Mohr–Coulomb Strength Parameters from Two Triaxial Tests

Cohesion and friction angle from the confining pressure and deviator stress at failure of two triaxial tests, by the common tangent to their Mohr circles.

Method: Mohr–Coulomb failure criterion

Input parameters

Unit system: SI

Parameter	Value	Unit
Test 1 cell pressure	100.00	kPa
Test 1 deviator stress at failure	210.00	kPa
Test 2 cell pressure	300.00	kPa
Test 2 deviator stress at failure	480.00	kPa

Calculated results

Parameter	Value	Unit
Friction angle	23.765	°
Cohesion intercept	24.462	kPa
Test 1 major principal stress	310.00	kPa
Failure plane angle from the major principal plane	56.882	°

Notes for this case

• Each test gives a Mohr circle of centre σ₃ + q/2 and radius q/2; the common tangent τ = c + σtanφ satisfies r = c·cosφ + s·sinφ for both, so sinφ = Δr/Δs. Use effective stresses (subtract pore pressure) for drained parameters; more than two tests are better fitted by least squares on the p′–q plot. A negative cohesion means the envelope is curved over the stress range.

Formula and method

$$\sin\varphi = \frac{r_2 - r_1}{s_2 - s_1}, \quad c = \frac{r_1 - s_1\sin\varphi}{\cos\varphi}, \quad s = \sigma_3 + \frac{q}{2}, \; r = \frac{q}{2}$$

Variables

$\sigma_{3,1}$	Test 1 cell pressure	Pa
q_1	Test 1 deviator stress at failure	Pa
$\sigma_{3,2}$	Test 2 cell pressure	Pa
q_2	Test 2 deviator stress at failure	Pa
φ	Friction angle	rad
c	Cohesion intercept	Pa
$\sigma_{1,1}$	Test 1 major principal stress	Pa
θ_f	Failure plane angle from the major principal plane	rad

Method and standards

Strength fit.

Assumptions and limits

- Linear envelope between the tests.

References

Mohr–Coulomb failure criterion

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/civil/geotechnical/triaxial-mohr-coulomb-fit

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Reopens the calculator with the inputs of this report.