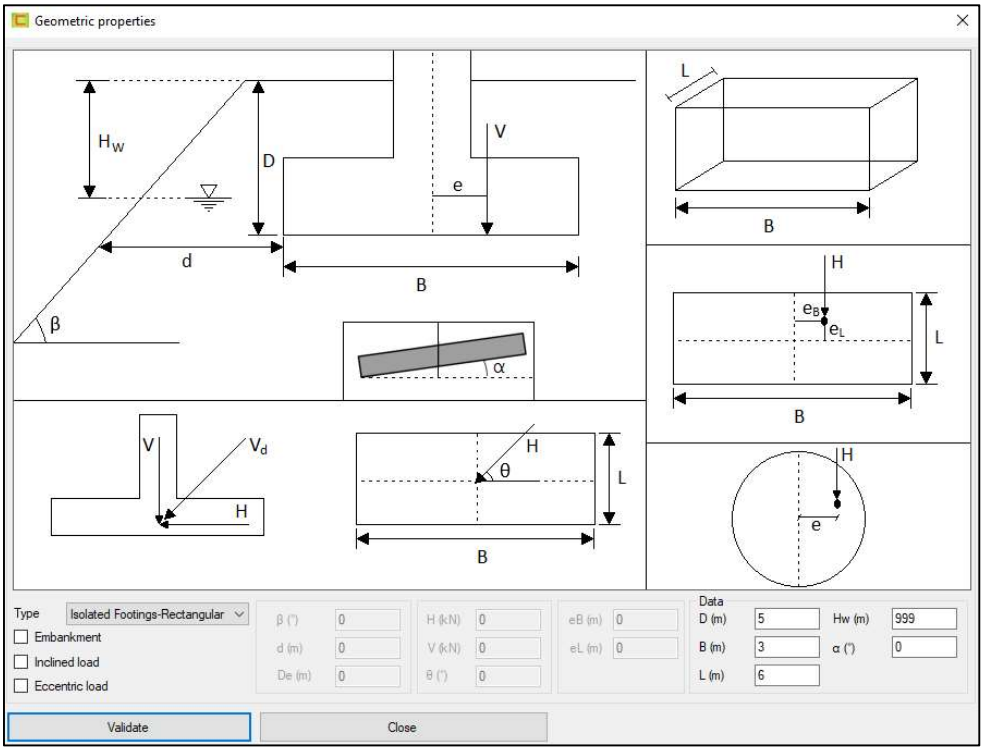
- If the foundation is near an embankment, check the corresponding box and enter the values for:
    - The angle of inclination β
    - The distances: d and De
- If the load is inclined, check the corresponding box and enter the values for:
    - The angle of inclination θ
    - The value of the horizontal load H
    - The value of the vertical load V

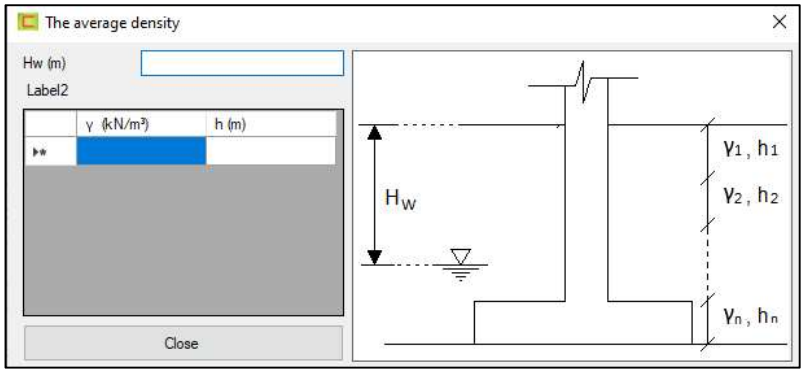
- If the load is eccentric, check the corresponding box and enter the values of e_B and e_L (or e, depending on the footing shape)
- Click on the “validate” button, then CiviLab automatically calculates the corresponding factors.

Click on the "Add / Modify" button







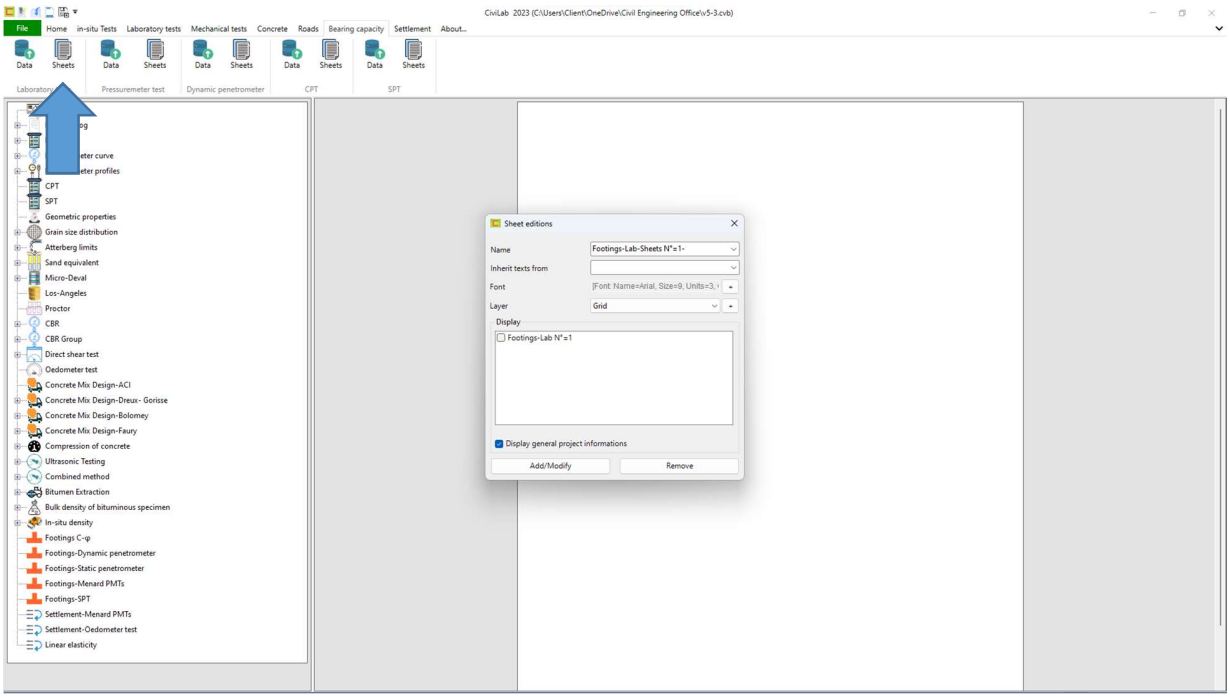


I-2- Add a sheet :

Click on the "Sheets" button in the “Laboratory Tests” panel and input:

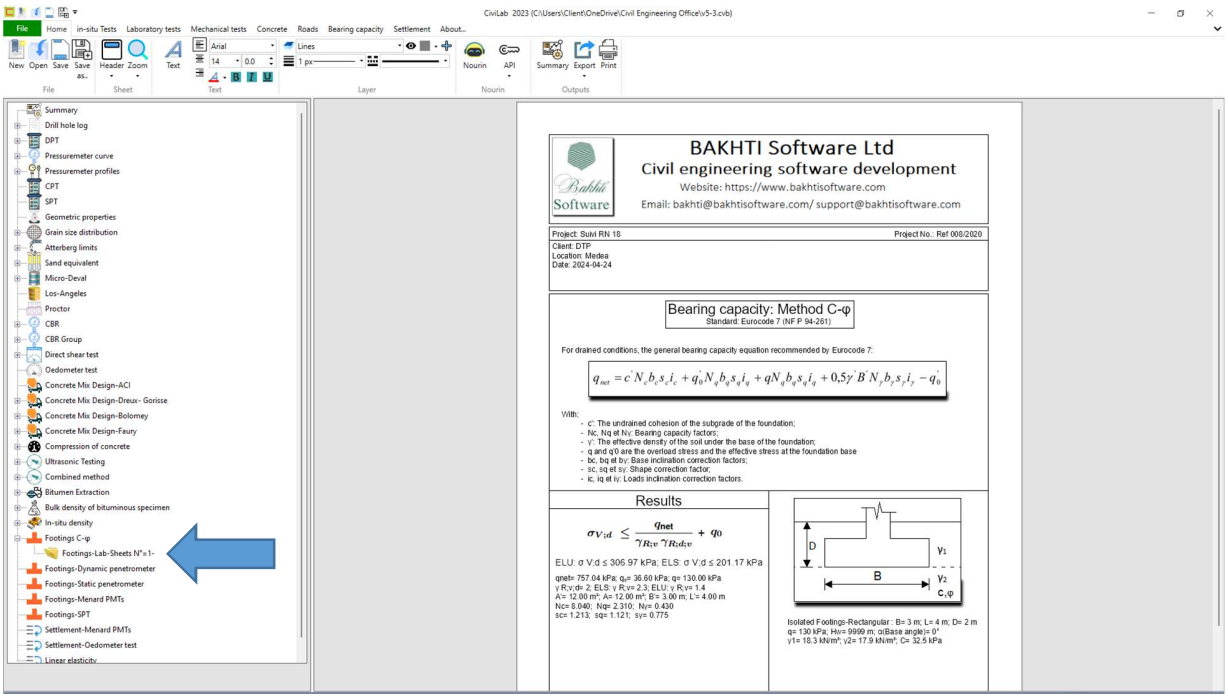
- The sheet name;
- Select the font;
- Select the layer used in the background drawing;
- Select the tests;
- To display general project information’s check the corresponding box;

Then click on "Add/Modify" button



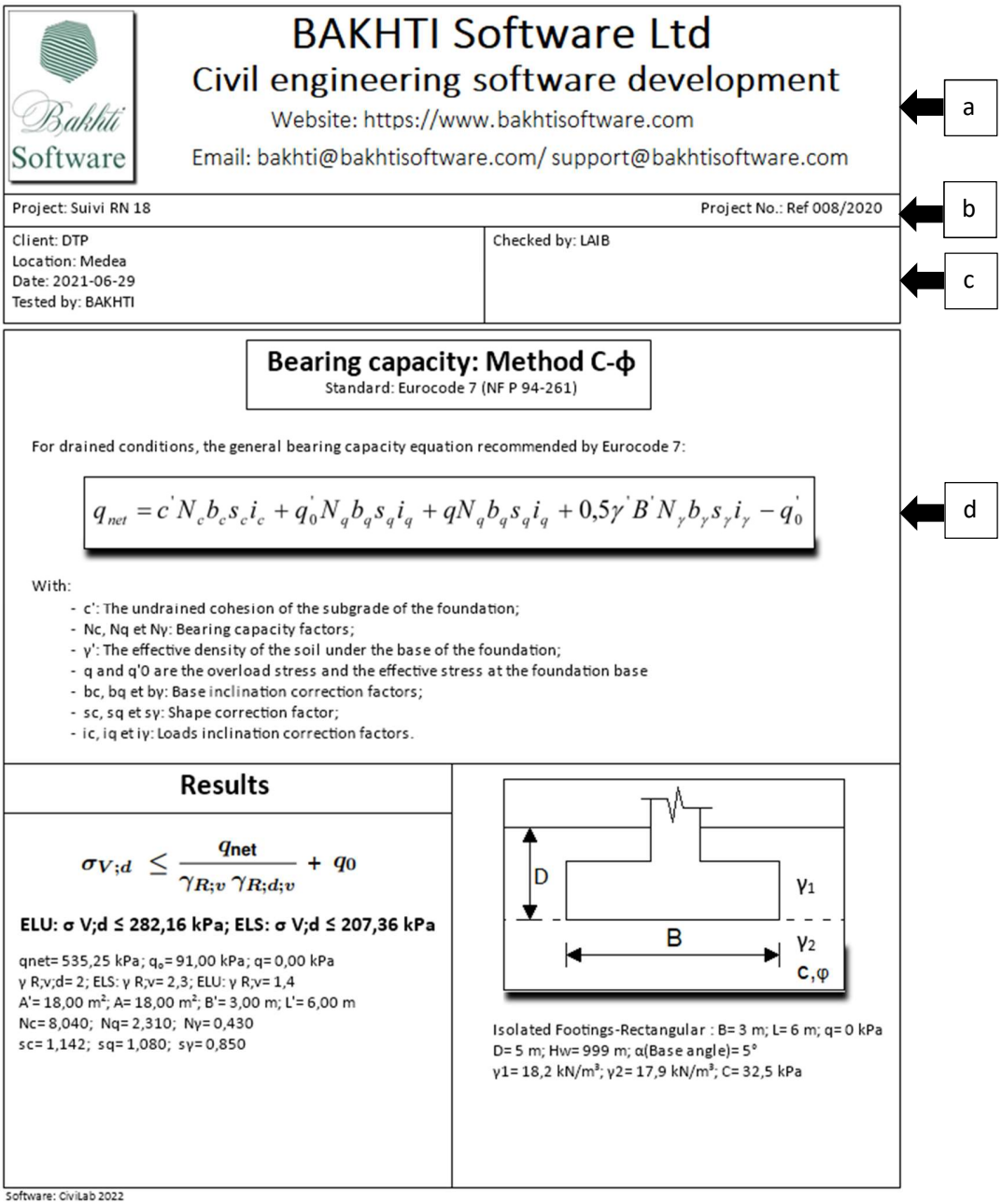
I-3- Display the report

To display the report, click on the sheet name in the tree view



To export or print the report, click on "Home" tab, then click the appropriate button in the outputs panel (Print or Export button)

Test report:



BAKHTI Software Ltd

Civil engineering software development

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a

Project: Suivi RN 18 — Project No.: Ref 008/2020

b

Client: DTP
Location: Medea
Date: 2021-06-29
Tested by: BAKHTI

Checked by: LAIB

c

Bearing capacity: Method C-ϕ

Standard: Eurocode 7 (NF P 94-261)

For drained conditions, the general bearing capacity equation recommended by Eurocode 7:

$$q_{net} = c' N_c b_c s_c i_c + q'_0 N_q b_q s_q i_q + q N_q b_q s_q i_q + 0{,}5\gamma' B' N_\gamma b_\gamma s_\gamma i_\gamma - q'_0$$

d

With:

- c': The undrained cohesion of the subgrade of the foundation;
- Nc, Nq et Nγ: Bearing capacity factors;
- γ': The effective density of the soil under the base of the foundation;
- q and q'0 are the overload stress and the effective stress at the foundation base
- bc, bq et bγ: Base inclination correction factors;
- sc, sq et sγ: Shape correction factor;
- ic, iq et iγ: Loads inclination correction factors.

Results

$$\sigma_{V;d} \leq \frac{q_{net}}{\gamma_{R;v}\,\gamma_{R;d;v}} + q_0$$

ELU: σ V;d ≤ 282,16 kPa; ELS: σ V;d ≤ 207,36 kPa

qnet= 535,25 kPa; q_o= 91,00 kPa; q= 0,00 kPa
γ R;v;d= 2; ELS: γ R;v= 2,3; ELU: γ R;v= 1,4
A'= 18,00 m²; A= 18,00 m²; B'= 3,00 m; L'= 6,00 m
Nc= 8,040; Nq= 2,310; Nγ= 0,430
sc= 1,142; sq= 1,080; sγ= 0,850

Isolated Footings-Rectangular : B= 3 m; L= 6 m; q= 0 kPa
D= 5 m; Hw= 999 m; α(Base angle)= 5°
γ1= 18,2 kN/m³; γ2= 17,9 kN/m³; C= 32,5 kPa

Software: CiviLab 2022

a. Sheet Header Presentation: To import or modify the sheet header, go to the "Home" tab and select the "Header" button.

b. Project Name and Reference: These details can be entered from the project's general information found in the File menu.
c. Area for Displaying Test Information: Test information can be input within this area from the Test Information window (to show it click on the "+" button next to the name of the test on Data window) and project's general information window.
d. Area for results: this area is designated to visualize the test results.

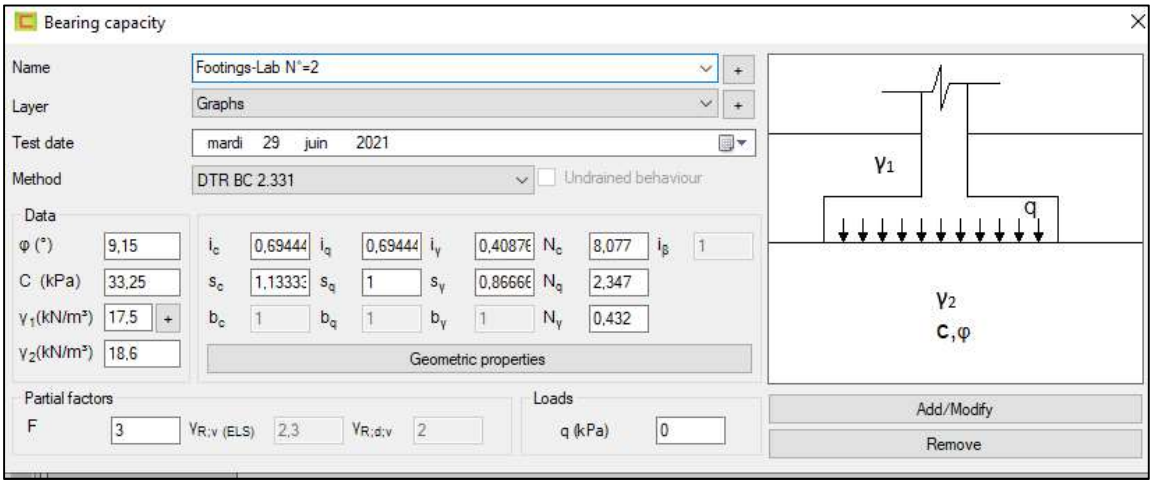
II- DTR BC 2.331 et DTU 13.12

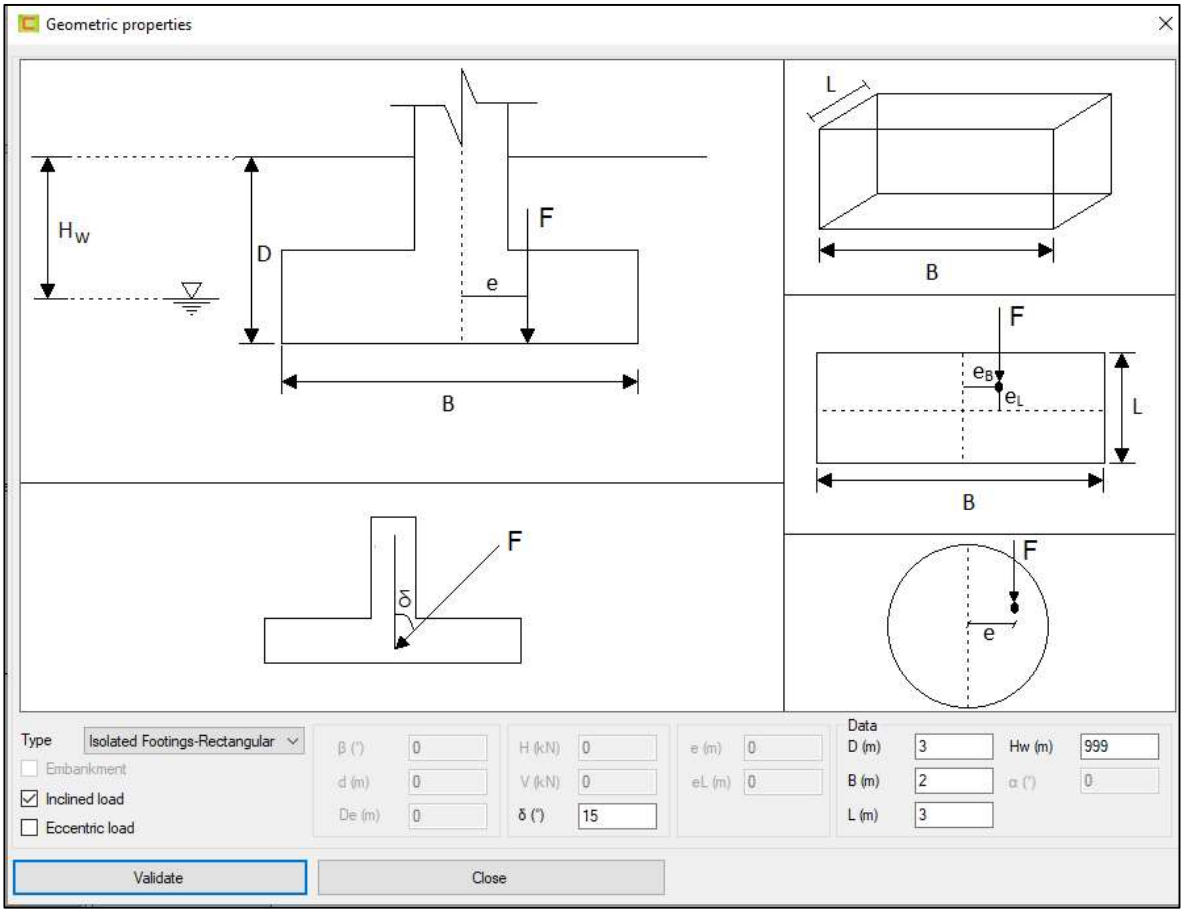
II-1- Test Data:

Click on the "Data" button in the "Laboratory Tests" panel, then input:

- The test name;
- Select the test date;
- Select the layer;
- The standard (DTR BC 2.331 or DTU 13.12)
- c et ϕ
- The density of the soil above and below the base of the footing (γ1, γ2)
- Load value q
- The value of the safety factor F
- Click on the "Geometric properties" button then:
  - Select the footing type
  - Enter the data of the geometric shape of the footing (B, L, D)
  - Enter the depth of the water table (if the water table is unknown enter the value 9999)
  - If the base of the footing is inclined, enter the angle value
  - If the load is inclined, check the corresponding box and enter the values for:
    - The angle of inclination δ
  - If the load is eccentric, check the corresponding box and enter the values of e_B and e_L (or e, depending on the footing shape)
  - Click on the "validate" button, then CiviLab automatically calculates the corresponding factors.

Click on the "Add / Modify" button





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II-2- Add sheet (same as section I-2)

II-3- Display report (same as section I-3)

II-4- Test report :

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Project: Suivi RN 18 — Project No.: Ref 008/2020

Client: DTP
Location: Medea
Date: 2021-06-29

Bearing capacity: Method C-ϕ

Standard: DTR BC 2.331

The general bearing capacity equation is given by

$$q_u = s_q i_q \gamma_1 D N_q + \frac{1}{2} s_\gamma i_\gamma \gamma_2 B' N_\gamma + s_c i_c c' N_c$$

With:

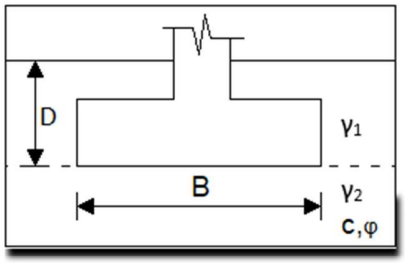
- C: The cohesion of the subgrade of the foundation;
- Nc, Nq et Nγ: Bearing capacity factors;
- γ1,γ2: The density of the soil above and below the base of the foundation
- B': The effective width of the foundation
- D: The embedding depth
- sc, sq et sγ: Shape correction factor;
- ic, iq et iγ: Loads inclination correction factors.

Results

$$q_{adm} = \frac{q_u - \gamma_1 D}{F} + \gamma_1 D \qquad F \geq 3$$

qadm = 134,93 kPa

qu= 299,78 kPa; q_o= 52,50 kPa; q= 0,00 kPa
F= 3
A'= 6,00 m²; A= 6,00 m²; B'= 2,00 m; L'= 3,00 m
Nc= 8,077; Nq= 2,347; Nγ= 0,432
sc= 1,133; sq= 1,000; sγ= 0,867
ic= 0,694; iq= 0,694; iγ= 0,409



Isolated Footings-Rectangular : B= 2 m; L= 3 m; q= 0 kPa
D= 3 m; Hw= 999 m
δ(Loads angle)= 15°
γ1= 17,5 kN/m³; γ2= 18,6 kN/m³; C= 33,25 kPa

Software: CiviLab 2022