CiviLab 7.1 — Validation report for tests and calculations

Summary of all modules: laboratory, in situ, foundations, settlement, stability, triaxial, concrete, roads

Bakhti Softwares — edition of 06/11/2026. Detailed reports: Slope-Stability-Validation-CiviLab-7.1.pdf; workbooks Validation-Essais-7.1.xlsx and Validation-Triaxial-7.1.xlsx.

1. Approach and categories

For each test and calculation of CiviLab, this report gives the check case, its source, the expected value and the value obtained by CiviLab. The **category** tells where the expected value comes from:

A	**Published example**: data and result taken from a cited publication (report, manual, reference study), reproduced with the CiviLab code.
B	**Standard or analytical solution**: values given by the standard (tables, expressions) or exact solution.
C	**Independent calculation**: constructed data set (plausible, unmeasured values) and result recalculated independently with the formula of the standard (Excel workbook). No verifiable numerical published example was found for these tests.

Execution: “Run” = the CiviLab value is produced by running the CiviLab code (calculation library or automated tests); “Code reviewed” = the calculation is done in the input window, the result is obtained by applying the reviewed code step by step, without running the window.

Result: **9** category A checks, **5** category B, **22** category C.

2. Validation table

Cat.	Test / calculation	Case and source	Expected	CiviLab 7.1	Execution
Slope stability					
A	Bishop, Spencer, Morgenstern-Price, seismic, non-circular surfaces	7 published cases: ACADS (Giam and Donald 1989) §2.1, 2.3, 2.4, 2.7, 2.8; Arai and Tagyo (1985); Greco (1996), compared with the references and with GeoStudio	see dedicated report	differences 0.1 to 1.8 % (Greco Bishop +2.5 %)	Run (engine + 14 tests)
B	Exact equilibrium φ = 0; infinite slope, static and seismic	Analytical solutions	1.39264; 1.4004; 1.1087	1.39258; 1.4012; 1.1093	Run
B	Seismic coefficients	RPA 2024 §10.3 (10.22, 10.23); NF P 94-270 annex I.4	0.100 / 0.050; 0.120 / 0.060	identical	Run
Triaxial (NF EN ISO 17892-8/9, NF P 94-070)					
A	CIU — c′, φ′	British Geological Survey, report IR/06/065: 4 published tests	φ′ 24.45 / 26.7 / 17.56 / 26.44°; c′ 28.78 / 0.36 / 7.4 / 3.76 kPa	identical within 0.01° and 0.01 kPa	Run (tests)

A	CD — failure, c′, φ′	University of Waterloo, CIV E 353 (2006), Winnipeg clay: raw readings of 4 specimens; independent calculation (Python, Excel)	φ′ 17.97°; c′ 26.14 kPa	17.97°; 26.14 kPa	Run (tests)
B	UU — equations (1) to (6)	NF EN ISO 17892-8: hand calculation of the corrections (piston, membrane, area)	hand calculation	identical	Run (tests)
Laboratory — soils					
A	Particle size — percent passing	Kennesaw State University, Geotechnical Engineering Lab Manual (2025), Lab 3, table 3-2 (7 sieves, 304.4 g)	95.99; 86.63; 57.65; 23.98; 6.01; 0.39 %	identical (to 0.01)	Run (window formula)
A	Atterberg limits — wP, wL (Casagrande)	Same manual, Lab 5, table 5-1	wP 28 %; wL ≈ 40 %	wP 27.99 %; wL 39.55 % (water contents recalculated from the masses); 39.93 % with the printed water contents	Run (Limite.Calculer, MoindreCarre)
C	Limits — 80 g / 30° cone	NF P 94-052-1: w at 17 mm	44.6 %	44.6 %	Code reviewed
C	Proctor — wOPT, ρd max	NF P 94-093: optimum by 2nd-degree polynomial	12.78 %; 1.879	identical	Code reviewed
C	CBR	NF P 94-078: max(F2.5/13.35; F5/19.93)	22.2	22.2	Code reviewed
C	Hydrometer — Stokes diameter	NF P 94-057	0.0751 mm	identical	Code reviewed
C	Direct shear — c′, φ′	NF EN ISO 17892-10: regression of failure τ	16.6 kPa; 29.9°	identical	Code reviewed
C	Oedometer — Cc	NF EN ISO 17892-5	0.172	identical	Code reviewed
C	Los Angeles, Micro-Deval, sand equivalent	NF EN 1097-2, 1097-1, 933-8	22.6; 13.8; 77.0	identical	Code reviewed
C	Particle size — FM, Cu, Cc	NF EN 12620 annex B; definitions of Cu and Cc	2.68; 5.26; 0.84	identical	Code reviewed
In-situ tests					
C	Ménard pressuremeter — pl (inverse curve, hyperbola)	NF P 94-110-1 annex D	2.006 MPa	2.006 MPa	Run
C	Ménard pressuremeter — EM	NF P 94-110-1 § D.2.2	8.80 MPa	identical	Code reviewed
C	Dynamic penetrometer — qd	NF EN ISO 22476-2, Dutch formula	3.39 MPa	identical	Code reviewed
C	CPT — qc, fs	NF P 94-113 / NF EN ISO 22476-1: Qc = 2.1 kN, Ac = 10 cm²; Qs = 0.75 kN, As = 150 cm²	2.100 MPa; 50.000 kPa	2.100 MPa; 50.000 kPa	Code reviewed
Foundations (bearing capacity)					
A	c-φ strip footing — c·Nc and q·Nq terms	FHWA NHI-06-089 (2006), example 8-1: B = 6 ft, D = 5 ft, c = 500 psf, φ = 20°, γ = 125 pcf	7 400 psf; 4 000 psf; qult 13 425 psf (Nγ Vesic 5.4)	7 400; 4 000 psf; qu 12 712 psf with Nγ DTU 13.12 = 3.5 (difference due only to the code Nγ)	Run (QnetCalc)

B	Factors Nc, Nq, Nγ	EN 1997-1 annex D; DTU 13.12 § 3.2.1 (table)	18.40 / 20.09 (φ = 30°); 5.14 (φ = 0); DTU 30 / 18.4 / 18.1	identical	Run
B	Shape and inclination factors	DTU 13.12 § 3.2.1 (B/L = 0.75; δ = 10°)	1.15 / 0.85 / 0.790 / 0.444	identical	Run
C	qu laboratory, pressuremeter, CPT (DTU 13.12)	DTU 13.12 § 3.2.1, 3.2.2, 3.2.3.1	626.6; 928.3; 670.6 kPa	identical	Code reviewed
C	SPT — Meyerhof (1956)	q = 12·N·Kd (B ≤ 1.2 m), published SI form	239.1 kPa	identical	Code reviewed
Settlement					
A	Oedometric — wide embankment	FHWA NHI-06-088 (2006), example 7-3: NC clay 10 ft, Cc 0.5, e0 1.0, p0 600 psf, Δp 2 400 psf	1.75 ft (0.53 m)	1.747 ft (0.5326 m)	Run (ComputeSc, EC7 and DTU)
A	Oedometric — under a footing	FHWA NHI-06-089 (2006), example 8-3: NC clay 10 ft, Cc 0.4, e0 0.75, p0 2 145 psf, Δp 208 psf	0.09 ft = 1.1 in	0.0919 ft = 1.10 in	Run (ComputeSc)
C	Ménard pressuremeter — sc, sd	NF P 94-261 annex H	0.40; 0.85 cm	0.40; 0.85 cm	Run
C	Elastic; modulus of subgrade reaction	$s = cf \cdot (1 - \nu^2) \cdot q \cdot B/E$; 1/kv (Ménard)	1.28 cm	identical	Code reviewed
Concrete					
A	ACI mix design	ACI 211.1-91, appendix 1, example 1	water 181; cement 289.1; coarse aggregate 1 136; sand 774.4 kg/m³; water to add 123	181; 289.1; 1 136; 774.4; 122.9	Run (test)
C	Rebound hammer	NF EN 12504-2 § 8 (median); ASTM C805 § 9.1	32; 31.33	identical	Run (tests)
C	Compression; ultrasonic pulse velocity	NF EN 12390-3; NF EN 12504-4	26.2 MPa; 4 161 m/s	identical	Code reviewed
C	SonReb	Published correlations (Meynink et al. 1979…)	34.5 MPa	identical	Code reviewed
C	Dreux-Gorisse, Bolomey, Faury	Published methods (Dreux and Festa; Bolomey 1925; Faury 1941)	YA 46.13 %; P(0.08) 15.1 %; 60.87 %	identical	Code reviewed
Roads and asphalt					
C	Bulk density (paraffin-coated)	NF EN 12697-6 method D	2.341 g/cm³	2.341	Run
C	Kumagawa; degree of compaction	Binder content; C = 100·γ/γmax	5.63 %; 96.6 %	identical	Code reviewed

3. Remarks

- **CPT**: qc = 10·Qc/Ac and fs = 10,000·Qs/As (Qc, Qs in kN; Ac, As in cm²; calculation revised in 7.1). CPT tests saved with an earlier version must be reopened and saved again to recalculate qc and fs.
- **c-φ bearing capacity**: CiviLab applies the Nγ of the selected standard (DTU 13.12: table; EN 1997-1: 2(Nq−1)·tan φ); the FHWA example uses the Vesic Nγ. The cohesion and surcharge terms are identical to the published example.
- **Published limits example**: in table 5-1 of the Kennesaw manual, the water mass of test 1 (7.2 g) does not match the published masses (31.6 − 24.6 = 7.0 g); CiviLab calculates the water content from the masses (39.77 %).
- **Category C — hand verification**: each calculation was redone by hand, step by step, and compared with CiviLab: 26 checks, all in agreement (document Hand-Verification-CiviLab-7.1.pdf). Point to be checked in the original source: coefficient 0.0297 (CiviLab) or 0.0294 (ALCONPAT 2023) of the SonReb correlation of Meynink et al. (1979), difference 0.09 MPa on the example.
- **Category C**: these tests apply simple formulas of the standards or empirical methods; they are checked by independent calculation. To move them to category A, it is enough to add reports of real tests whose results were established by other means (accredited laboratory, other software, publication): the data are entered in CiviLab and the results compared.

4. References

- FHWA (2006). Soils and Foundations Reference Manual, Vol. I (FHWA-NHI-06-088) and Vol. II (FHWA-NHI-06-089), N.C. Samtani, E.A. Nowatzki.
- Hu D., Kwon J., Kaplan A., Bangerjee G. (2025). Geotechnical Engineering Lab Manual. Kennesaw State University, CC BY-NC 4.0 licence.
- British Geological Survey (2006). Report IR/06/065 (CIU triaxial tests). University of Waterloo (2006), CIV E 353, CD tests on Winnipeg clay.
- ACI 211.1-91, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete, appendix 1, example 1.
- Giam P.S.K., Donald I.B. (1989); Arai and Tagyo (1985); Greco (1996); Seequent/GeoStudio (2025) — see the slope stability report.
- Standards: NF P 94-261, NF P 94-270, DTU 13.12, EN 1997-1, NF P 94-110-1, NF EN ISO 22476-1/-2, NF EN ISO 17892-5/-8/-9/-10, NF P 94-051/-052-1/-057/-078/-093, NF EN 933-8, NF EN 1097-1/-2, NF EN 12620, NF EN 12390-3, NF EN 12504-2/-4, ASTM C805, NF EN 12697-6, RPA 2024.