Andrew Spokis, Kai Grocki, Jonathan Jordan, Nicholas Valianti
CEE320 Soil Mechanics
Dept. of Civil and Environmental Engineering
University of Massachusetts Amherst
Amherst, MA 01003

December 1, 2022

Professor Don J. DeGroot
CEE320 Soil Mechanics
Dept. of Civil and Environmental Engineering
University of Massachusetts Amherst
Amherst, MA 01003

Table 1. Summary of soil properties and interpreted values for test IL563.

Test No.	w	e_0	γ_t	γ_d	s	$C_{r\varepsilon}$	$C_{c\varepsilon}$	$\sigma'v_o$	$\sigma'p$	OCR
	%	-	kN/m3	kN/m3	%	-	-	kPa	kPa	-
	1	2	3	4	5	6	7	8	9	10
IL565	32.77	0.92	18.5	13.94	94.52	0.025	0.17	171.06	190	1.11

Table 2. Summary of vertical effective stress and End of increment strain and void ratio for test IL563.

			Log Time	----------	----------	Square Root Time	----------
	σ'_v	$\sigma'_{v,ave}$	H_{50}	t_{50}	C_v	t_{90}	C_v
Increment No.	kPa	kPa	mm	s	cm^2/s	s	cm^2/s
	1	2	3	4	5	6	7
4	50	50.71	18.84	42.00	0.42	71.9	1.05
5	100	100.94	18.66	67.20	0.26	97.08	0.76
6	200	200.94	18.42	67.50	0.25	180	0.40
7	400	400.98	17.85	124.20	0.13	186	0.36
14	800	800.24	16.57	157.80	0.09	192	0.30
15	1600	1601.75	15.78	45.00	0.27	97.38	0.54

Table 3. Summary of interpreted coefficient of consolidation data for test IL563.

Increment #	σ'_v	EOI ε	EOI e
	kPa	(%)	(-)
1	6.230	0.021	0.917
2	13.390	0.335	0.911
3	26.080	0.826	0.902
4	50.710	1.563	0.888
5	100.940	2.413	0.871
6	200.940	4.259	0.836
7	400.980	9.573	0.734
8	201.050	9.712	0.731
9	100.850	9.52	0.735
10	51.310	9.185	0.742
11	101.480	9.216	0.741
12	200.680	9.493	0.736
13	400.520	10.595	0.714
14	800.240	15.472	0.621
15	1601.860	19.757	0.539
16	2500.830	22.402	0.488
17	1600.920	22.356	0.489
18	801.550	22.096	0.494
19	401.320	21.68	0.502
20	201.210	21.064	0.514
21	101.510	20.37	0.527
22	6.120	16.936	0.593

Figure 1. Stress vs Strain graph using EOI strain values.

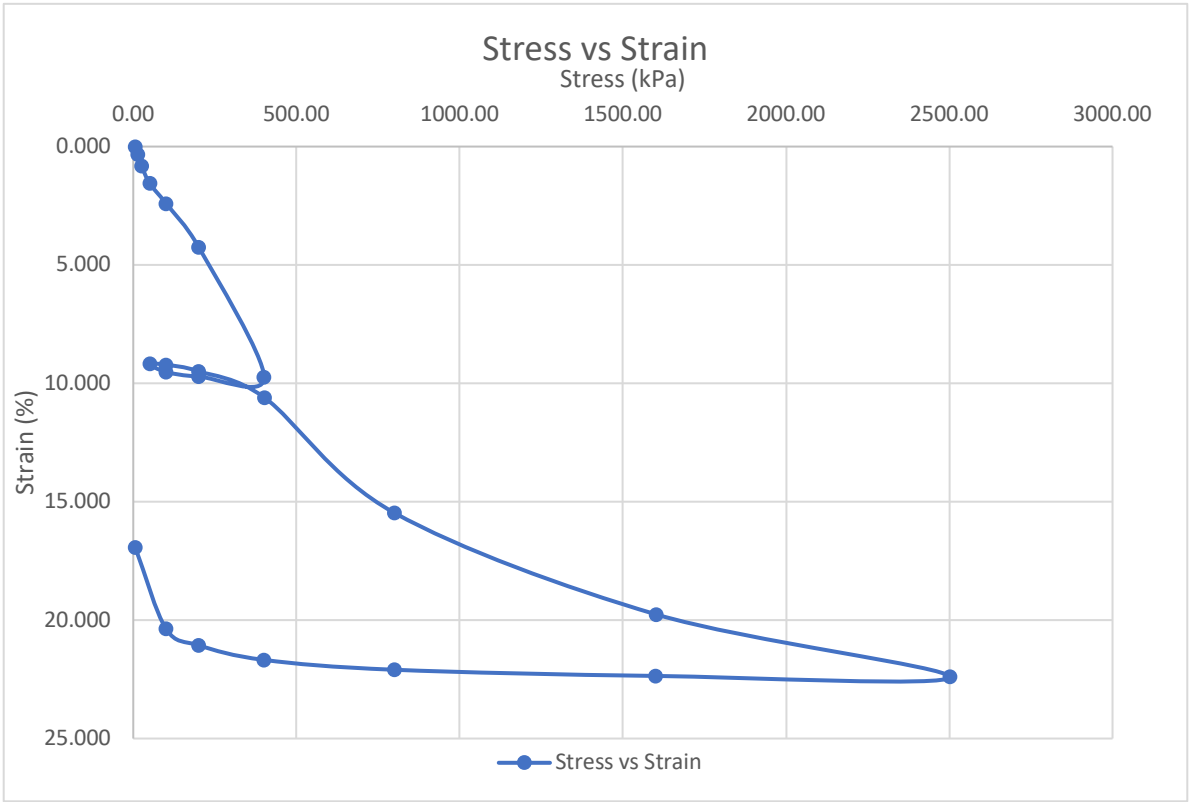


Figure 2. Stress vs Strain graph using EOI strain in log scale.

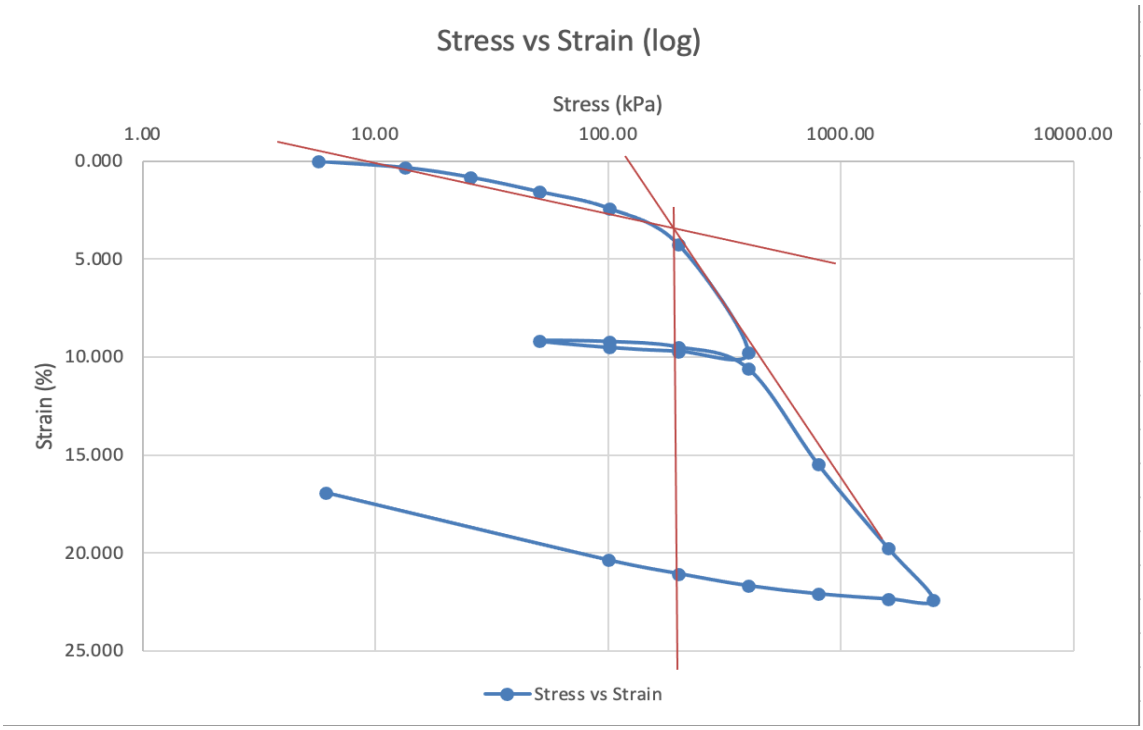


Figure 3. Stress vs Void Ratio graph using EOI e values.

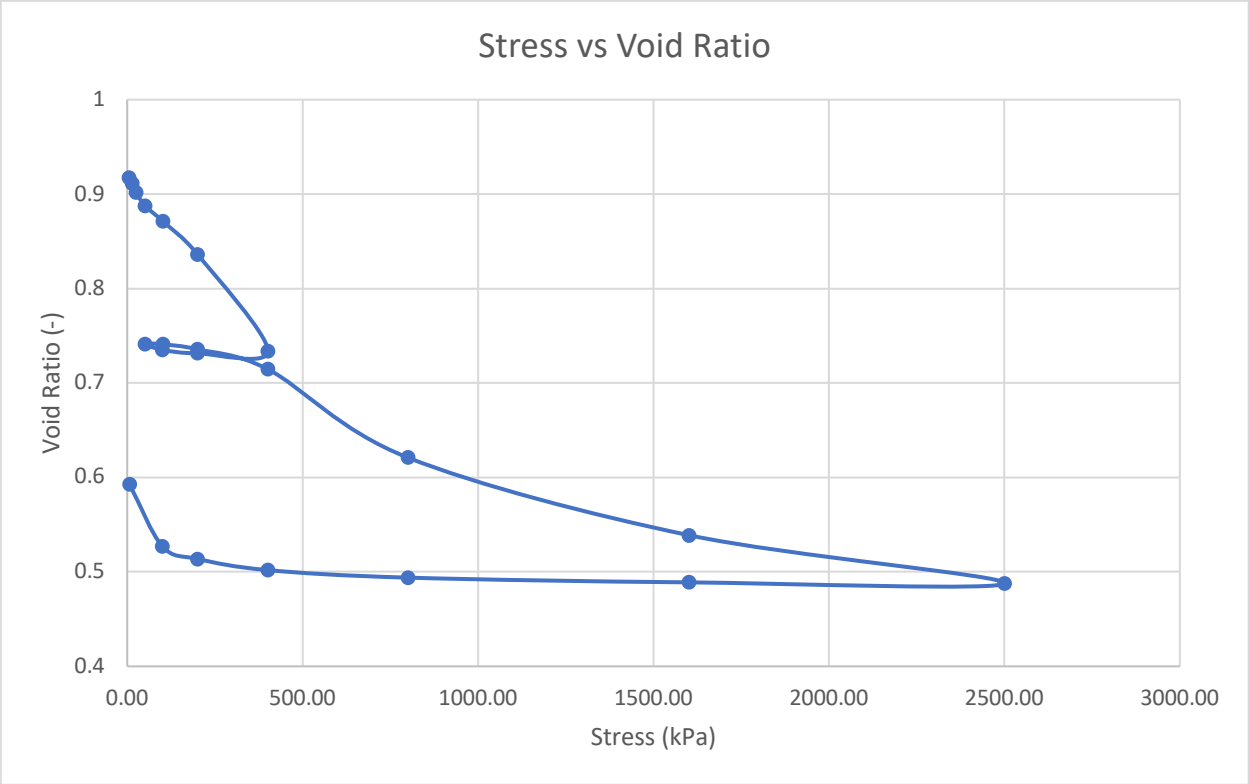


Figure 4. Stress vs Void Ratio graph using EOI e values in log scale.

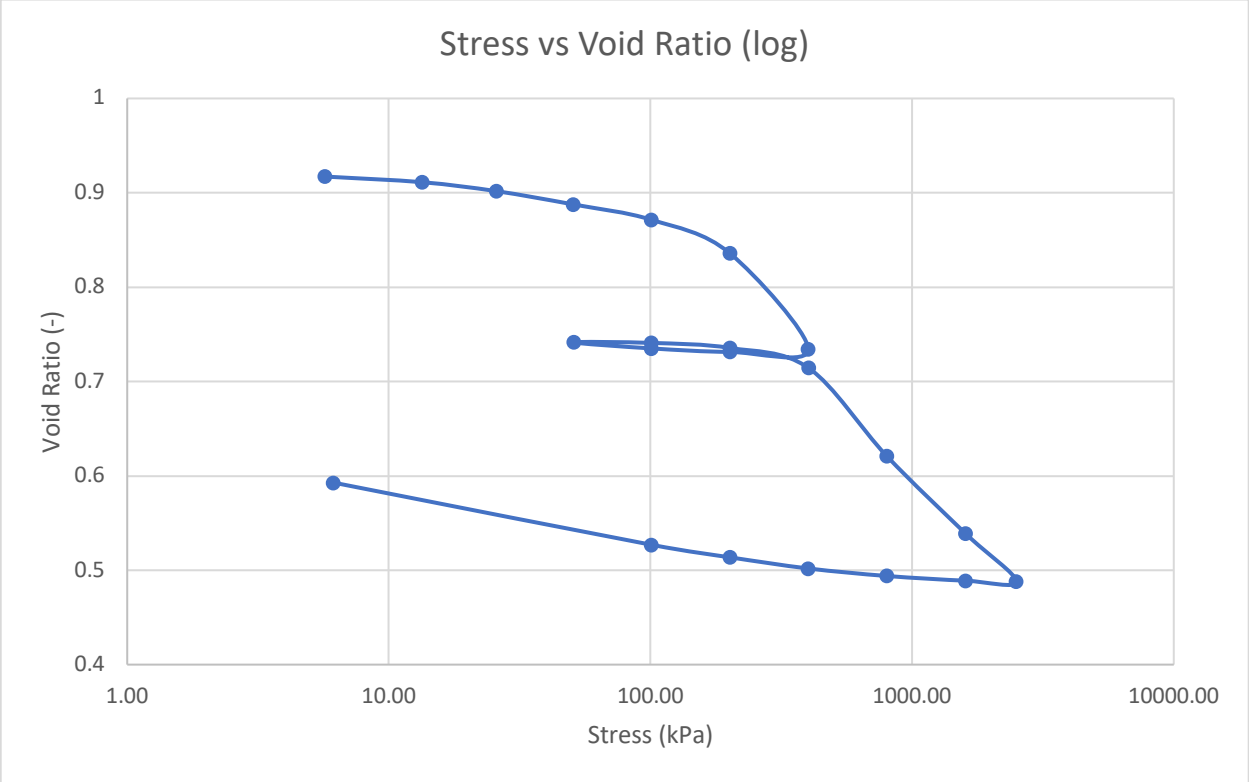


Figure 5. Specimen height versus time for step 4 with vertical effective stress equal to 50 kPa

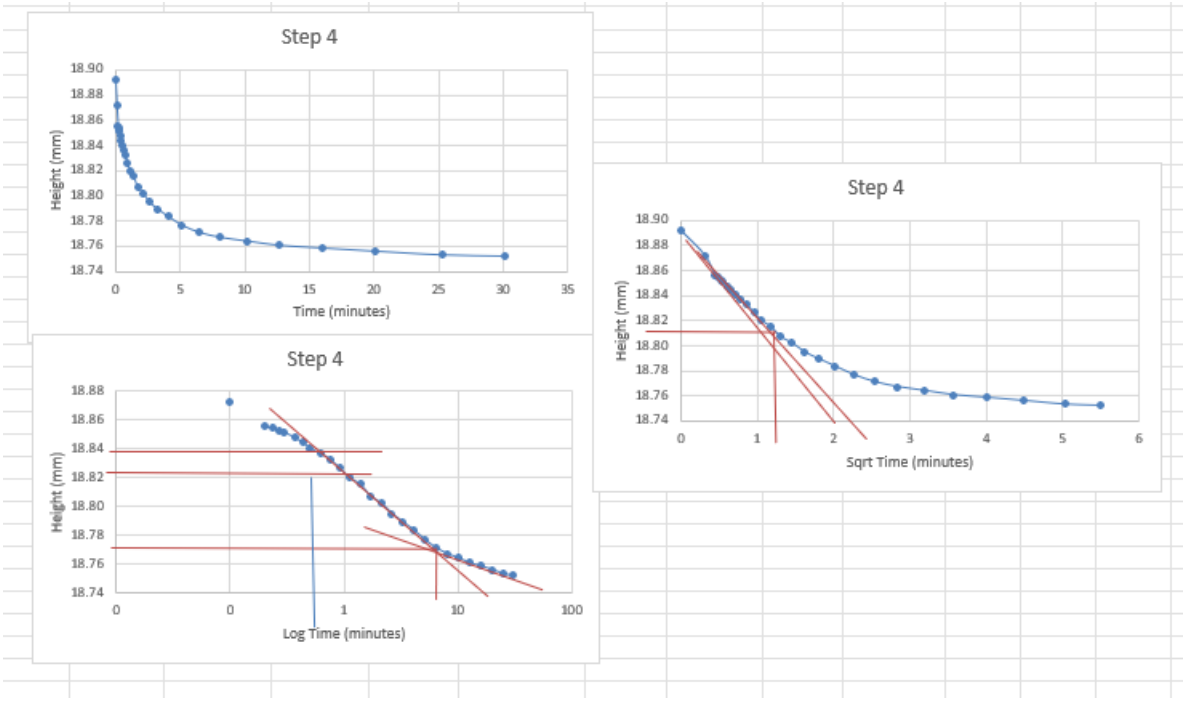


Figure 6. Specimen height versus time for step 5 with vertical effective stress equal to 100 kPa

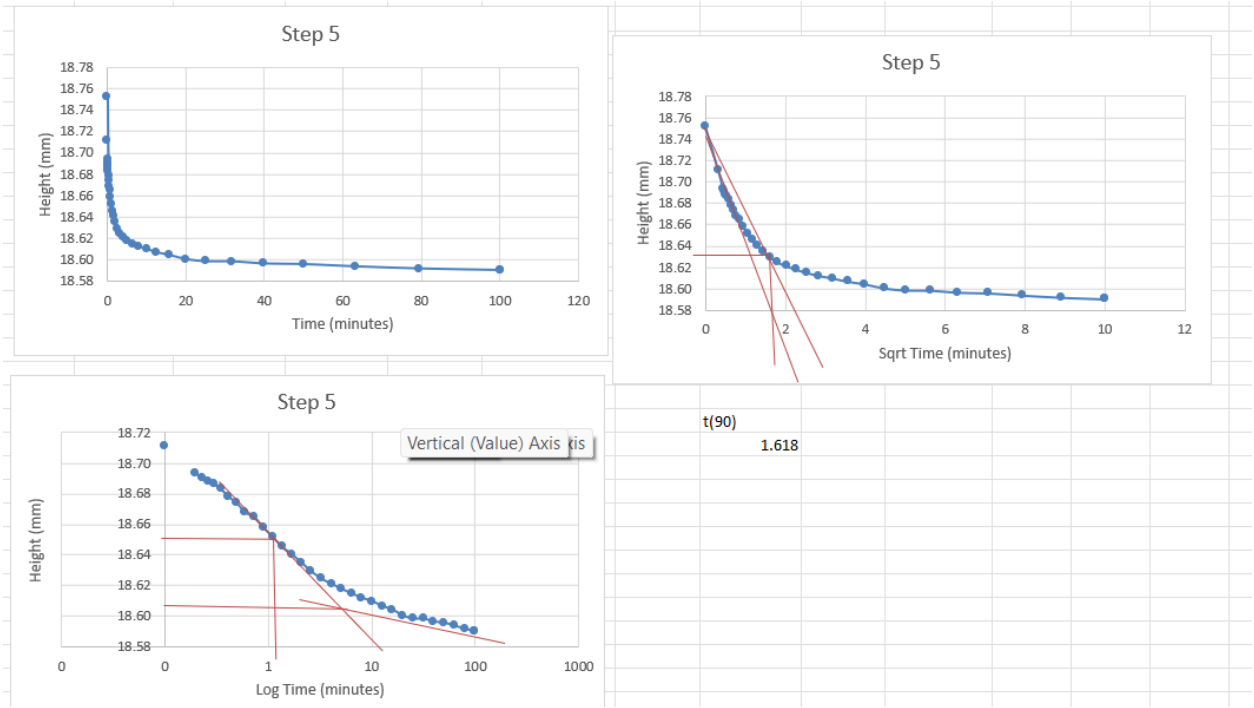


Figure 7. Specimen height versus time for step 6 with vertical effective stress equal to 200 kPa

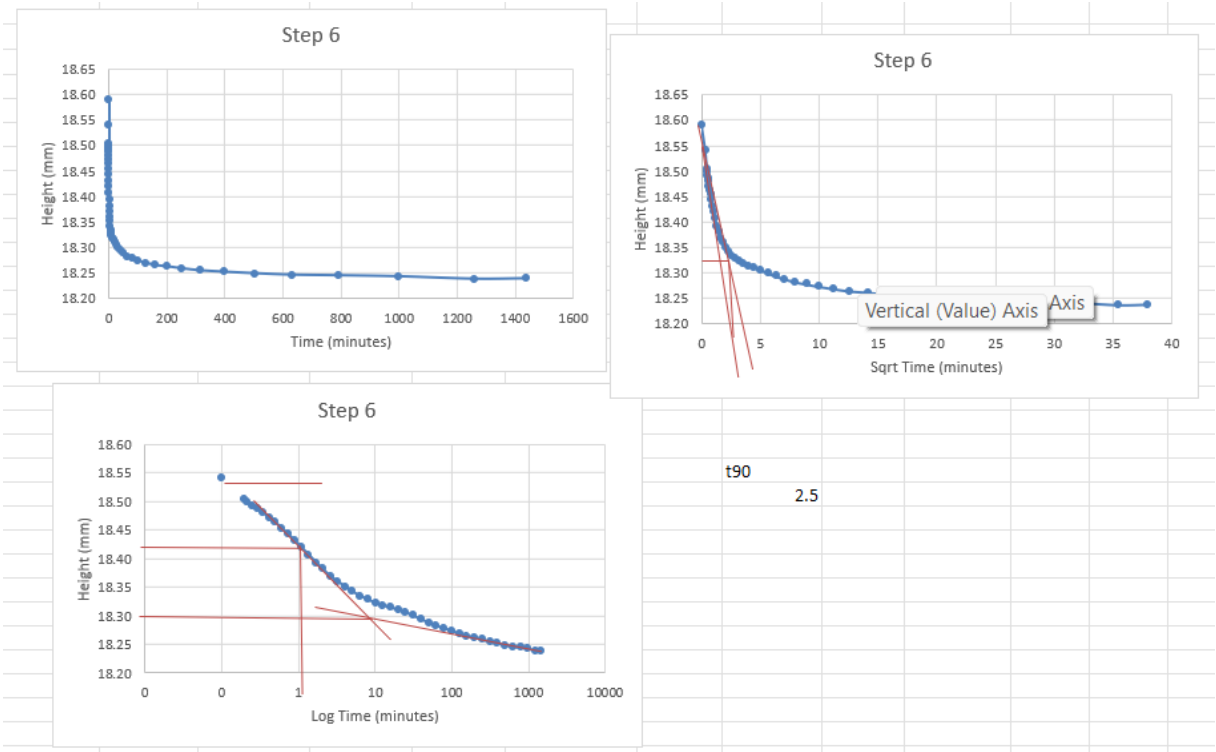


Figure 8. Specimen height versus time for step 7 with vertical effective stress equal to 401 kPa

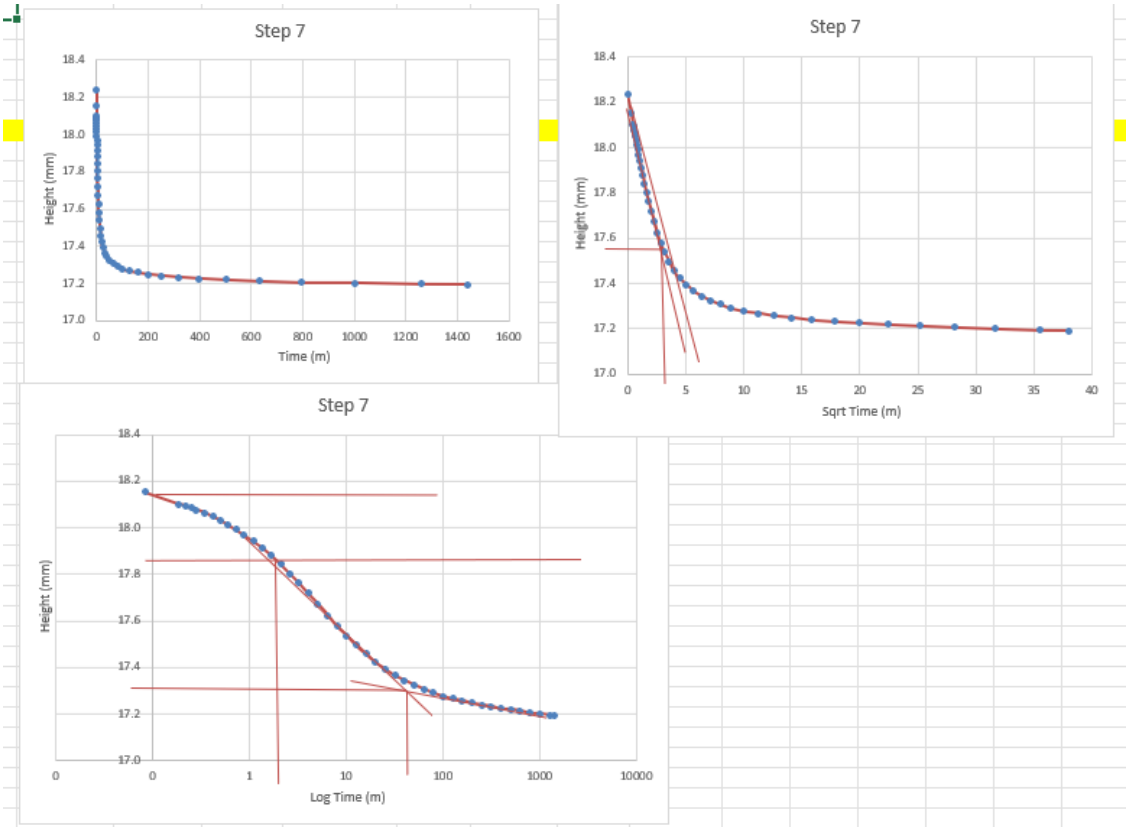


Figure 9. Specimen height versus time for step 14 with vertical effective stress equal to 800.24 kPa

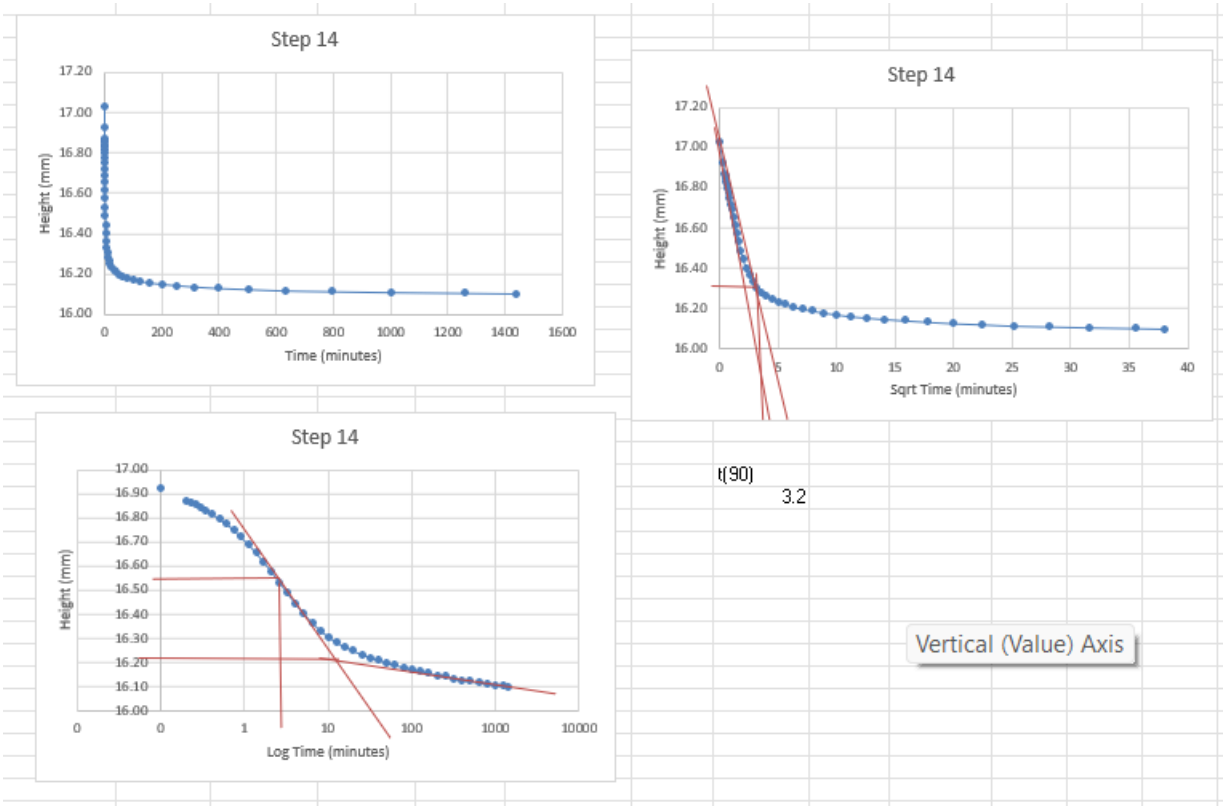
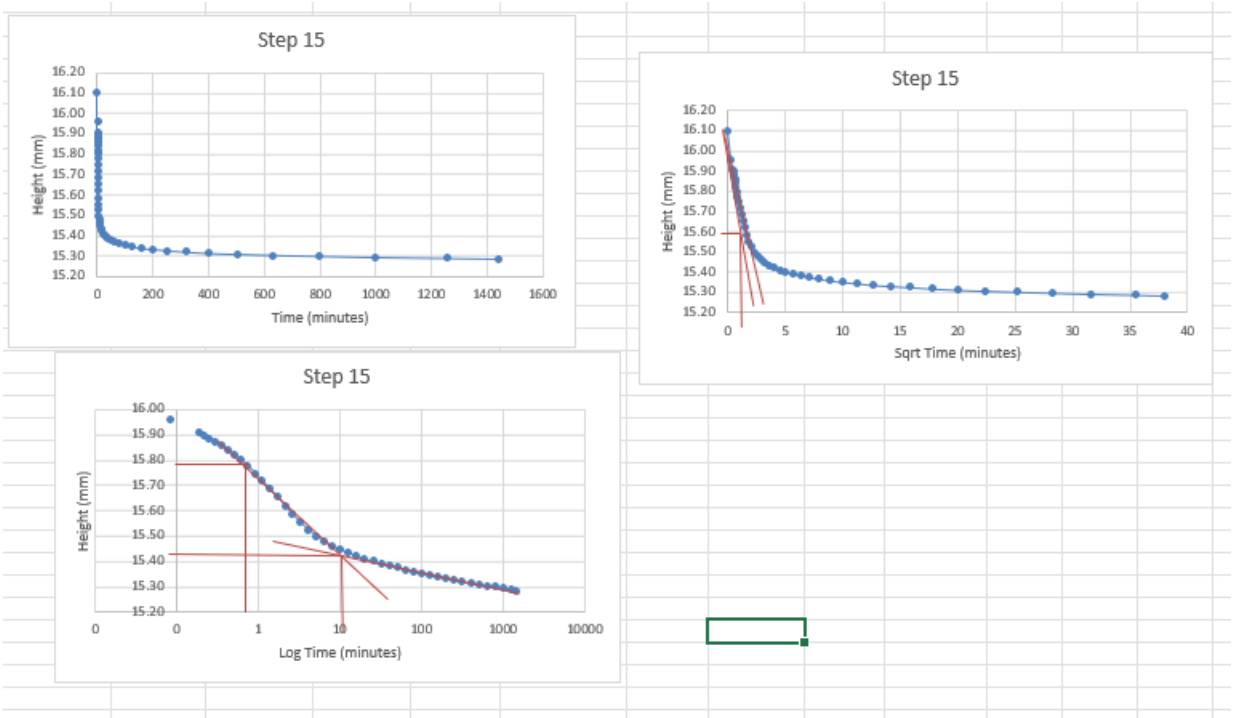
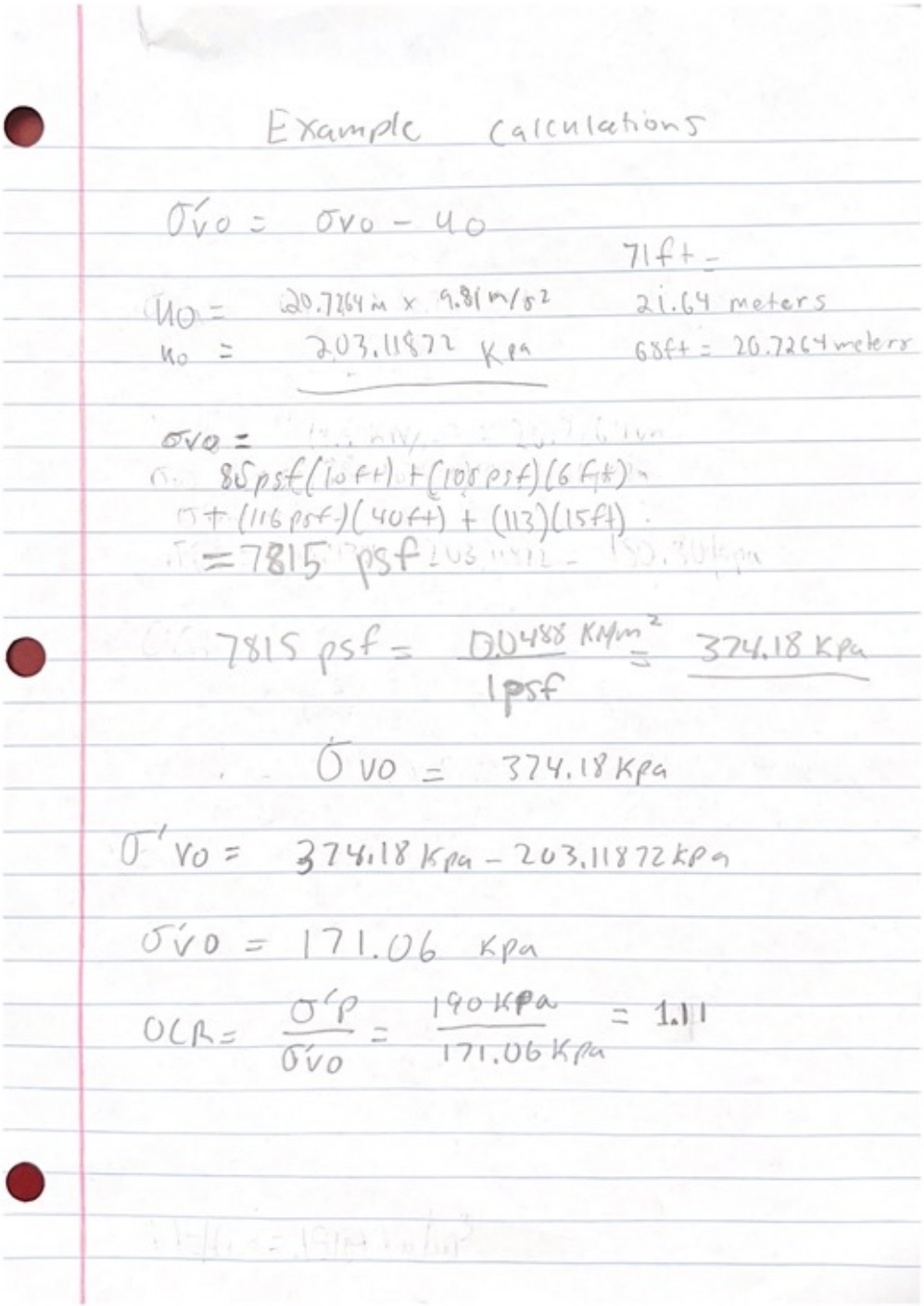


Figure 10. Specimen height versus time for step 15 with vertical effective stress equal to 1601.75 kPa



Appendix:

Sample Calculations. Calculations for σ'_v and OCR. Also, calculations of c_v for 400 kPa of log time and square root time methods.



Example calculations

$\sigma'_{vo} = \sigma_{vo} - u_o$

$u_o = 20.7264\,m \times 9.81\,m/s^2$

$u_o = 203.11872\,Kpa$

71 ft = 21.64 meters

68 ft = 20.7264 meters

$\sigma_{vo} =$

$85\,psf(10\,ft) + (108\,psf)(6\,ft) + (116\,psf)(40\,ft) + (113)(15\,ft)$

$= 7815\,psf$

$7815\,psf = \frac{0.0488\,KN/m^2}{1\,psf} = 374.18\,Kpa$

$\sigma_{vo} = 374.18\,Kpa$

$\sigma'_{vo} = 374.18\,Kpa - 203.11872\,kPa$

$\sigma'_{vo} = 171.06\,Kpa$

$OCR = \frac{\sigma'_p}{\sigma'_{vo}} = \frac{190\,kPa}{171.06\,Kpa} = 1.11$

Example Calculations

400 Kpa

C_v (Taylor) $= 0.848 H_{dr}^2 / t_{90}$

$= 0.848 \left(\frac{H_{50}}{2}\right)^2 / t_{90}$

$= \left(0.848 \left(\frac{17.85}{2}\right)^2\right) / (186 sec)$

$= 0.363 \ cm^2/sec$

C_v Casagrande $= 0.197 H_{dr}^2 / t_{50}$

$= 0.197 \left(\frac{H_{50}}{2}\right)^2 / t_{50}$

$= 0.197 \left(\frac{17.85^2}{2}\right) / (124.2 sec)$

$= 0.126 \ cm^2/sec$