



Geotechnical Engineering–II

BSc Civil Engineering – 5th Semester

Lab # 5

by

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Lecture Handouts: <https://groups.google.com/forum/#!forum/geotech-ii>

SHEAR STRENGTH

- LAB DETERMINATION -

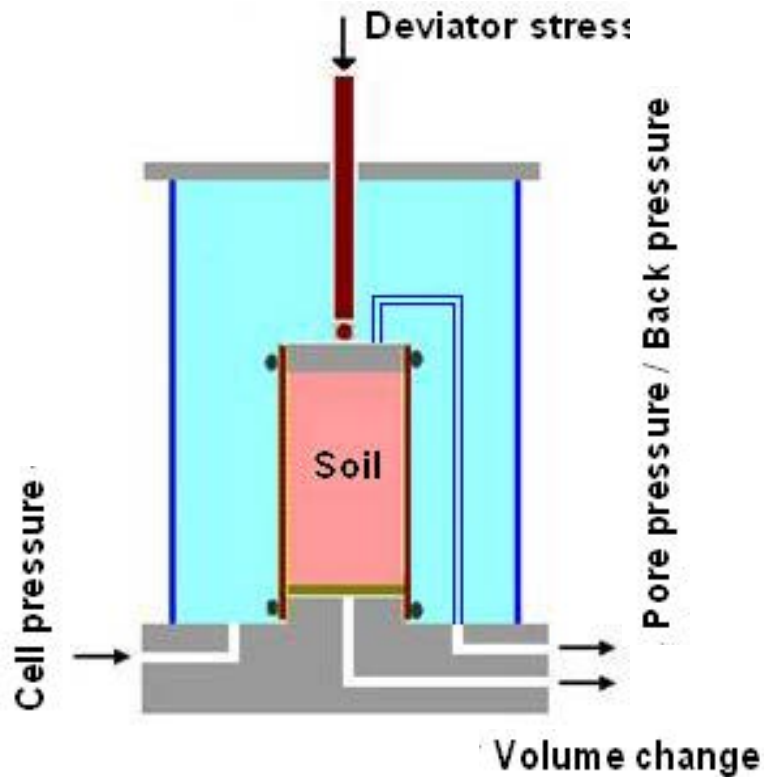
1. Direct shear test
2. Unconfined compression test
3. Triaxial compression test

Triaxial Compression Test

- “*Tri-axial*” compression
- For all types of soils

TRIAXIAL COMPRESSION TEST

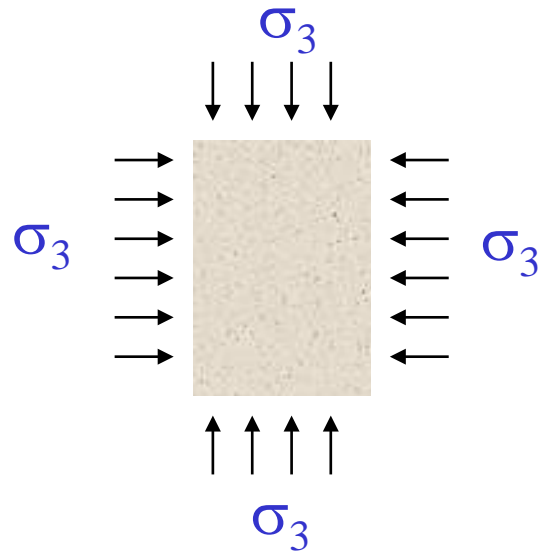
$$\tau_f = c + \sigma \tan \phi$$



TRIAXIAL COMPRESSION TEST

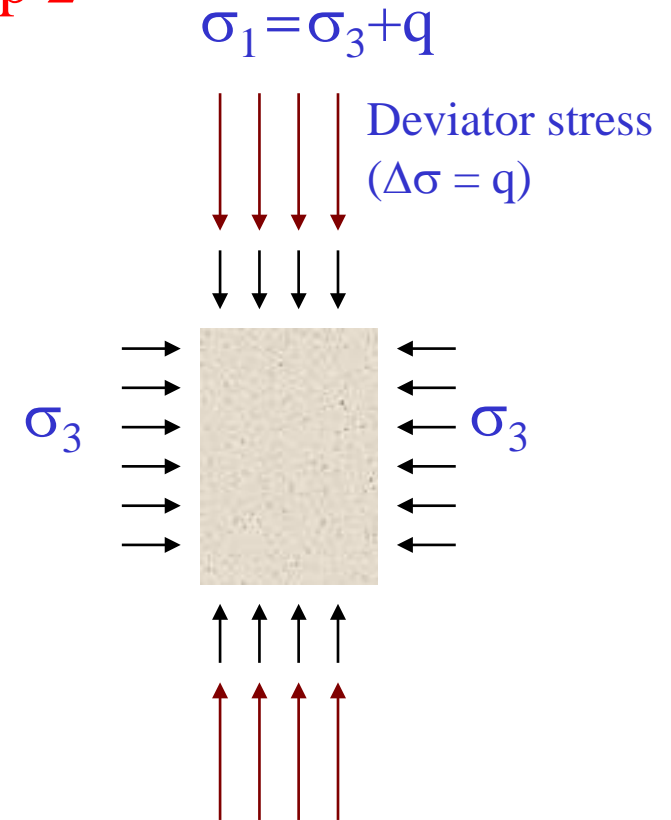
Normal Stress (σ_1) = Confining Pressure (σ_3) + Deviator Stress (q)

Step 1



All-around cell pressure σ_3

Step 2



Shearing (loading)

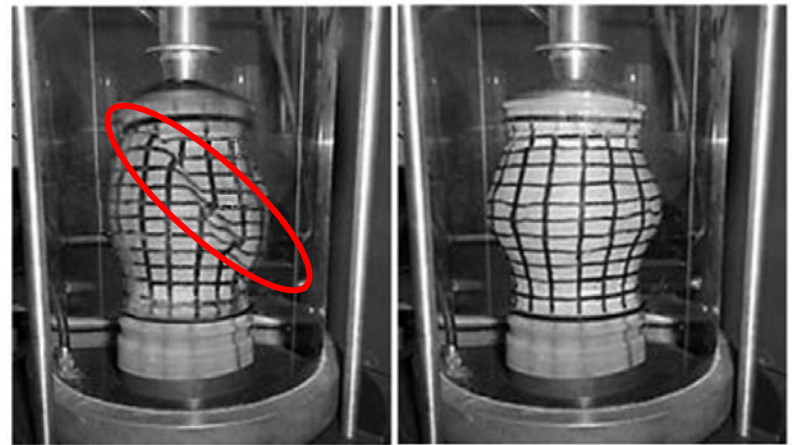
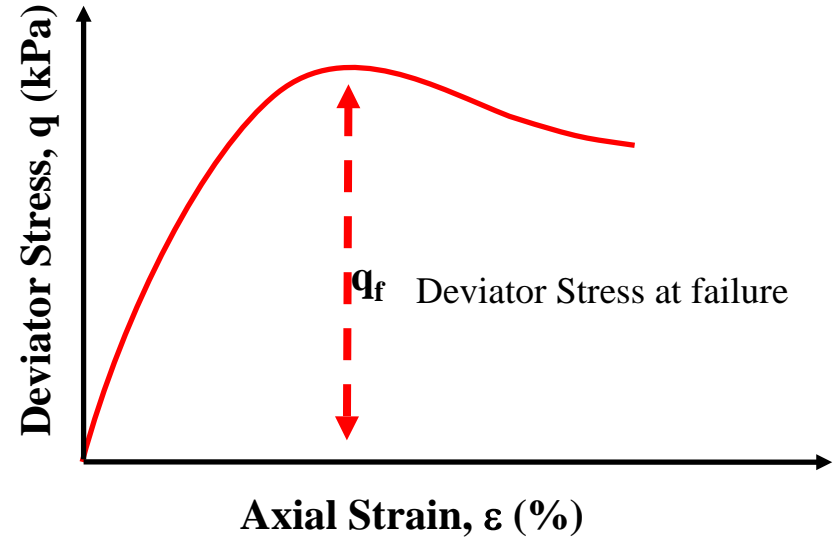
TRIAXIAL COMPRESSION TEST

- Analysis of Results -

Proving ring to measure the deviator load



Dial gauge to measure vertical displacement



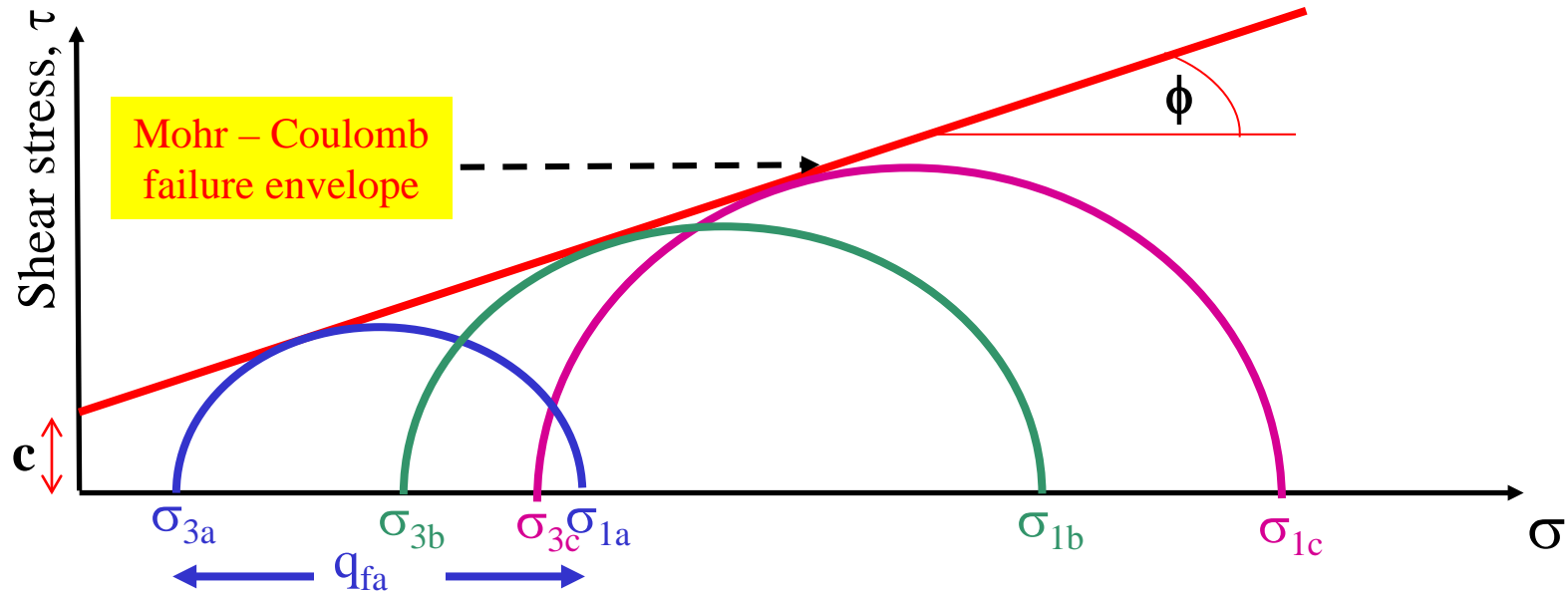
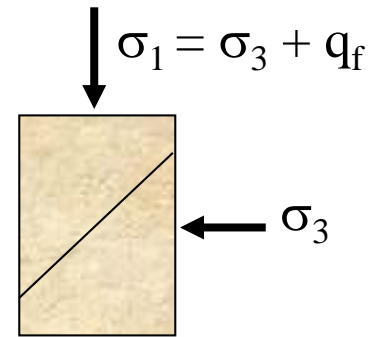
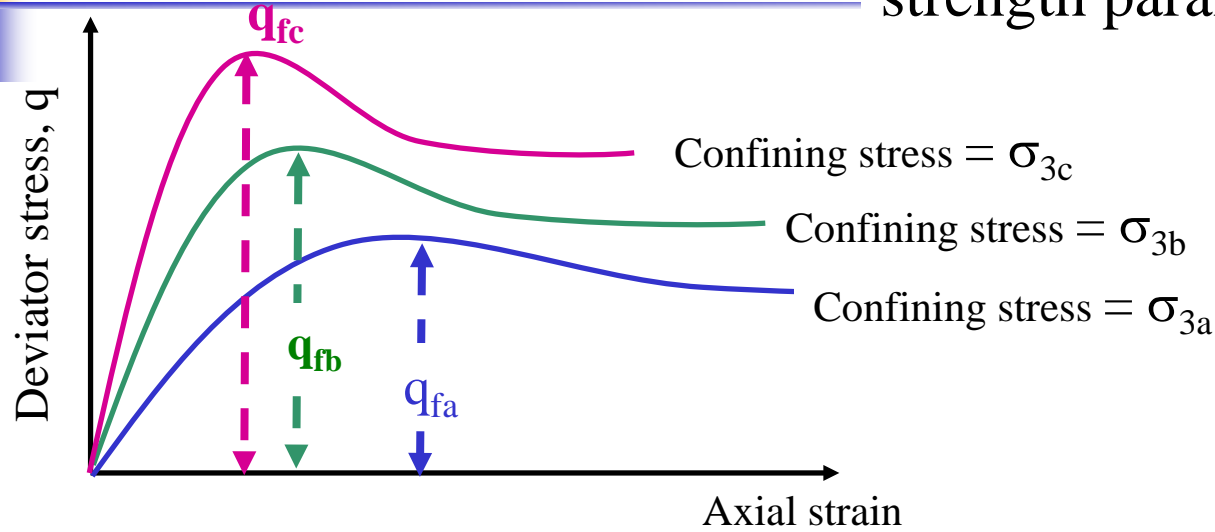
Shear Failure

Bulging Failure

TRIAxIAL COMPRESSION TEST

- Analysis of Results -

How to determine shear strength parameters c and ϕ ?



TRIAxIAL COMPRESSION TEST

- Calculations -

Dia. Of Sample, D	=	1.5 in	Sample Calculations
Length of Sample, Lo	=	3 in	
Original x-area of Sample, Ao	=	1.767 in ²	
Volume of the Sample, V	=	5.30 in ³	
Proving Ring Constant	=	0.8 lb/div	
DDG L.C.	=	0.0005 in	
Cell Pressure	=	20 psi	

Sample #	Cell Pressure	DDG Reading	Proving Ring DG Reading	Sample Deformation	Axial Strain	Corrected Area	Axial Load	Deviator Stress	
				$\Delta L = \text{Col-3} \times \text{LC}$	$\xi = \Delta L / L_o$	$A' = A_o / (1 - \xi)$	Col-4 x PRC	Col-8 / Col-7	
	(kPa)	(div.)	(div.)	(in)		(in ²)	(lb)	(psi)	(kPa)
Col-1	Col-2	Col-3	Col-4	Col-5	Col-6	Col-7	Col-8	Col-9	
2	137.9	0	0	0.000	0.0000	1.767	0.00	0.00	0.00
		50	14	0.025	0.0083	1.782	11.20	6.29	43.34
		100	44	0.050	0.0167	1.797	35.20	19.59	135.05
		150	65	0.075	0.0250	1.812	52.00	28.69	197.82
		200	84	0.100	0.0333	1.828	67.20	36.76	253.46

TRIAXIAL COMPRESSION TEST

- Specimen Preparation -

1. Undisturbed Sample
2. Remolded Sample

Hands-on Learning

TRIAXIAL COMPRESSION TEST

Specimen Preparation (undisturbed sample)



Sampling Tubes



Sample Extruder

TRIAXIAL COMPRESSION TEST

Specimen Preparation (undisturbed sample)



Edges of the sample are carefully trimmed



Setting up the sample in the triaxial cell

TRIAXIAL COMPRESSION TEST

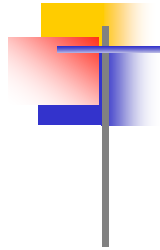
Specimen Preparation (undisturbed sample)



Sample is covered with a rubber membrane and sealed



Cell is completely filled with water



CONCLUDED