



User Manual

CIVILAB 2023

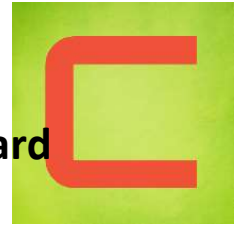
SETTLEMENT: MENARD PRESSUREMETER TEST

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How to use CiviLab to calculate the settlement from Menard pressuremeter test results?

I- NF P 94 261 (Eurocode 7)

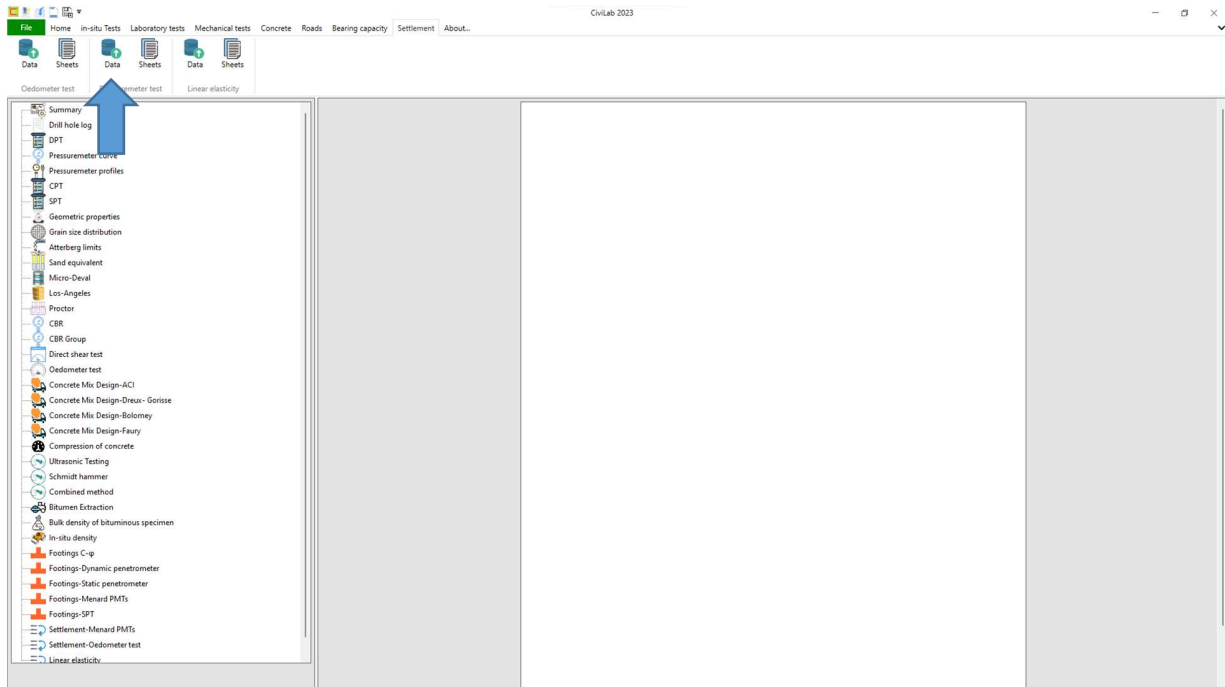
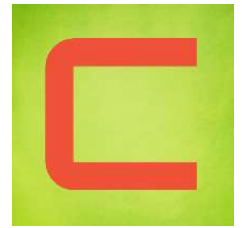
I-1- Test Data:

Click on the "Data" button in the "Pressuremeter test" panel, then input:

- The test name;
- Select the test date;
- Select the layer;
- The standard (NF P 94 261)
- Select the type of soil (heterogeneous, homogeneous and with a soft interlayer)
- The equivalent Menard pressuremeter modulus corresponding to the spherical influence zone (E_c). For the case of a homogeneous soil, input the Menard (E_M) pressuremeter modulus
- The equivalent Menard pressuremeter module corresponding to the deviatoric influence zone (E_d). Click on the "+" button to automatically calculate E_d
- The rheological coefficient α . Click on the "+" button to automatically calculate α
- The shape factors λ_c and λ_d . Click on the "+" button for automatic calculation
- The footing width B
- The initial effective stress at the foundation level σ'_{v0}
- Area loads from the structure q'
- For the case of a soft interlayer:
 - The value of the soft layer overload Δq_m . Estimated according to Boussinesq formulas
 - The average pressuremeter modulus of the soft layer E_m
 - The rheological coefficient of the soft layer α_m
 - The thickness of the soft layer H_m

Click on the "Add / Modify" button





Settlement

Name: Settlement-PRE N°=1

Layer: Graphs

Date: mercredi 30 juin 2021

Method: Eurocode 7 (NF P 94-261)

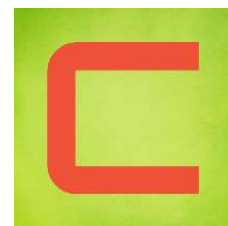
Soil type: A soft interlayer

Data

E_c (kPa)	12350	σ'_{v0} (kPa)	42
E_d (kPa)	6250	q' (kPa)	350
α	1	Δq_m (kPa)	18,5
λ_c	1,1	E_m (kPa)	6580
λ_d	1,12	α_m	0,8
B (m)	3	H (m)	1,5

Add/Modify Remove





Pressuremeter modulus

Layer N°	E (kPa)
1	12350
2	14256
3	16250
4	17350
5	13500
6	14560
7	18250
8	19500

Validate Close

Rheological factor

Soil Peat

Type Normally consolidated

α 1

Validate Close

λ_c

Type Square

L/B 2

λ_c 1,1

Validate Close

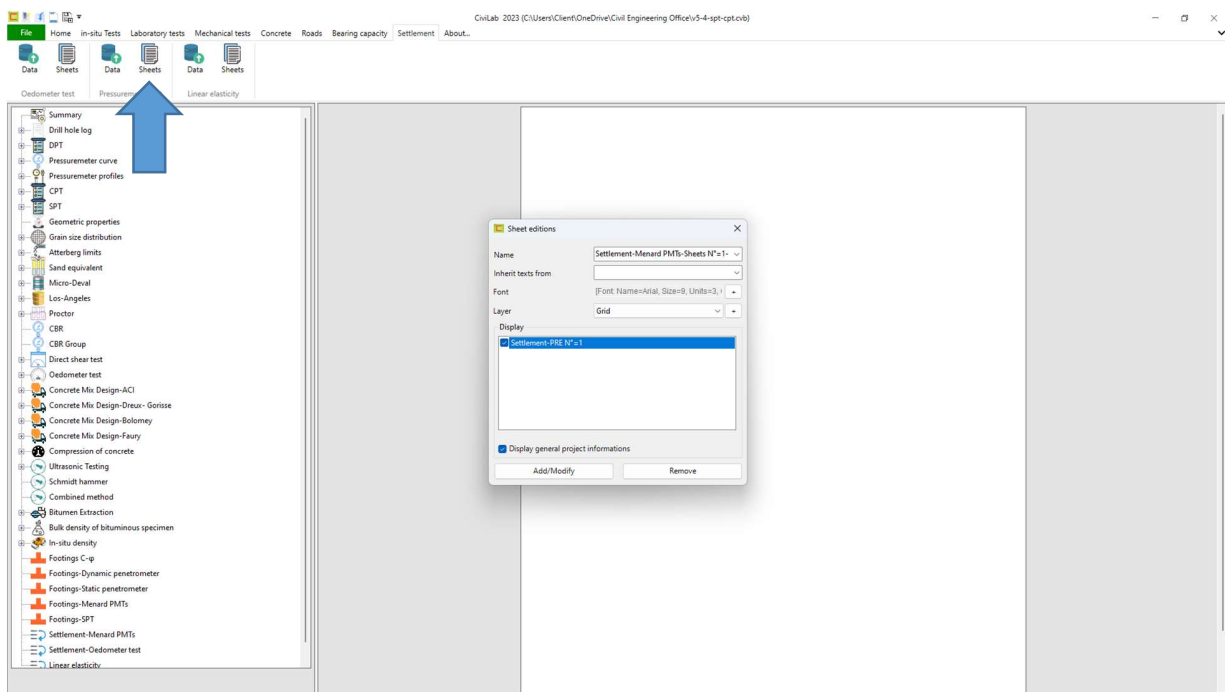


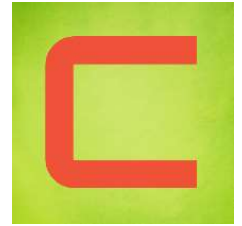
I-2- Add a sheet :

Click on the "Sheets" button in the "Pressuremeter test" 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

The screenshot shows the BAKHTI Software interface. On the left is a tree view containing various test categories such as 'Summary', 'Drill hole log', 'DTT', 'Pressuremeter curve', 'CPT', 'SPT', 'Geometric properties', 'Grain size distribution', 'Atterberg limits', 'Sand equivalent', 'Micro-Deval', 'Los-Angelès', 'Proctor', 'CBR', 'Direct shear test', 'Oedometer test', 'Concrete Mix Design-ACI', 'Concrete Mix Design-Dreux- Gorisse', 'Concrete Mix Design-Bolomey', 'Concrete Mix Design-Faury', 'Compression of concrete', 'Ultrasonic Testing', 'Schmidt hammer', 'Combined method', 'Bitumen Extraction', 'Bulk density of bituminous specimen', 'In-situ density', 'Footings-C-q', 'Footings-Dynamic penetrometer', 'Footings-Static penetrometer', 'Footings-Menard PMTs', 'Footings-SPT', 'Settlement-Menard PMTs', and 'Settlement-Oedometer test'. A blue arrow points to the 'Settlement-Menard PMTs' sheet. The main window displays a report titled 'Settlement: Menard PMTs' (Standard: Eurocode 7 (NF P 94-261)). The report includes the BAKHTI Software Ltd logo and contact information, project details (Project RN 16, Client: SARL EGN, Location: Media, Date: 2021-09-09), and technical data for settlement calculations. The settlement calculation is shown as $S_T = S_c + S_d$. The spherical component S_c is calculated as $S_c = \frac{\alpha}{9E_c} (q' - \sigma'_{v0}) \lambda B$. The deviatoric component S_d is calculated as $S_d = \frac{2}{9E_d} (q' - \sigma'_{v0}) B_0 \left(\lambda_d \frac{B}{B_0} \right)^\alpha$. The deviatoric modulus E_d is given by $E_d = E_1 / \left(\frac{1}{E_{1,2}} + \frac{0,25}{E_2} + \frac{0,3}{E_2} + \frac{0,25}{E_{3,5}} + \frac{0,1}{E_{6,8}} + \frac{0,1}{E_{9,16}} \right)$. The report also includes a diagram of a footing of width B on a soil profile with layers of thickness 1m and modulus E_i . The settlement calculation table shows the following values:

Layer	Modulus E_i (kPa)	Thickness z_i (m)	Modulus $E_{i,2}$ (kPa)	Modulus $E_{i,3,5}$ (kPa)	Modulus $E_{i,6,8}$ (kPa)	Modulus $E_{i,9,16}$ (kPa)
1	E_1	1				
2	E_2	1				
3	$E_{3,5}$	1				
4	$E_{3,5}$	1				
5	$E_{3,5}$	1				
6	$E_{6,8}$	1				
7	$E_{6,8}$	1				
8	$E_{6,8}$	1				
9	$E_{9,16}$	1				
10	$E_{9,16}$	1				
11	$E_{9,16}$	1				
12	$E_{9,16}$	1				
13	$E_{9,16}$	1				
14	$E_{9,16}$	1				
15	$E_{9,16}$	1				
16	$E_{9,16}$	1				

The report also includes a 'Results' section with the following values:


- Total settlement: $S_T = 2.5393$ cm
- $S_c = 0.8800$ cm, $S_d = 1.6593$ cm
- $\alpha = 1.000$, $\alpha' = 450$ kPa, $\sigma'_{v0} = 150$ kPa
- $E_c = 12500$ kPa, $E_d = 13500$ kPa, $B = 3$ m
- $\lambda = 1.1$, $\lambda_d = 1.12$

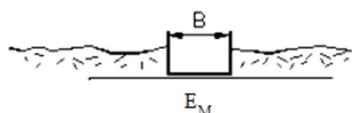
To export or print the report, click on "Home" tab, then click the appropriate button in the outputs panel (Print or Export button)





I-4- Test report:

	<h2 style="margin: 0;">BAKHTI Software Ltd</h2> <h3 style="margin: 0;">Civil engineering software development</h3> <p style="margin: 0;">Website: https://www.bakhtisoftware.com</p> <p style="margin: 0;">Email: bakhti@bakhtisoftware.com / support@bakhtisoftware.com</p>	← a
Project: Suivi RN 18	Project No.: Ref 008/2020	← b
Client: DTP Location: Medea Date: 2021-06-30		← c

Settlement: Menard PMTs <small>Standard: Eurocode 7 (NF P 94-261)</small>		
$S_f = S_c + S_d$ $s_c = \frac{\alpha}{9E_M} (q' - \sigma'_{v0}) \lambda_c B$ $s_d = \frac{2}{9E_M} (q' - \sigma'_{v0}) B_0 \left(\lambda_d \frac{B}{B_0} \right)^\alpha$	 <p><i>Homogeneous soil</i></p>	← d
<p>S_f : Total settlement</p> <p>S_c : Spherical component of the footing settlement</p> <p>S_d : Deviatoric component of the footing settlement</p> <p>E_M : Pressuremeter modulus</p> <p>q' : Area load from the structure</p> <p>σ'_{v0} : Initial effective stress at the level of the foundation</p>	<p>B_0 : Reference width equal to 0.60 m</p> <p>B : Footing width</p> <p>α : Rheological factor</p> <p>λ_c, λ_d are shape factor</p>	

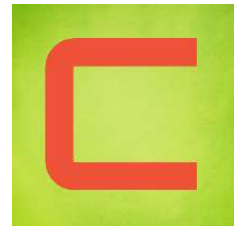
Results:

Total settlement: Sf= 2,7766 cm

$S_c = 0,9144$ cm, $S_d = 1,8621$ cm
 $\alpha = 1,000$, $q' = 350$ kPa, $\sigma'_{v0} = 42$ kPa
 $E_M = 12350$ kPa, $B = 3$ m
 $\lambda_c = 1,1$, $\lambda_d = 1,12$

- 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 results.

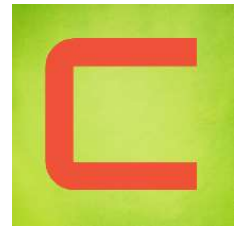
II- DTR BC 2.331 et DTU 13.12

II-1- Test Data:

Click on the "Data" button in the "Pressuremeter test" panel, then input:

- The test name;
- Select the test date;
- Select the layer;
- The standard (DTR BC 2.331 or DTU 13.12)
- The equivalent Menard pressuremeter modulus corresponding to the spherical influence zone (E_c)
- The equivalent Menard pressuremeter module corresponding to the deviatoric influence zone (E_d). Click on the "+" button to automatically calculate E_d
- The rheological coefficient α . Click on the "+" button to automatically calculate α
- The shape factors λ_c and λ_d . Click on the "+" button for automatic calculation
- The footing width B
- The initial effective stress at the foundation level σ'_{v0}
- Area loads from the structure q'

Click on the "Add / Modify" button



Settlement [X]

Name: Settlement-PRE N°=2 [+]

Layer: Graphs [+]

Date: mercredi 30 juin 2021 [calendar icon]

Method: DTR BC 2.331 [v]

Soil type: A heterogeneous soil [v]

Data

E_c (kPa)	12350	σ'_{v0} (kPa)	42
E_d (kPa)	7018,89 [+]	q' (kPa)	350
α	1 [+]	Δq_m (kPa)	0
λ_c	1,1 [+]	E_m (kPa)	0
λ_d	1,12 [+]	α_m	0
B (m)	3	H (m)	0

[Add/Modify] [Remove]

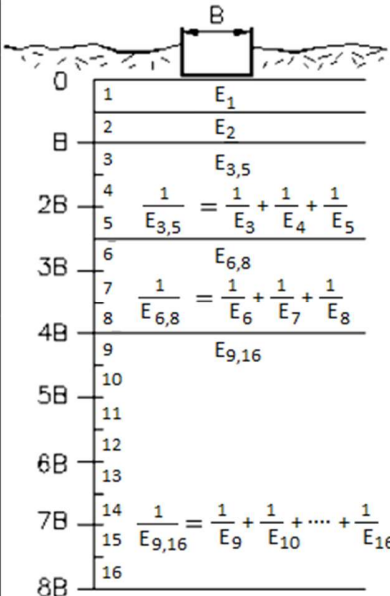
- II-2- Add sheet (same as section I-2)
- II-3- Display report (same as section I-3)



II-4- Test report :

	<h2 style="margin: 0;">BAKHTI Software Ltd</h2> <h3 style="margin: 0;">Civil engineering software development</h3> <p style="margin: 0;">Website: https://www.bakhtisoftware.com</p> <p style="margin: 0;">Email: bakhti@bakhtisoftware.com / support@bakhtisoftware.com</p>
Project: Suivi RN 18	Project No.: Ref 008/2020
Client: DTP Location: Medea Date: 2021-06-30	

Settlement: Menard PMTs
Standard: DTR BC 2.331

$S_f = S_c + S_d$ $s_c = \frac{\alpha}{9E_c} (q' - \sigma'_{v0}) \lambda_c B$ $s_d = \frac{2}{9E_d} (q' - \sigma'_{v0}) B_0 \left(\lambda_d \frac{B}{B_0} \right)^\alpha$ $E_c = E_1 / \frac{1}{E_d} = \frac{0,25}{E_1} + \frac{0,3}{E_2} + \frac{0,25}{E_{3,5}} + \frac{0,1}{E_{6,8}} + \frac{0,1}{E_{9,16}}$	
<p>S_f : Total settlement</p> <p>S_c : Spherical component of the footing settlement</p> <p>S_d : Deviatoric component of the footing settlement</p> <p>E_i : Pressuremeter modulus of layer i</p> <p>q' : Area load from the structure</p> <p>σ'_{v0} : Initial effective stress at the level of the foundation</p> <p>B_0 : Reference width equal to 0.60 m</p> <p>B : Footing width</p> <p>α : Rheological factor</p> <p>λ_c, λ_d are shape factor</p>	

Results:

Total settlement: Sf= 4,1909 cm

Sc= 0,9144 cm, Sd= 3,2765 cm

$\alpha= 1,000$, $q'= 350$ kPa, $\sigma'_{v0}= 42$ kPa

$E_c= 12350$ kPa, $E_d= 7018,89$ kPa, $B= 3$ m

$\lambda_c= 1,1$, $\lambda_d= 1,12$

