



Developing confidence in critical state soil mechanics

2. Set Up xls for CamClay

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January, 2015



Find file...

- Folder: /data_and_progs
- CamClay txlu template.xls
 - Has framework
 - Build model on that for *undrained* triaxial compression
 - Has closed form results
- Describe how the xls is set up before going through Cam Clay equations...



CamClay_txlu.xls

CamClay_txlu.xlsx

Search in Sheet

Calibri (Body) 12 B I U

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H22

Soil properties....		Units	
CSL parameters		$\Gamma =$	0.817 @ 1 kPa
		$\lambda =$	0.02
Plasticity		$M_{tc} =$	1.28
		$N =$	---
		$H_0 =$	---
		$\chi_{tc} =$	---
Elasticity		$G_{max} =$	2000 MPa @ p_0
		$G_{exp} =$	1
		$\nu =$	0.2
		$\kappa =$	0.005
Initial soil state...		$e_0 =$	0.711
		$p_0 =$	200 kPa
		$\psi_0 =$	---

deviator stress, q: kPa

axial strain: %

deviator stress, q: kPa

mean effective stress, p': kPa

Inputs & Plots | Calcs | OCC closed form undrained

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3

Sum=0



Soil Property Inputs

CamClay_txlu.xlsx

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Mtc 1.28

	A	B	C	D	E	F	G	H
1	Soil properties ...							
2		<i>CSL parameters</i>			Units			
3			$\Gamma =$	0.817	@ 1 kPa			
4			$\lambda =$	0.02	---			
5		<i>Plasticity</i>						
6			Mtc =	1.28	---			
7			N =		---			
8			H ₀ =		---			
9			$\chi_{tc} =$		---			
10		<i>Elasticity</i>						
11			Gmax =	2000	MPa @ p ₀			
12			G _{exp} =	1	---			
13			$\nu =$	0.2	---			
14			$\kappa =$	0.005	---			
15	Initial soil state...							
16			e₀ =	0.711	---			
17			p₀ =	200	kPa			
18			$\psi_0 =$		---			

deviator stress, q: kPa

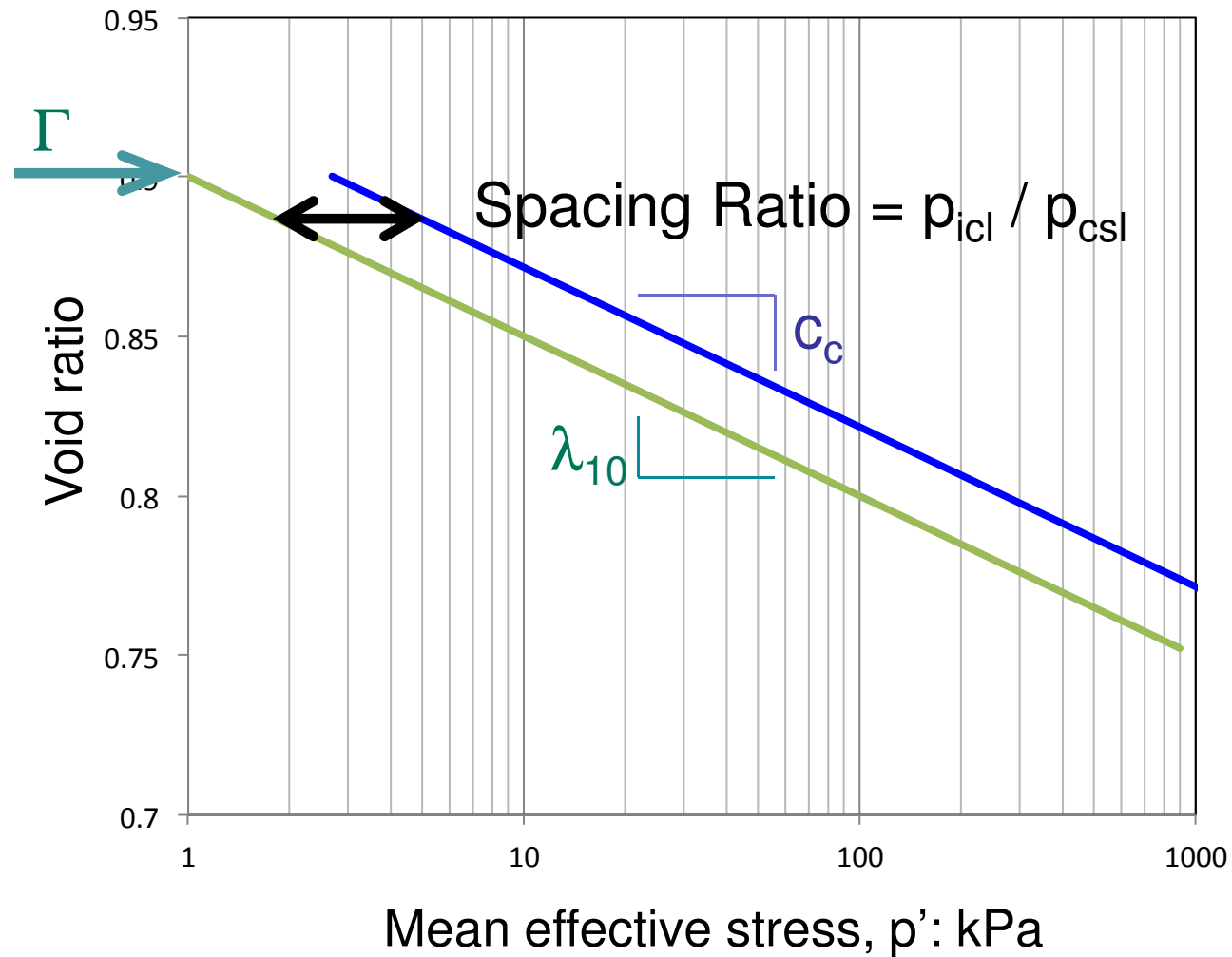
axial strain: %

Sum=1.28

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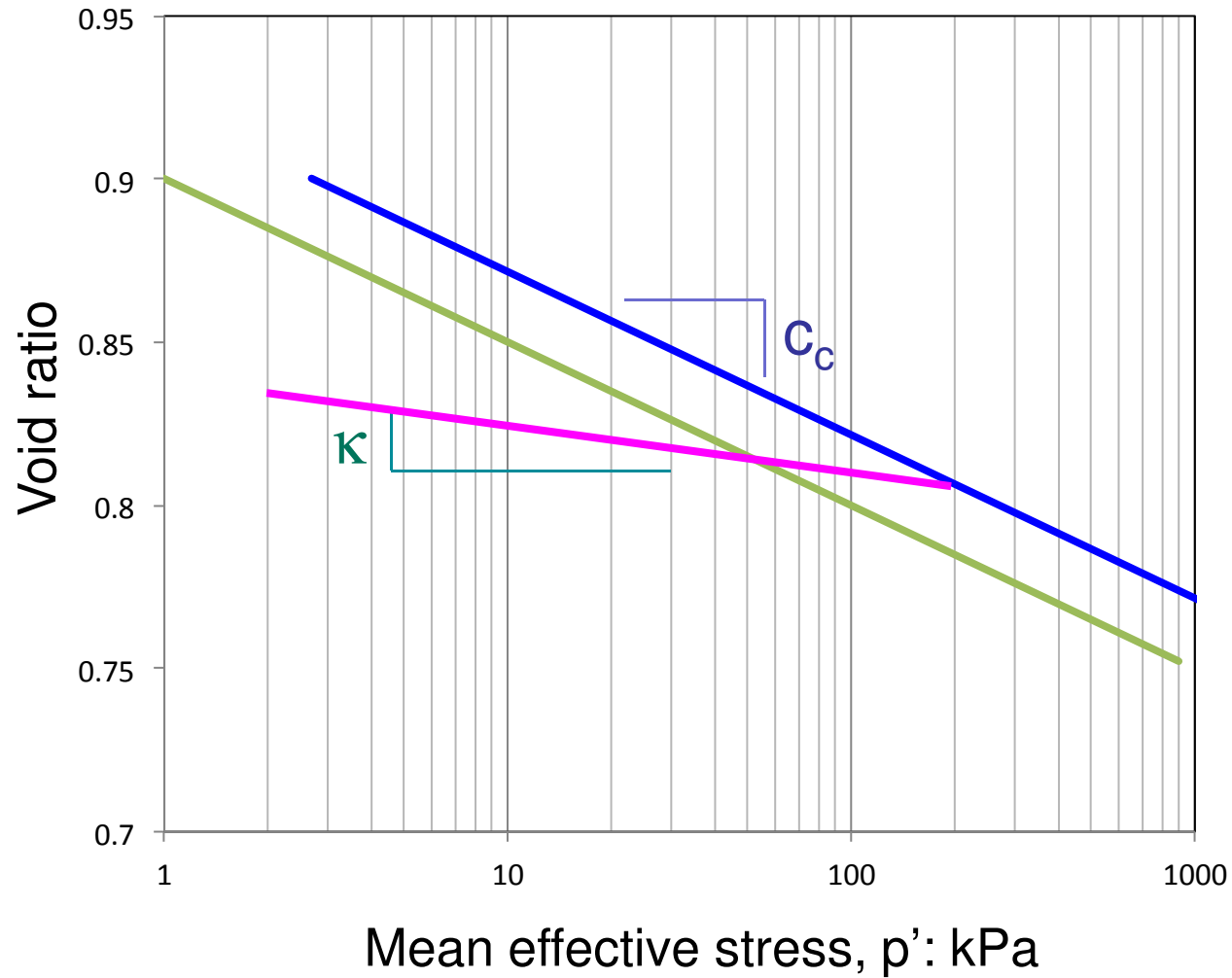


Isotropic compression





Elasticity





Log10 versus Ln

Used in theory

- CSL: $e_c = \Gamma \lambda \ln(p')$
- Elasticity: $\Delta e = \kappa \Delta p' / p'$

What the lab reports

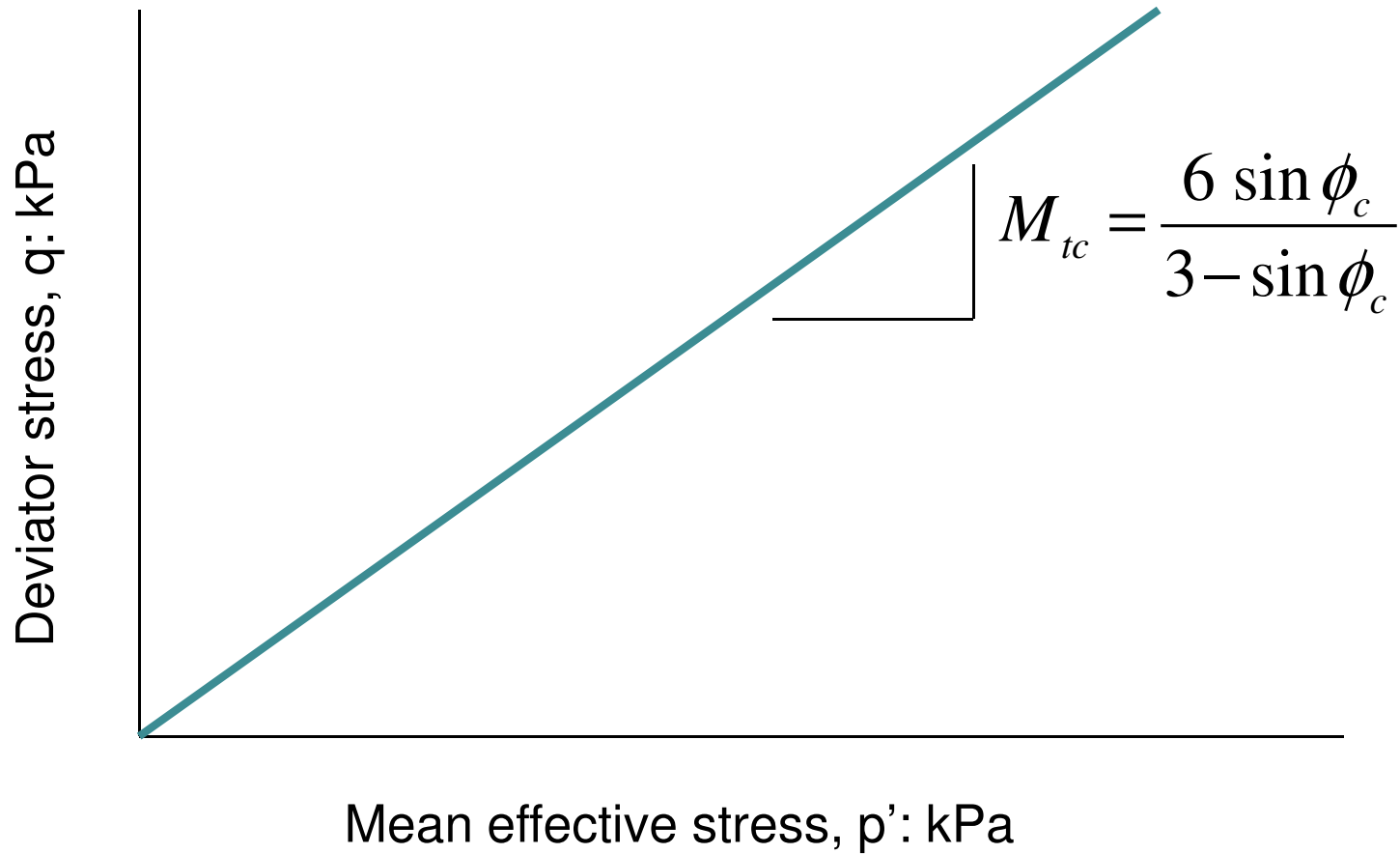
- CSL: $e_c = \Gamma \lambda_{10} \log(p')$
- Elasticity: $\Delta e = c_r \Delta p' / p'$

$$\lambda = \lambda_{10} / 2.3$$

$$\kappa = c_r / 2.3$$

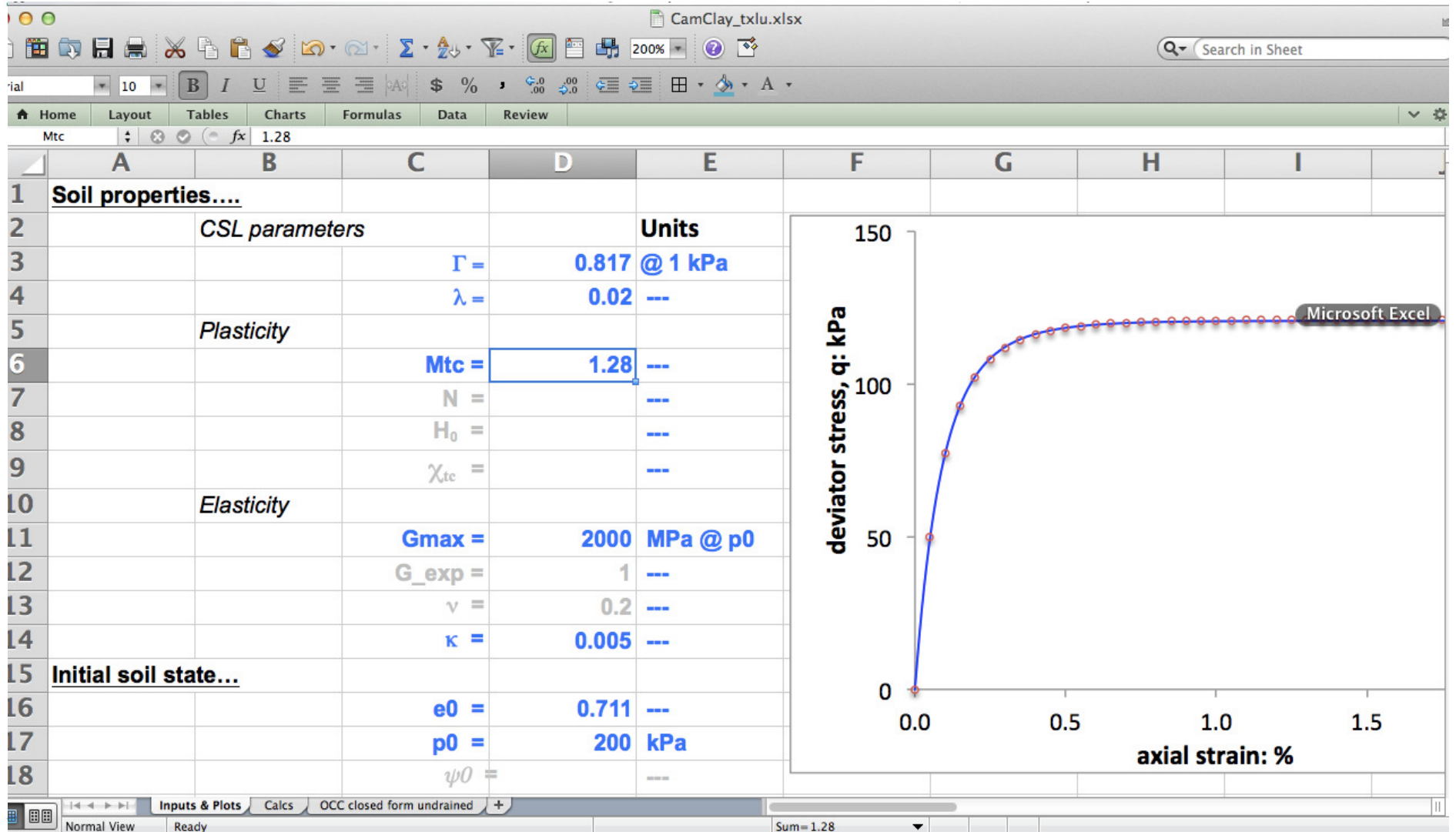


Critical Friction Ratio





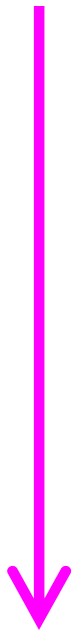
Soil Property Inputs





Integration loop

Repeat until done



- $(\varepsilon_q^p)_{j+1} = (\varepsilon_q^p)_j + \Delta\varepsilon_q^p$... step forward plastic strain step
- Get state variables ... G, K, M_i depend on (e, σ)
- Apply flowrule $\Rightarrow \Delta\varepsilon_v^p$... the other strain increment
- Harden yield surface ... yield surface changes size
- Find new stress state ... depends on stress path
- Add elastic strain *incs*
- Update e



The Integration "Loop"

CamClay_CIU_template.xlsx

Calibri (Body) 12

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N9 =d_epQp

the calculation...

CONSTANT Δe_q^p 0.0001 (step size for integration)

ratio $K/G = 1.33$

Drained $Dq/Dp = 3.00$

Spacing Ratio = 2.72

STEP	ep1 (%)	epV (%)	p' (kPa)	q (kPa)	e	ψ	G (MPa)	K (MPa)	pc (kPa)	Mi	η_1	Dp	depQ_p	depV_p	H	dPc_over_Pc	Pc [UPDATED] (kPa)	dp (kPa)	p' (kPa)	eta	q (kPa)	d_epV_e	epV	d_epQ_e
1	0.00	0.00%	200.00	0.00	0.726				33.50				0.0001											
2													0.0001											
3													0.0001											
4													0.0001											
5													0.0001											
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33													0.0001											

Inputs & Outputs OCC Calcs OCC closed form undrained

Normal View Ready

Sum=0.0330



Euler's method

