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Determination of the shrinkage and swelling properties of the Lias Clay: OEDOMETER CONSOLIDATION TESTING

Urban Geoscience and Geohazards Programme

Internal Report IR/04/137

BRITISH GEOLOGICAL SURVEY

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Determination of the shrinkage and swelling properties of the Lias Clay: OEDOMETER CONSOLIDATION TESTING

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Keywords

Oedometer, Lias Clay

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Keyworth, Nottingham British Geological Survey 2004

BRITISH GEOLOGICAL SURVEY

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Foreword

This report is a published product of a study by the British Geological Survey (BGS) into the shrinking and swelling of Lias Clays. This is a factual laboratory report into the one-dimensional consolidation properties of samples taken from a range of sites within the UK. The study of the Lias Clay is the Fourth phase of the BGS project entitled " The shrinkage and swelling behaviour of UK clay soils", the others having dealt with the Gault (clay) Formation, the mudstones of the Mercia Mudstone group and the Clays of the Lambeth Group.

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Summary

This report presents the factual results of laboratory tests into the one-dimensional consolidation properties of clays from the Lias group. Two sets of tests were carried out, one loading to 4400 kPa and the other loading to 1776 kPa, based on the size of sample available. The lowest range of volume compressibility was 0.021 m^2/MN and the highest 2.302 m^2/MN. The lowest range of consolidation coefficient was 0.27 m^2/year and the highest 159.54 m^2/year.

1 Introduction

The behaviour of clay rich geological formations in response to a change in moisture content is often exhibited as shrinking or swelling. The material is able to change volume with a change in effective stress causing a geological hazard for engineering construction. These changes vary with clay content and composition and hence geological formation.

The work described in this report concerns one of a number of tests used to determine the likelihood and extent of these changes. The one-dimensional consolidation (oedometer) test measures the deformation of a saturated sample with time over a range of applied loadings.

The report presents the results on tests carried out on samples taken from eleven sites along the outcrop of the Lias clay, from the south of England to the coastal Durham, North Yorkshire border. The locations of the sample sites are given in table 1.

2 Test method

Testing was carried out to British Standard 1377: Part 5: 1990: Test 3 Determination of the one-dimensional consolidation properties. The equipment used in this test has a data-logger attached. The time was recorded at intervals corresponding to a settlement of 0.01mm differing from the procedure described in section 3.5.2.4 of the British Standard. Values of the coefficient of consolidation (C_v) were derived graphically using the deformation – log (time) graph. Two differing sample diameters were used for this test, as the size of the undisturbed samples available was restricted. As this led to different levels of applied pressure the two sets of data have been reported separately.

3 Results

3.1 TEST SITES

Table 1 Test Site Locations

Sample Site	Site Location
Bishops Cleeve, Gloucestershire	SO 946 272
Blockley, Gloucestershire	SP 181 371
Brixworth, Northamptonshire	SP 757 720
Conesby, Lincolnshire	SK 895 145
Dimmer, Somerset	ST 615 313
Flixborough, Lincolnshire	SK 877 142
Ravenscar, North Yorkshire	NZ 980 016
Sidegate Lane, Northamptonshire	SP 916 703
Southam, Warwickshire	SP 422 640
Stowey, Avon	ST 598 587

3.2 SAMPLE SET 1

Table 2. Summary of results for 50mm samples

Sample Site	e_o	M_v Range (m^2/MN)	C_v Range (m^2/year)
Bishops Cleeve	0.613	0.003-0.937	1.63-10.55
Blockley Site 1	0.731	0.005-0.501	1.83-33.87
Brixworth	0.710	0.004-0.191	0.84-2.86
Dimmer	0.520	0.005-0.626	0.01-3.06
Ravenscar	1.285	0.005-1.765	10.17-499.64
Sidegate Lane	0.629	0.004-0.139	1.93-4.24
Southam	0.444	0.012-0.033	0.75-1.02

The results in Table 1 are for 50mm diameter samples tested at applied pressures up to 4400kPa. The greatest range of volume compressibility and consolidation coefficient values were obtained from the Ravenscar sample. This is also the sample with the highest initial void ratio. The lowest range of volume compressibility and consolidation coefficient values were obtained from the Southam sample. This is the sample with the lowest initial voids ratio. There is, however no discernable correlation between initial voids ratio and compressiblity for the range of samples.

Figure 1 shows the voids ratio (e) vs log pressure (log P) graph for these samples. There is a range of values at which the sample starts rapid compression, shown by an inflexion point on the lines. This appears to be related to the initial voids ratio of the sample. The exception to this is the Brixworth sample, which shows three distinct compression periods.

One feature of the graph is the similarity of change in voids ratio exhibited by the samples. With the notable exception of the Ravenscar sample, the change is in the range 0.2 - 0.3. The final voids ratio of the Ravenscar sample is, however, the same as that for the other samples. The dry densities and particle densities of the samples, which are shown in Appendix 1 can explain what is happening to the samples. All the samples are composed of clay of similar particle density. The difference in dry density and hence voids ratio can only arise as a results of air voids in the sample. Stiffer, more lithified clays with higher fracture densities can have these voids, especially as there will be some stress relief on the sample when it is removed no matter how much care is taken not to disturb it. It is likely that the Ravenscar sample was disturbed, with the air-filled stress relief fissures resulting in a higher initial voids ratio. These fissures would close on loading, reducing the voids ratio substantially.

3.3 SAMPLE SET 2

Table 3. Summary of results for 75mm samples

Sample Site	e_o	M_v Range (m^2/MN)	C_v Range (m^2/year)
Blockley Site 2	0.595	0.012-2.614	0.98-160.52
Conesby Site 2	0.299	0.006-0.121	1.13-58.92
Flixborough	0.338	0.007-0.183	1.93-5.5
Stowey	1.049	0.024-3.439	0.55-157.13

The results in Table 2 are for 75mm samples tested at applied pressures up to 1776 kPa. The greatest range of volume compressibility values were obtained from the Stowey site, which is the sample with the highest initial void ratio. The lowest range of volume compressibility obtained is from the Conesby site 2, which is the sample with the lowest initial voids ratio. The greatest range of consolidation coefficient values were obtained from Blockley site 2 and the lowest from Flixborough.

Figure 2 shows the voids ratio (e) vs log pressure (log P) graph for these samples. As with the 50mm diameter samples, the inflection point on the line occurs at a lower applied pressure for the samples with higher initial voids ratio.

The change in voids ratio for these samples is approximately 0.1 for the Flixborough and Conesby Site 2 samples, which had the lowest initial voids ratio. The Blockley Site 2 change is 0.3, which is similar to the values from the 50mm samples having similar initial voids ratios. The greatest change, 0.6, is in the Stowey sample.

As with the 50mm samples this variation in change can be explained by the differences in dry density and initial voids ratio of the samples. The Stowey sample is likely to have been disturbed during sampling with resulting air-voids being formed in resulting stress relief fissures in a similar manner to the Ravenscar sample. The 0.1 ratio change from the Flixborough and Conesby Site 2 samples can be explained by their having the lowest initial voids ratio of all the samples, however it should be borne in mind that their highest loading was 40% of the maximum for the 50mm samples.

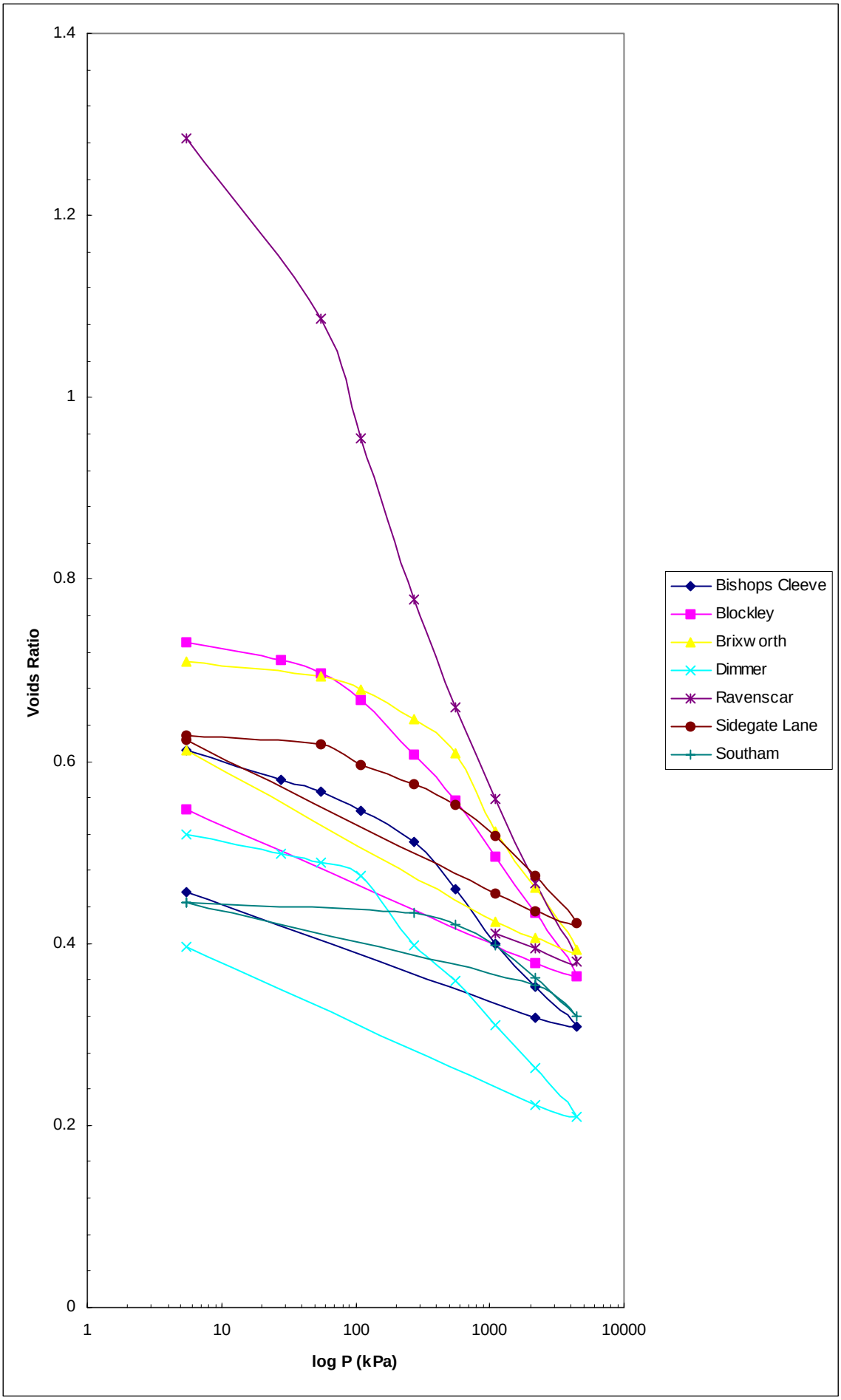


Figure 1 Voids Ratio / Applied Pressure plot for samples loaded to 4400kPa

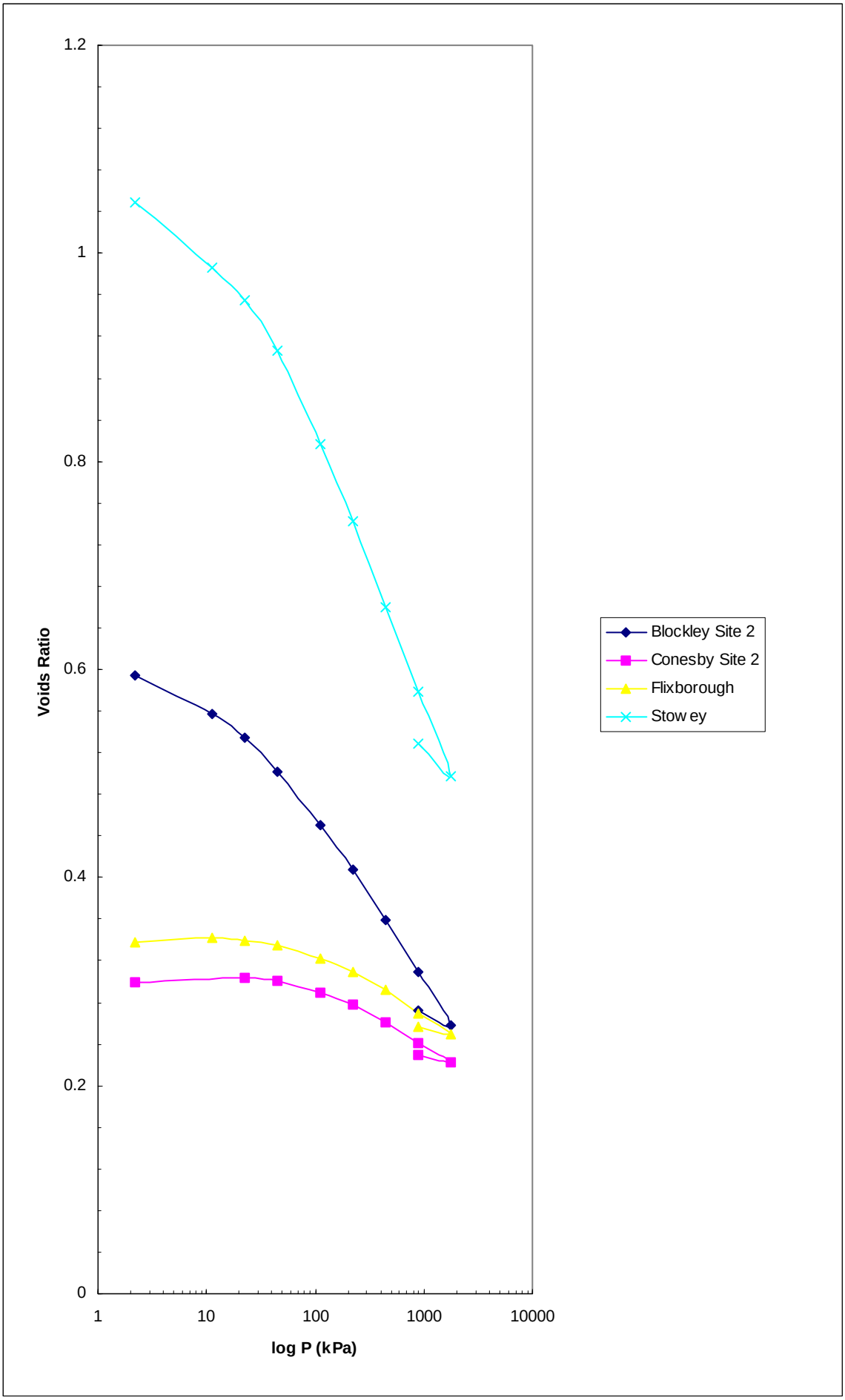


Figure 2 Voids Ratio / Applied Pressure plot for samples loaded to 1776kPa

References

Most of the references listed below are held in the Library of the British Geological Survey at Keyworth, Nottingham. Copies of the references may be purchased from the Library subject to the current copyright legislation.

Anon (1990) Methods of tests for soils for civil engineering purposes BS1377. *British Standards Institution*, London.

Appendix 1 Raw and Calculated Data

OEDOMETER CONSOLIDATION

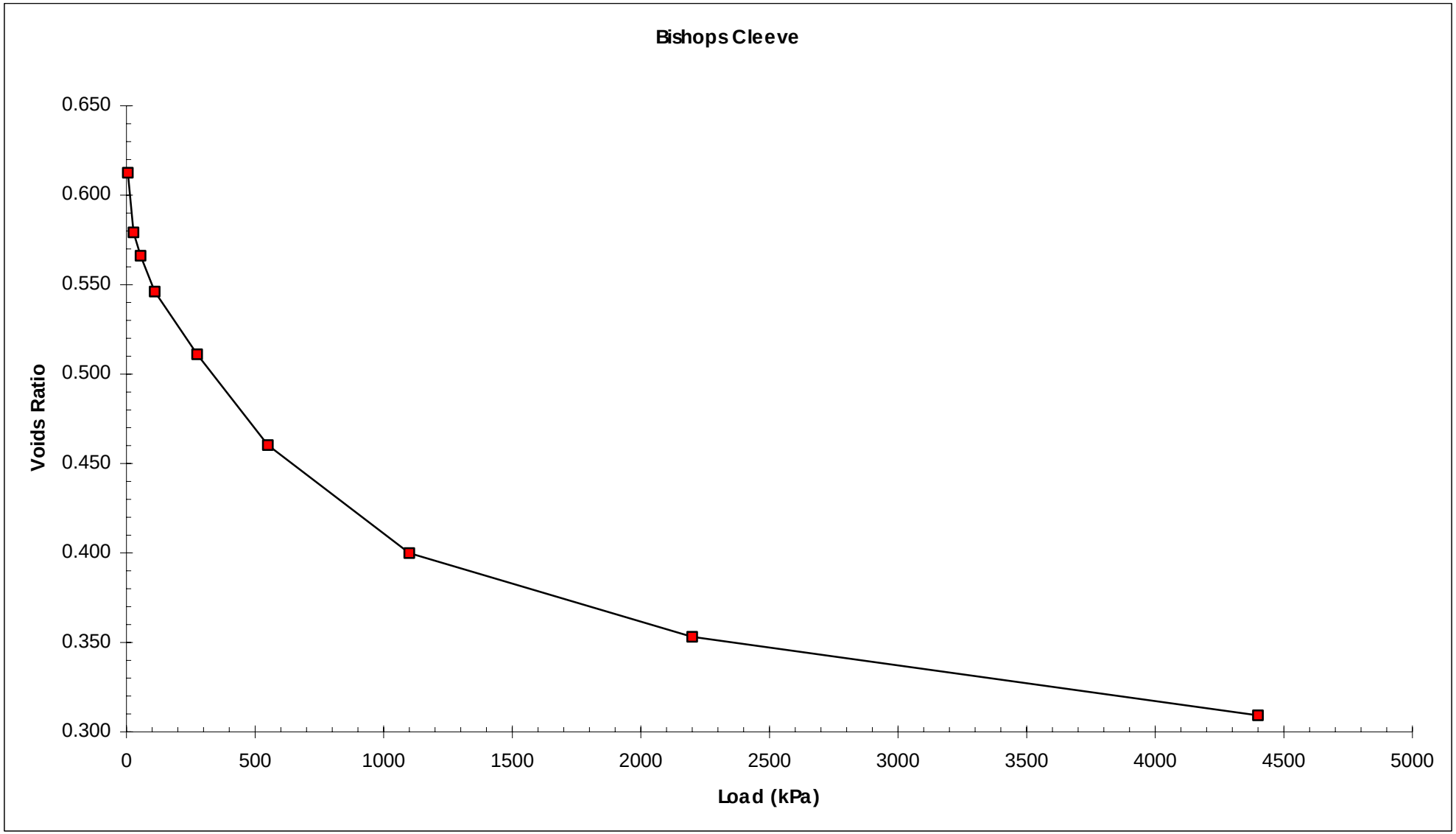
CALCULATION SHEET

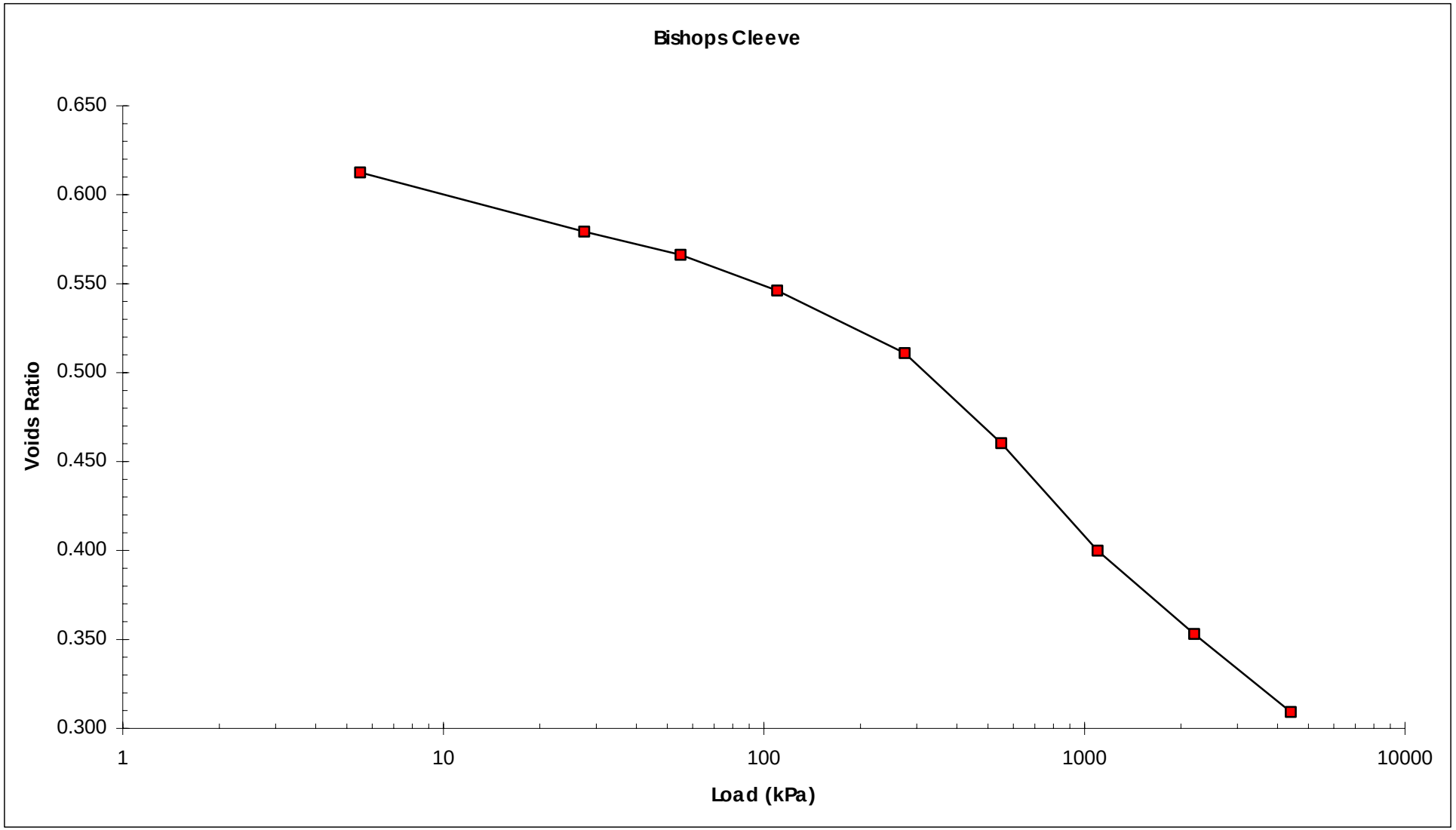
LOCATION:	Bishops Cleeve	**SOIL TYPE:**	Lias Clay
SAMPLE No.		**DEPTH:**	

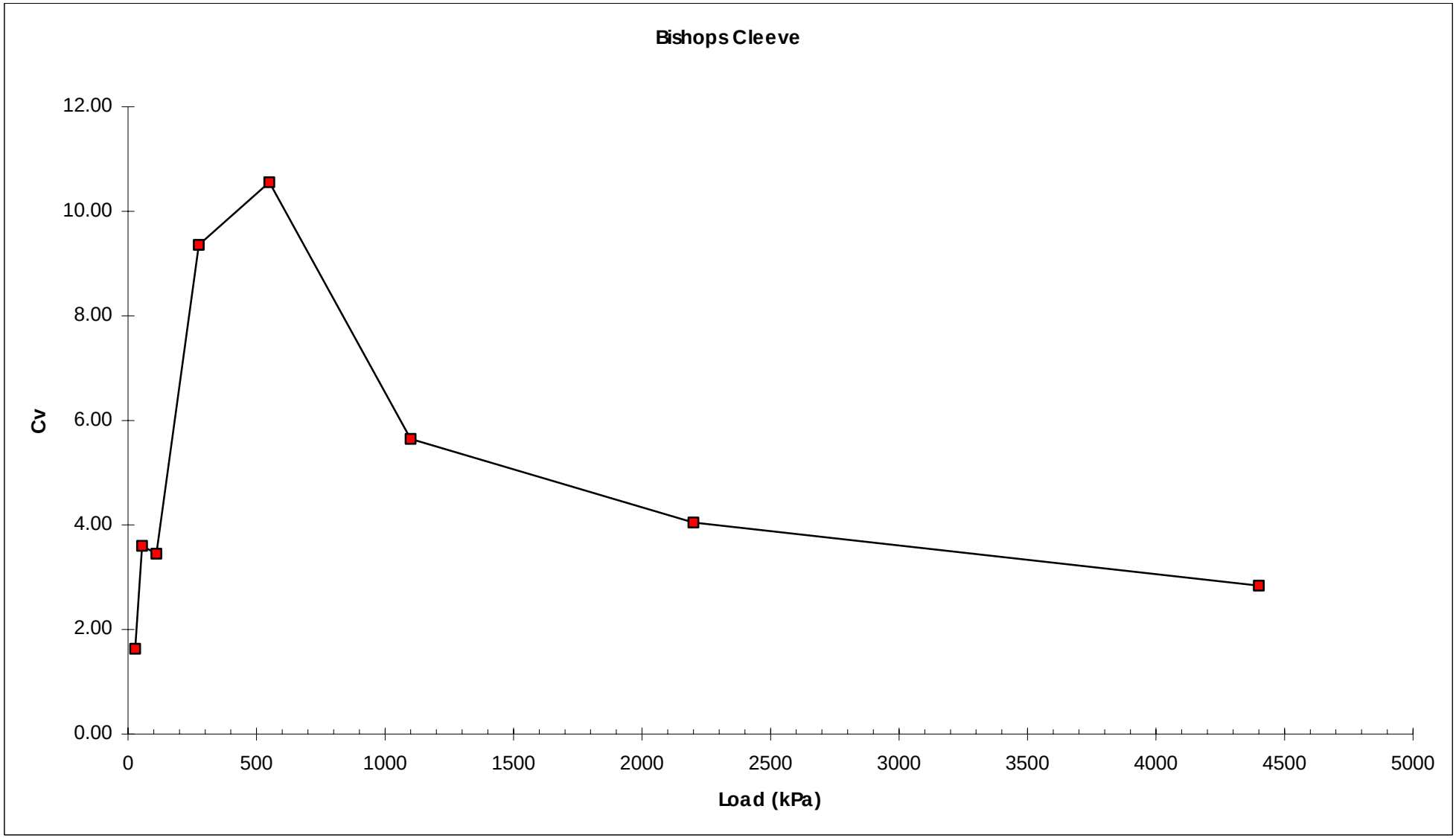
Ho	Gs	DDo	eo	F
17.9	2.68	1.662	0.613	0.090

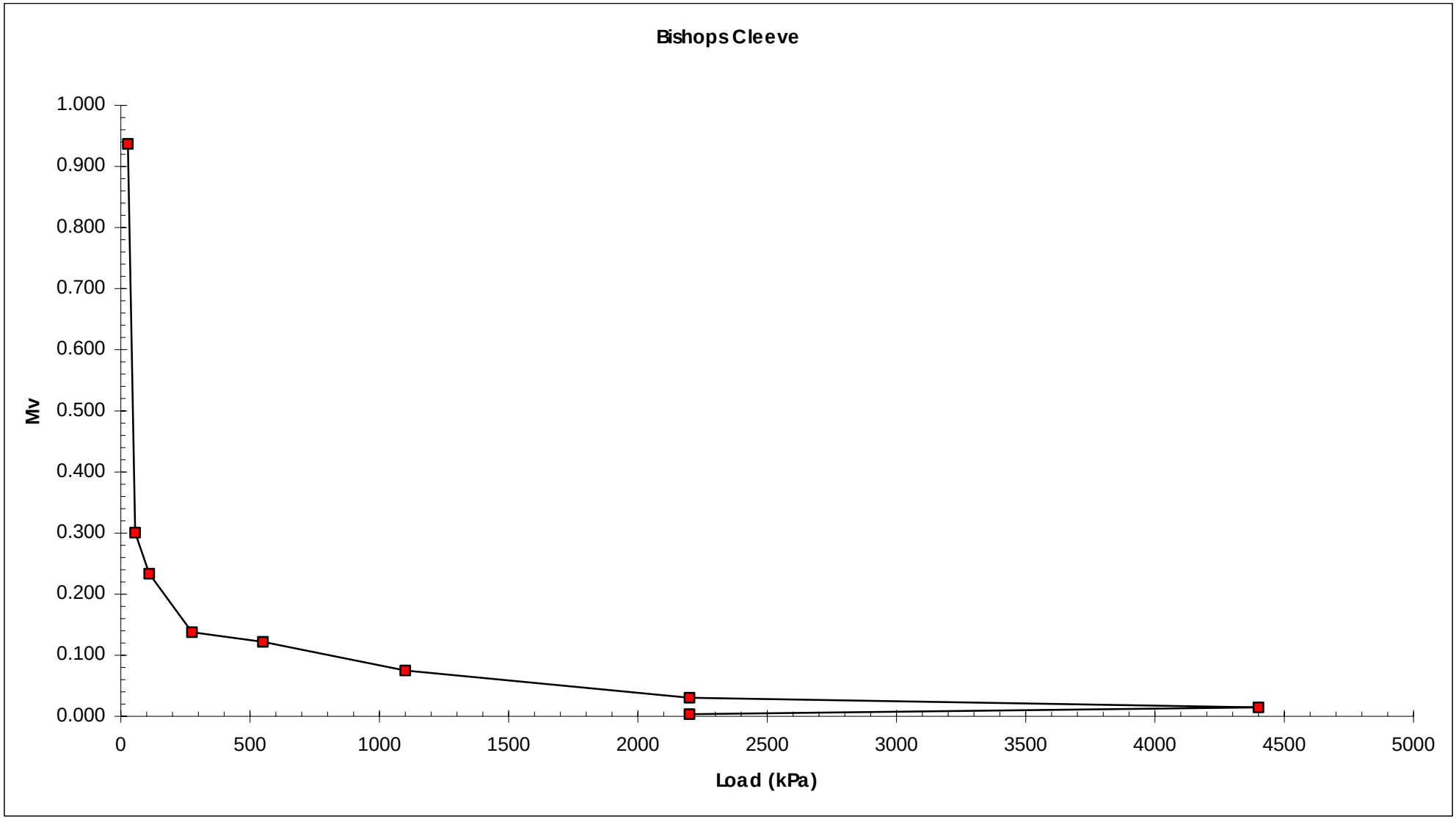
e-logP plot | *Coeff. of Volume Compressibility* | *Coeff. of Consolidation*

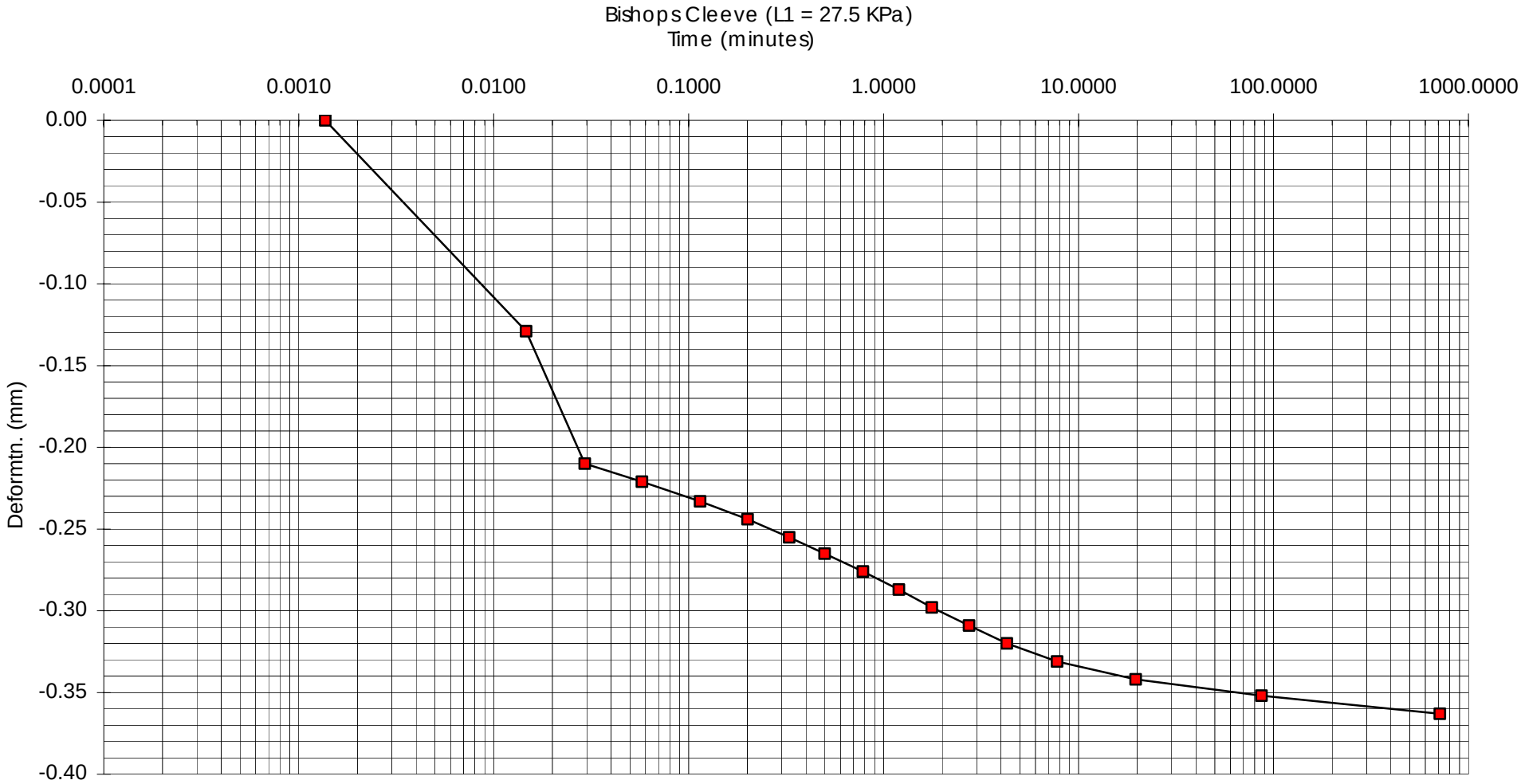
Incr. No.	Press. (kPa)	Nett Sett (mm)	Nett de	e1	Incr. de	Incr. dp (kPa)	1+e1	Mv (m2/MN)	t50 (mins)	H (mm)	Mean Ht H' (mm)	Cv (m2/yr)
				0								
	5.5	0	0.000	**0.613**						17.900		
1	**27.5**	0.369	0.033	**0.579**	0.033	22	1.613	**0.937**	5	17.531	17.7155	**1.63**
2	**55**	0.514	0.046	**0.566**	0.013	27.5	1.579	**0.301**	2.2	17.386	17.4585	**3.60**
3	**110**	0.737	0.066	**0.546**	0.020	55	1.566	**0.233**	2.25	17.163	17.2745	**3.45**
4	**275**	1.127	0.102	**0.511**	0.035	165	1.546	**0.138**	0.8	16.773	16.968	**9.36**
5	**550**	1.690	0.152	**0.460**	0.051	275	1.511	**0.122**	0.67	16.21	16.4915	**10.55**
6	**1100**	2.36	0.213	**0.400**	0.060	550	1.460	**0.075**	1.16	15.54	15.875	**5.65**
7	**2200**	2.880	0.259	**0.353**	0.047	1100	1.400	**0.030**	1.5	15.02	15.28	**4.05**
8	**4400**	3.367	0.303	**0.309**	0.044	2200	1.353	**0.015**	2	14.533	14.7765	**2.84**
9	**2200**	3.261	0.294	**0.319**	-0.010	-2200	1.309	**0.003**		14.639	14.586	
10	**5.5**	1.725	0.155	**0.457**	-0.138	-2194.5	1.319	**0.048**		16.175	15.407	

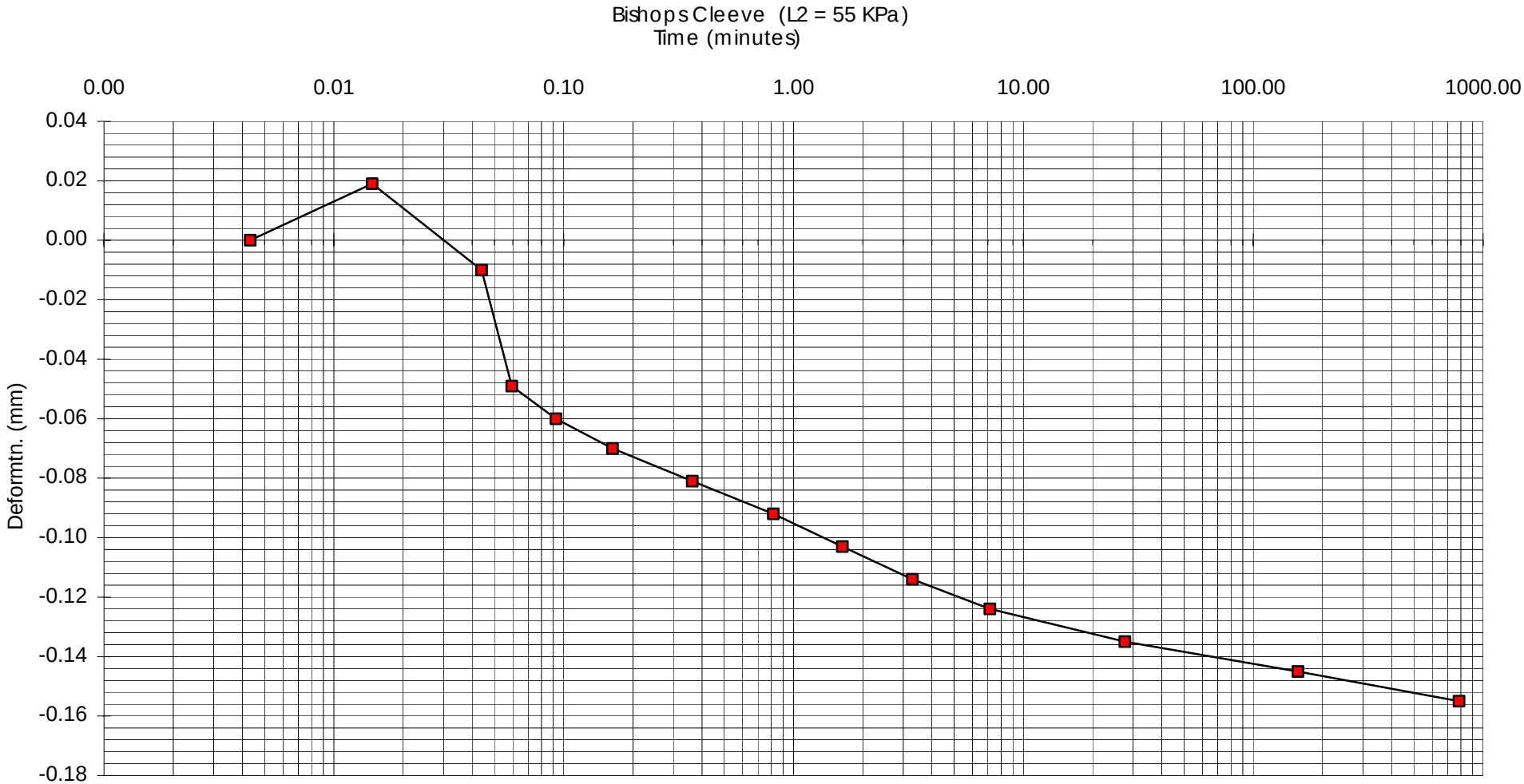

Bishops Cleeve
Voids Ratio
0.650
0.600
0.550
0.500
0.450
0.400
0.350
0.300
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

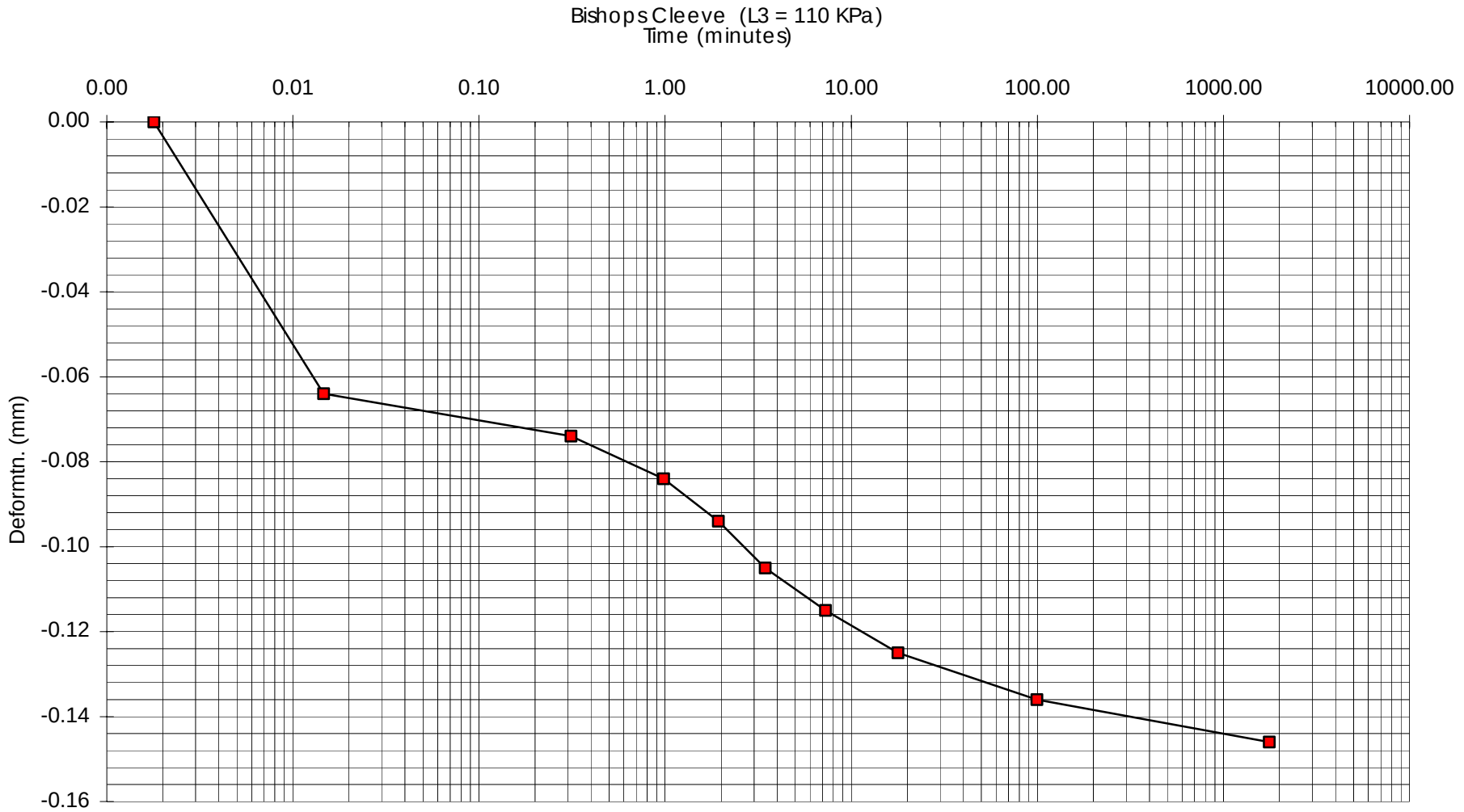

Bishops Cleeve
Voids Ratio
0.650
0.600
0.550
0.500
0.450
0.400
0.350
0.300
1
10
100
1000
10000
Load (kPa)

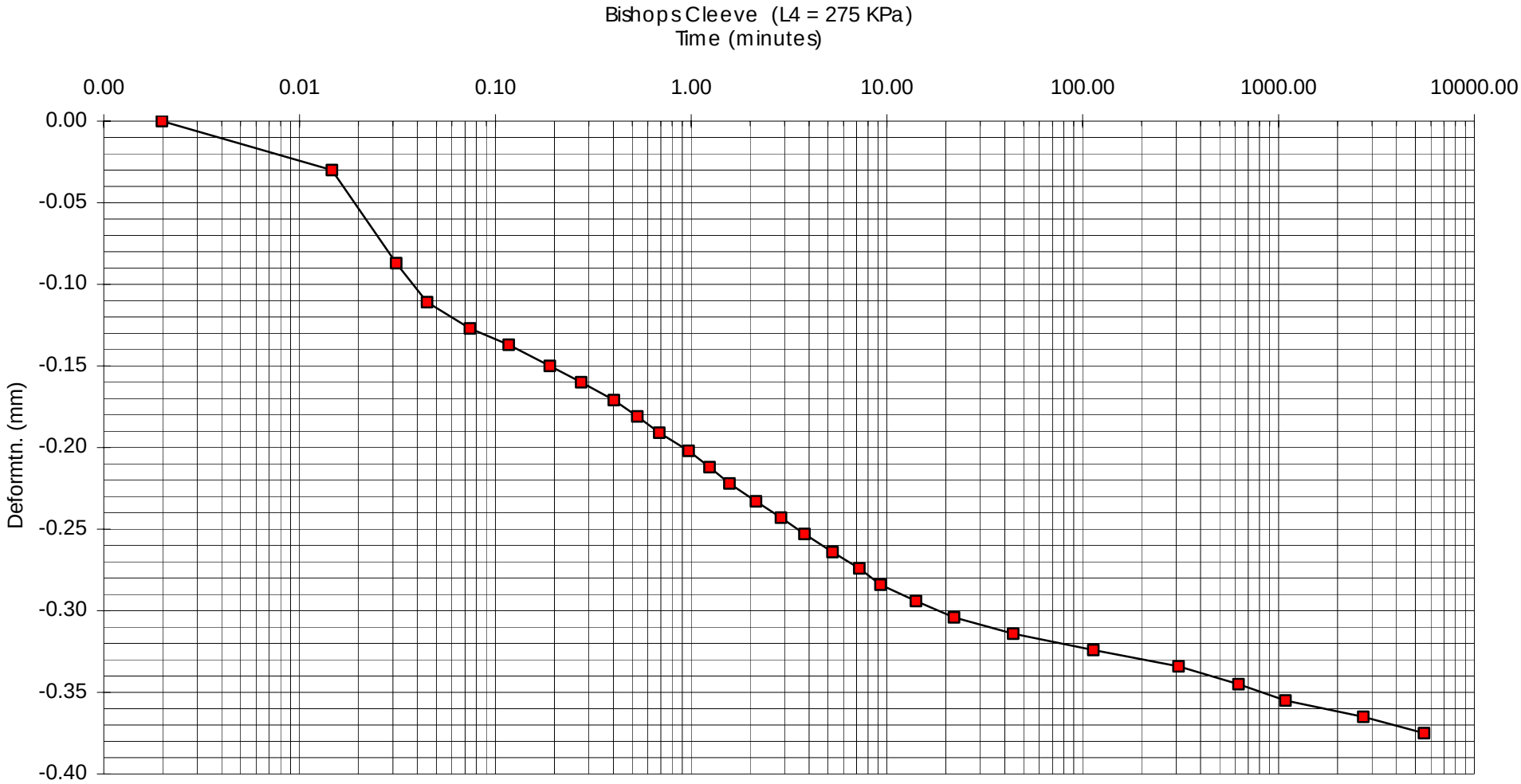

Bishops Cleeve
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Cv
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

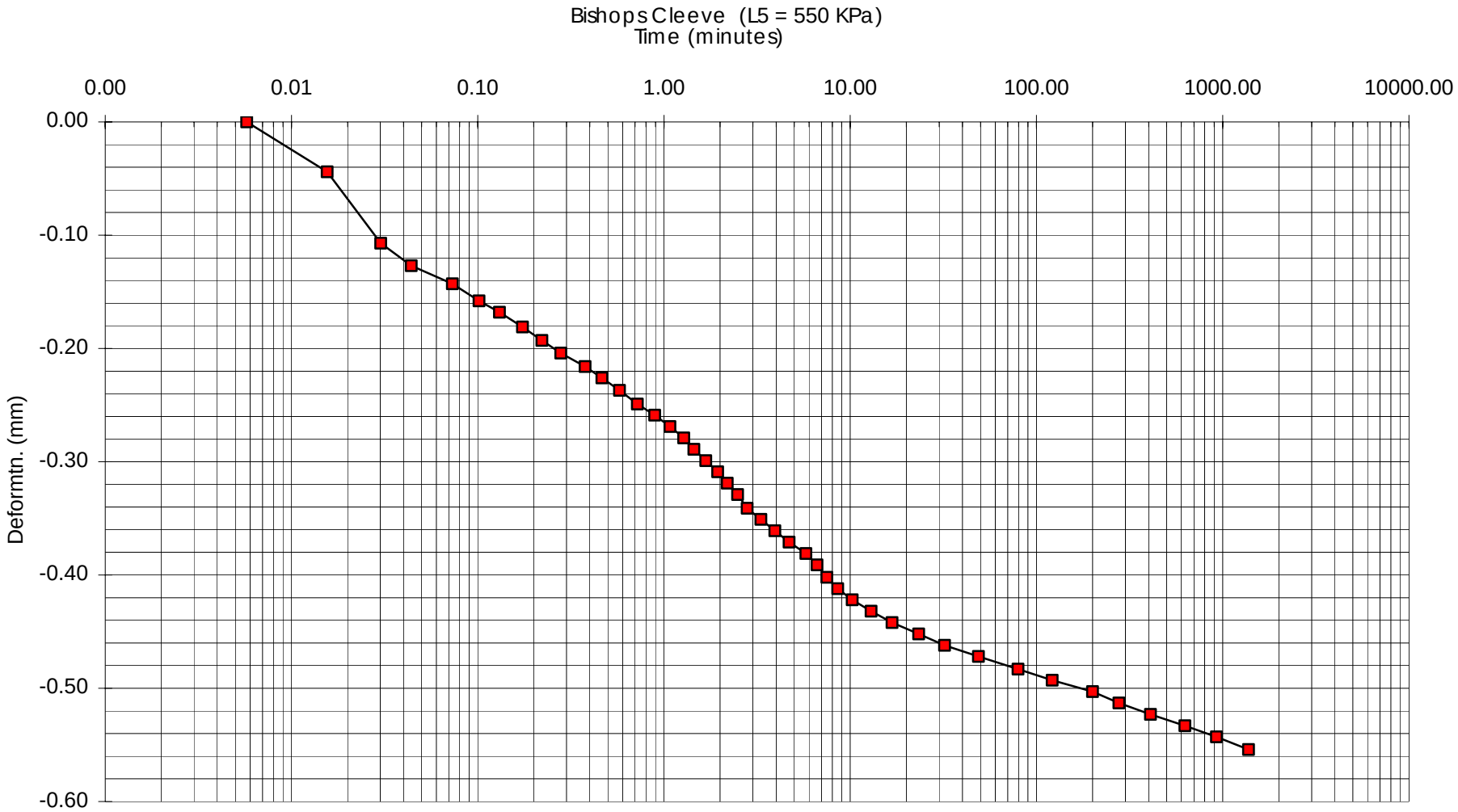

Bishops Cleeve
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Mv
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

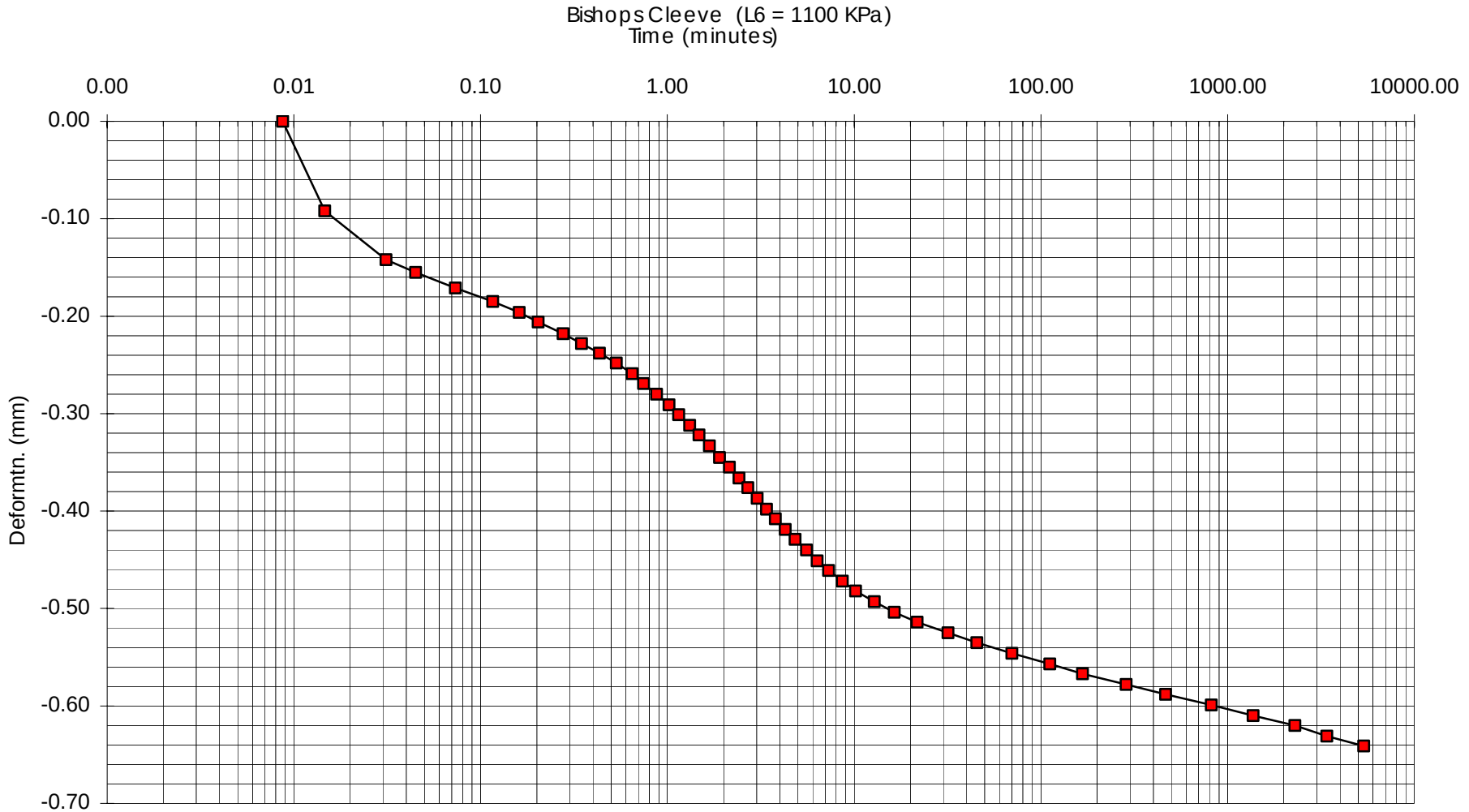

Bishops Cleeve (L1 = 27.5 KPa)
Time (minutes)
0.0001
0.0010
0.0100
0.1000
1.0000
10.0000
100.0000
1000.0000
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
Deformtn. (mm)

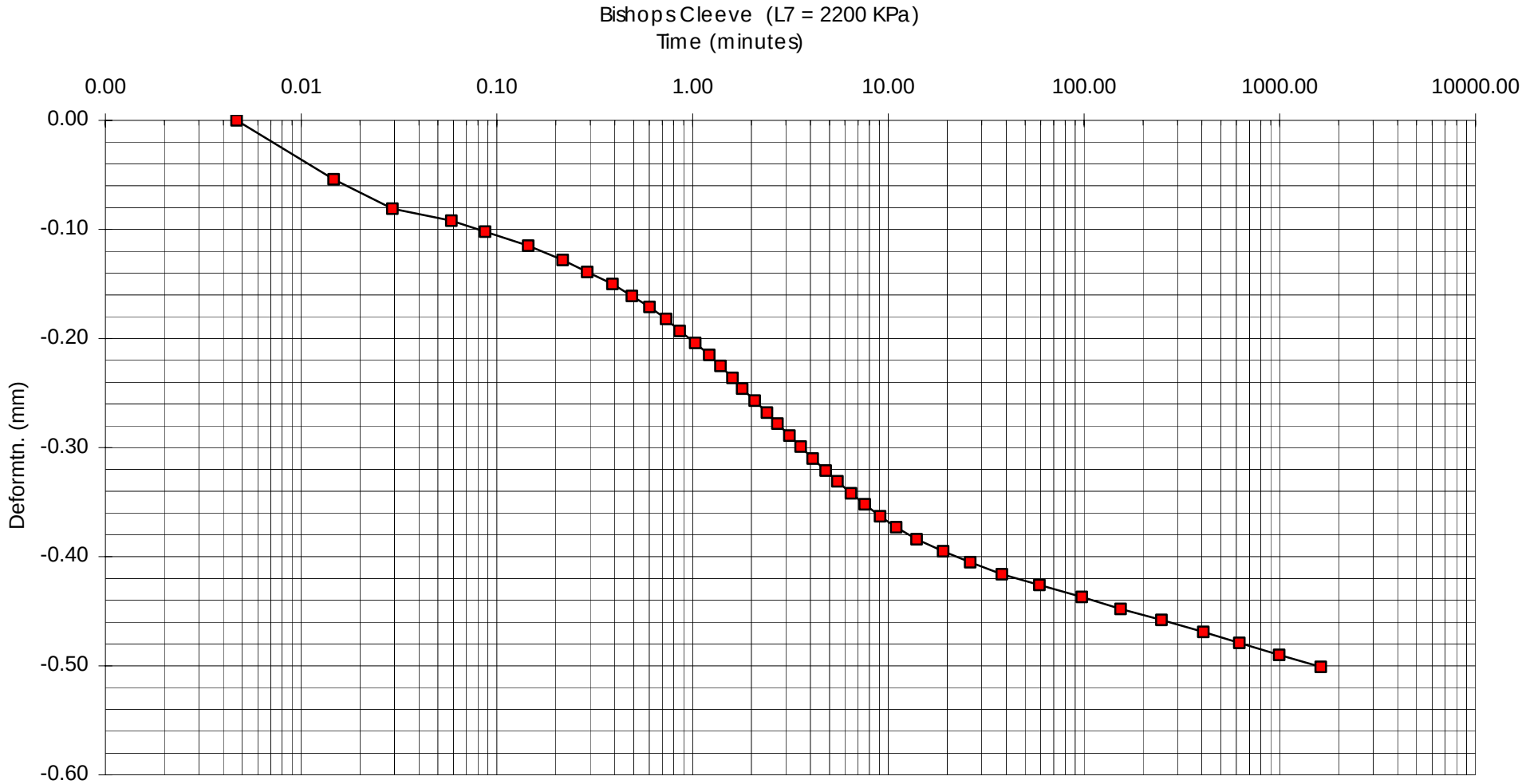

Bishops Cleeve (L2 = 55 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
-0.16
-0.18
Deformtn. (mm)

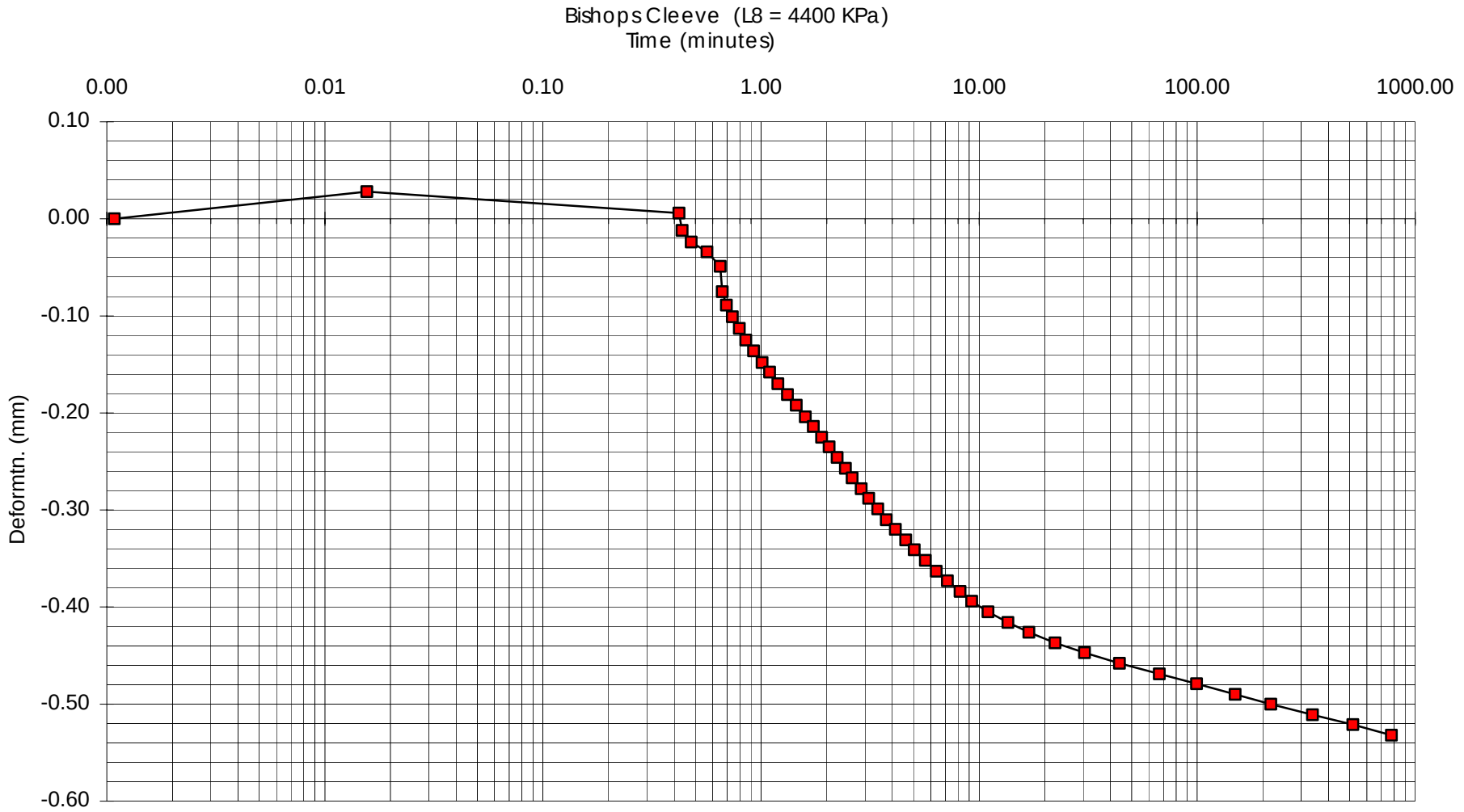

Bishops Cleeve (L3 = 110 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
-0.16
Deformtn. (mm)


Bishops Cleeve (L4 = 275 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
Deformtn. (mm)


Bishops Cleeve (L5 = 550 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
Deformtn. (mm)


Bishops Cleeve (L6 = 1100 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
Deformtn. (mm)
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70


Bishops Cleeve (L7 = 2200 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
Deformtn. (mm)


Bishops Cleeve (L8 = 4400 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
Deformtn. (mm)

OEDOMETER CONSOLIDATION

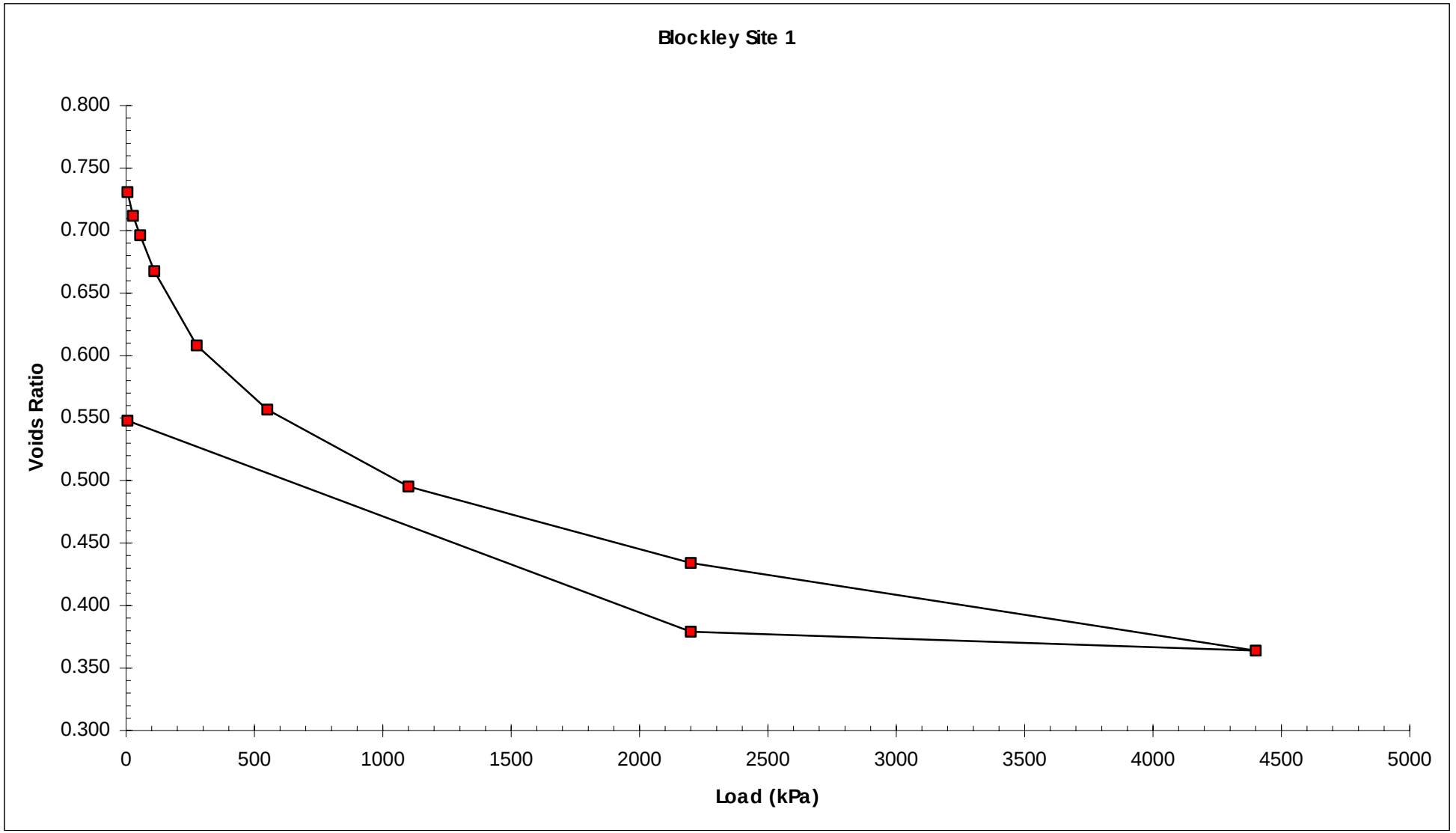
CALCULATION SHEET

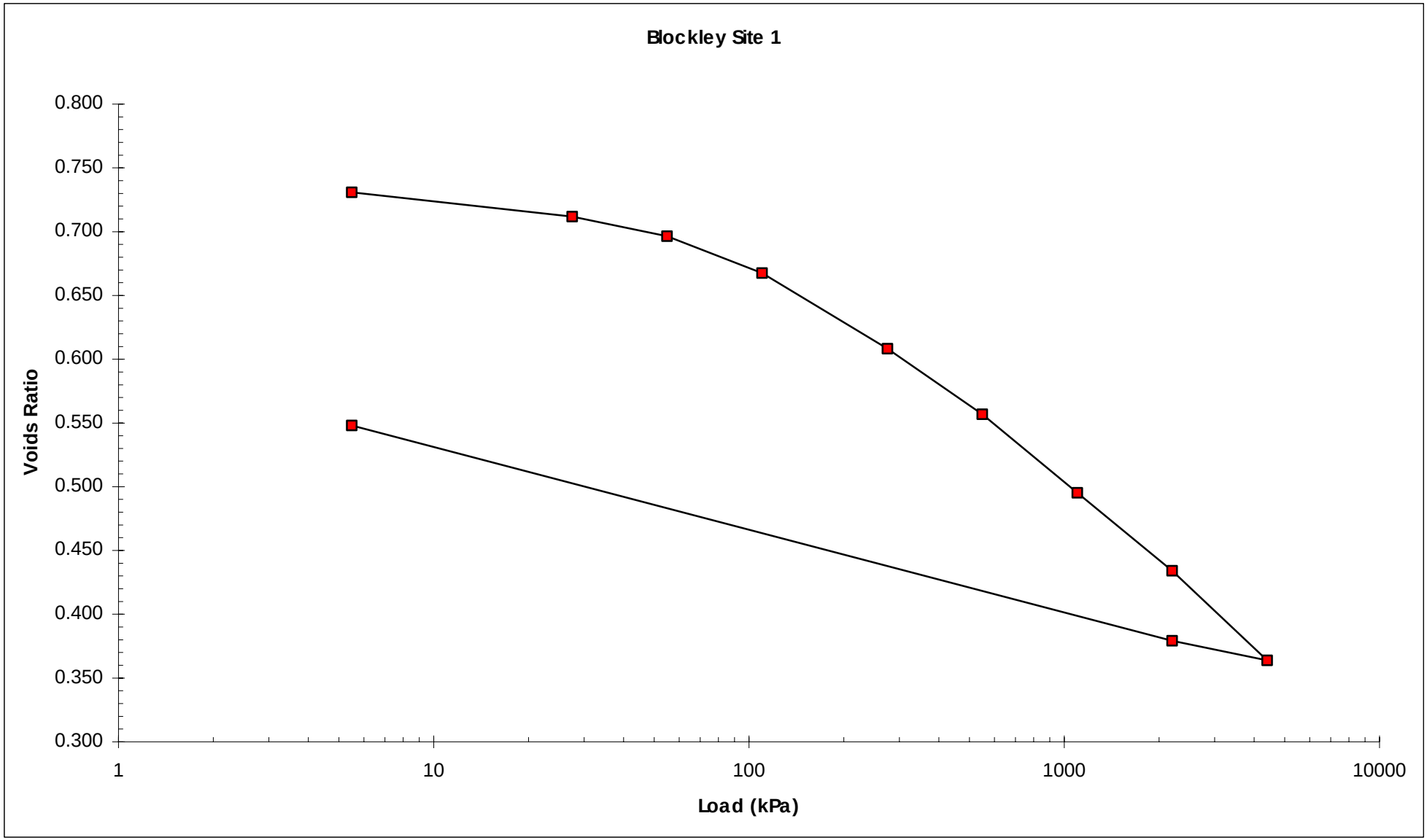
LOCATION:	Blockley	**SOIL TYPE:**	Lias Clay
SAMPLE No.	1	**DEPTH:**	

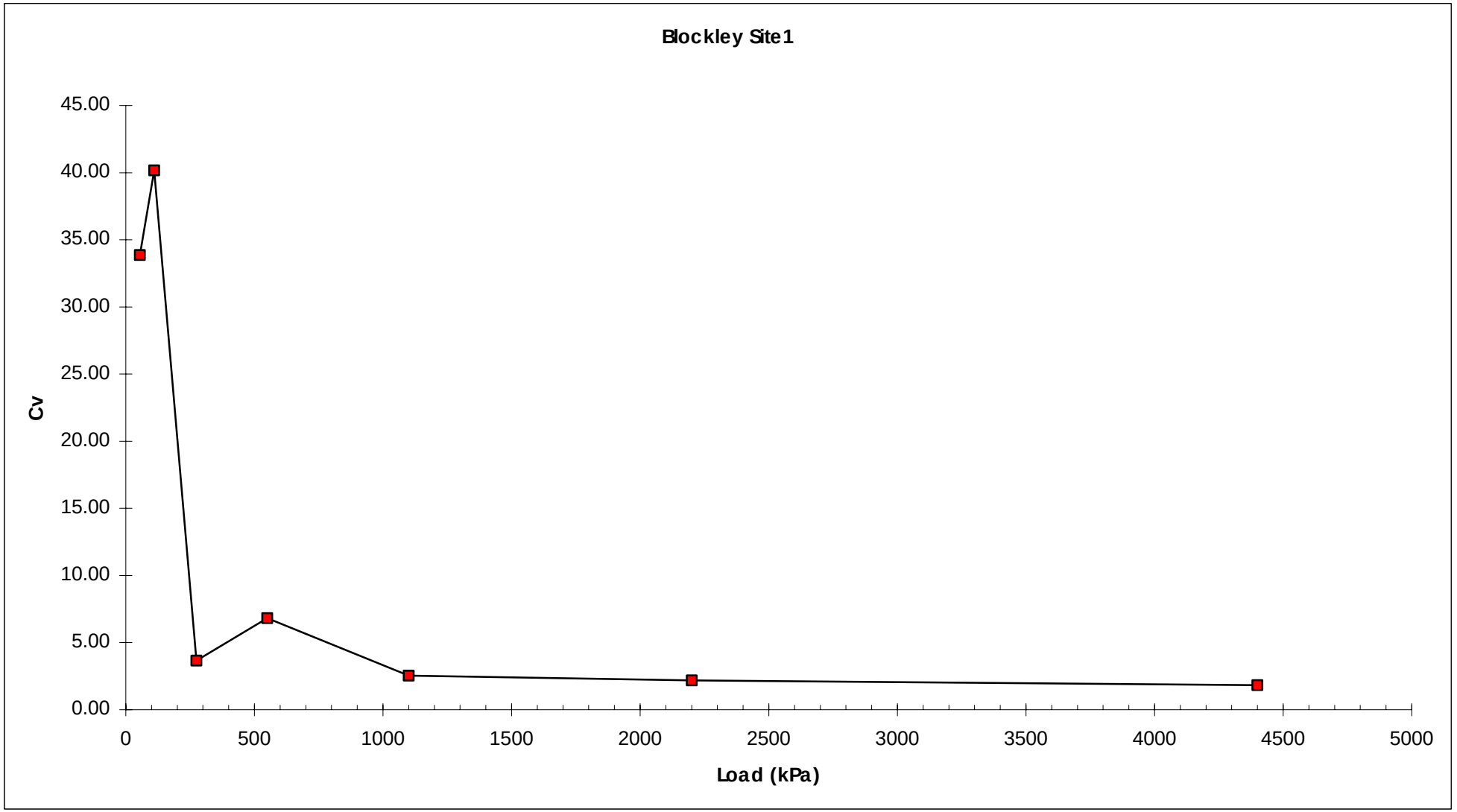
Ho	Gs	DDo	eo	F
19.4	2.65	1.531	0.731	0.089

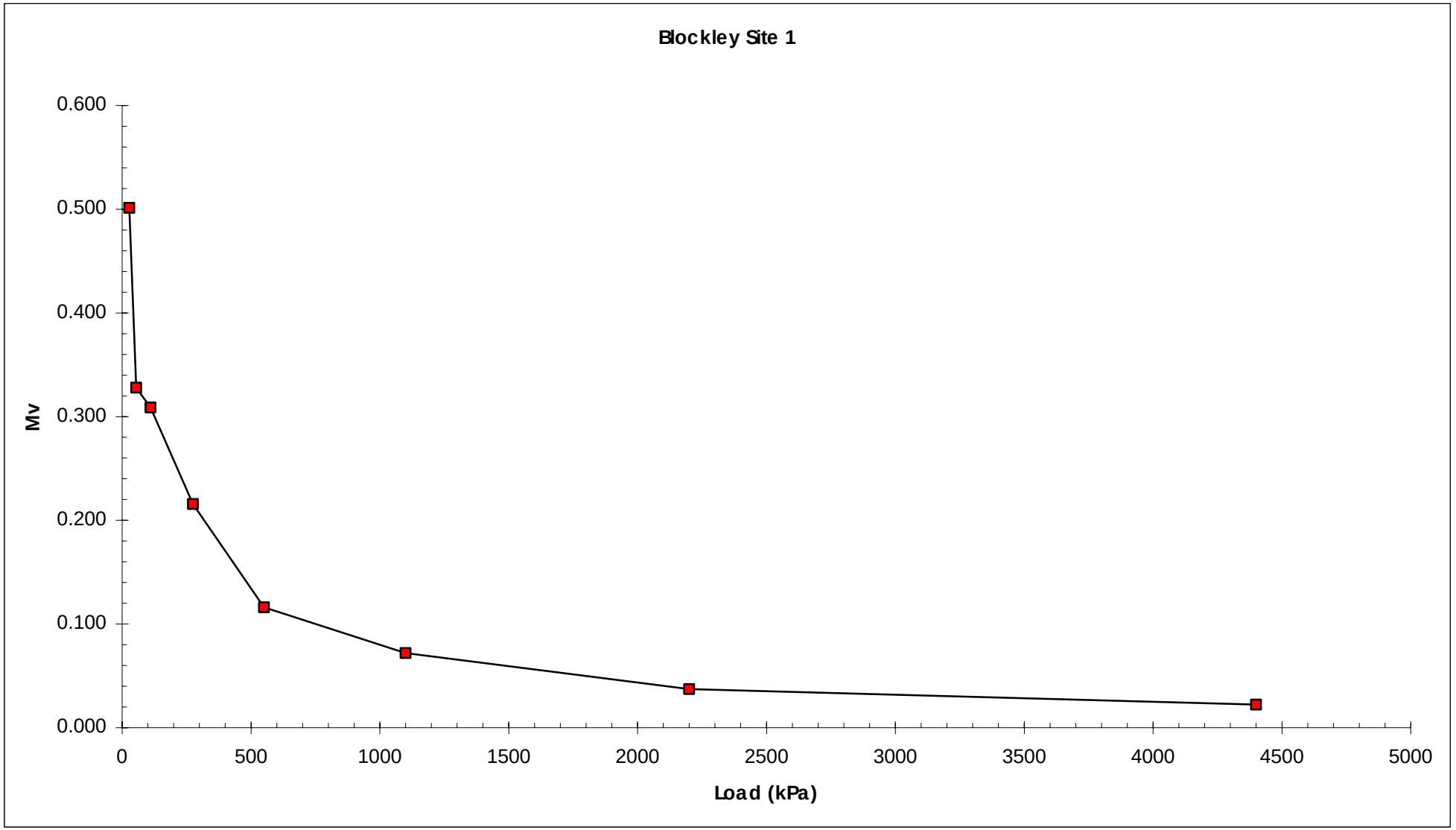
e-logP plot *Coeff. of Volume Compressibility* *Coeff. of Consolidation*

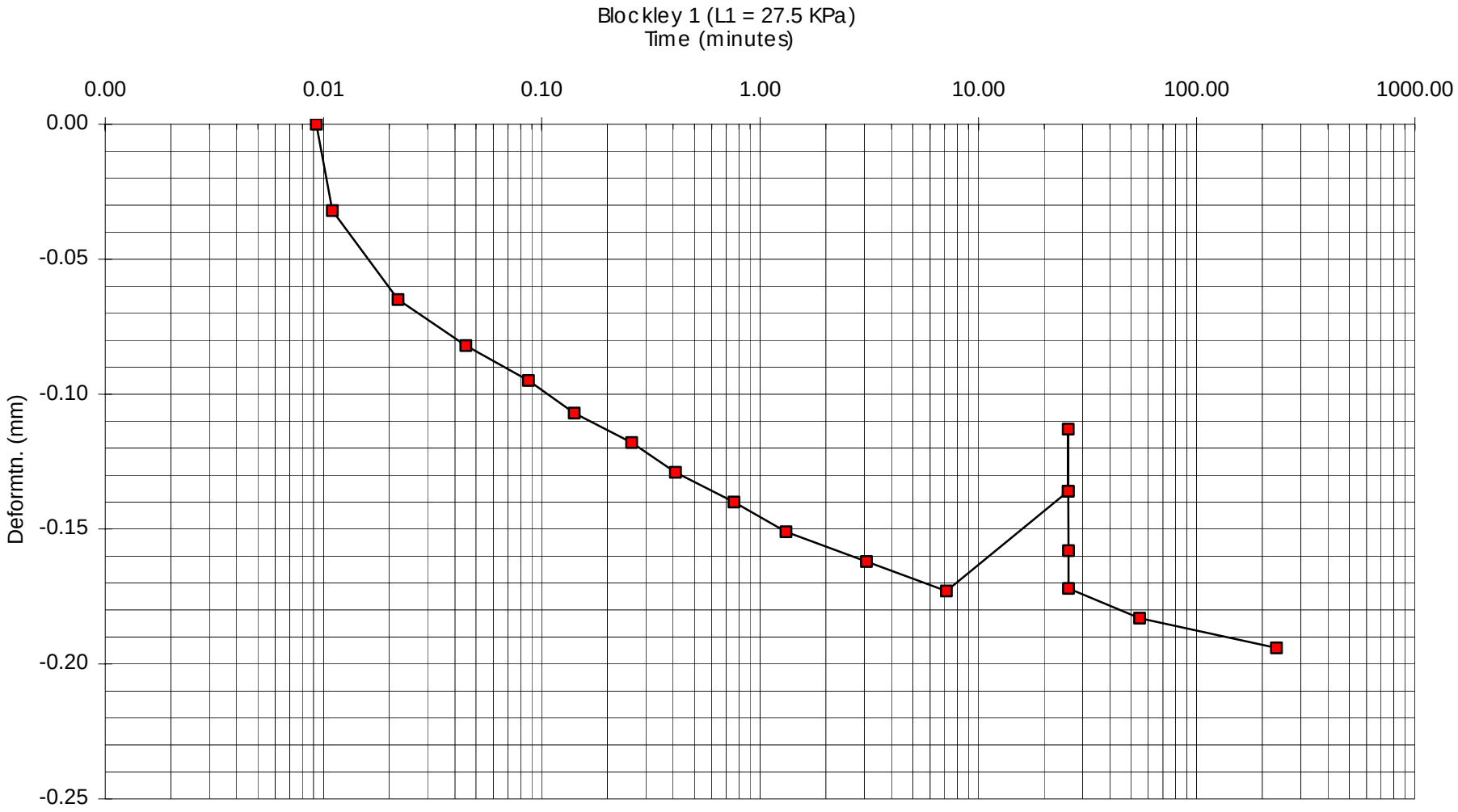
Incr. No.	Press. (kPa)	Nett Sett (mm)	Nett de	e1	Incr. de	Incr. dp (kPa)	1+e1	Mv (m2/MN)	t50 (mins)	H (mm)	Mean Ht H' (mm)	Cv (m2/yr)
	5.5	0	0.000	**0.731**						19.400		
1	**27.5**	0.214	0.019	**0.712**	0.019	22	1.731	**0.501**		19.186	19.293	
2	**55**	0.387	0.035	**0.696**	0.015	27.5	1.712	**0.328**	0.28	19.013	19.0995	**33.87**
3	**110**	0.710	0.063	**0.668**	0.029	55	1.696	**0.309**	0.23	18.69	18.8515	**40.17**
4	**275**	1.375	0.123	**0.608**	0.059	165	1.668	**0.216**	2.4	18.025	18.3575	**3.65**
5	**550**	1.951	0.174	**0.557**	0.051	275	1.608	**0.116**	1.2	17.449	17.737	**6.82**
6	**1100**	2.641	0.236	**0.495**	0.062	550	1.557	**0.072**	3	16.759	17.104	**2.54**
7	**2200**	3.327	0.297	**0.434**	0.061	1100	1.495	**0.037**	3.2	16.073	16.416	**2.19**
8	**4400**	4.113	0.367	**0.364**	0.070	2200	1.434	**0.022**	3.5	15.287	15.68	**1.83**
9	**2200**	3.942	0.352	**0.379**	-0.015	-2200	1.364	**0.005**		15.458	15.3725	
10	**5.5**	2.050	0.183	**0.548**	-0.169	-2194.5	1.379	**0.056**		17.35	16.404	

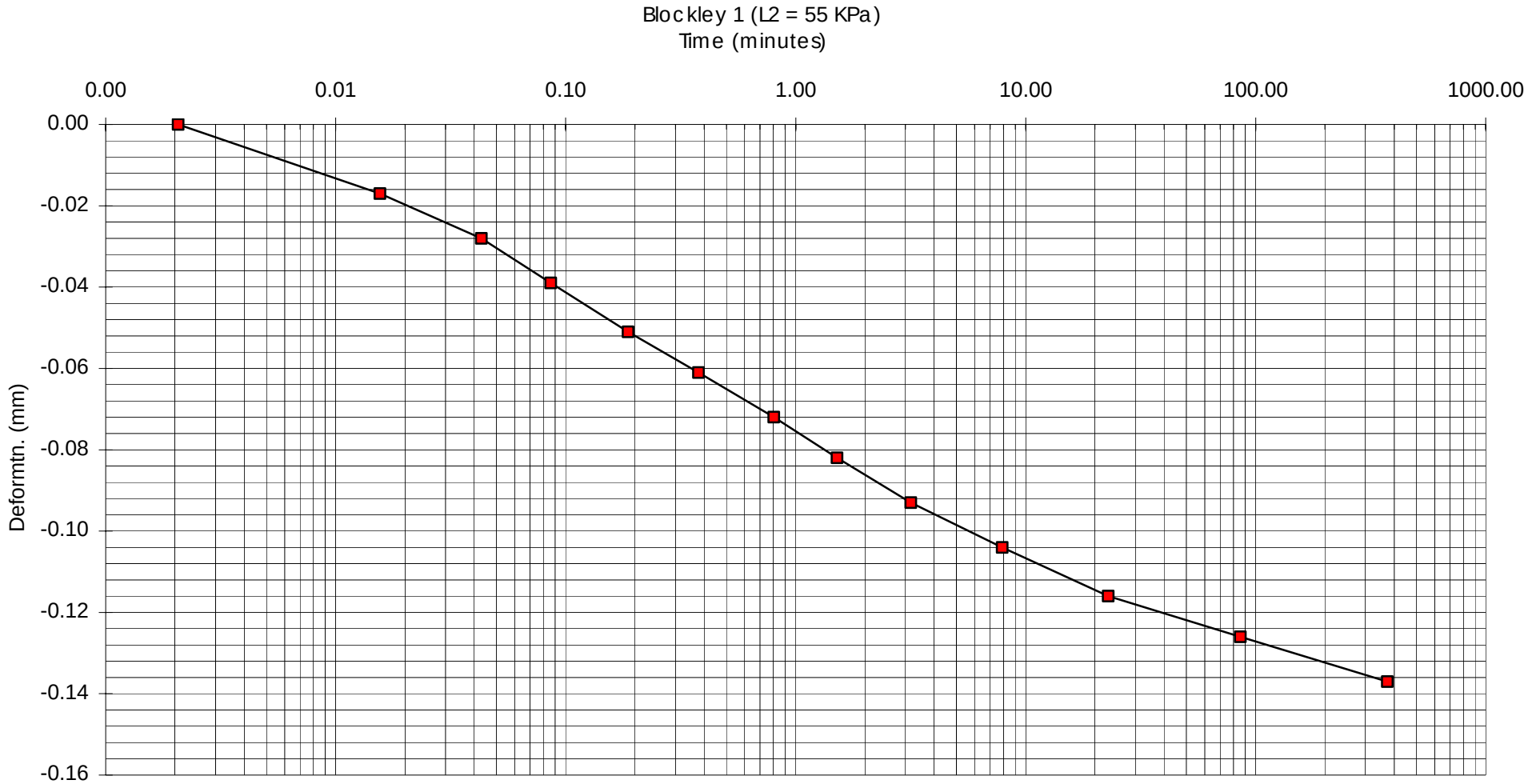

Blockley Site 1
Voids Ratio
0.800
0.750
0.700
0.650
0.600
0.550
0.500
0.450
0.400
0.350
0.300
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

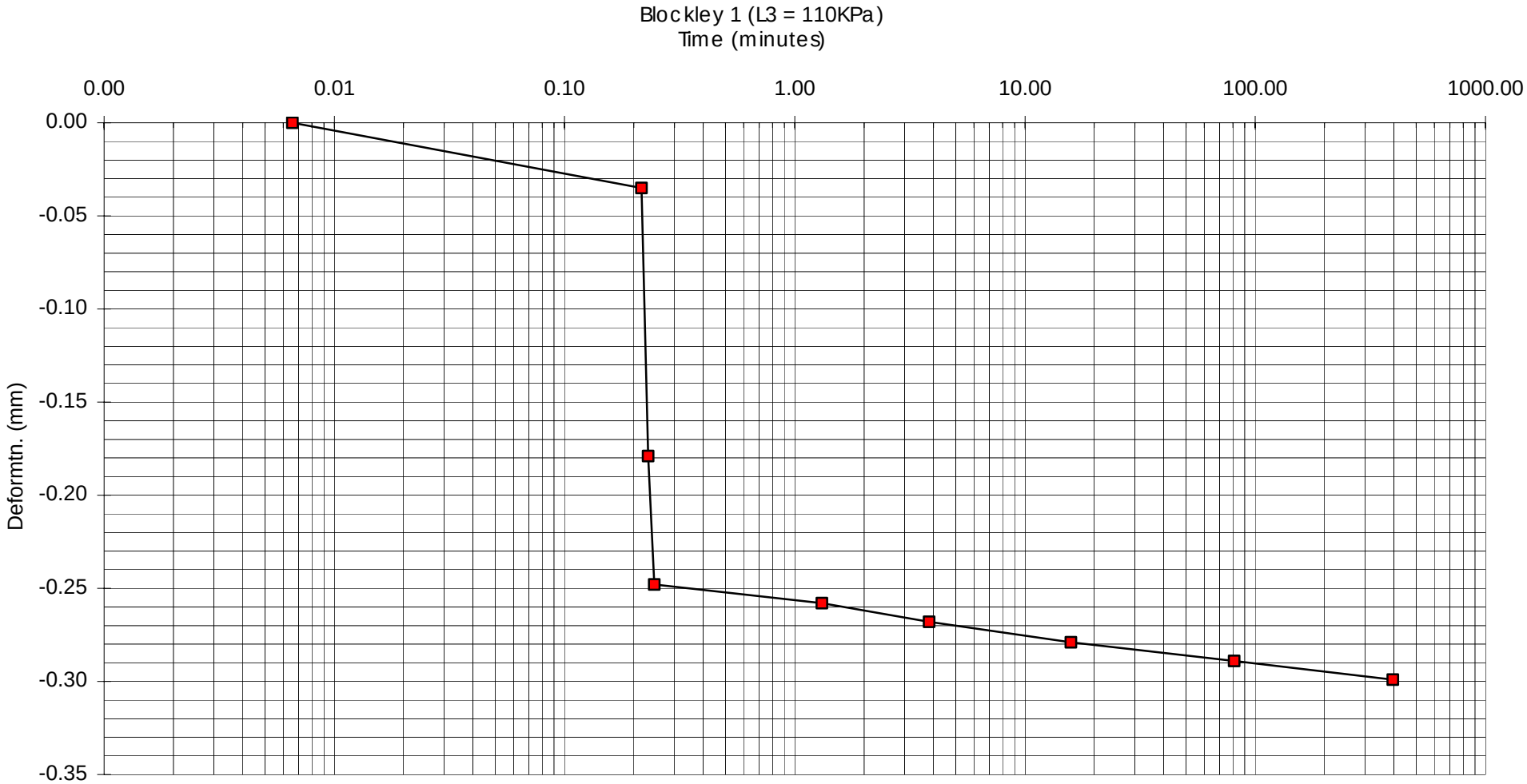

Blockley Site 1
Voids Ratio
0.800
0.750
0.700
0.650
0.600
0.550
0.500
0.450
0.400
0.350
0.300
1
10
100
1000
10000
Load (kPa)

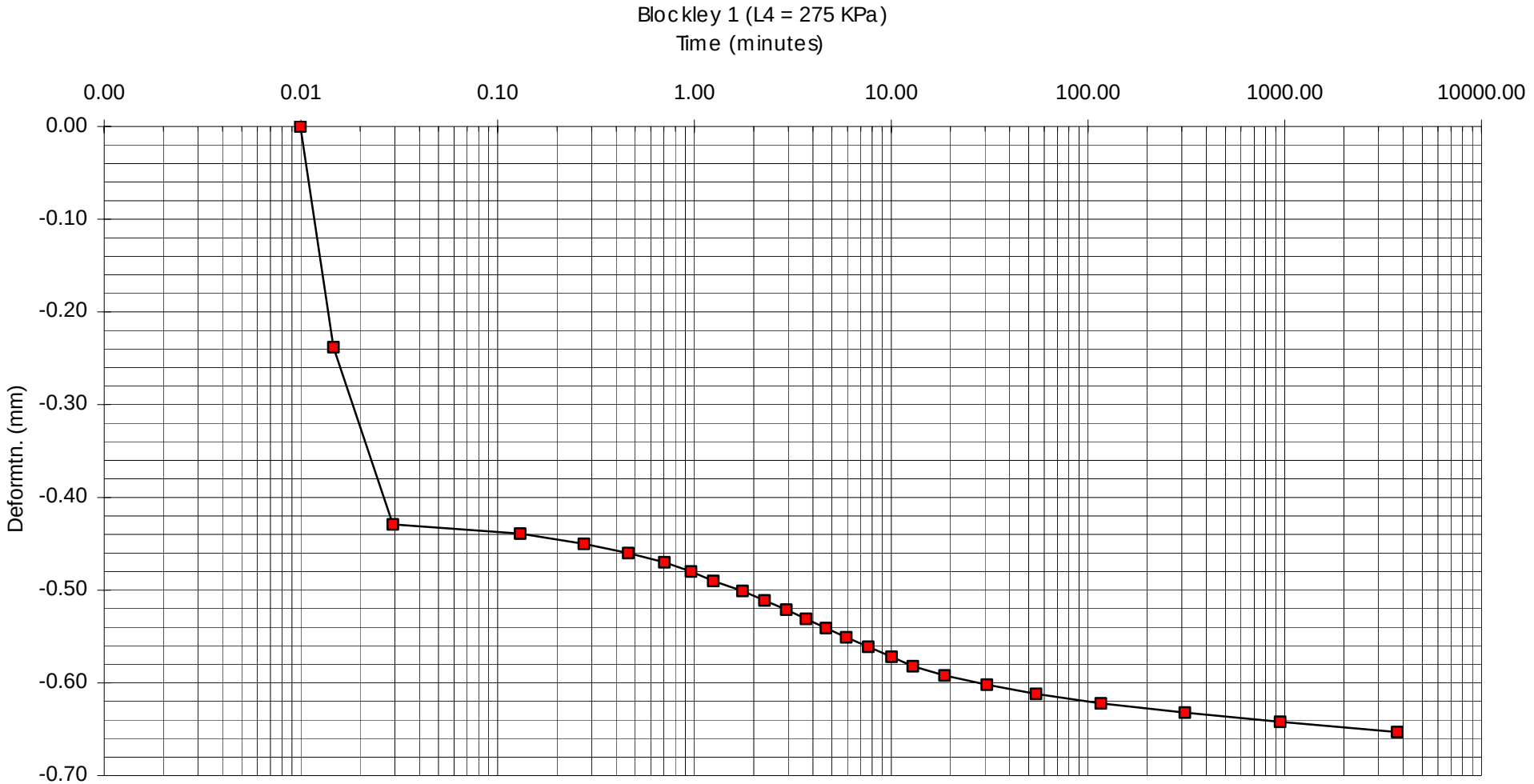

Blockley Site1
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Cv
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

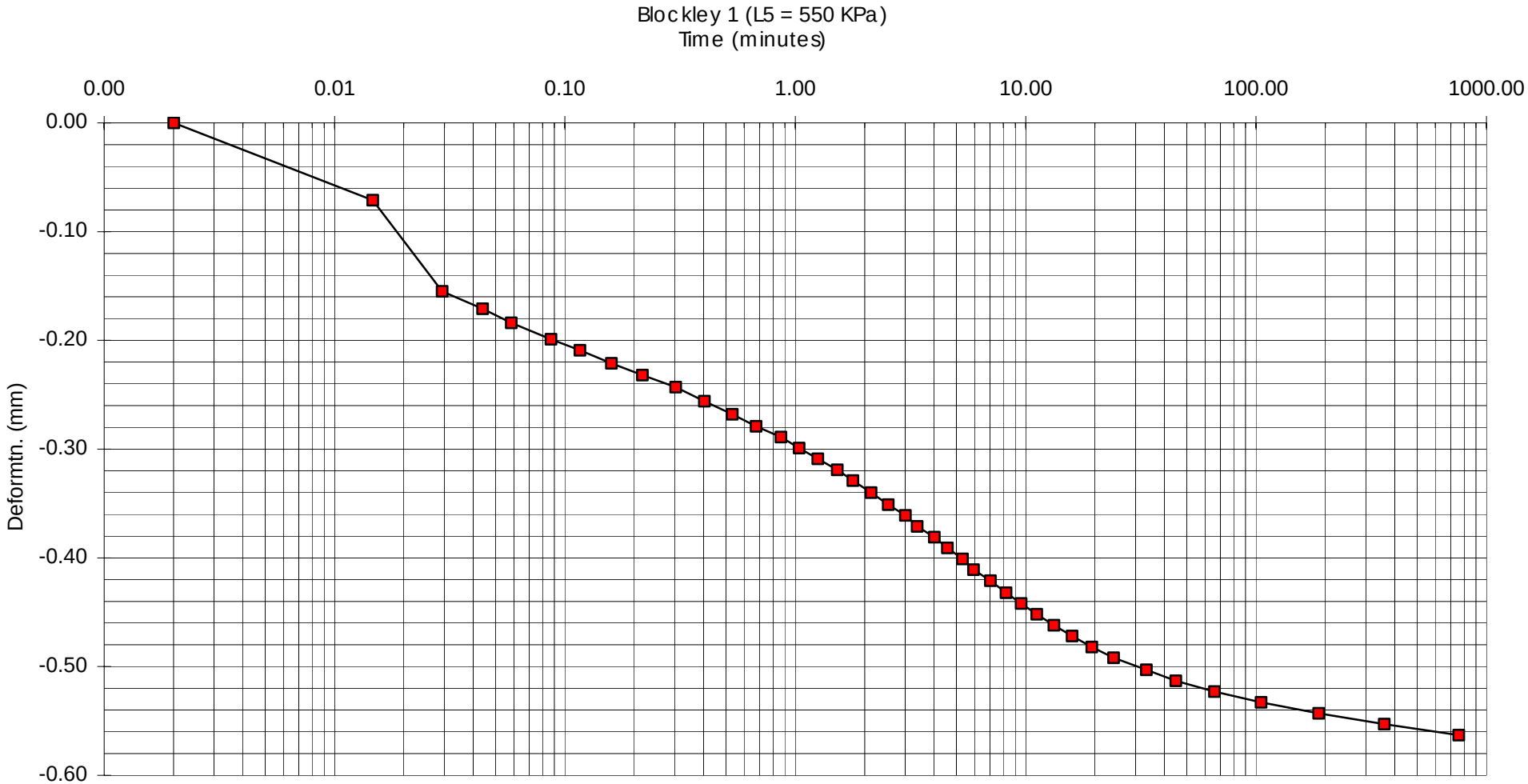

Blockley Site 1
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Mv
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

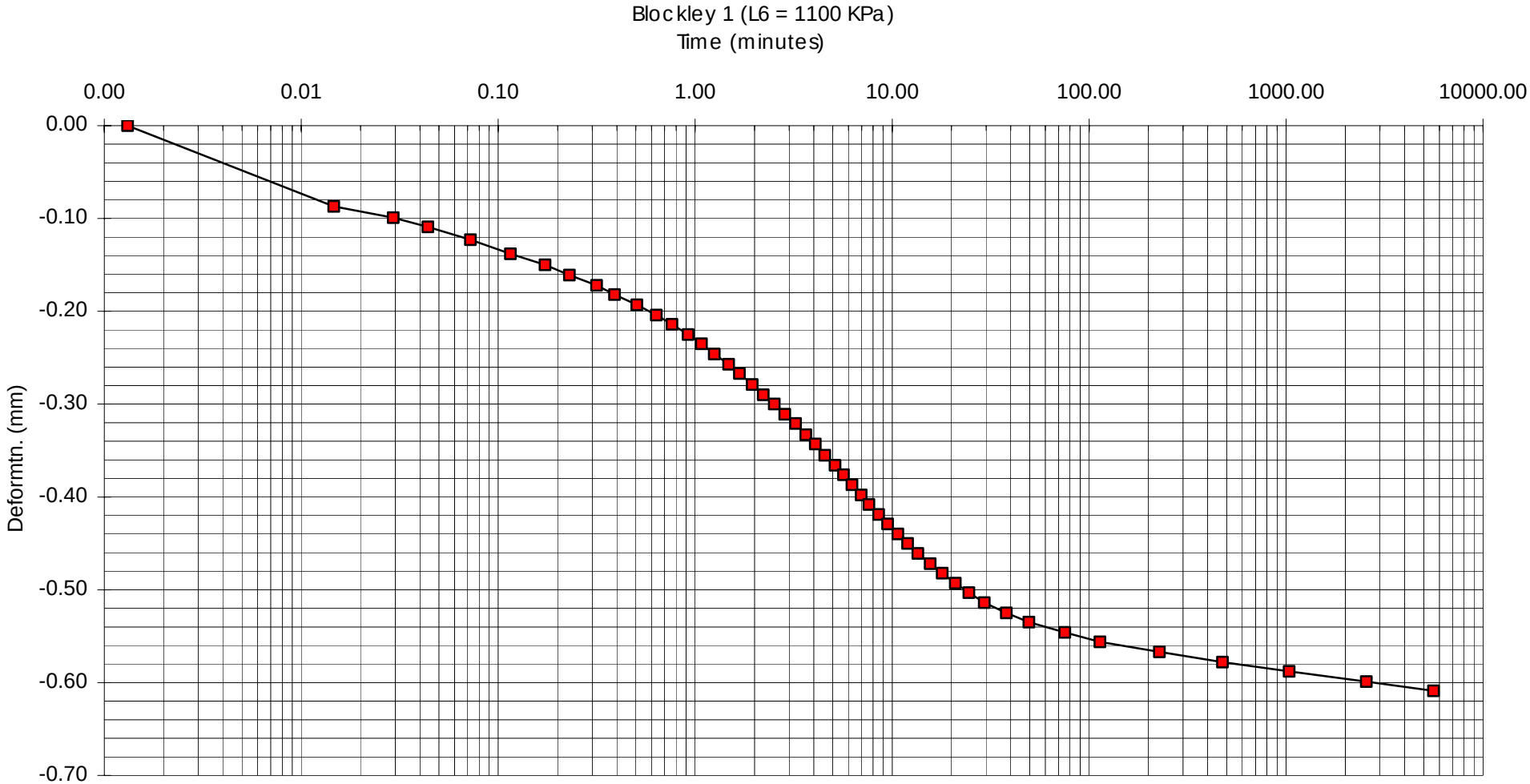

Blockley 1 (L1 = 27.5 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
Deformtn. (mm)

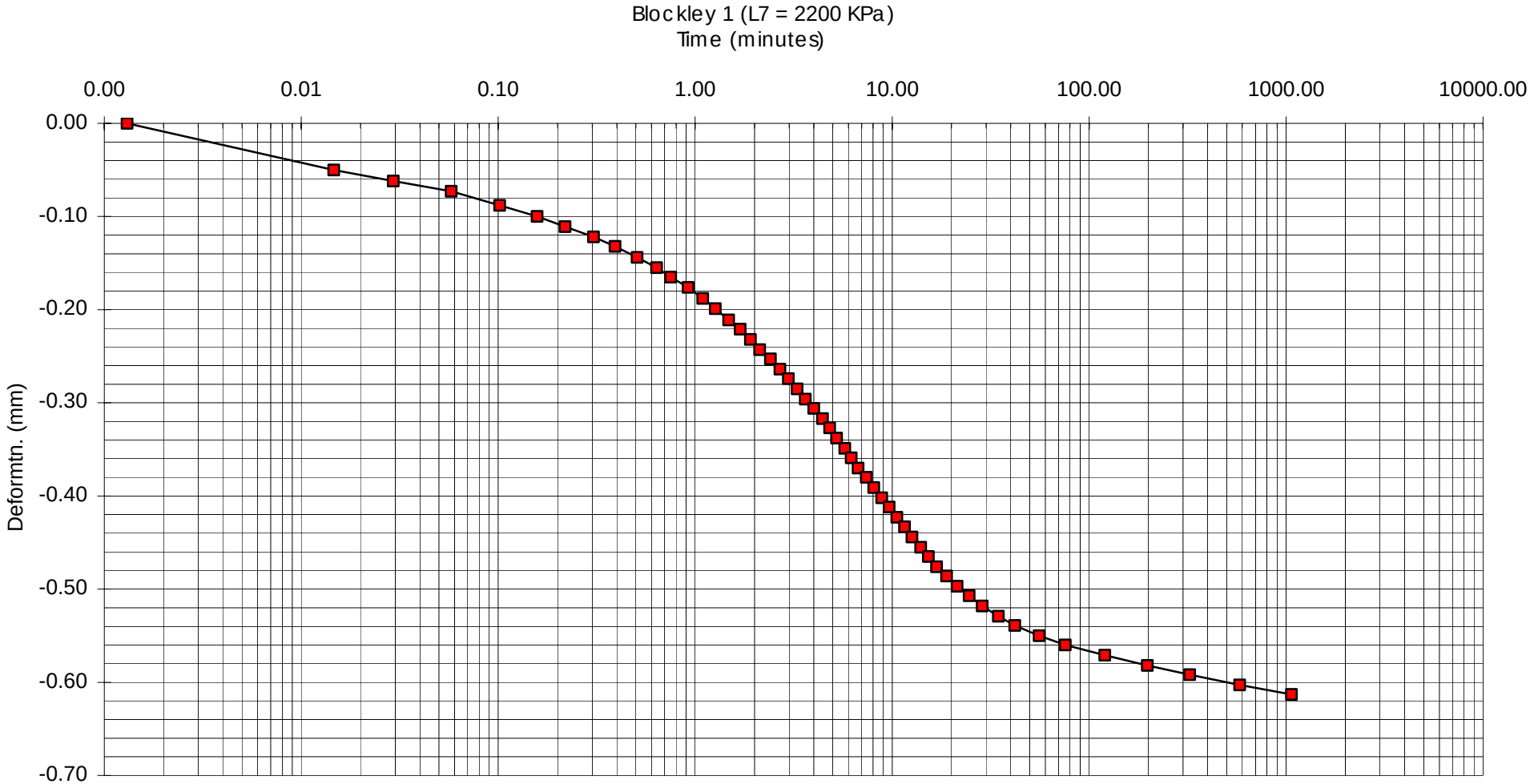

Blockley 1 (L2 = 55 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
-0.16
Deformtn. (mm)

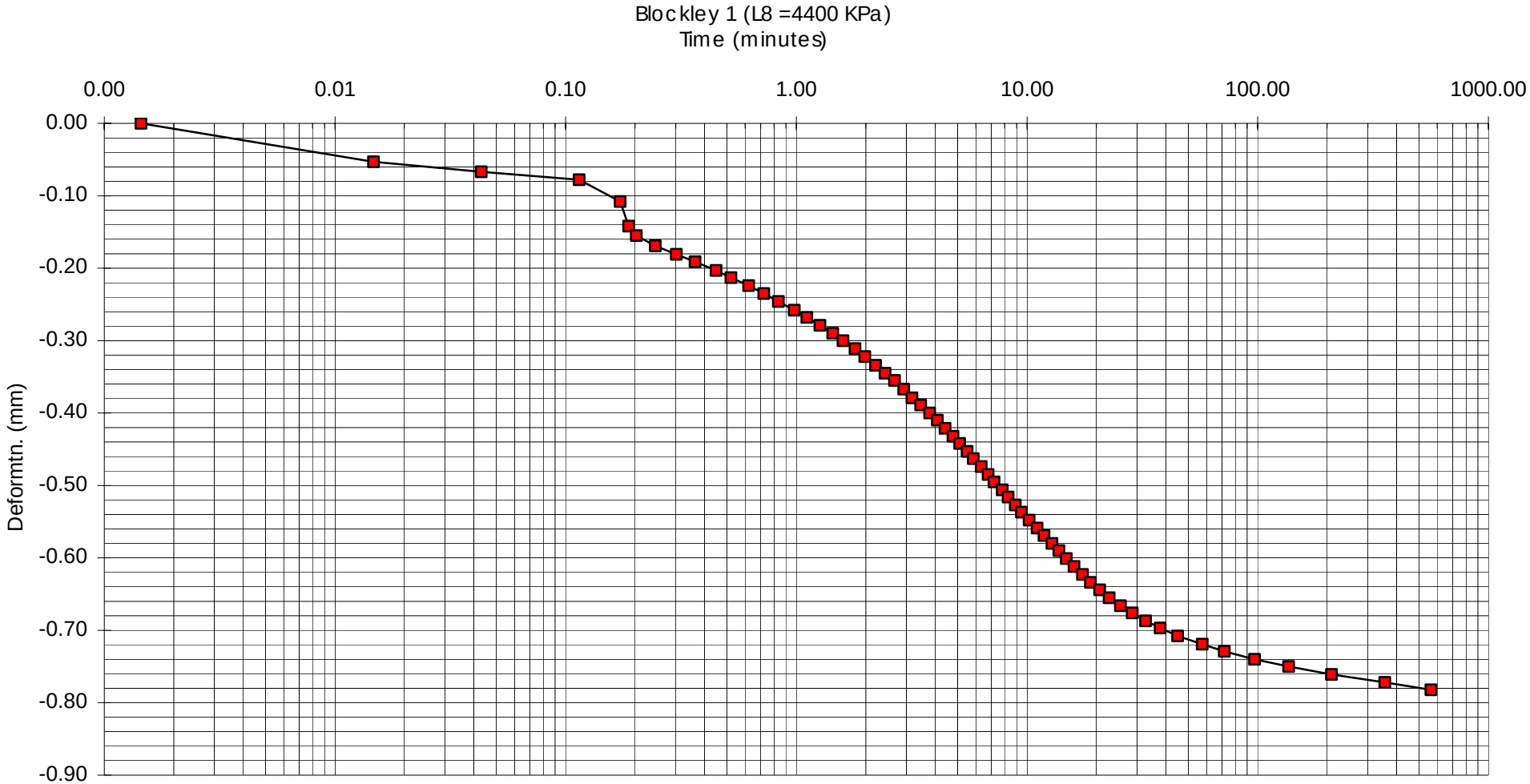

Blockley 1 (L3 = 110KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
Deformtn. (mm)


Blockley 1 (L4 = 275 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
Deformtn. (mm)


Blockley 1 (L5 = 550 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
Deformtn. (mm)


Blockley 1 (L6 = 1100 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
Deformtn. (mm)
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70


Blockley 1 (L7 = 2200 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
Deformtn. (mm)
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70


Blockley 1 (L8 =4400 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
Deformtn. (mm)
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90

OEDOMETER CONSOLIDATION

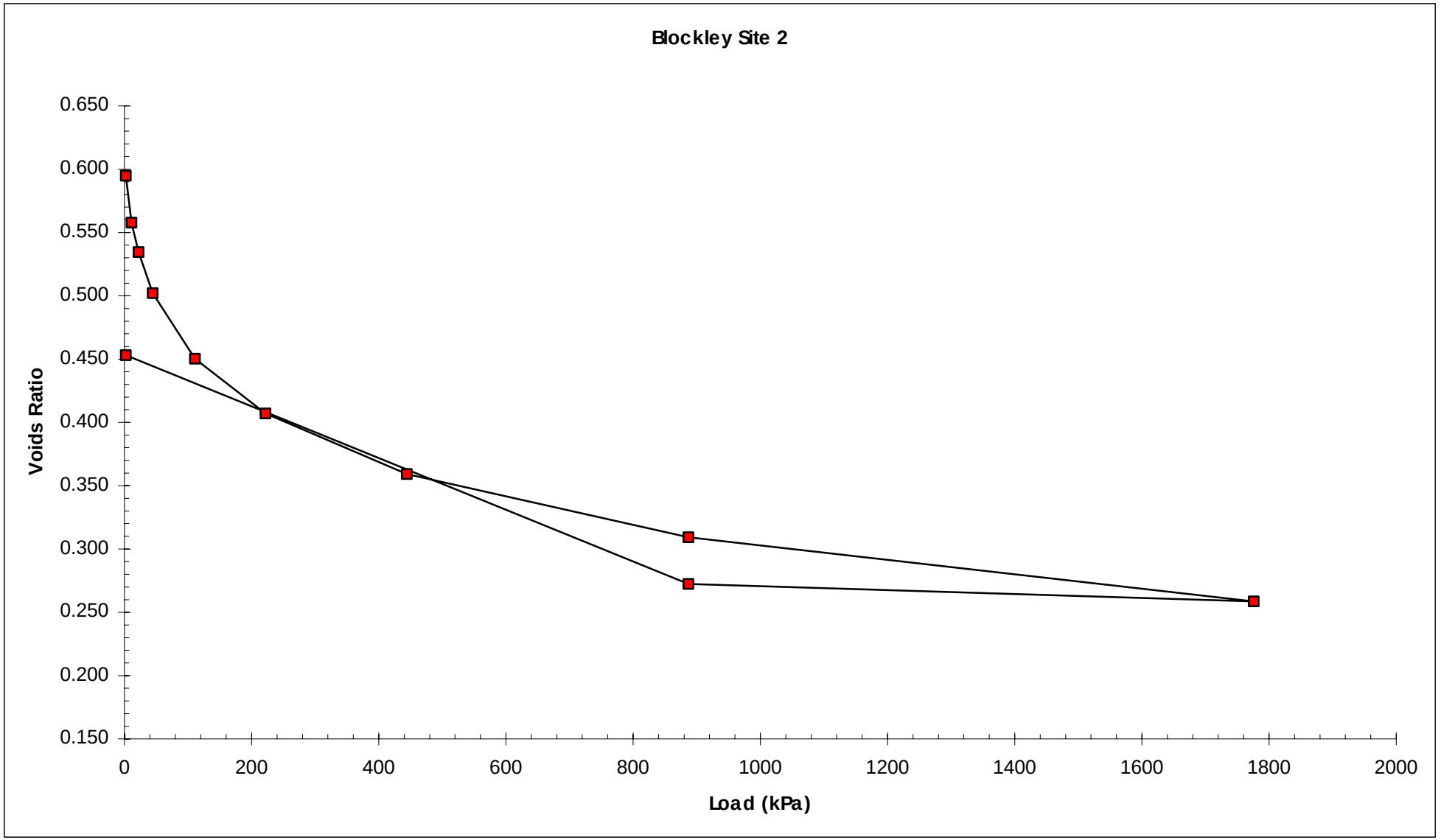
CALCULATION SHEET

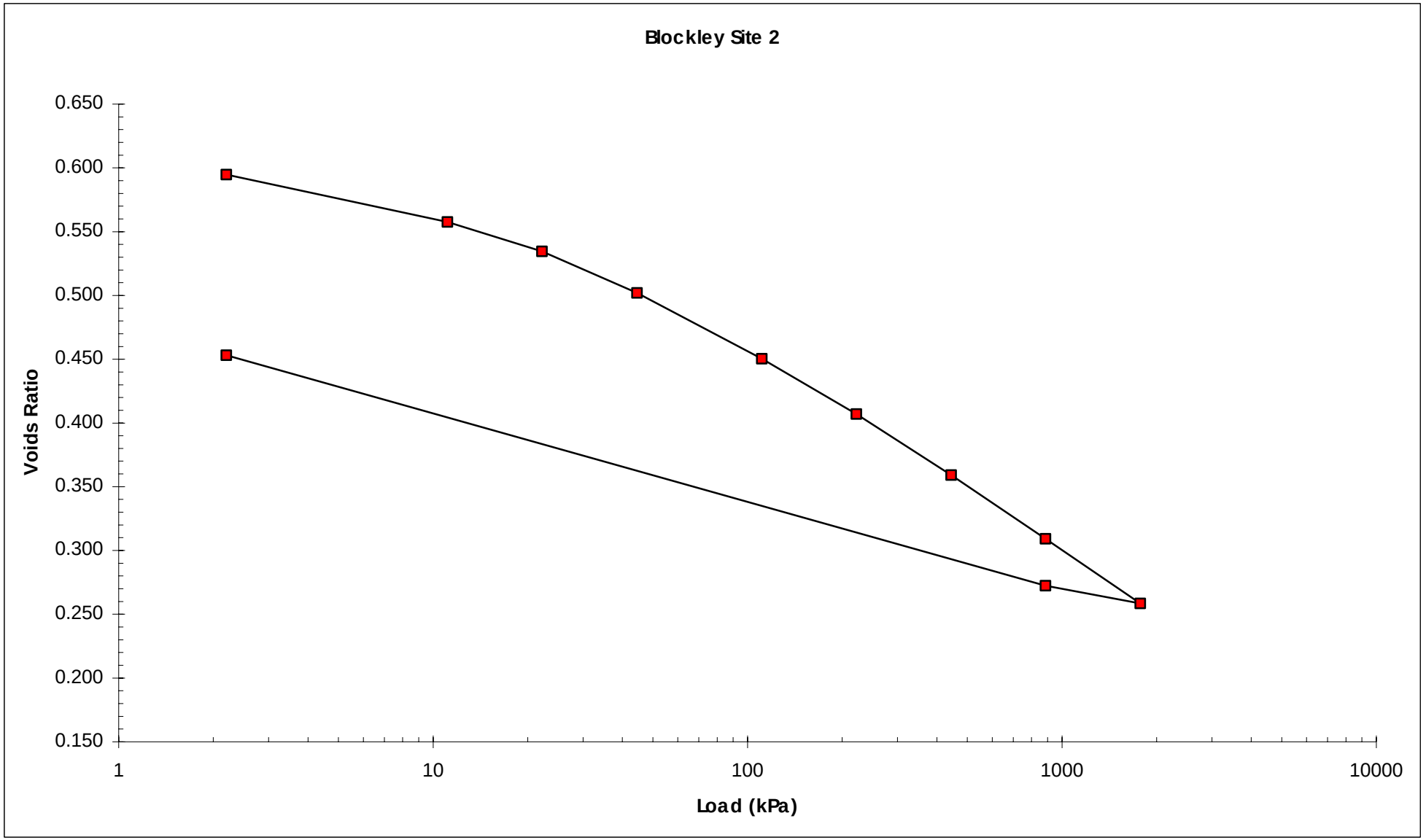
LOCATION:	Blockley Site 2	**SOIL TYPE:**	Lias Clay
SAMPLE No.	2	**DEPTH:**	

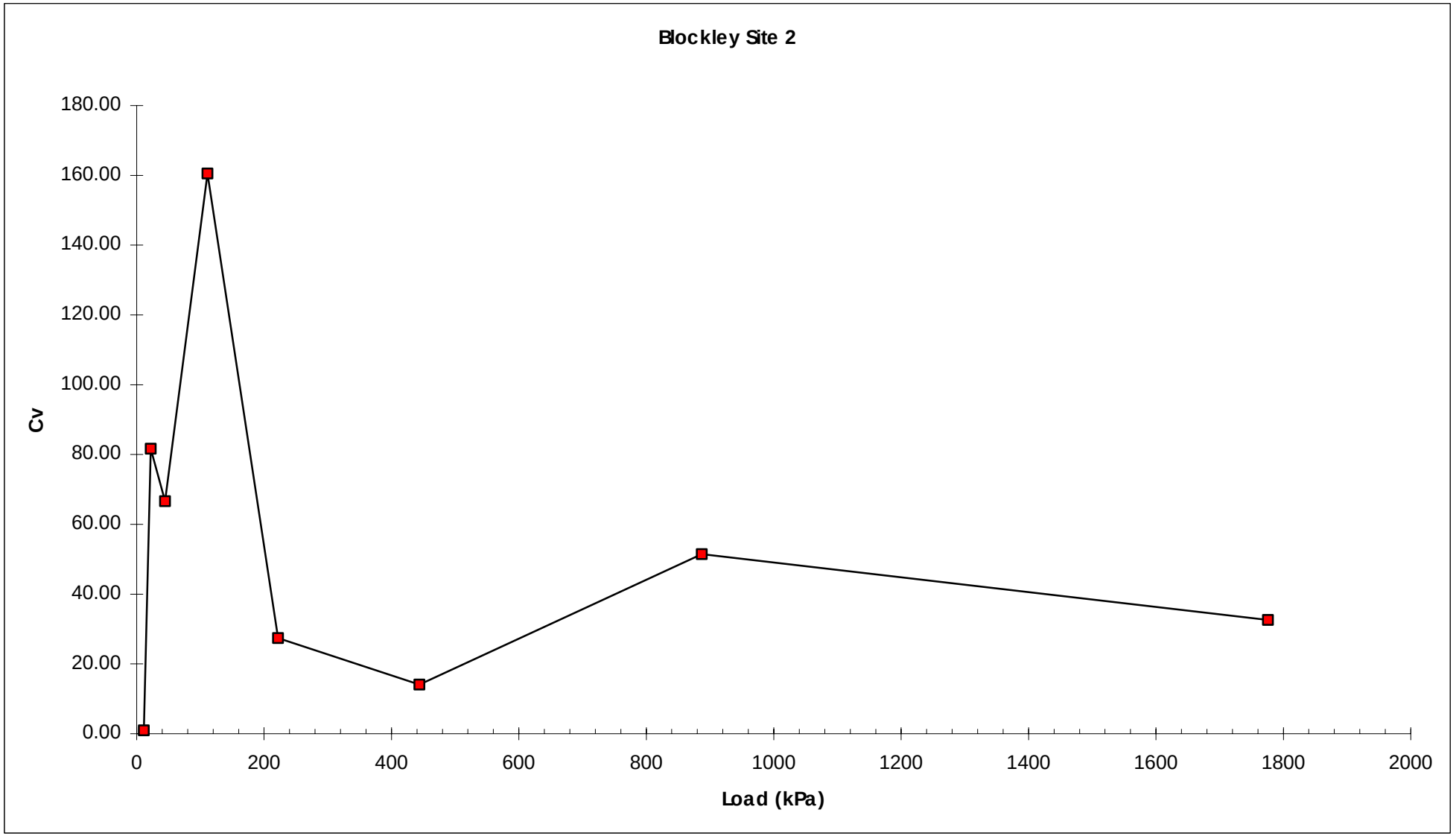
Ho	Gs	DDo	eo	F
19.2	2.7	1.693	0.595	0.083

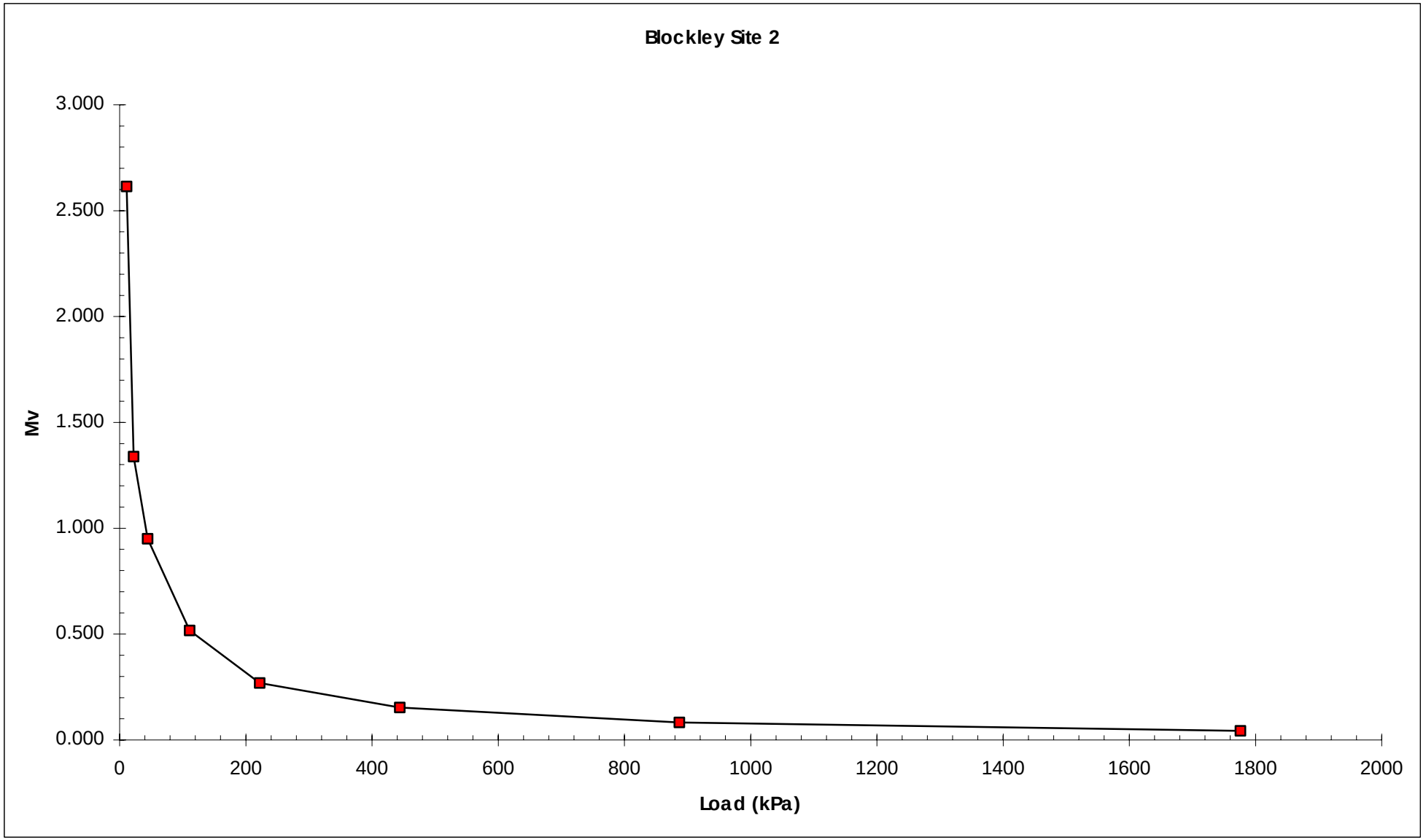
e-logP plot | *Coeff. of Volume Compressibility* | *Coeff. of Consolidation*

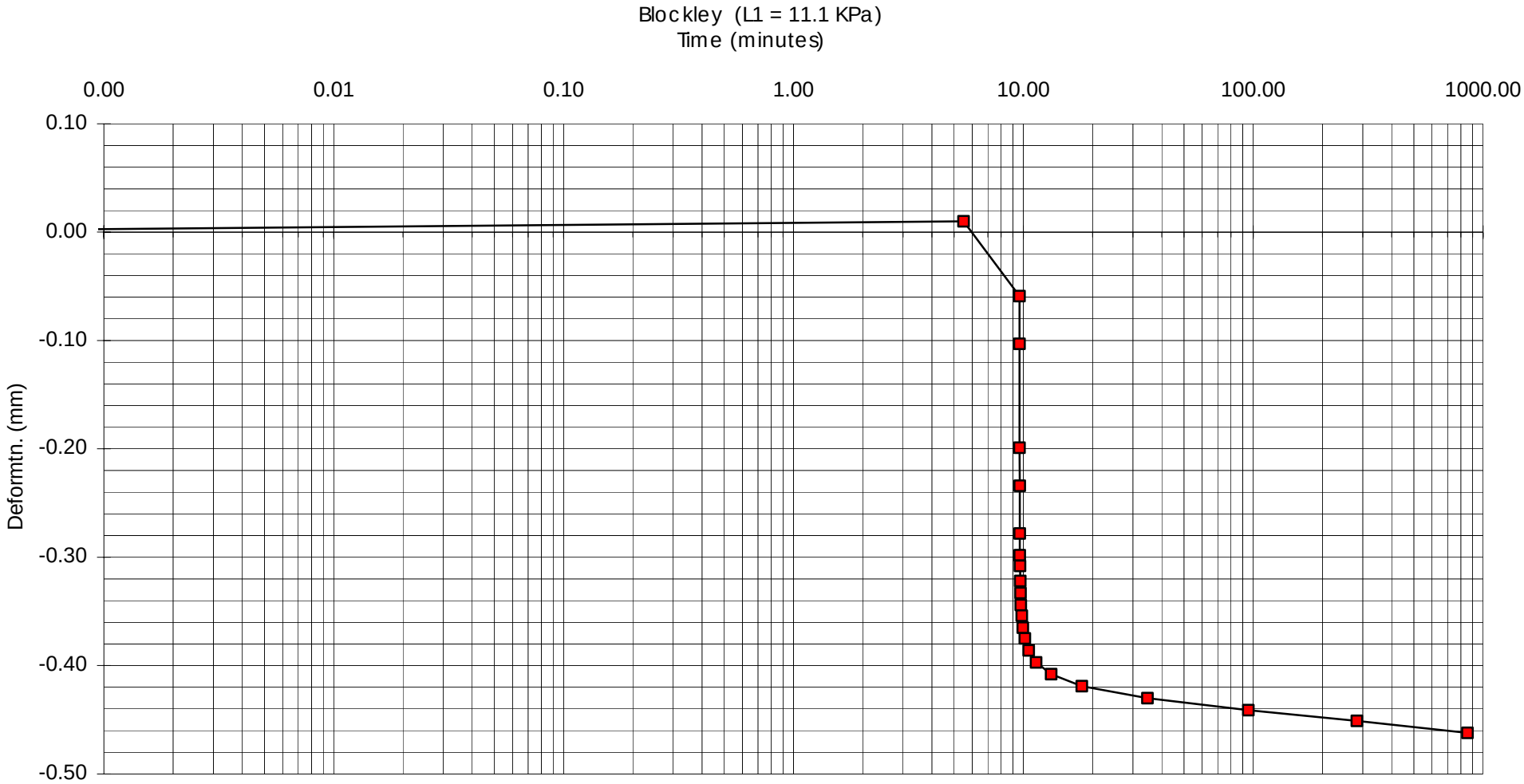
Incr. No.	Press. (kPa)	Nett Sett (mm)	Nett de	e1	Incr. de	Incr. dp (kPa)	1+e1	Mv (m2/MN)	t50 (mins)	H (mm)	Mean Ht H' (mm)	Cv (m2/yr)
	2.2	0	0.000	**0.595**						19.170		
1	**11.1**	0.446	0.037	**0.558**	0.037	8.9	1.595	**2.614**	9.5	18.7	18.947	**0.98**
2	**22.2**	0.724	0.060	**0.535**	0.023	11.1	1.558	**1.338**	0.11	18.4	18.585	**81.64**
3	**44.5**	1.115	0.093	**0.502**	0.033	22.3	1.535	**0.951**	0.13	18.1	18.2505	**66.62**
4	**111**	1.736	0.144	**0.450**	0.052	66.5	1.502	**0.517**	0.051	17.4	17.7445	**160.52**
5	**222**	2.257	0.188	**0.407**	0.043	111	1.450	**0.269**	0.28	16.9	17.1735	**27.39**
6	**444**	2.833	0.236	**0.359**	0.048	222	1.407	**0.153**	0.51	16.3	16.625	**14.09**
7	**887**	3.433	0.286	**0.309**	0.050	443	1.359	**0.083**	0.13	15.7	16.037	**51.44**
8	**1776**	4.042	0.336	**0.259**	0.051	889	1.309	**0.044**	0.19	15.1	15.4325	**32.59**
9	**887**	3.876	0.322	**0.272**	-0.014	-889	1.259	**0.012**		15.3	15.211	
10	**2.2**	1.703	0.142	**0.453**	-0.181	-884.8	1.272	**0.161**		17.5	16.3805	

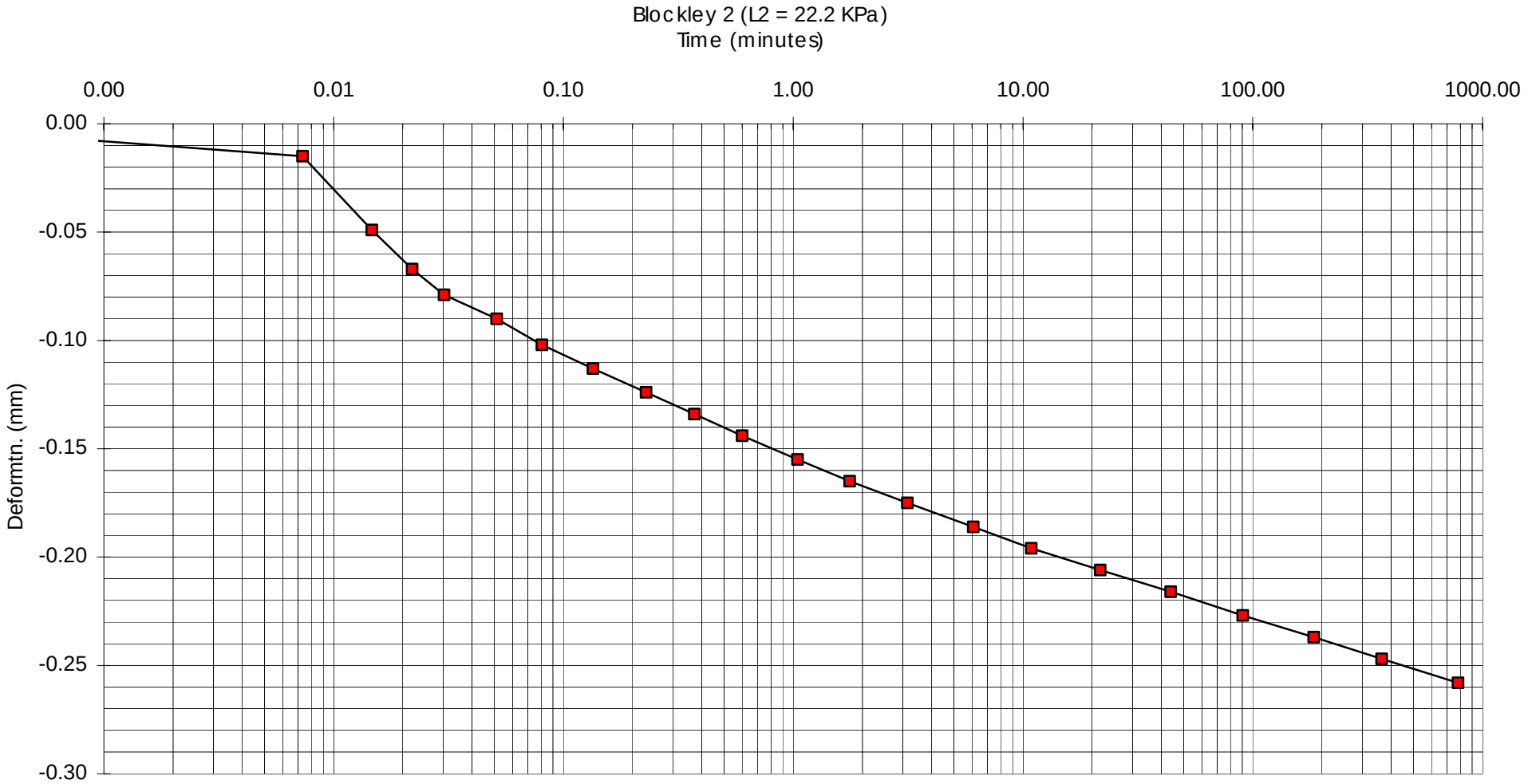

Blockley Site 2
Voids Ratio
0.650
0.600
0.550
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Load (kPa)

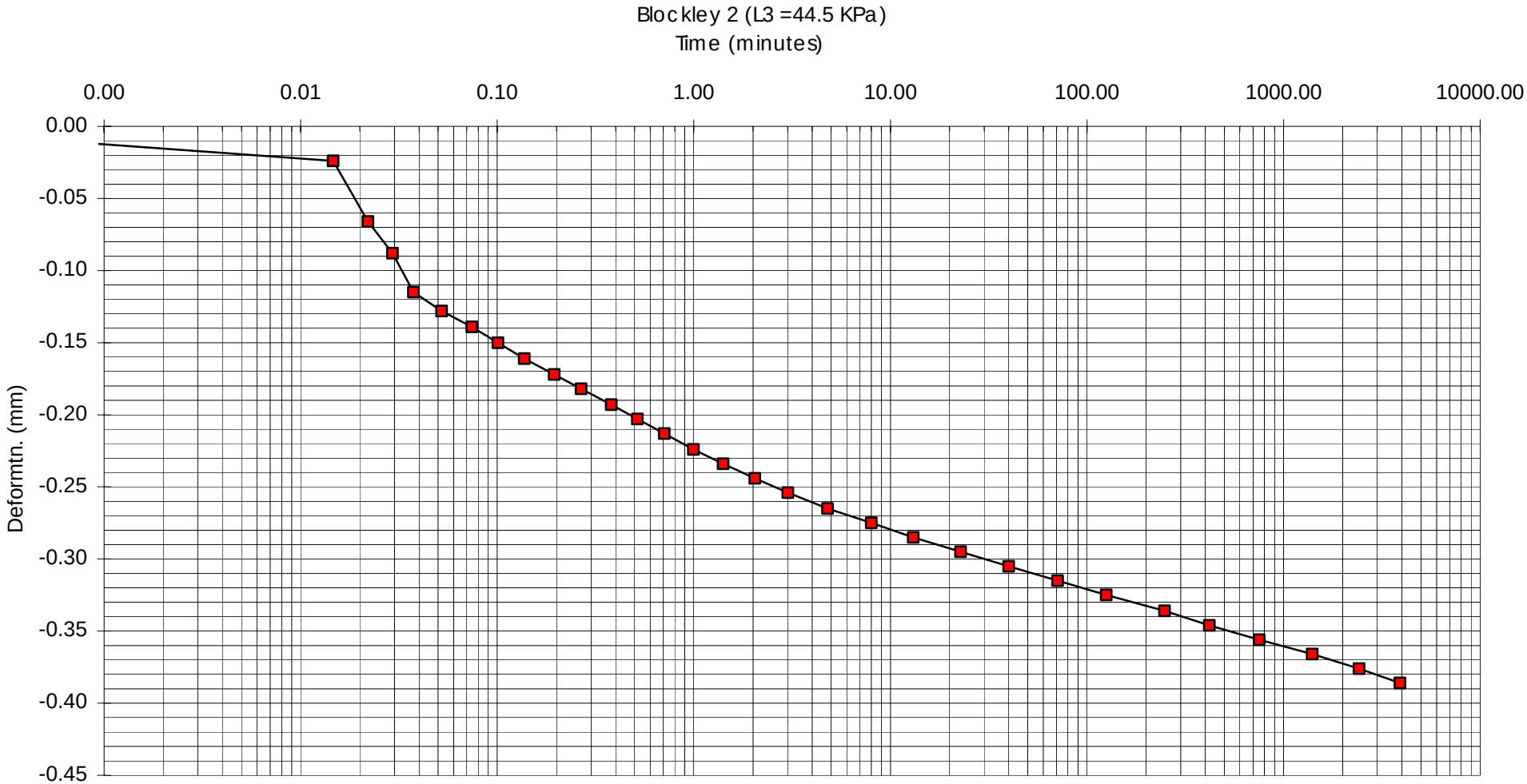

Blockley Site 2
Voids Ratio
0.650
0.600
0.550
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
1
10
100
1000
10000
Load (kPa)

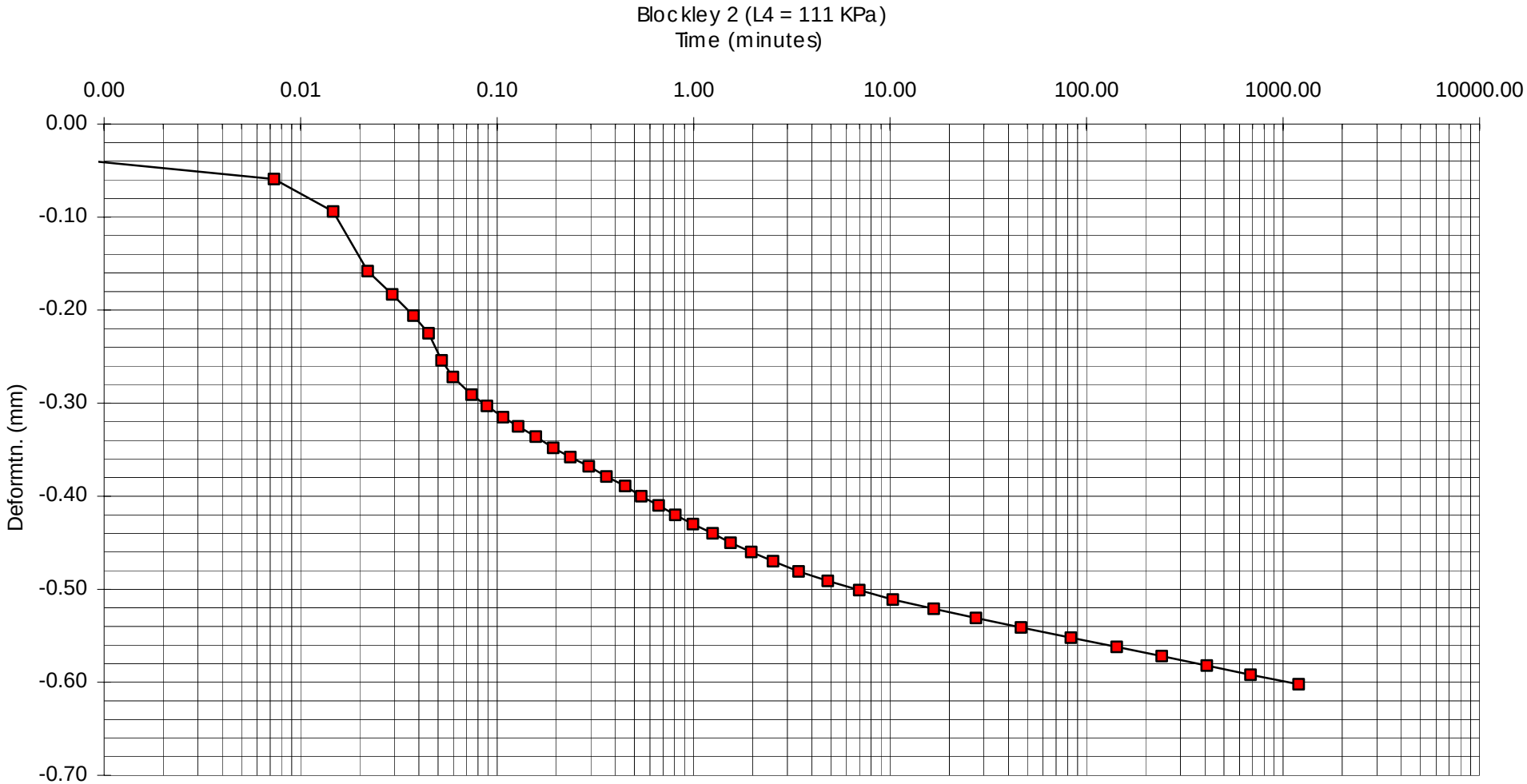

Blockley Site 2
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Cv
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Load (kPa)

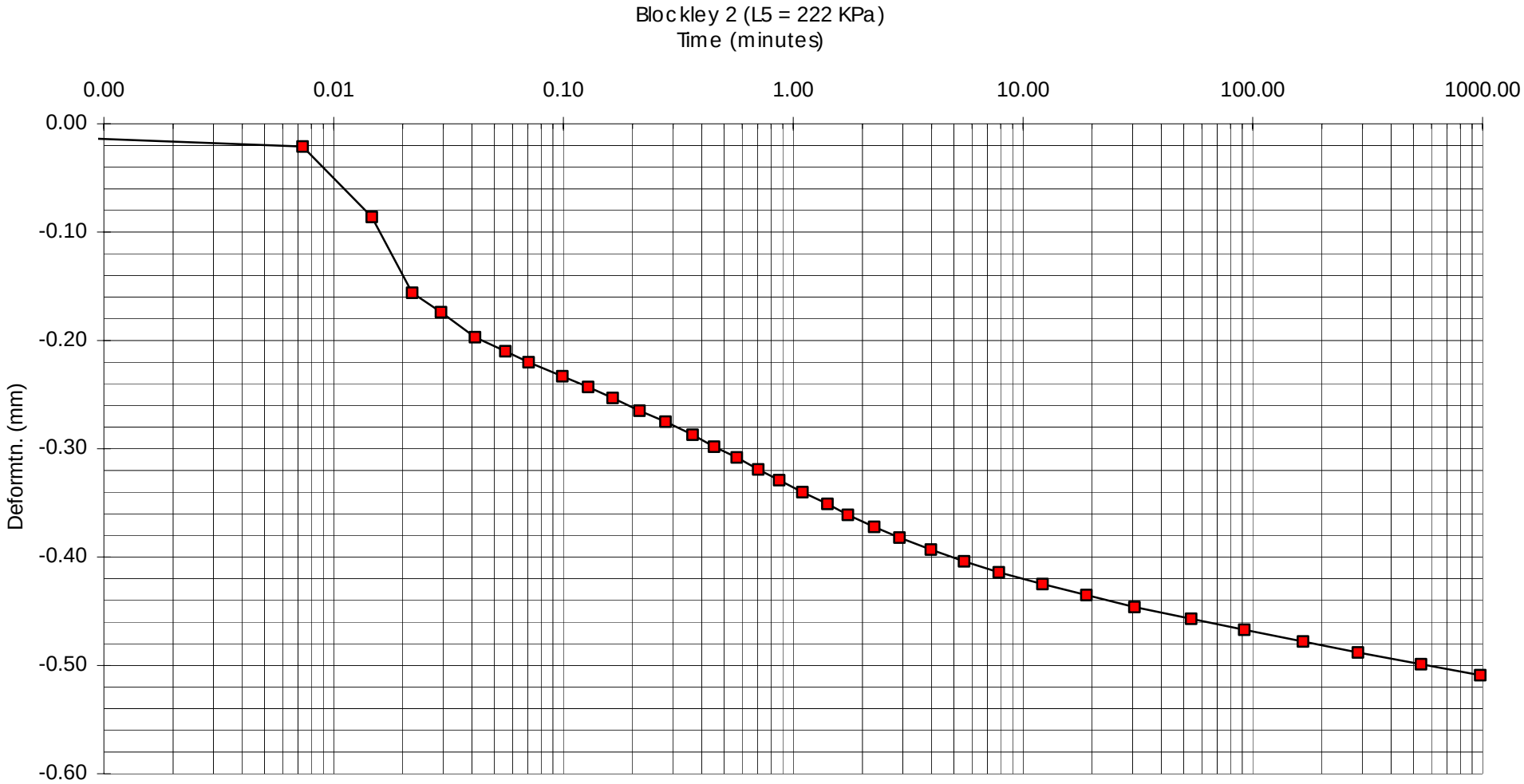

Blockley Site 2
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Mv
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Load (kPa)

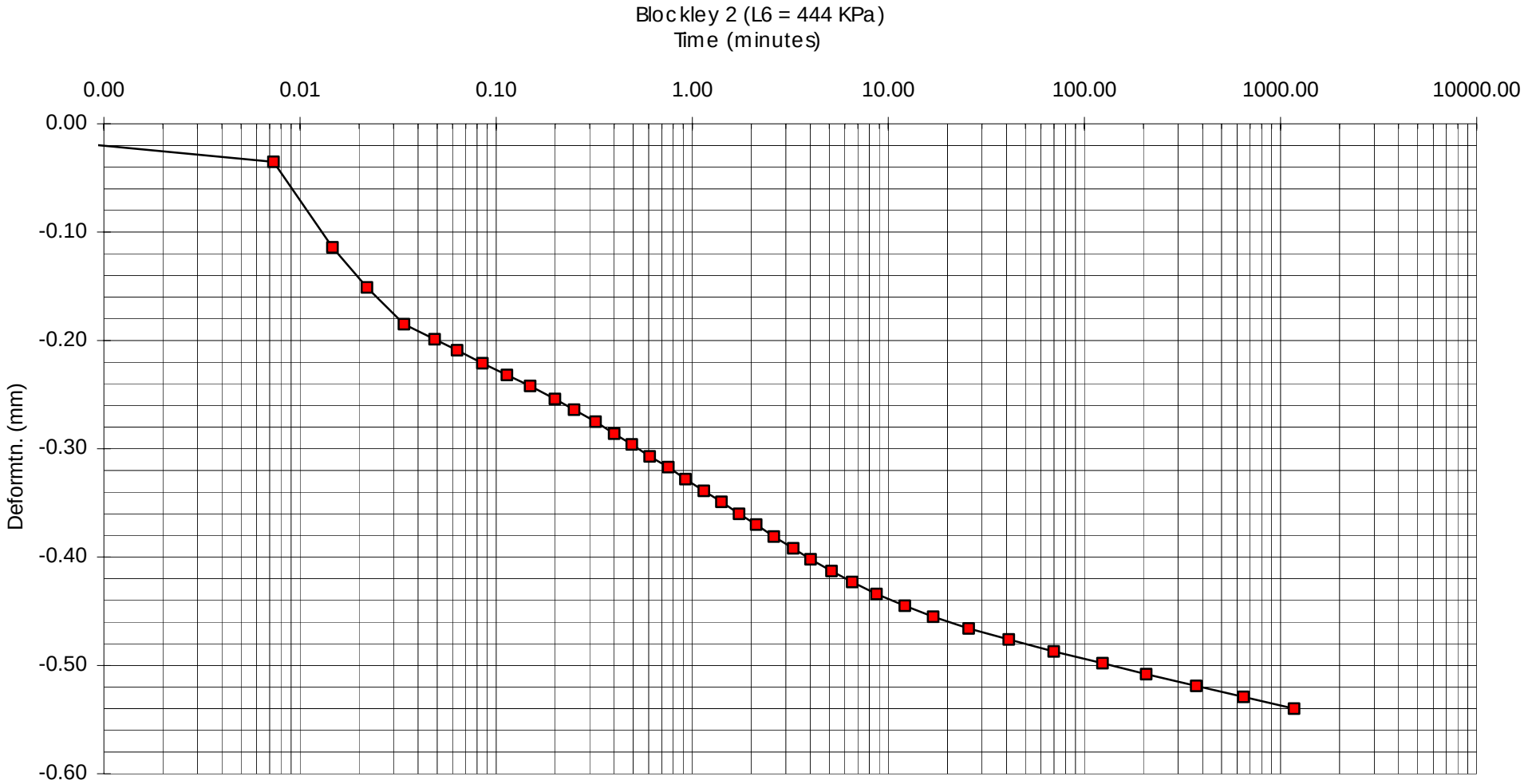

Blockley (L1 = 11.1 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
Deformtn. (mm)

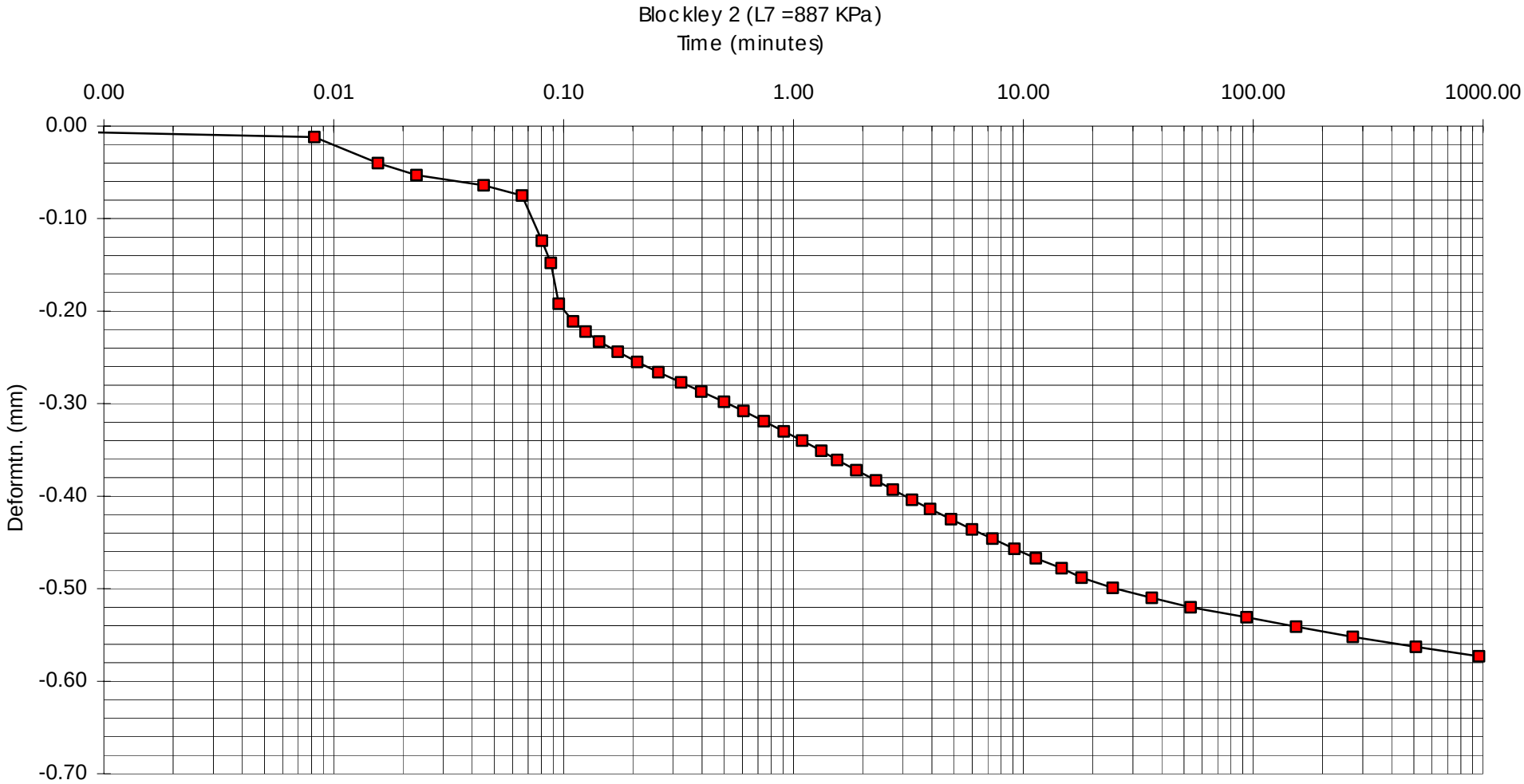

Blockley 2 (L2 = 22.2 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
Deformtn. (mm)

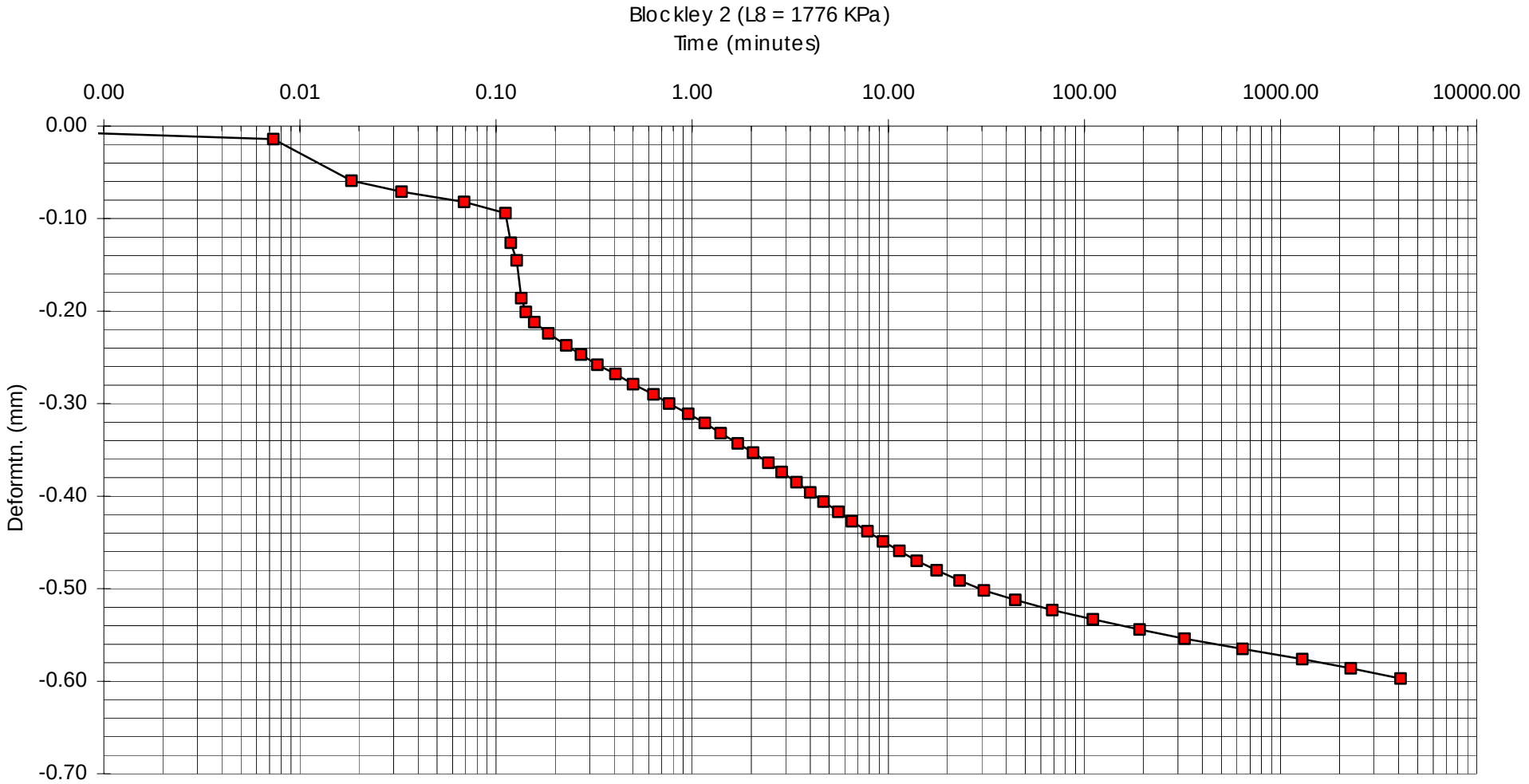

Blockley 2 (L3 =44.5 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
Deformtn. (mm)
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45


Blockley 2 (L4 = 111 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
Deformtn. (mm)


Blockley 2 (L5 = 222 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
Deformtn. (mm)


Blockley 2 (L6 = 444 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
Deformtn. (mm)


Blockley 2 (L7 =887 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
Deformtn. (mm)


Blockley 2 (L8 = 1776 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
Deformtn. (mm)

OEDOMETER CONSOLIDATION

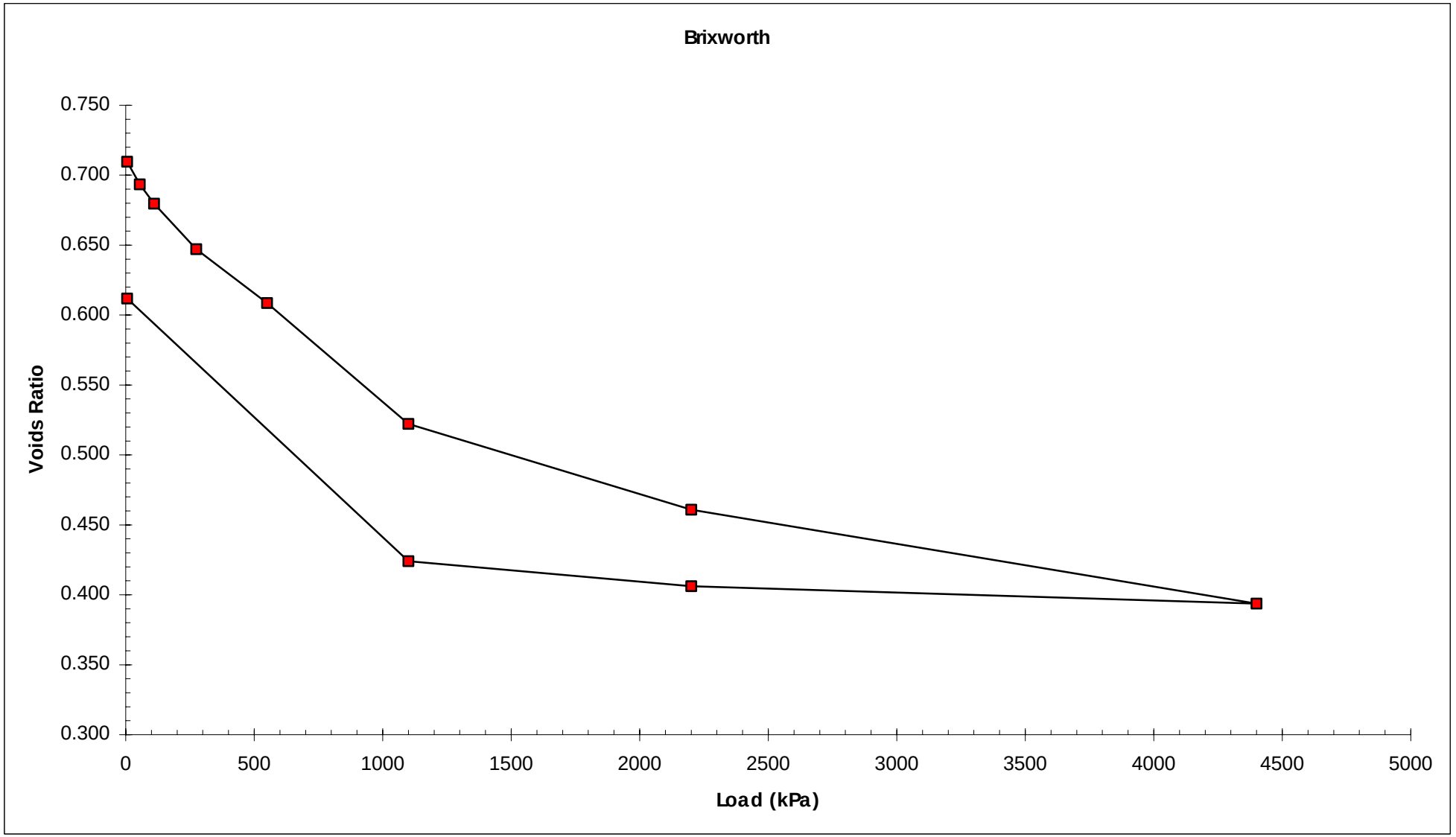
CALCULATION SHEET

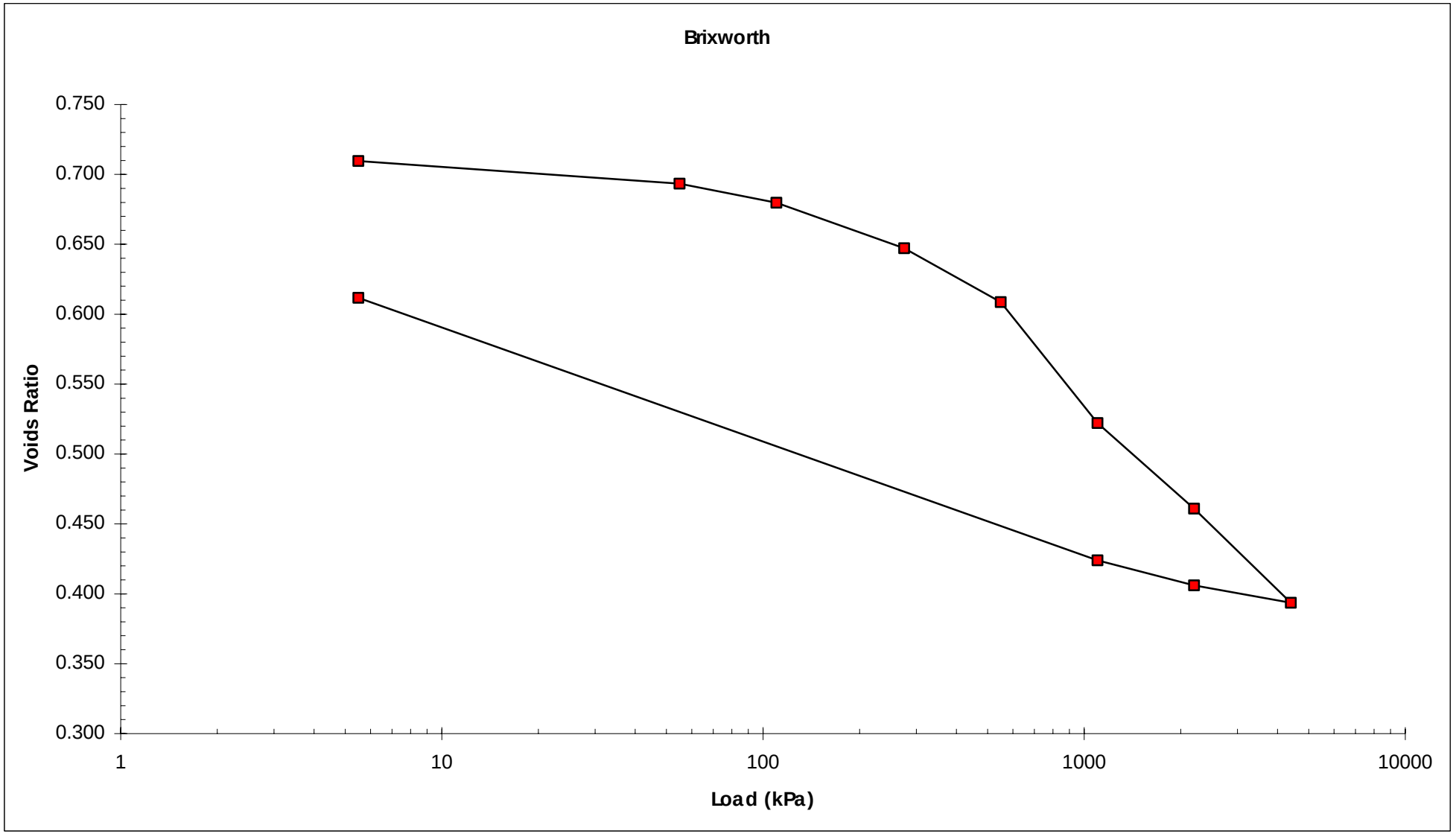
LOCATION:	Brixworth	**SOIL TYPE:**	Upper Lias Clay
SAMPLE No.		**DEPTH:**	

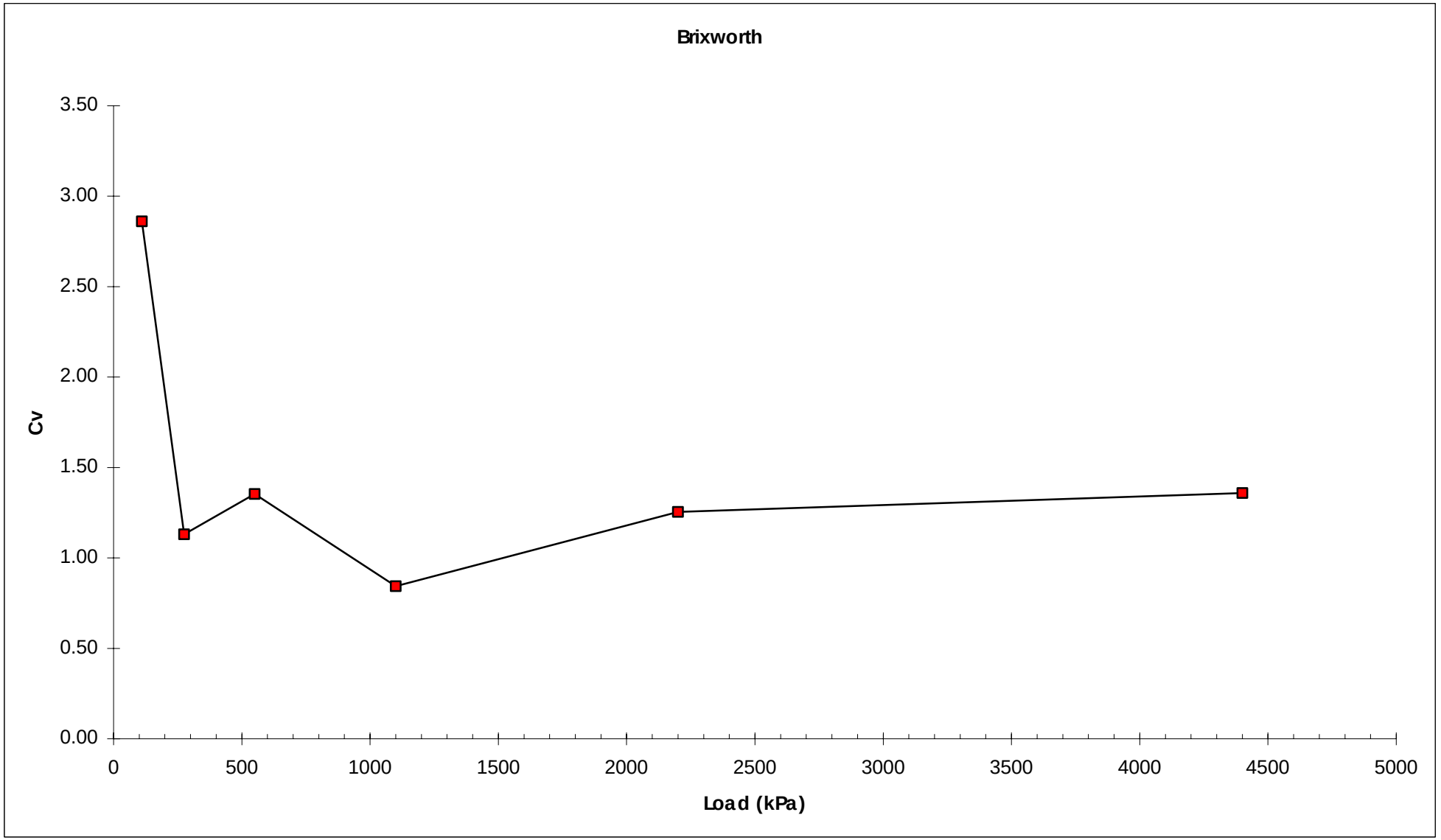
Ho	Gs	DDo	eo	F
19.2	2.79	1.632	0.710	0.089

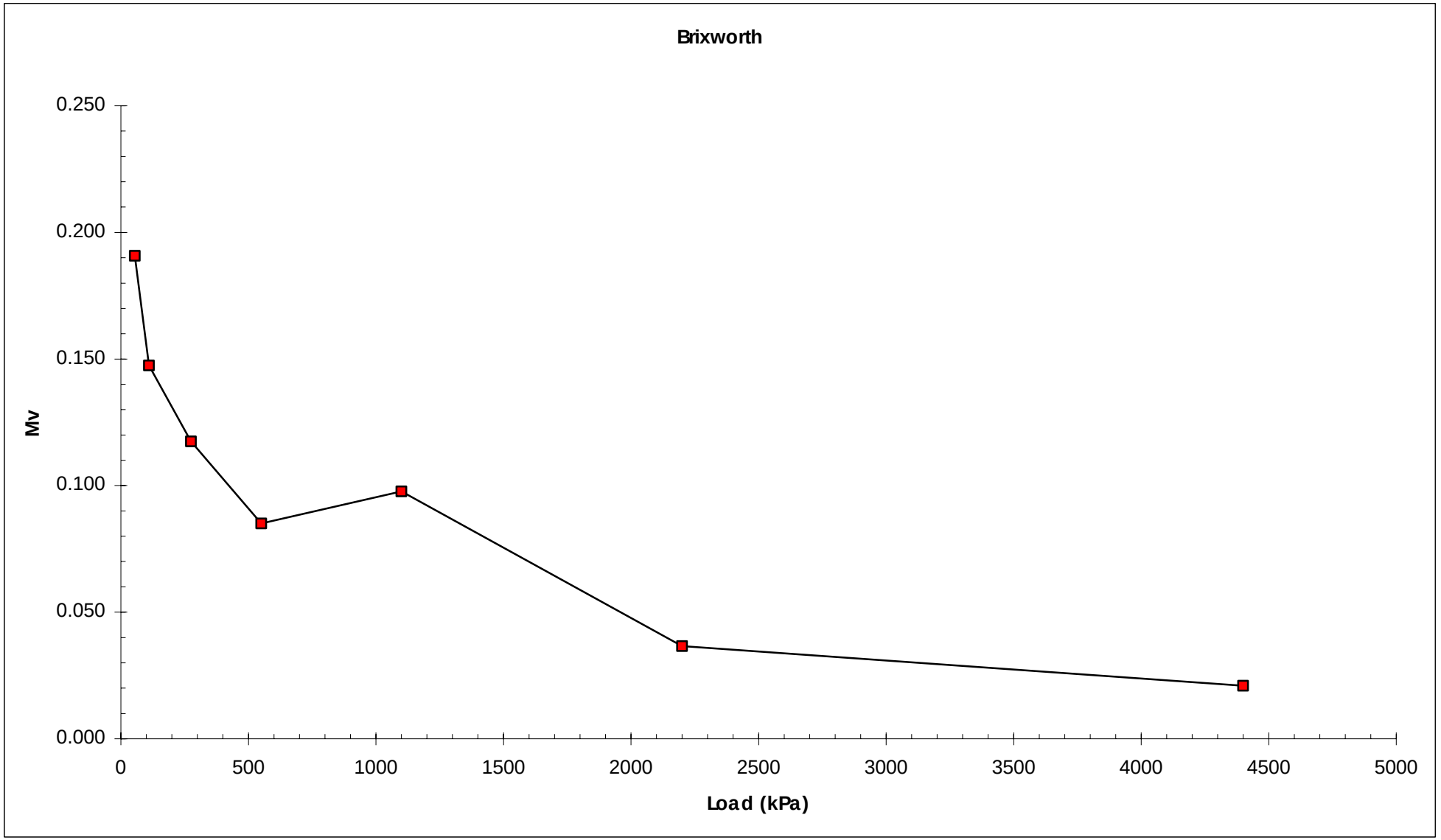
e-logP plot — *Coeff. of Volume Compressibility* — *Coeff. of Consolidation*

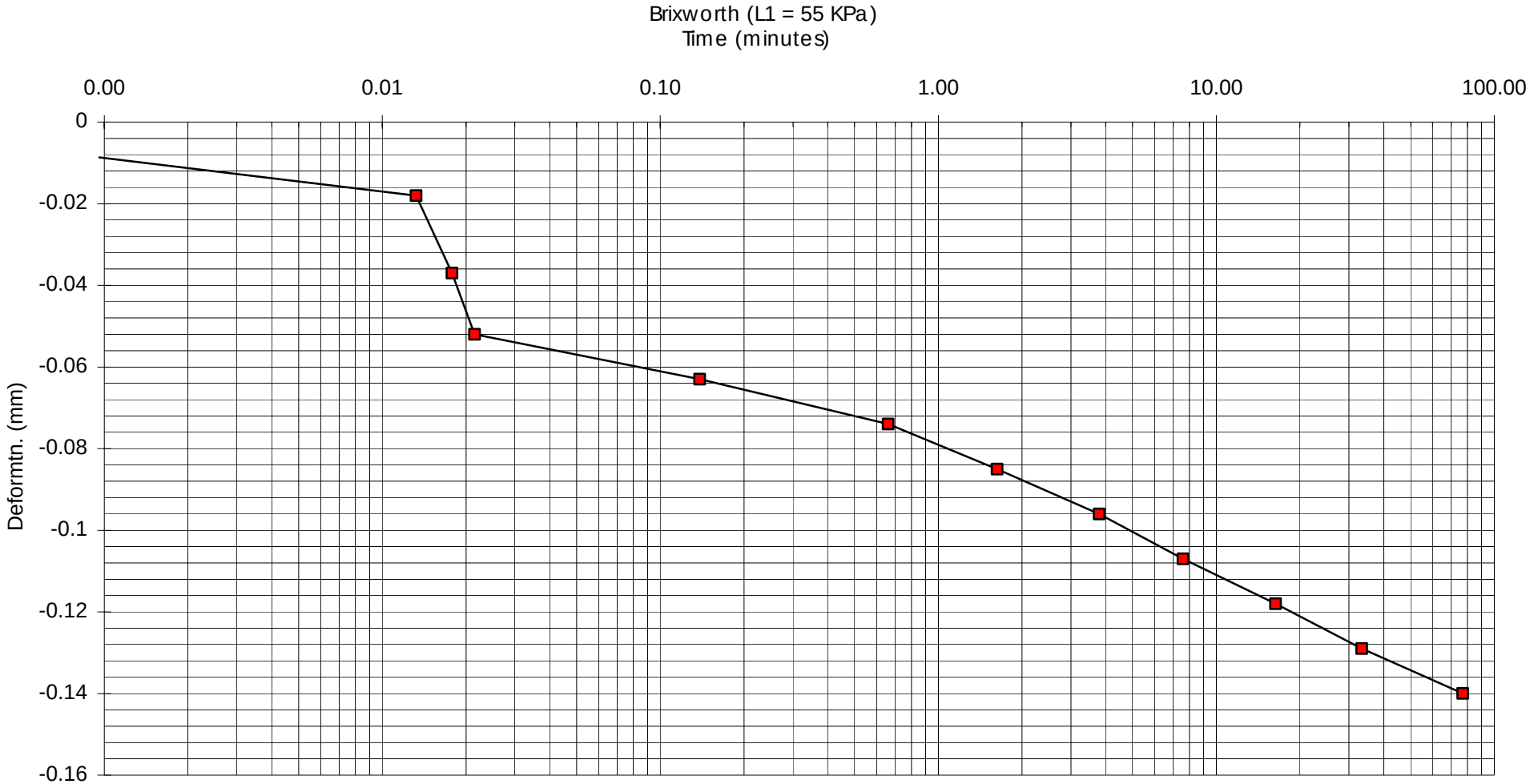
Incr. No.	Press. (kPa)	Nett Sett (mm)	Nett de	e1	Incr. de	Incr. dp (kPa)	1+e1	Mv (m2/MN)	t50 (mins)	H (mm)	Mean Ht H' (mm)	Cv (m2/yr)
	5.5	0.004	0.000	**0.710**						19.170		
1	**55**	0.181	0.016	**0.693**	0.016	49.5	1.710	**0.191**		18.989	19.0795	
2	**110**	0.335	0.030	**0.680**	0.014	55	1.693	**0.147**	3.25	18.835	18.912	**2.86**
3	**275**	0.700	0.062	**0.647**	0.033	165	1.680	**0.117**	8	18.47	18.6525	**1.13**
4	**550**	1.132	0.101	**0.609**	0.039	275	1.647	**0.085**	6.4	18.038	18.254	**1.35**
5	**1100**	2.101	0.187	**0.522**	0.086	550	1.609	**0.098**	9.5	17.069	17.5535	**0.84**
6	**2200**	2.788	0.249	**0.461**	0.061	1100	1.522	**0.037**	5.8	16.382	16.7255	**1.25**
7	**4400**	3.542	0.316	**0.394**	0.067	2200	1.461	**0.021**	4.9	15.628	16.005	**1.36**
8	**2200**	3.403	0.303	**0.406**	-0.012	-2200	1.394	**0.004**		15.767	15.6975	
9	**1100**	3.202	0.286	**0.424**	-0.018	-1100	1.406	**0.012**		15.968	15.8675	
10	**5.5**	1.097	0.098	**0.612**	-0.188	-1094.5	1.424	**0.120**		18.073	17.0205	

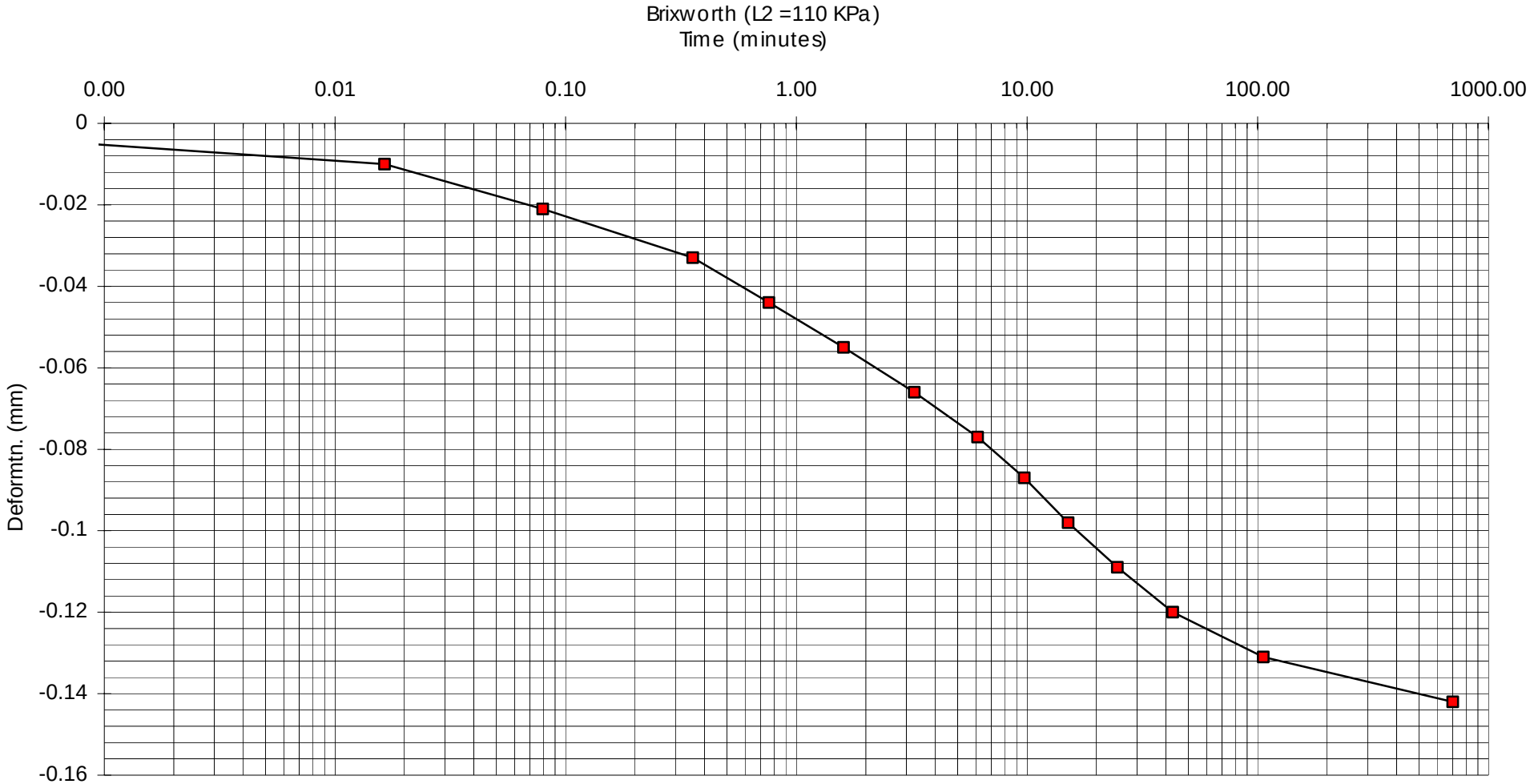

Brixworth
Voids Ratio
0.750
0.700
0.650
0.600
0.550
0.500
0.450
0.400
0.350
0.300
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

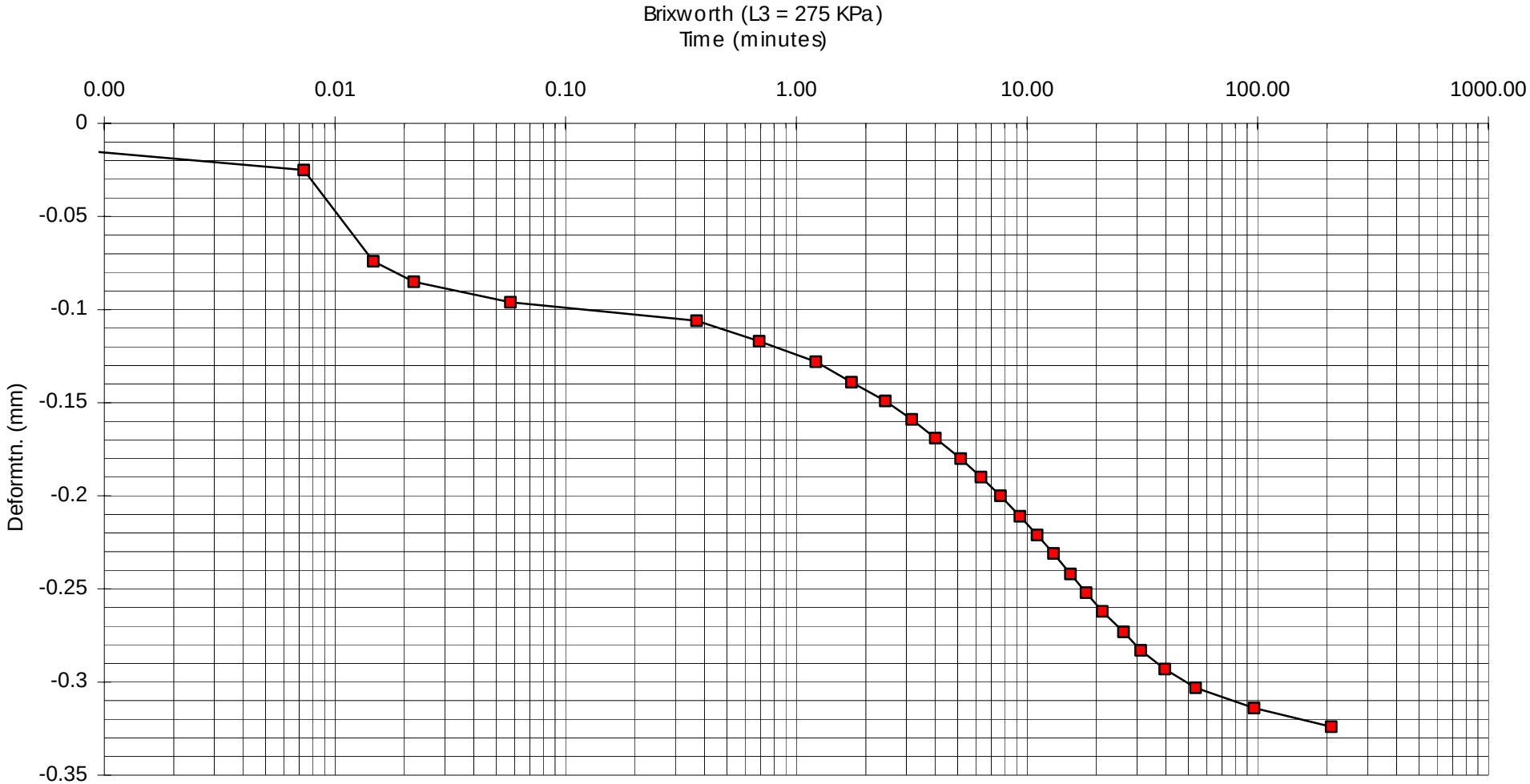

Brixworth
0.750
0.700
0.650
0.600
0.550
0.500
0.450
0.400
0.350
0.300
Voids Ratio
1
10
100
1000
10000
Load (kPa)

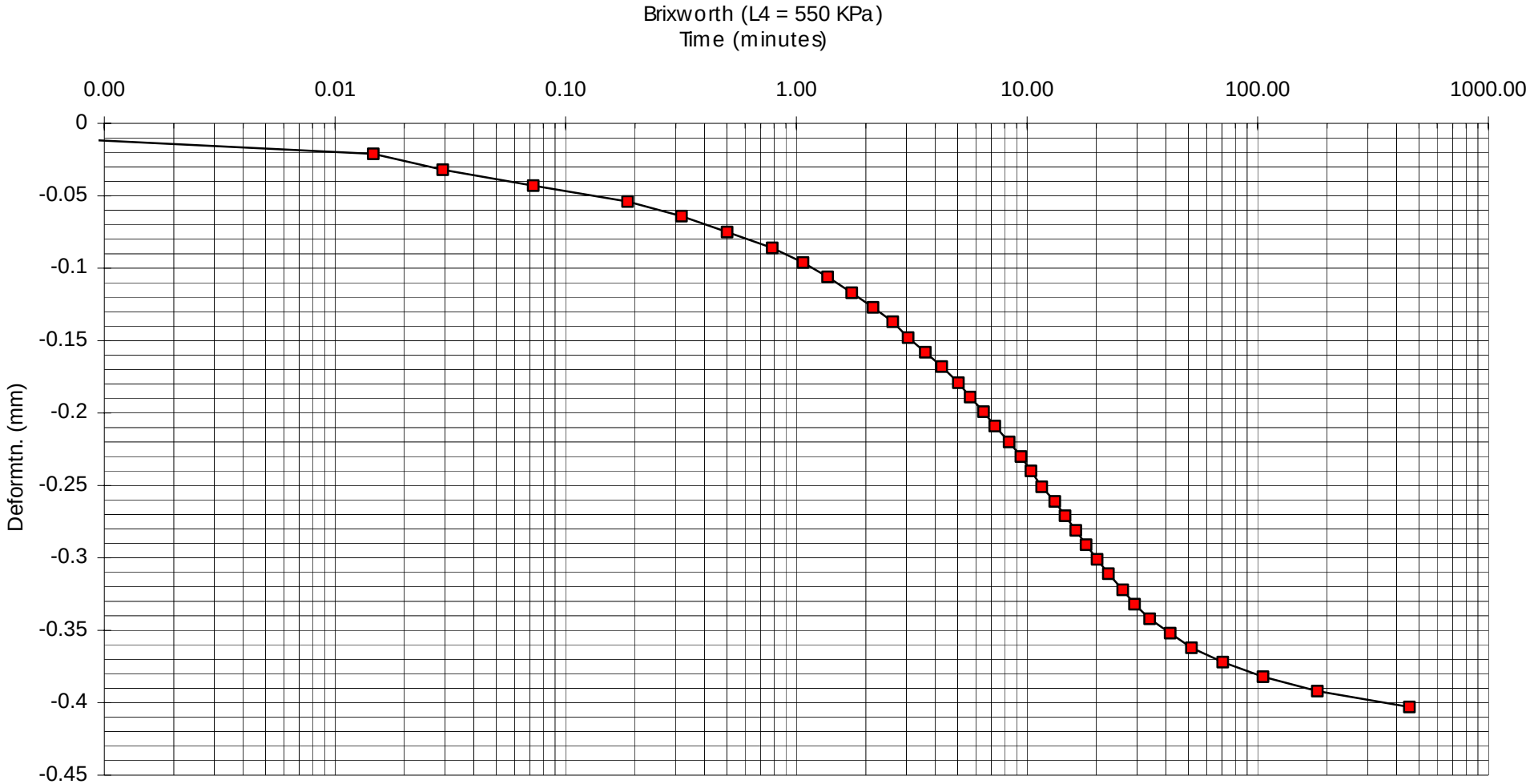

Brixworth
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Cv
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

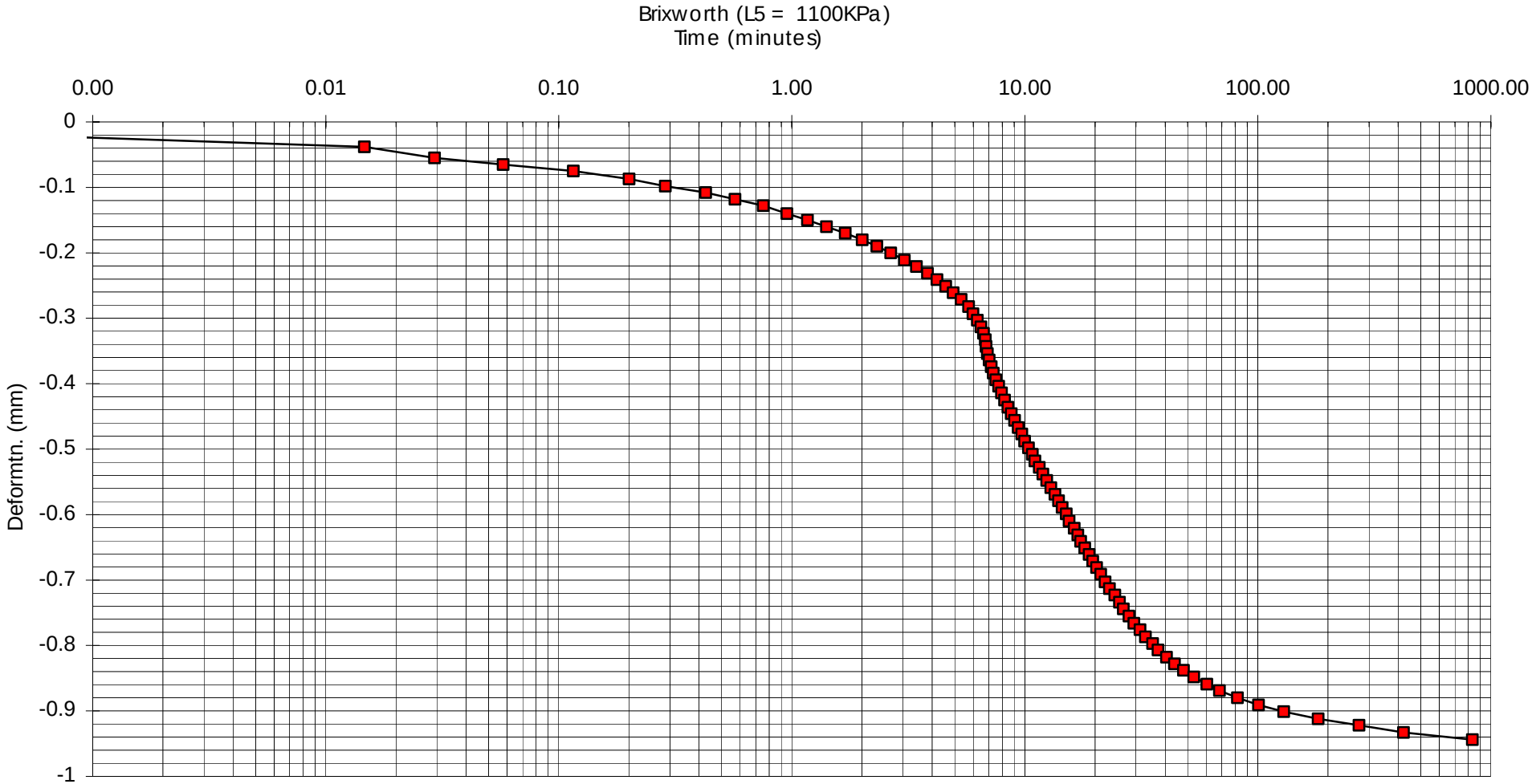

Brixworth
0.250
0.200
0.150
0.100
0.050
0.000
Mv
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

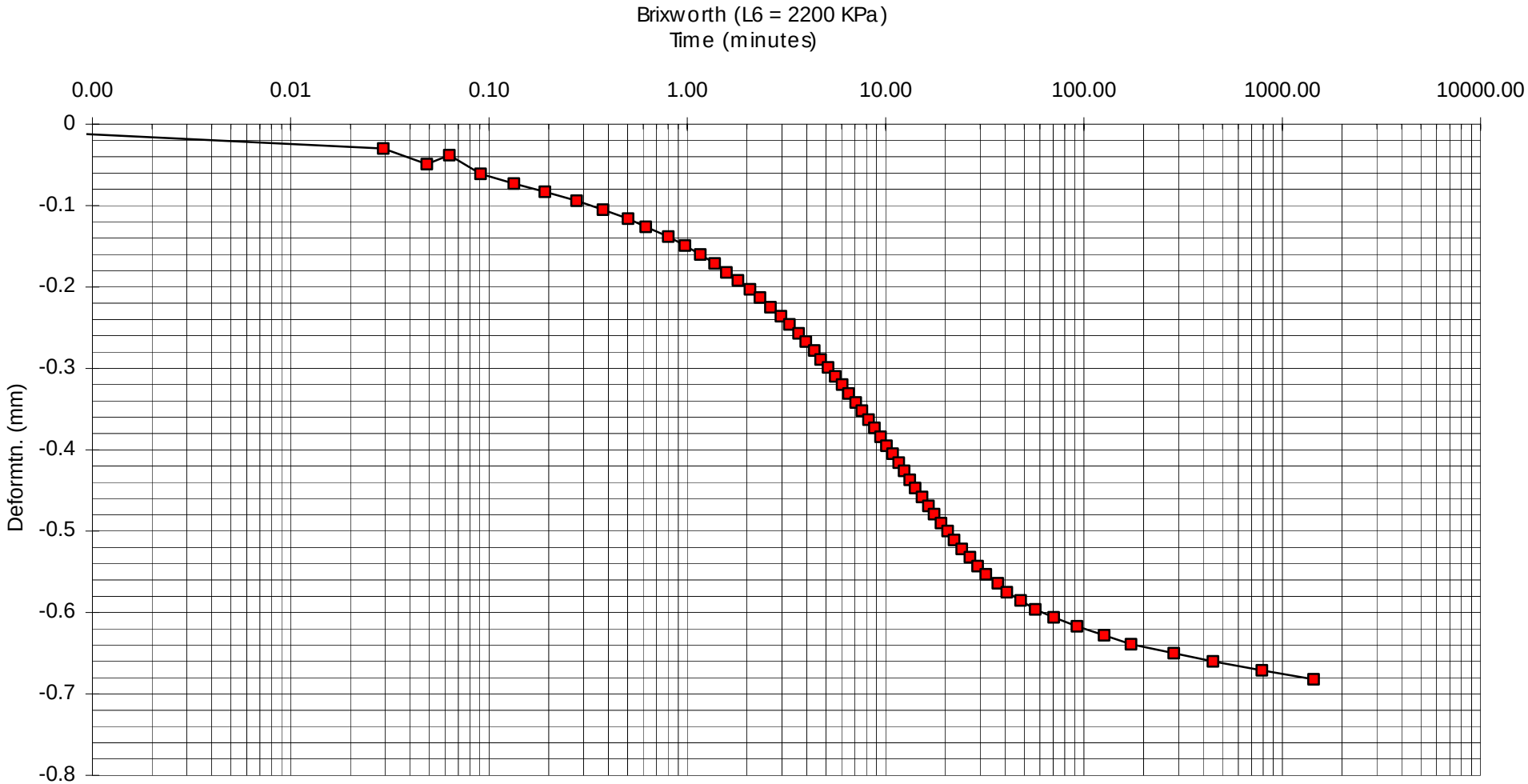

Brixworth (L1 = 55 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
-0.16
Deformtn. (mm)

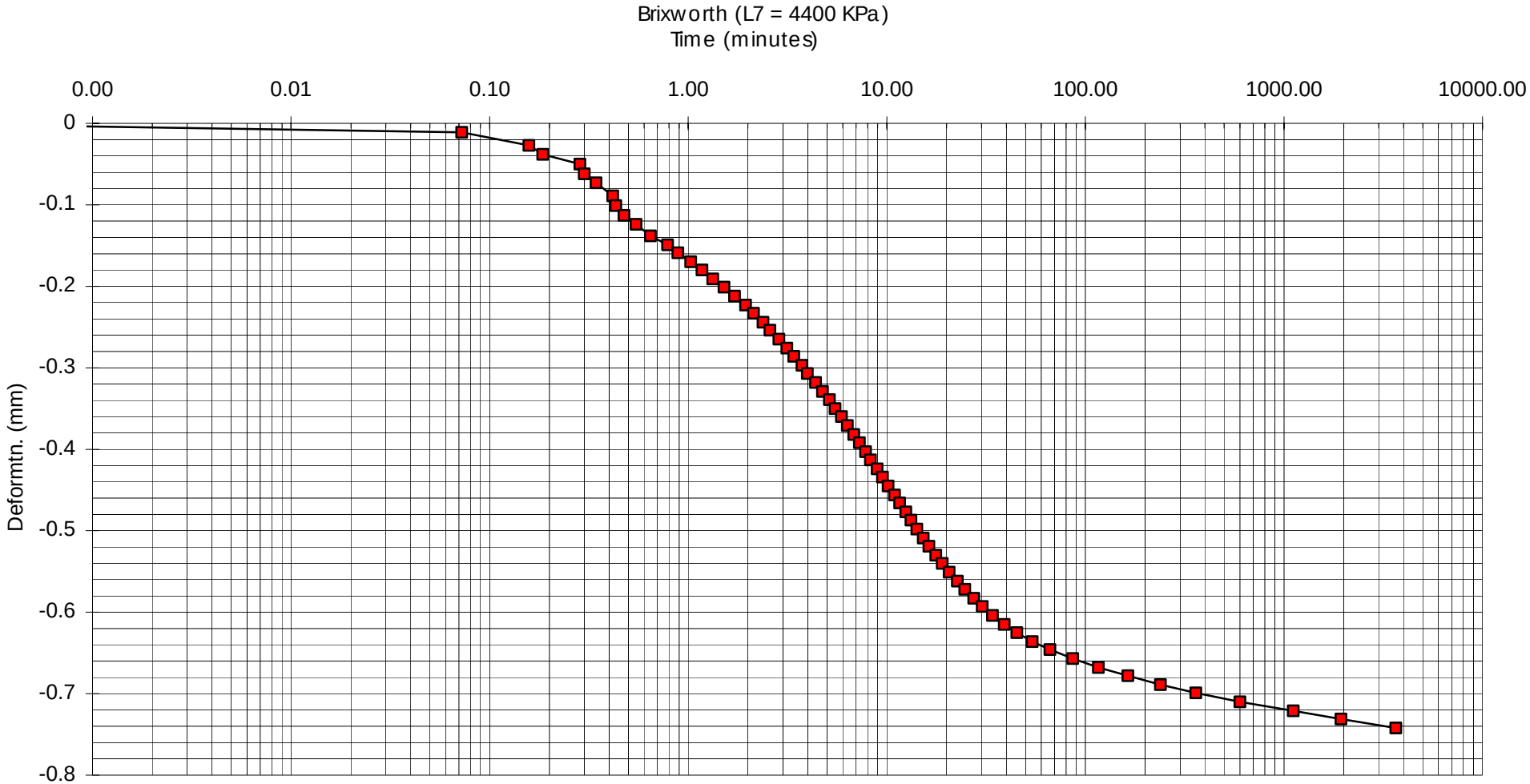

Brixworth (L2 =110 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
-0.16
Deformtn. (mm)


Brixworth (L3 = 275 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
Deformtn. (mm)


Brixworth (L4 = 550 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
-0.4
-0.45
Deformtn. (mm)


Brixworth (L5 = 1100KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
Deformtn. (mm)
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1


Brixworth (L6 = 2200 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
Deformtn. (mm)


Brixworth (L7 = 4400 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
Deformtn. (mm)

OEDOMETER CONSOLIDATION

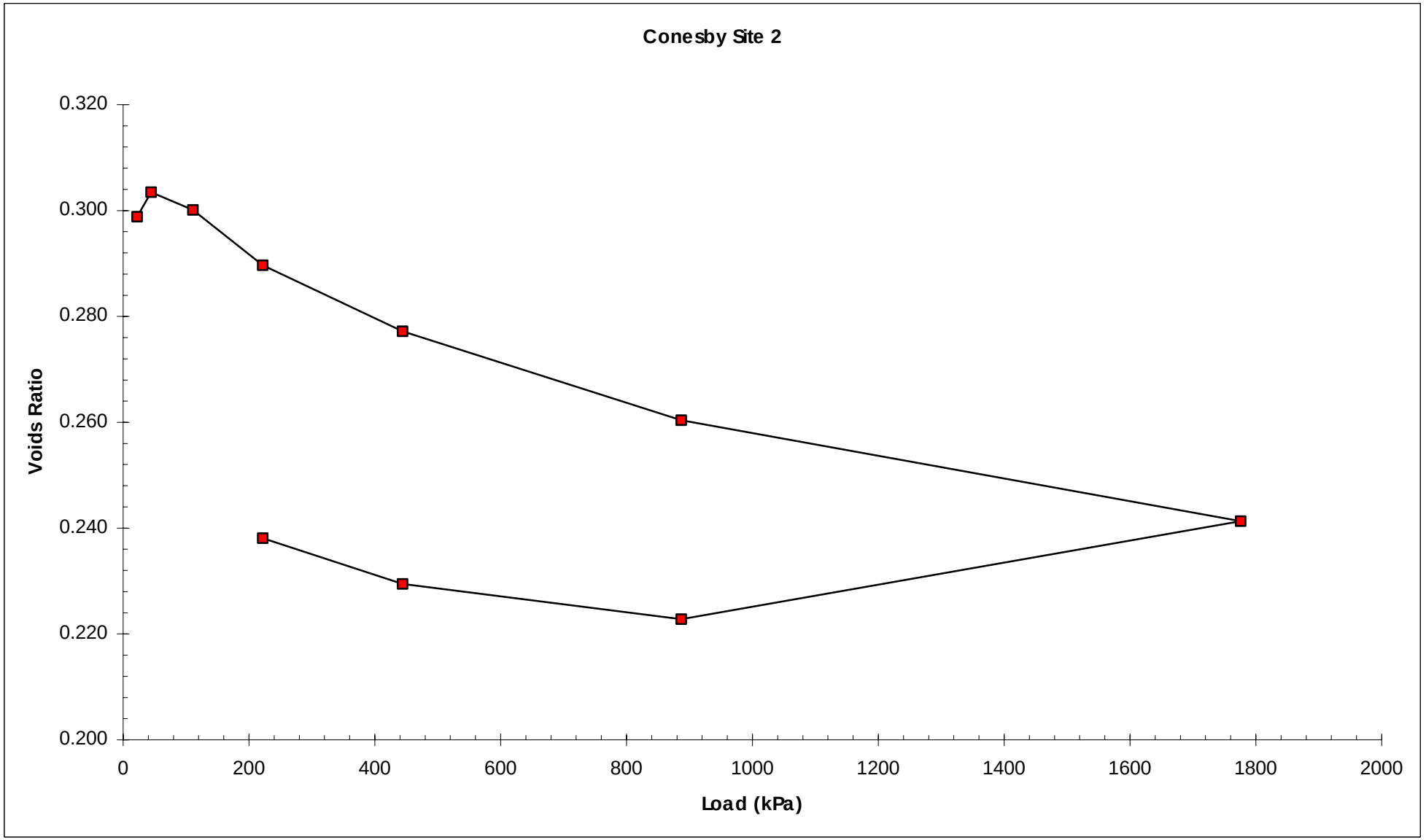
CALCULATION SHEET

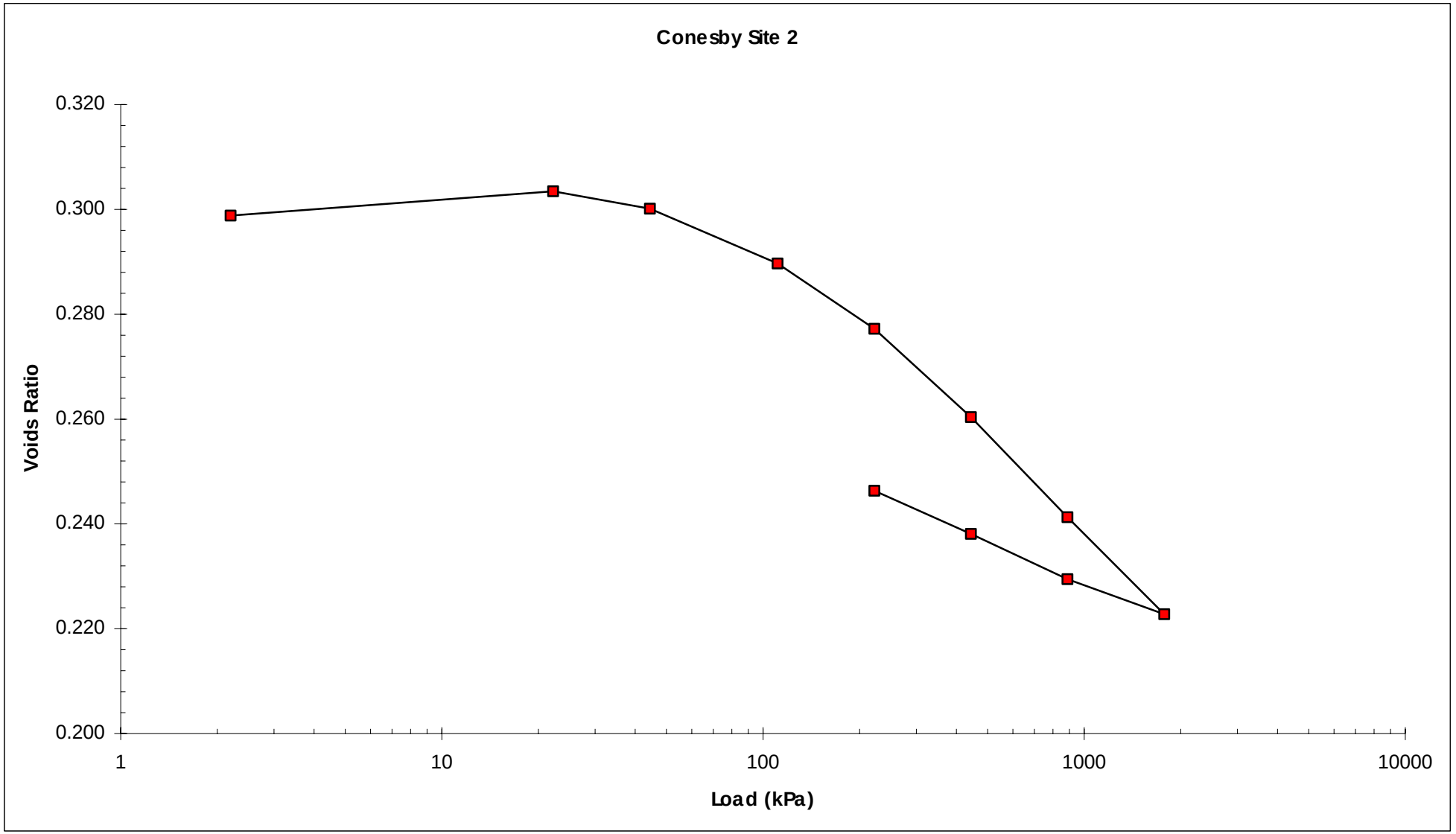
LOCATION:	Conesby Site 2	**SOIL TYPE:**	Upper Lias Clay
SAMPLE No.	2	**DEPTH:**	

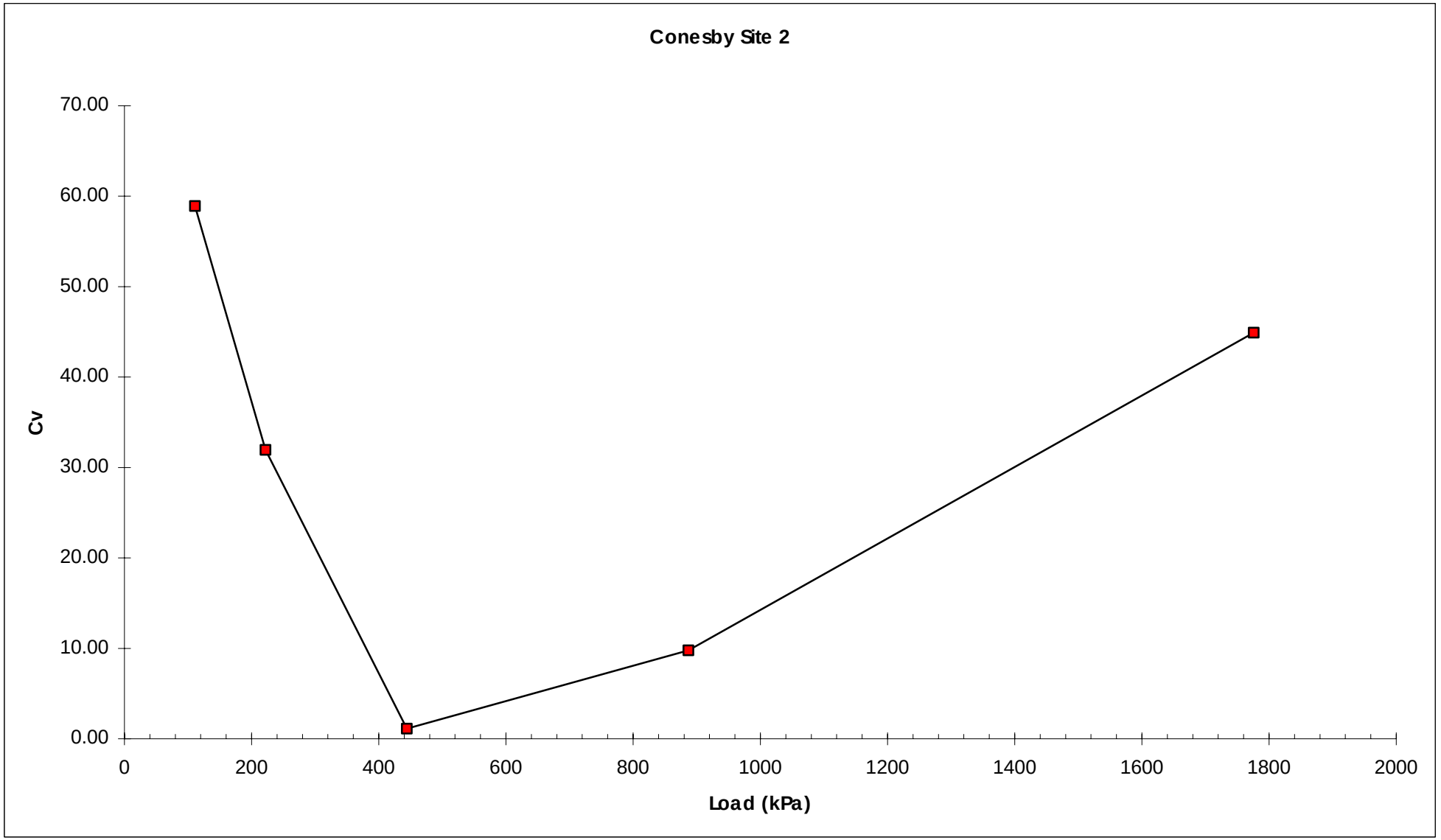
Ho	Gs	DDo	eo	F
19.1	2.66	2.048	0.299	0.068

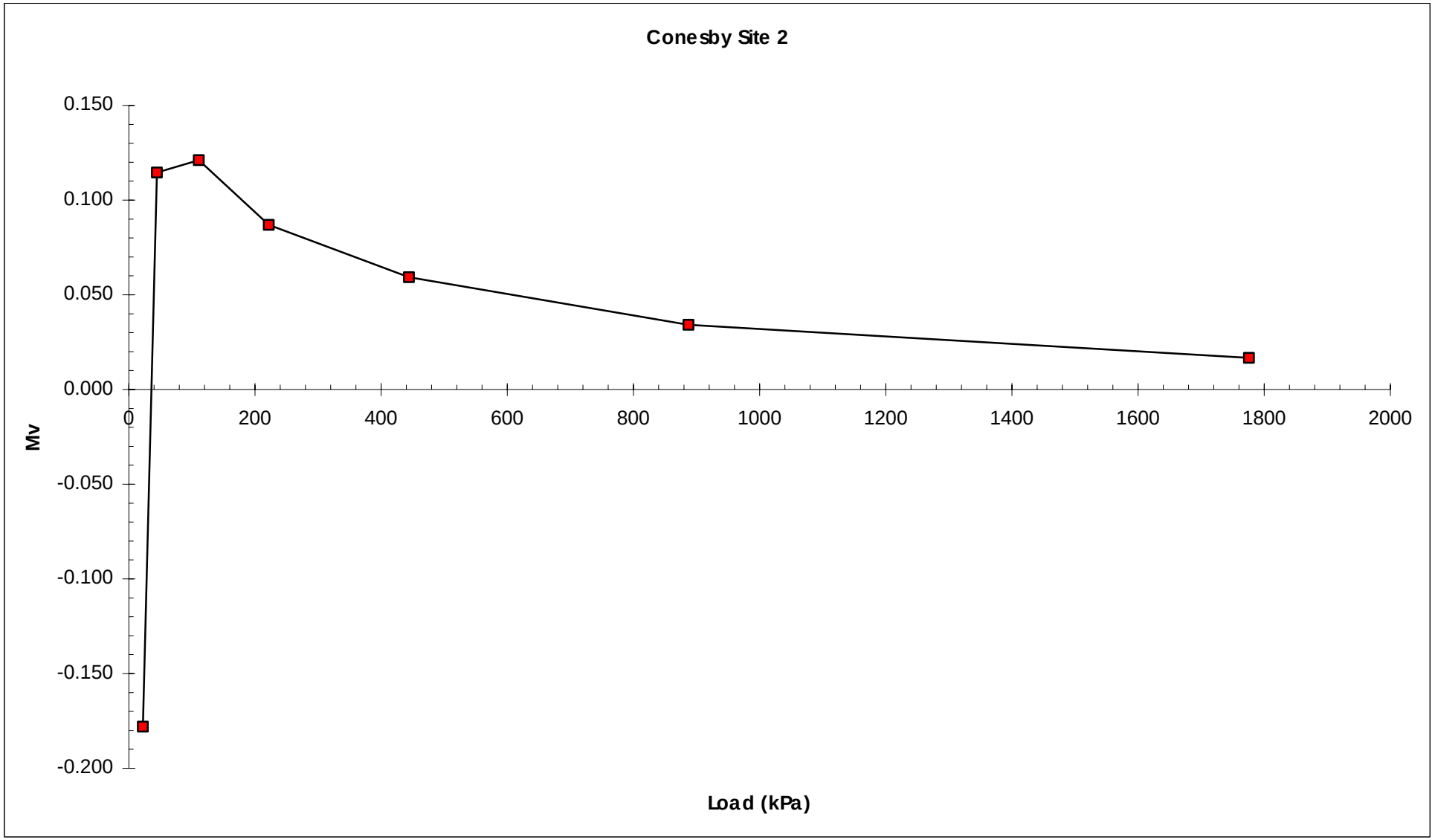
e-logP plot | *Coeff. of Volume Compressibility* | *Coeff. of Consolidation*

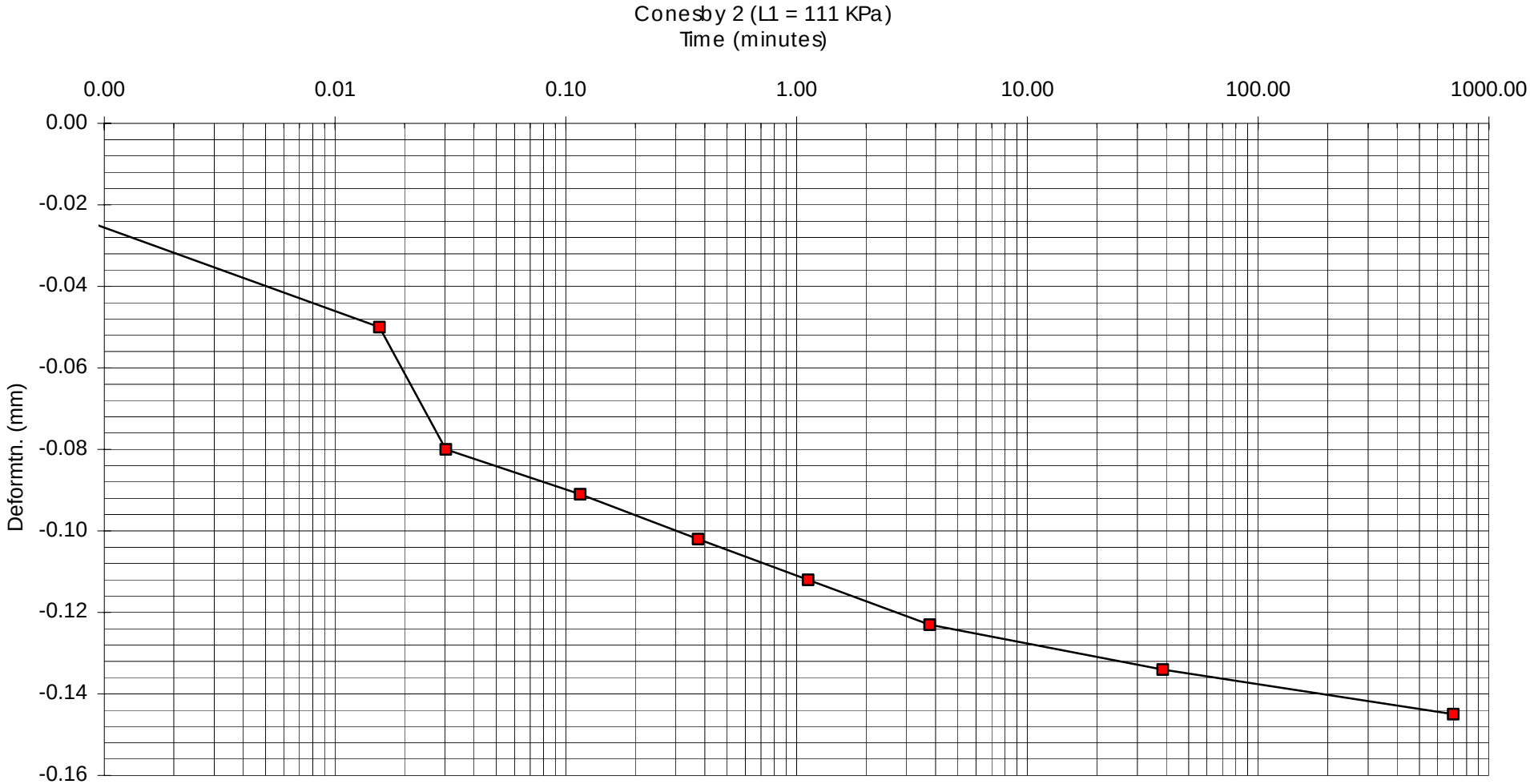
Incr. No.	Press. (kPa)	Nett Sett (mm)	Nett de	e1	Incr. de	Incr. dp (kPa)	1+e1	Mv (m2/MN)	t50 (mins)	H (mm)	Mean Ht H' (mm)	Cv (m2/yr)
1	2.2	0	0.000	**0.299**						19.100		
2	**22.2**	-0.068	-0.005	**0.303**	-0.005	20	1.299	**-0.178**		19.119	19.1095	
3	**44.5**	-0.019	-0.001	**0.300**	0.003	22.3	1.303	**0.115**	0.16	18.965	19.042	**58.92**
4	**111**	0.135	0.009	**0.290**	0.010	66.5	1.300	**0.121**	0.29	18.782	18.8735	**31.94**
5	**222**	0.318	0.022	**0.277**	0.012	111	1.290	**0.087**	8	18.535	18.6585	**1.13**
6	**444**	0.565	0.038	**0.260**	0.017	222	1.277	**0.059**	0.9	18.254	18.3945	**9.77**
7	**887**	0.846	0.058	**0.241**	0.019	443	1.260	**0.034**	0.19	17.982	18.118	**44.92**
8	**1776**	1.118	0.076	**0.223**	0.018	889	1.241	**0.017**		18.08	18.031	
9	**887**	1.020	0.069	**0.229**	-0.007	-889	1.223	**0.006**		18.207	18.1435	
10	**444**	0.893	0.061	**0.238**	-0.009	-443	1.229	**0.016**		18.328	18.2675	
11	**222**	0.772	0.052	**0.246**	-0.008	-222	1.238	**0.030**		19.1	18.714	

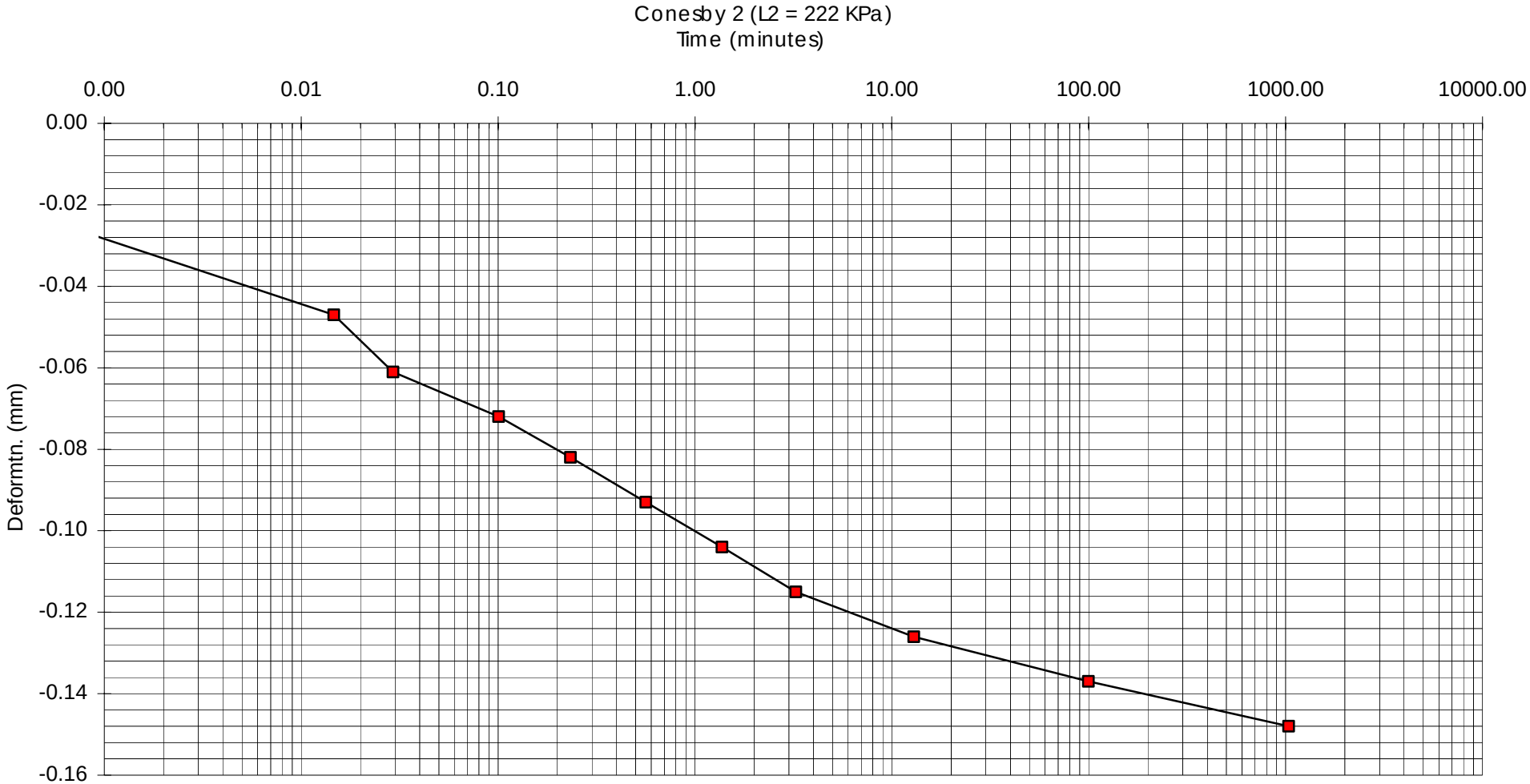

Conesby Site 2
Voids Ratio
0.320
0.300
0.280
0.260
0.240
0.220
0.200
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Load (kPa)

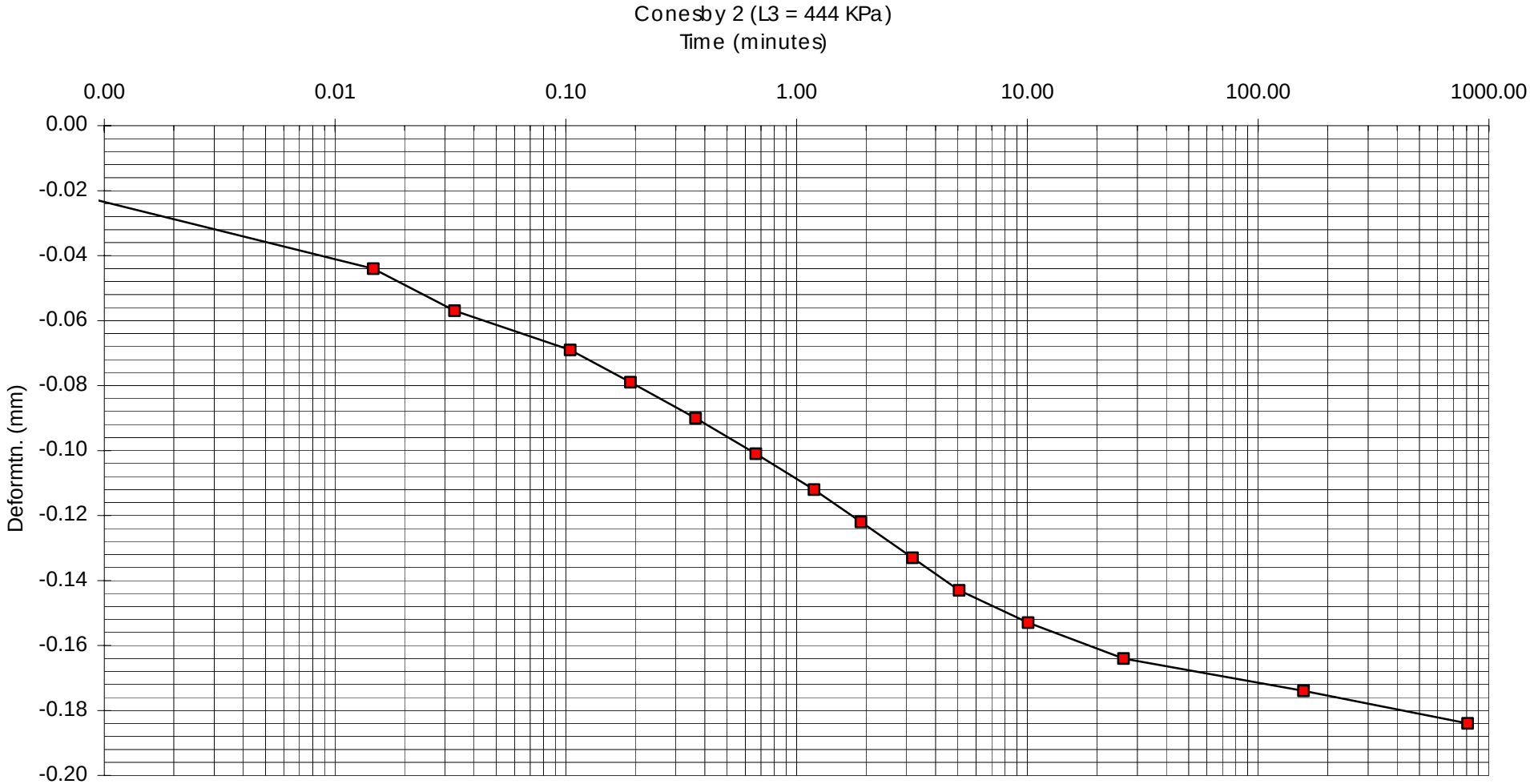

Conesby Site 2
Voids Ratio
0.320
0.300
0.280
0.260
0.240
0.220
0.200
1
10
100
1000
10000
Load (kPa)

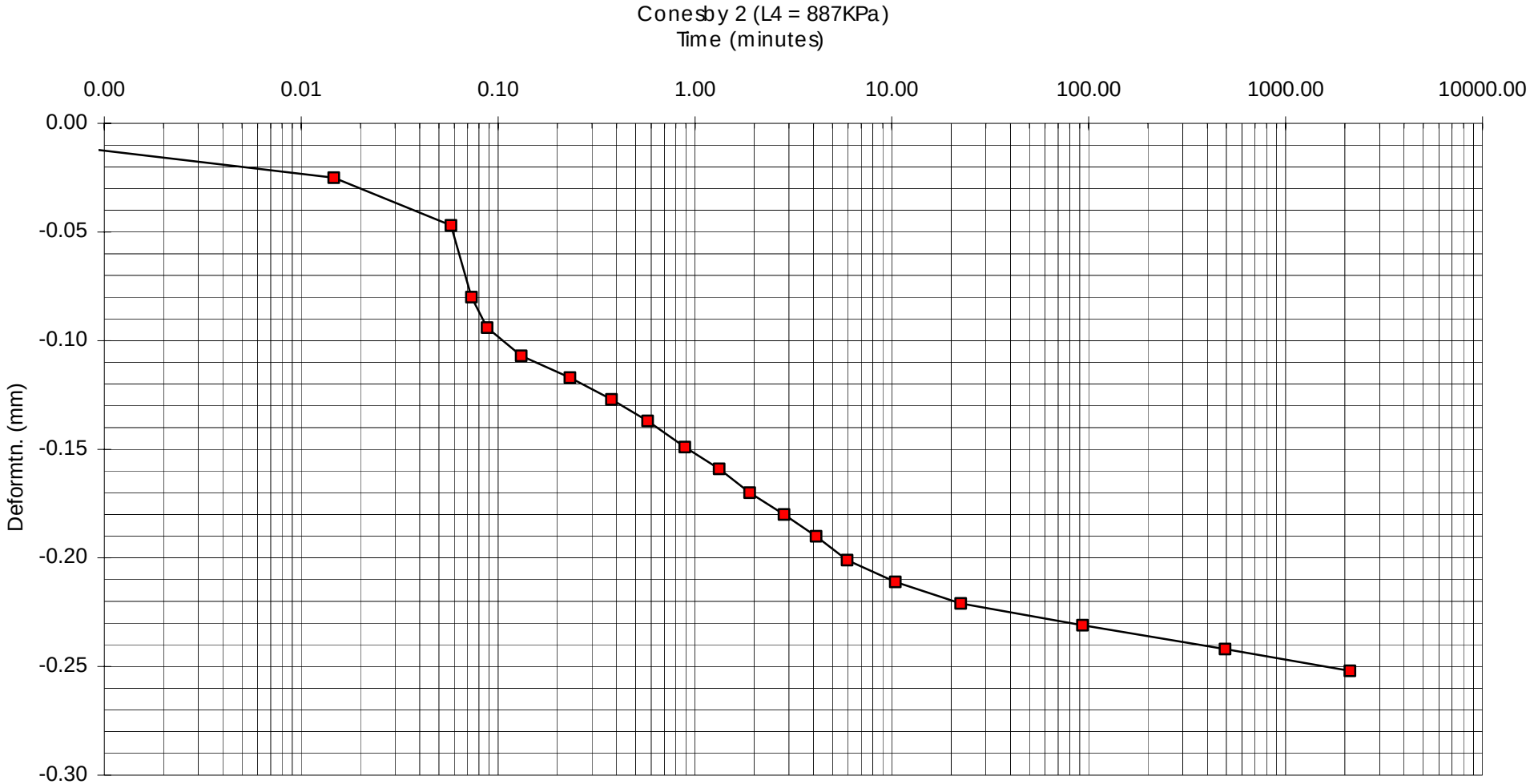

Conesby Site 2
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Cv
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Load (kPa)

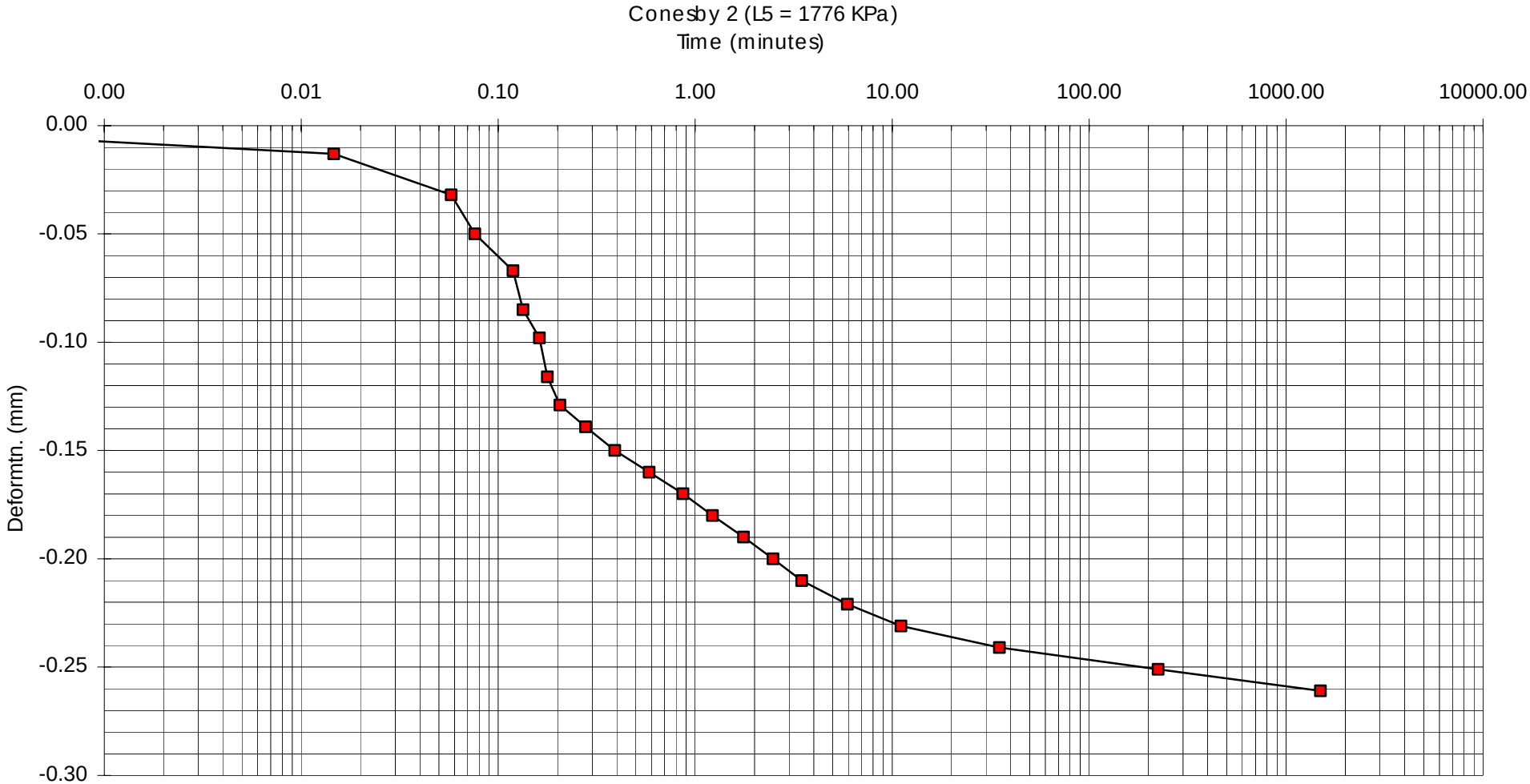

Conesby Site 2
0.150
0.100
0.050
0.000
-0.050
-0.100
-0.150
-0.200
Mv
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Load (kPa)


Conesby 2 (L1 = 111 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
-0.16
Deformtn. (mm)


Conesby 2 (L2 = 222 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
-0.16
Deformtn. (mm)


Conesby 2 (L3 = 444 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
Deformtn. (mm)
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
-0.16
-0.18
-0.20


Consby 2 (L4 = 887KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
Deformtn. (mm)


Conesby 2 (L5 = 1776 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
Deformtn. (mm)

OEDOMETER CONSOLIDATION

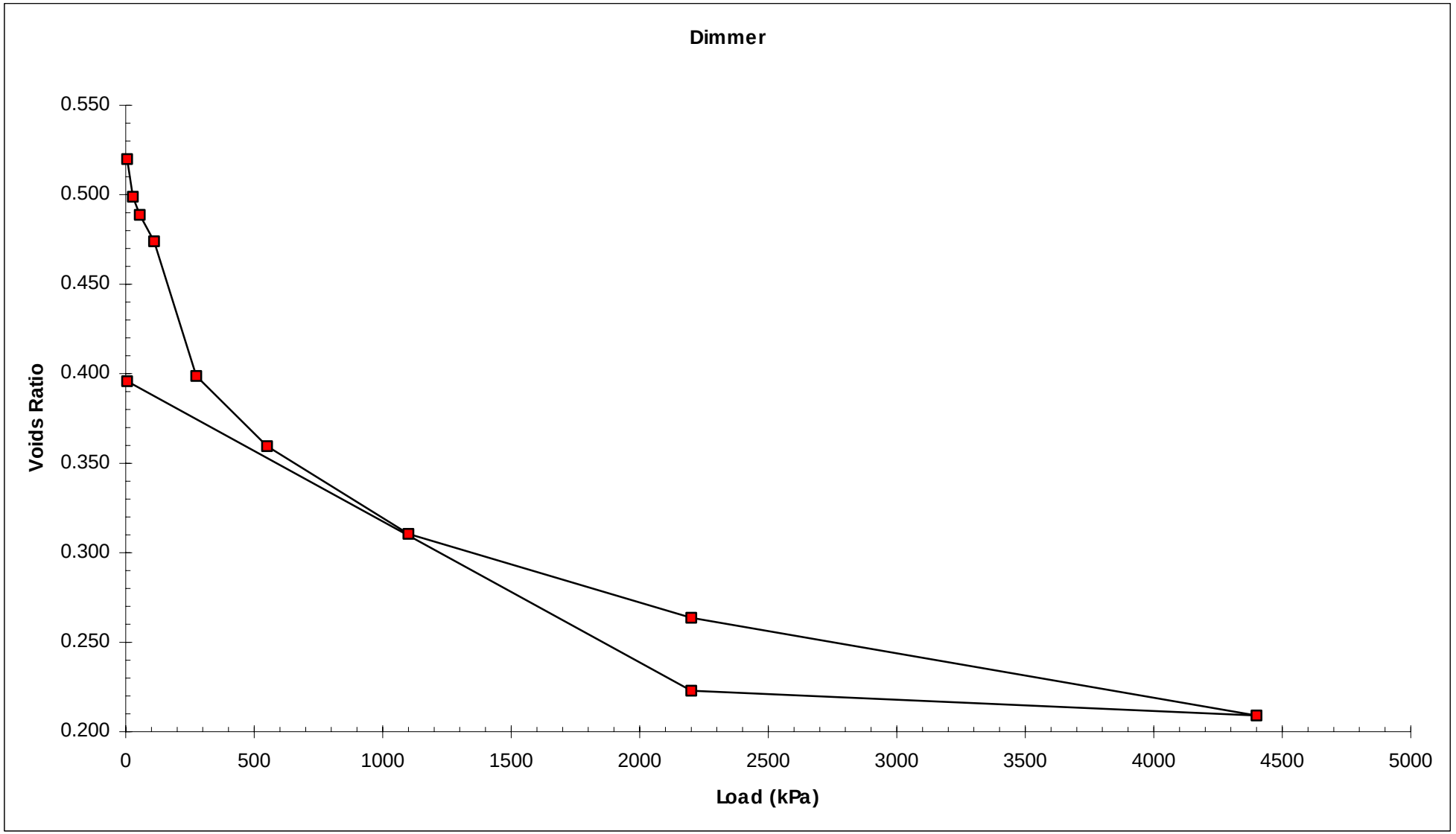
CALCULATION SHEET

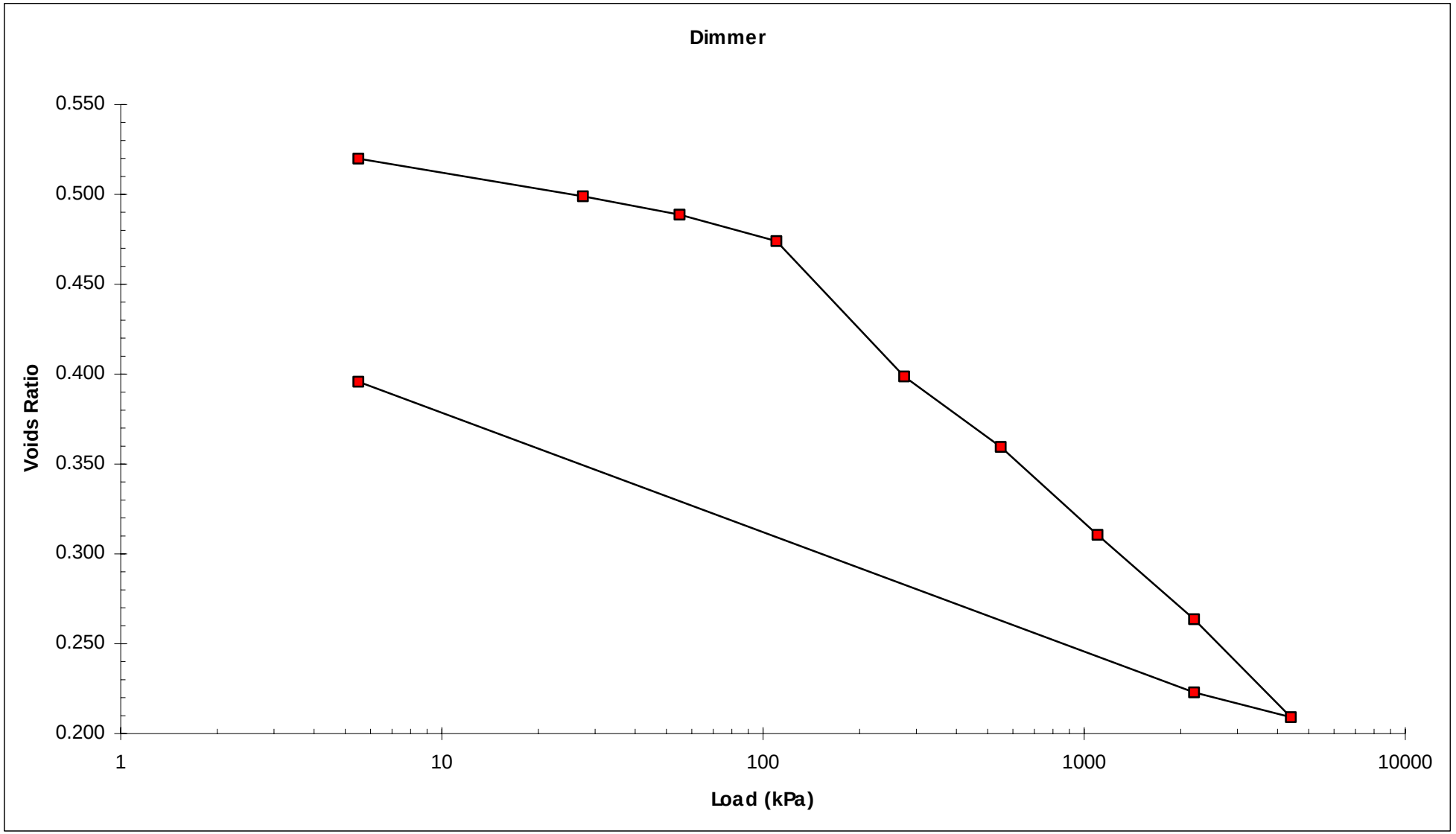
LOCATION:	Dimmer	**SOIL TYPE:**	Lias Clay
SAMPLE No.		**DEPTH:**	

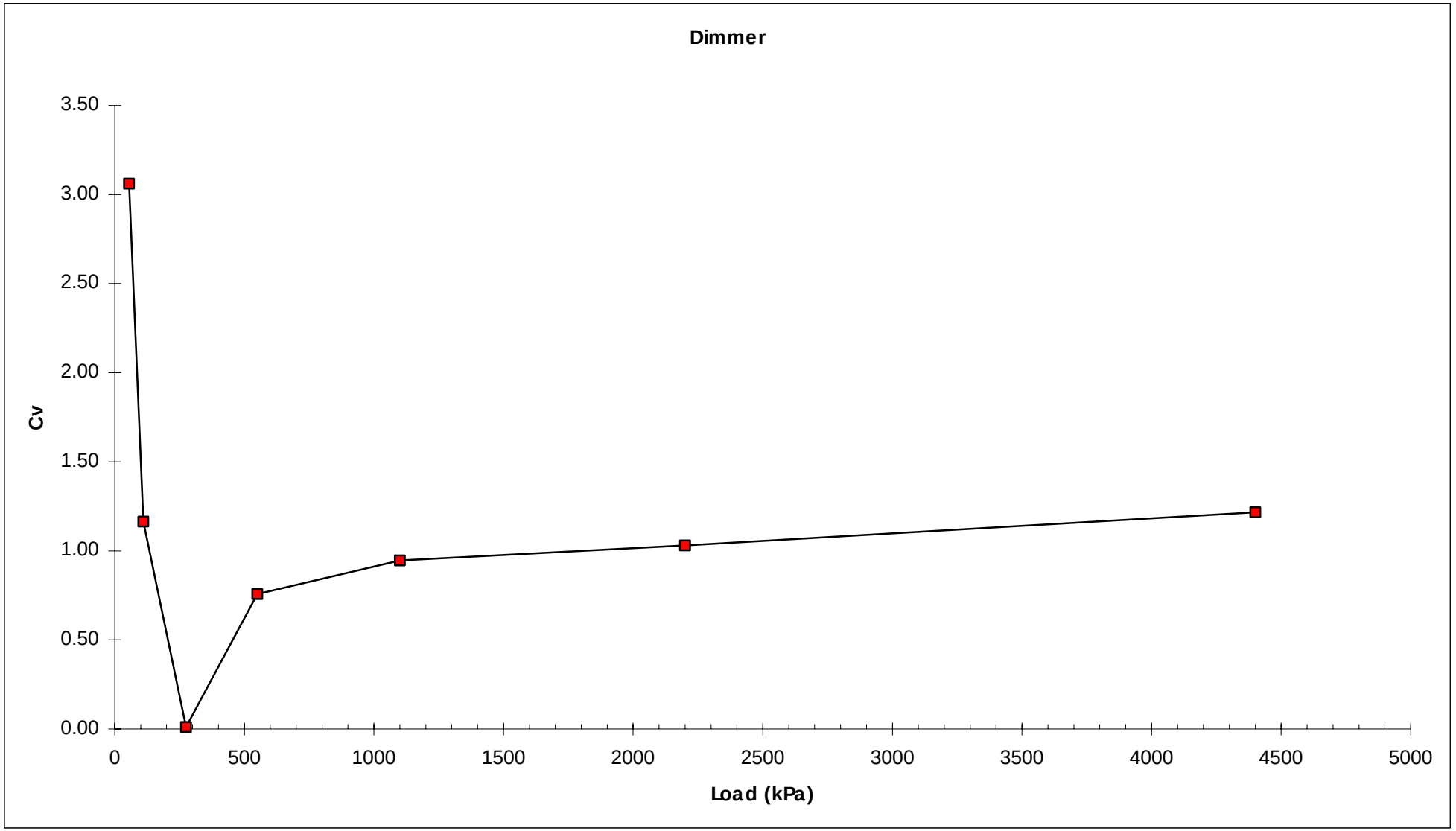
Ho	Gs	DDo	eo	F
18.8	2.64	1.737	0.520	0.081

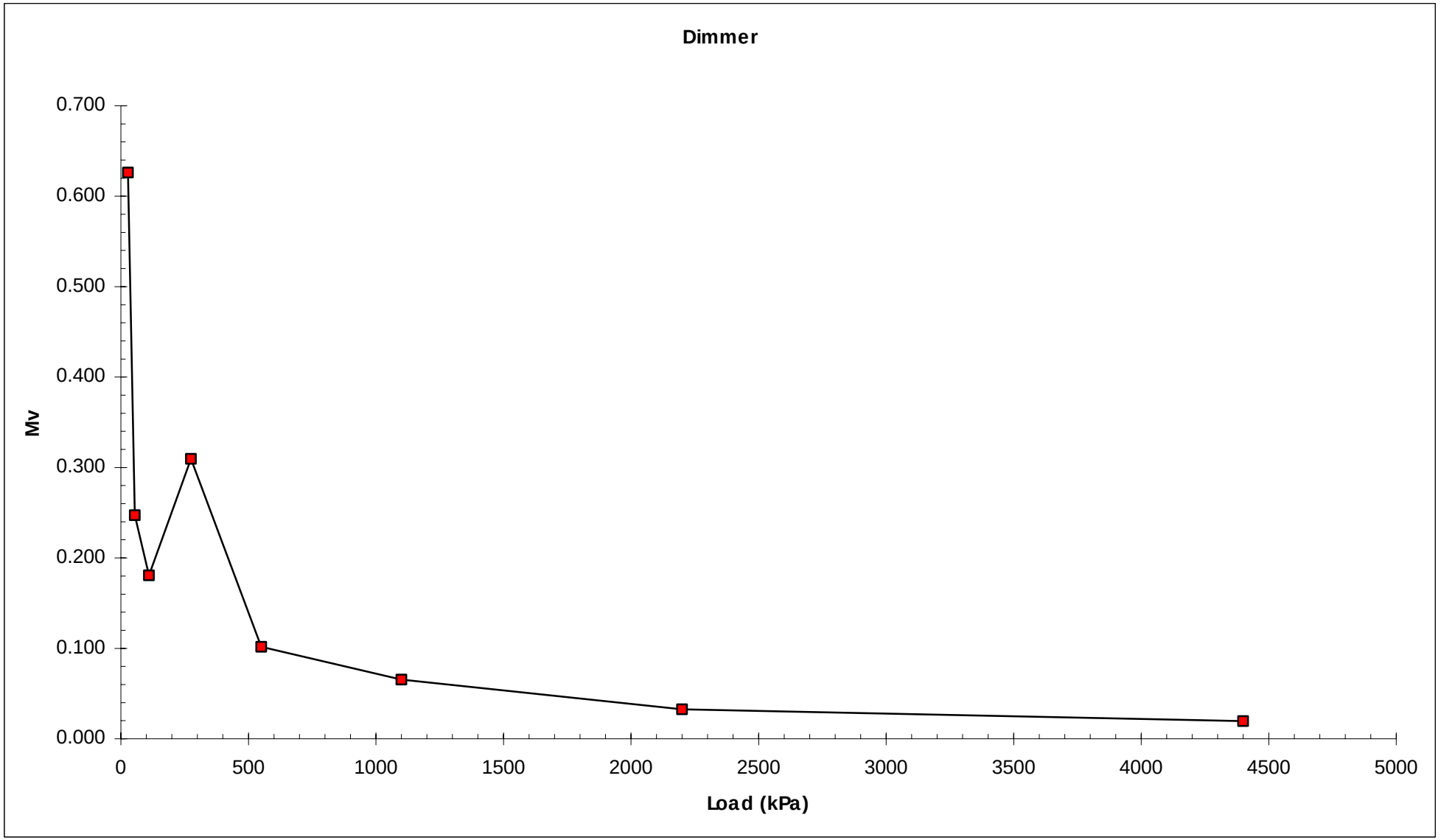
e-logP plot | *Coeff. of Volume Compressibility* | *Coeff. of Consolidation*

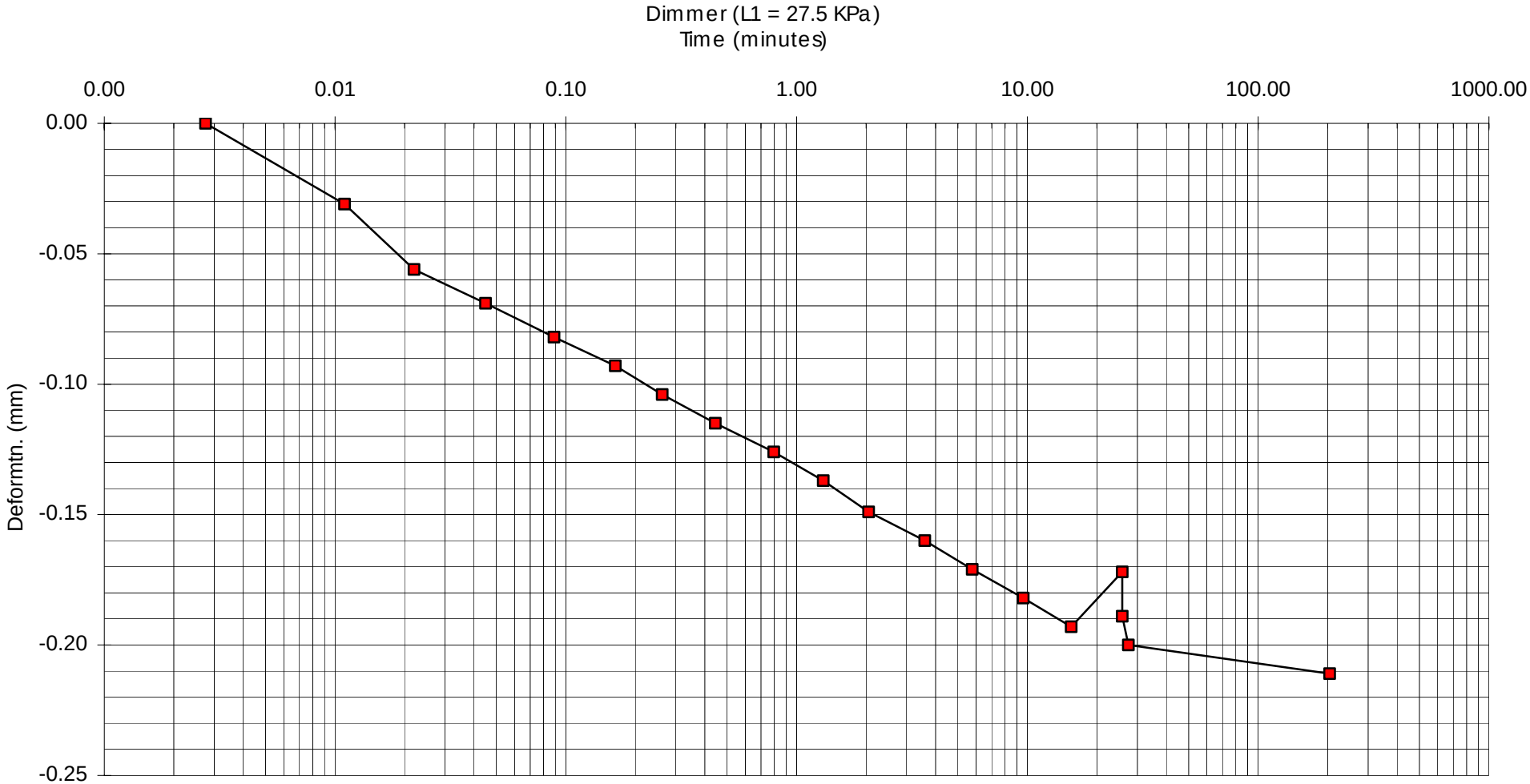
Incr. No.	Press. (kPa)	Nett Sett (mm)	Nett de	e1	Incr. de	Incr. dp (kPa)	1+e1	Mv (m2/MN)	t50 (mins)	H (mm)	Mean Ht H' (mm)	Cv (m2/yr)
				0								
	5.5	0	0.000	**0.520**						18.800		
1	**27.5**	0.259	0.021	**0.499**	0.021	22	1.520	**0.626**		18.541	18.6705	
2	**55**	0.385	0.031	**0.489**	0.010	27.5	1.499	**0.247**	2.9	18.415	18.478	**3.06**
3	**110**	0.568	0.046	**0.474**	0.015	55	1.489	**0.181**	7.5	18.232	18.3235	**1.16**
4	**275**	1.499	0.121	**0.399**	0.075	165	1.474	**0.309**	750	17.301	17.7665	**0.01**
5	**550**	1.983	0.160	**0.360**	0.039	275	1.399	**0.102**	10	16.817	17.059	**0.76**
6	**1100**	2.589	0.209	**0.311**	0.049	550	1.360	**0.066**	7.5	16.211	16.514	**0.95**
7	**2200**	3.169	0.256	**0.264**	0.047	1100	1.311	**0.033**	6.4	15.631	15.921	**1.03**
8	**4400**	3.844	0.311	**0.209**	0.055	2200	1.264	**0.020**	5	14.956	15.2935	**1.22**
9	**2200**	3.673	0.297	**0.223**	-0.014	-2200	1.209	**0.005**		15.127	15.0415	
10	**5.5**	1.535	0.124	**0.396**	-0.173	-2194.5	1.223	**0.064**		17.265	16.196	

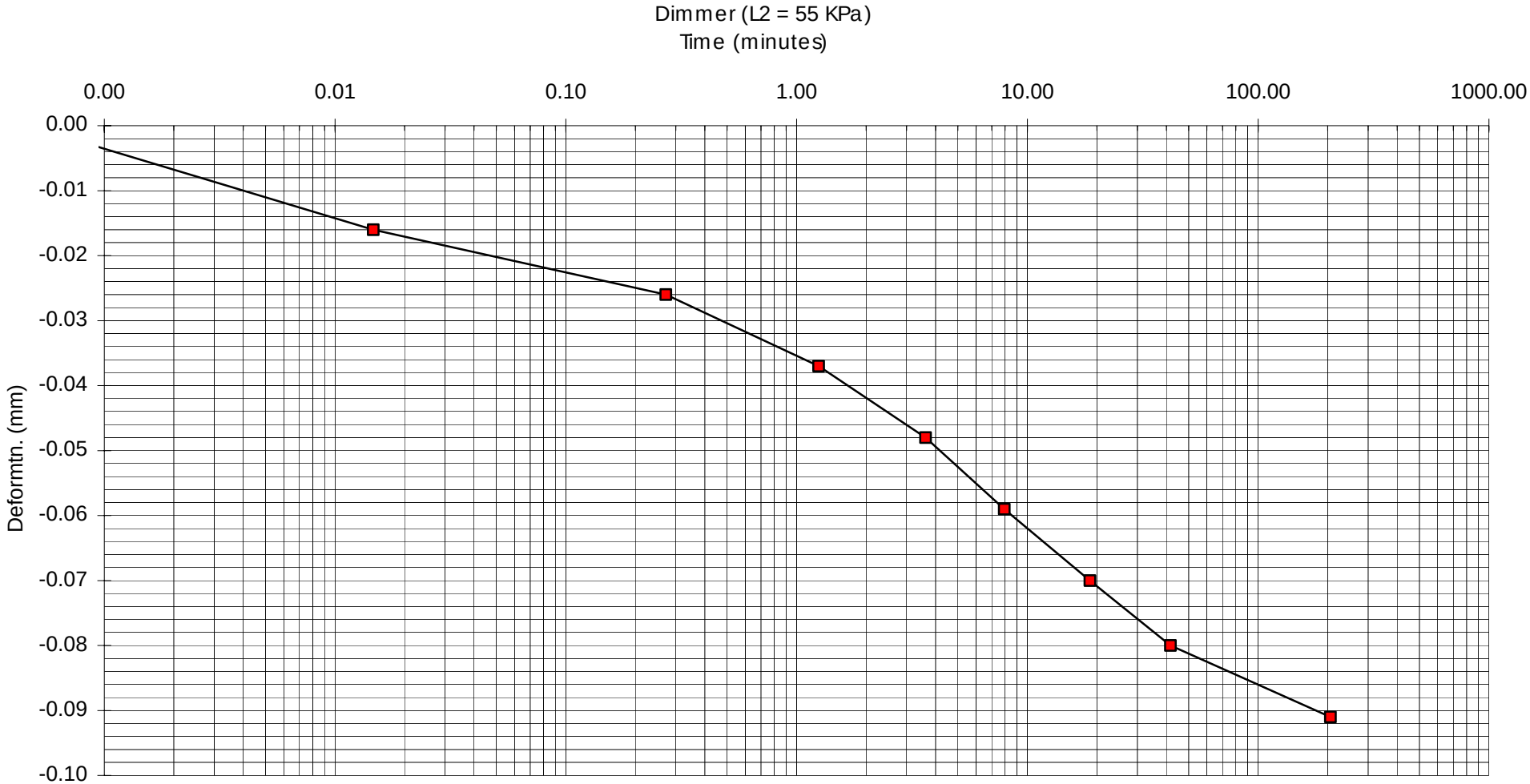

Dimmer
Voids Ratio
0.550
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

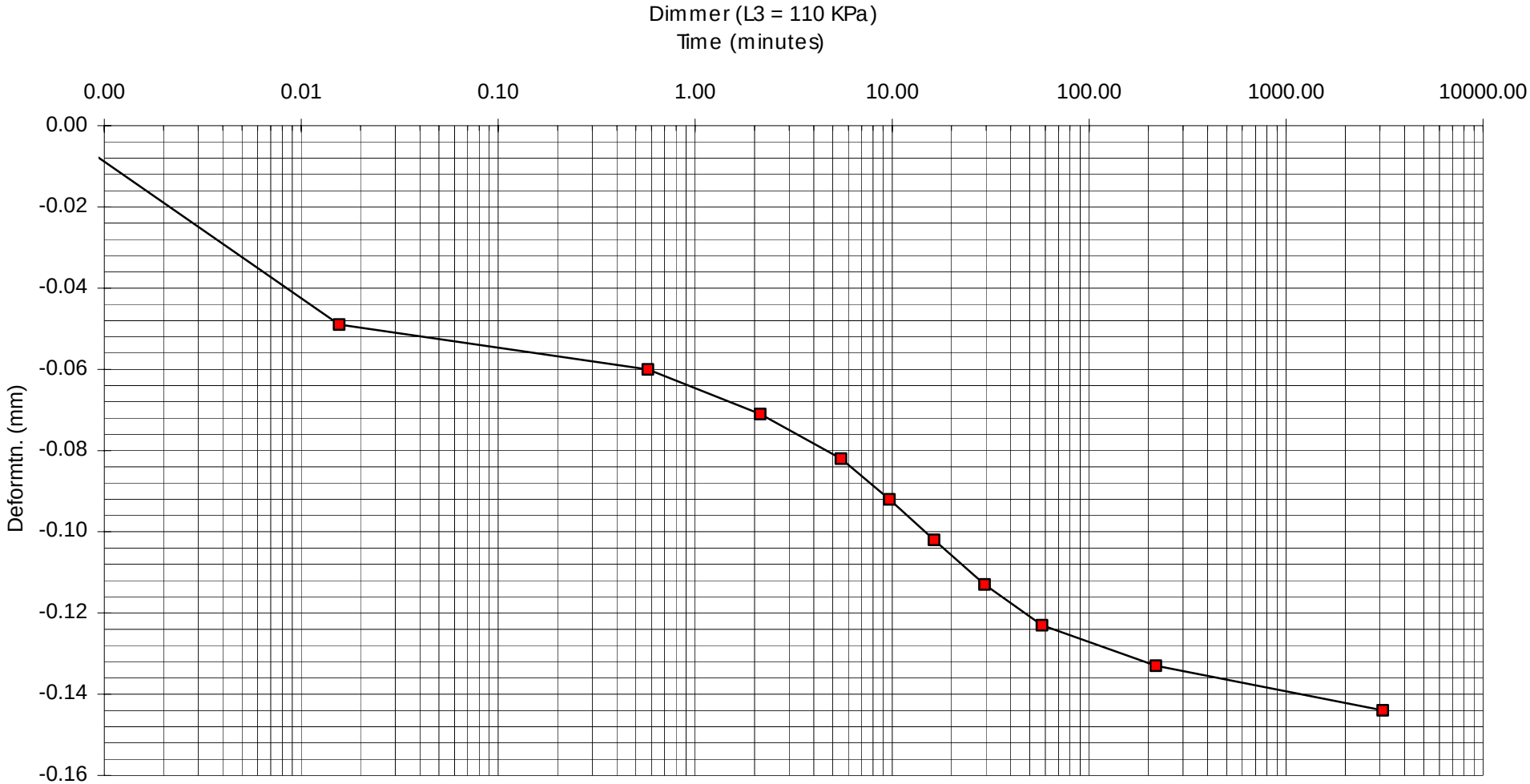

Dimmer
Voids Ratio
0.550
0.500
0.450
0.400
0.350
0.300
0.250
0.200
1
10
100
1000
10000
Load (kPa)

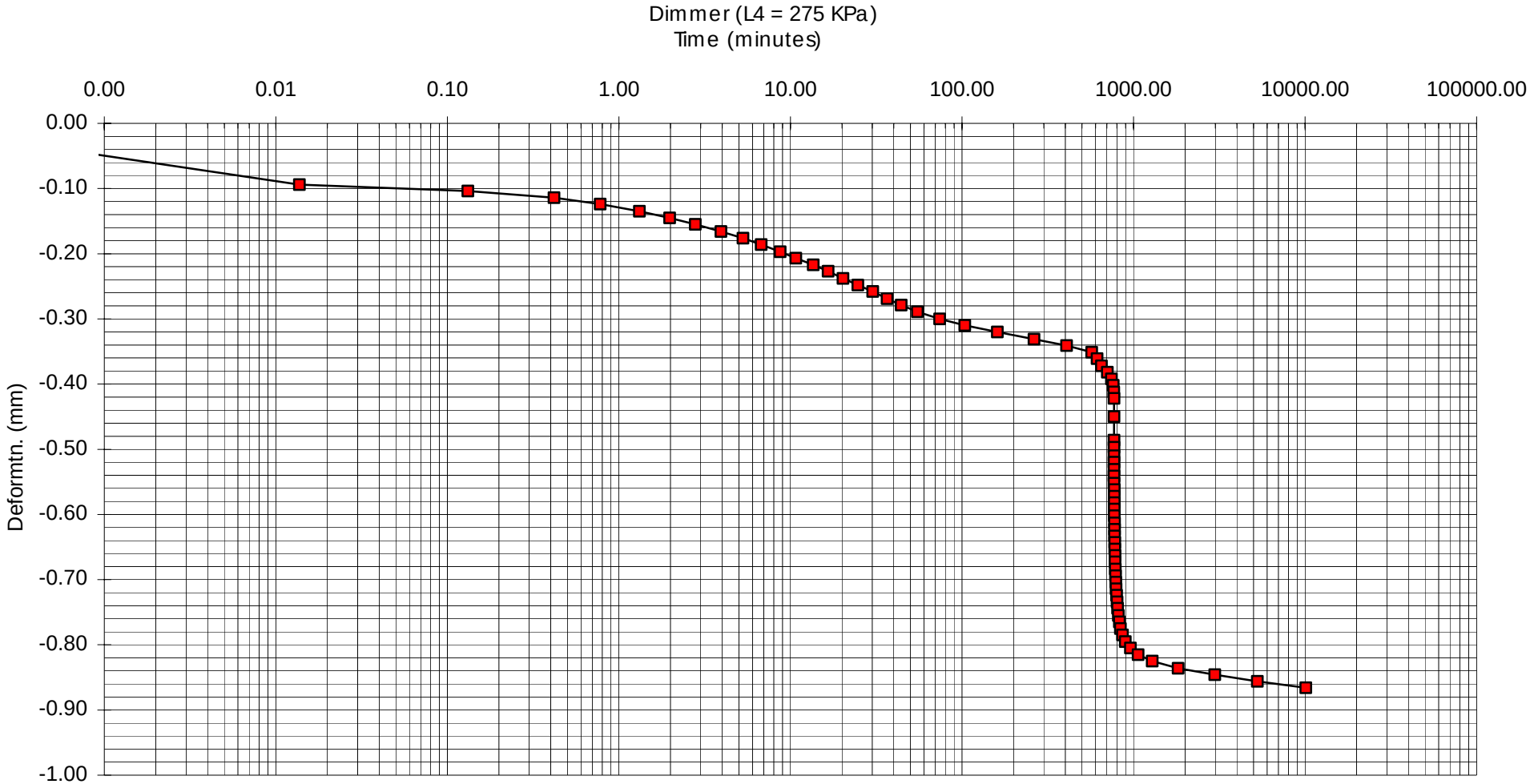

Dimmer
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Cv
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

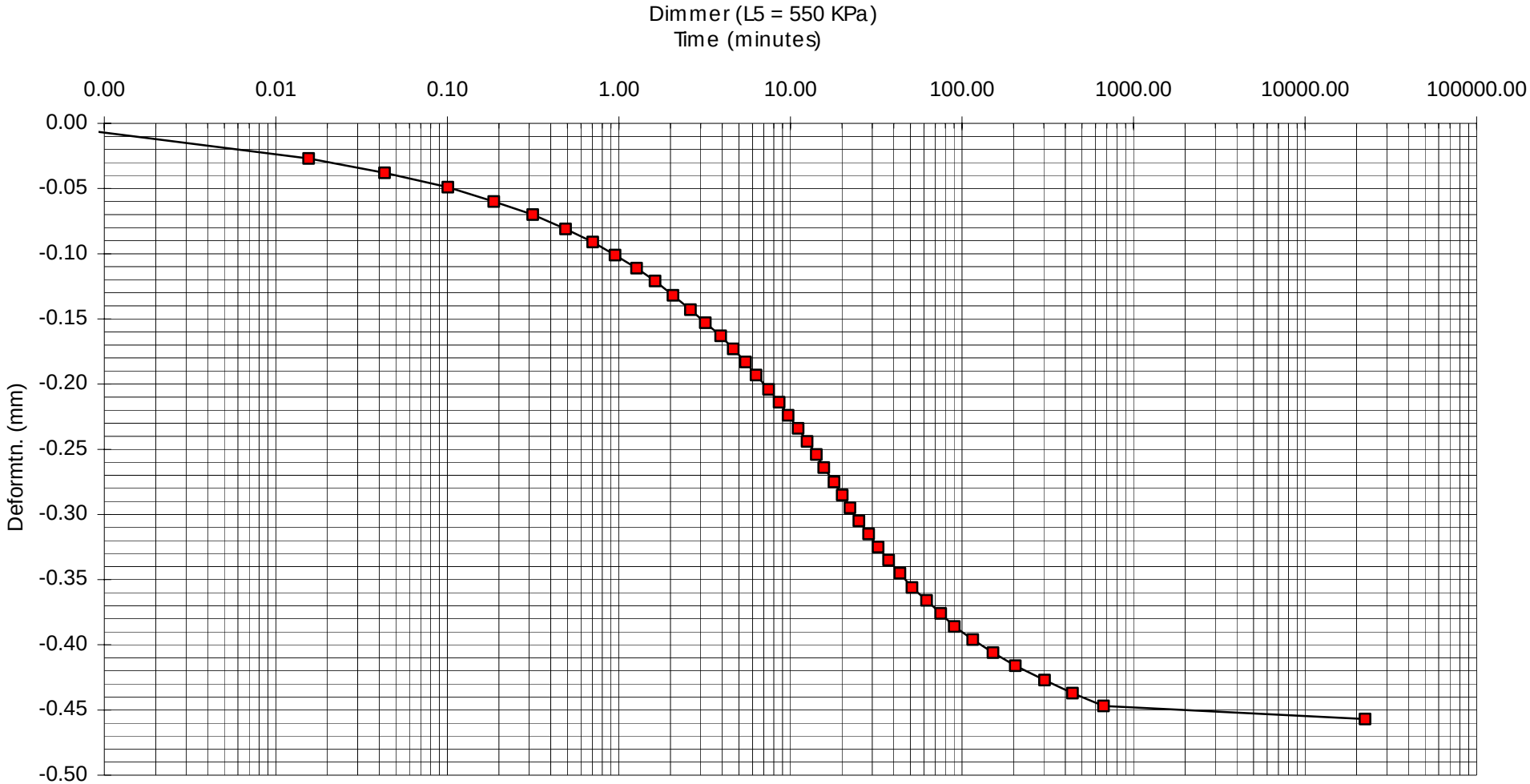

Dimmer
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Mv
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

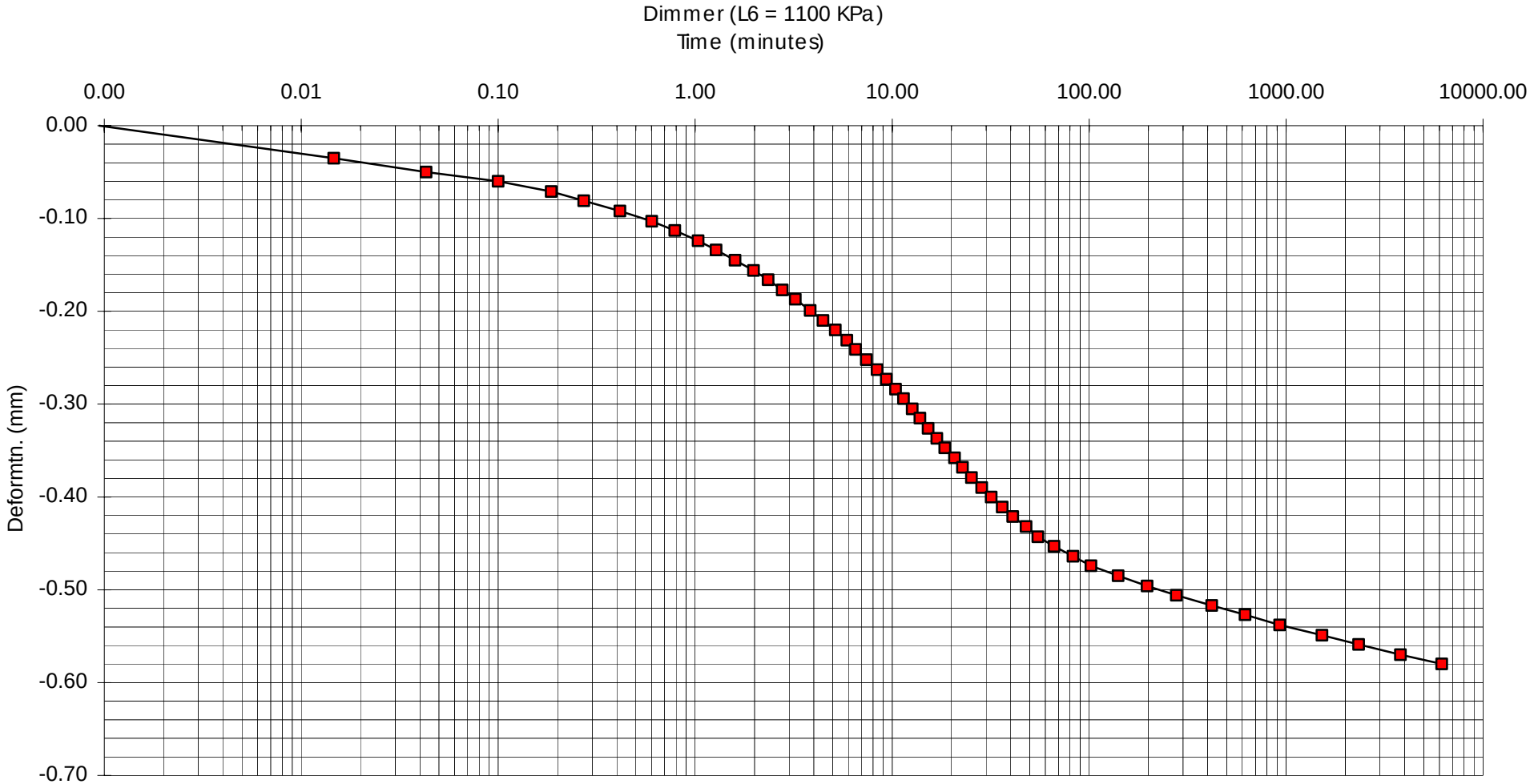

Dimmer (L1 = 27.5 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
Deformtn. (mm)
0.00
-0.05
-0.10
-0.15
-0.20
-0.25

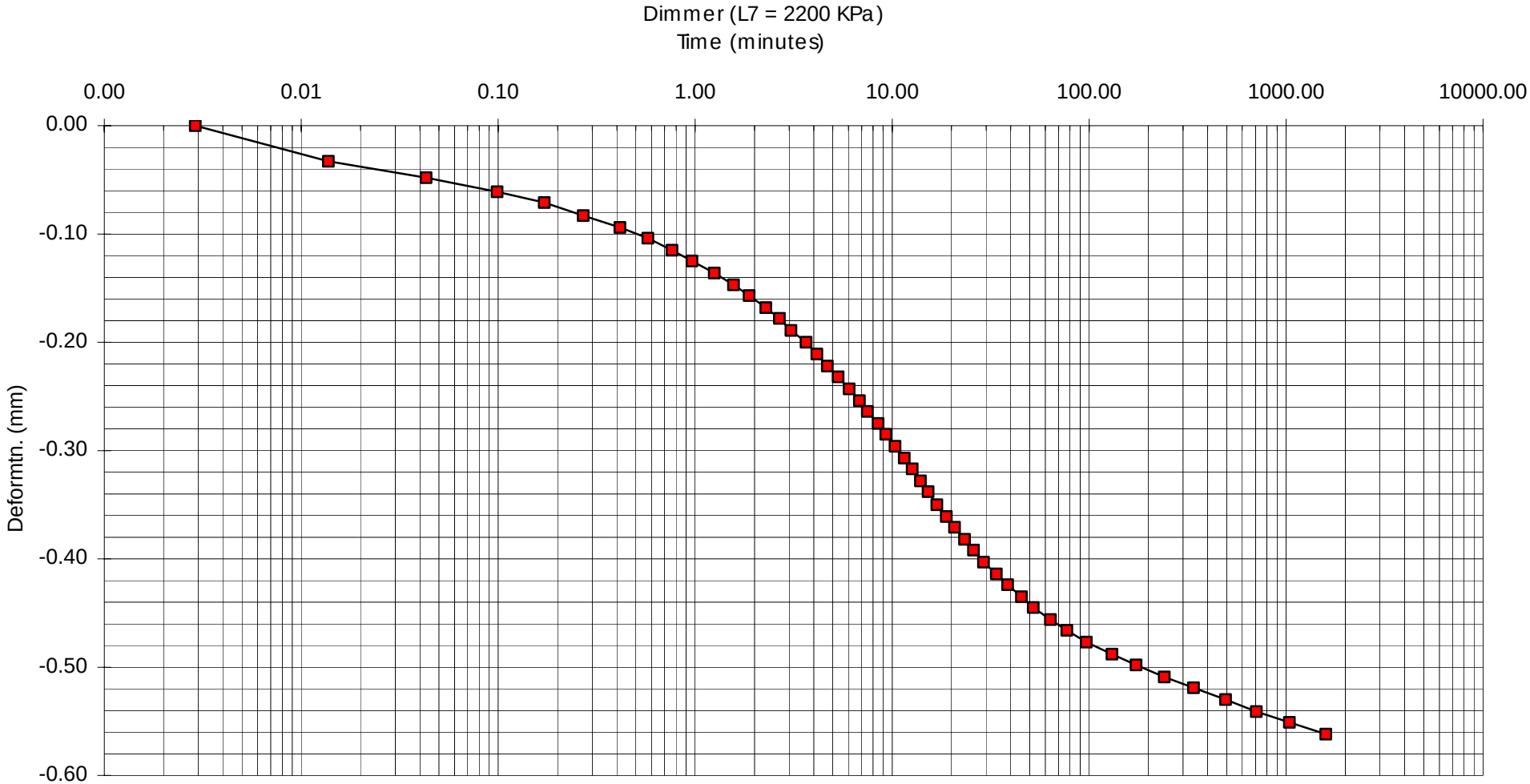

Dimmer (L2 = 55 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
Deformtn. (mm)
0.00
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
-0.07
-0.08
-0.09
-0.10

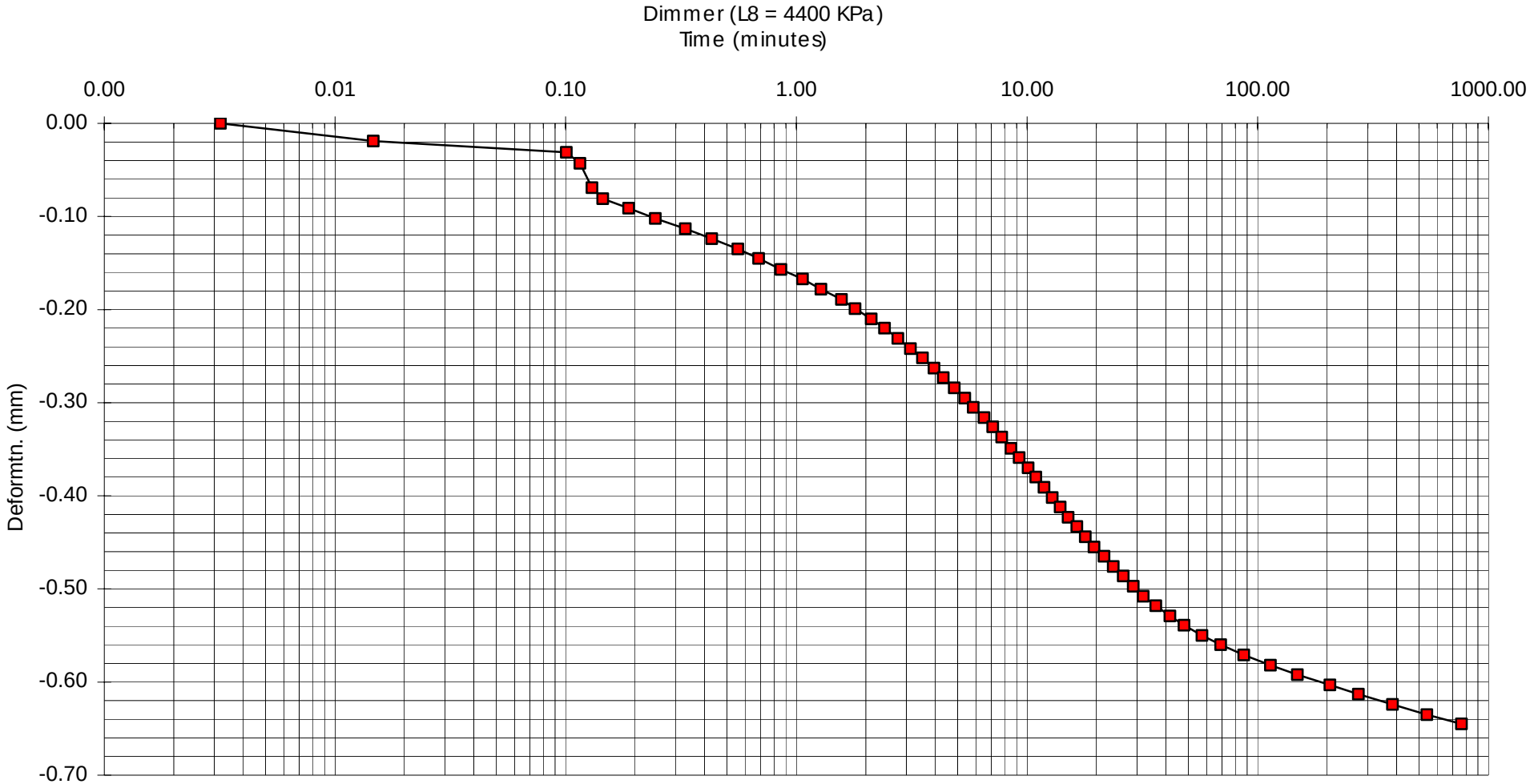

Dimmer (L3 = 110 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
Deformtn. (mm)
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
-0.16


Dimmer (L4 = 275 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
100000.00
Deformtn. (mm)
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90
-1.00


Dimmer (L5 = 550 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
100000.00
Deformtn. (mm)
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45
-0.50


Dimmer (L6 = 1100 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
Deformtn. (mm)


Dimmer (L7 = 2200 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
Deformtn. (mm)


Dimmer (L8 = 4400 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
Deformtn. (mm)

OEDOMETER CONSOLIDATION

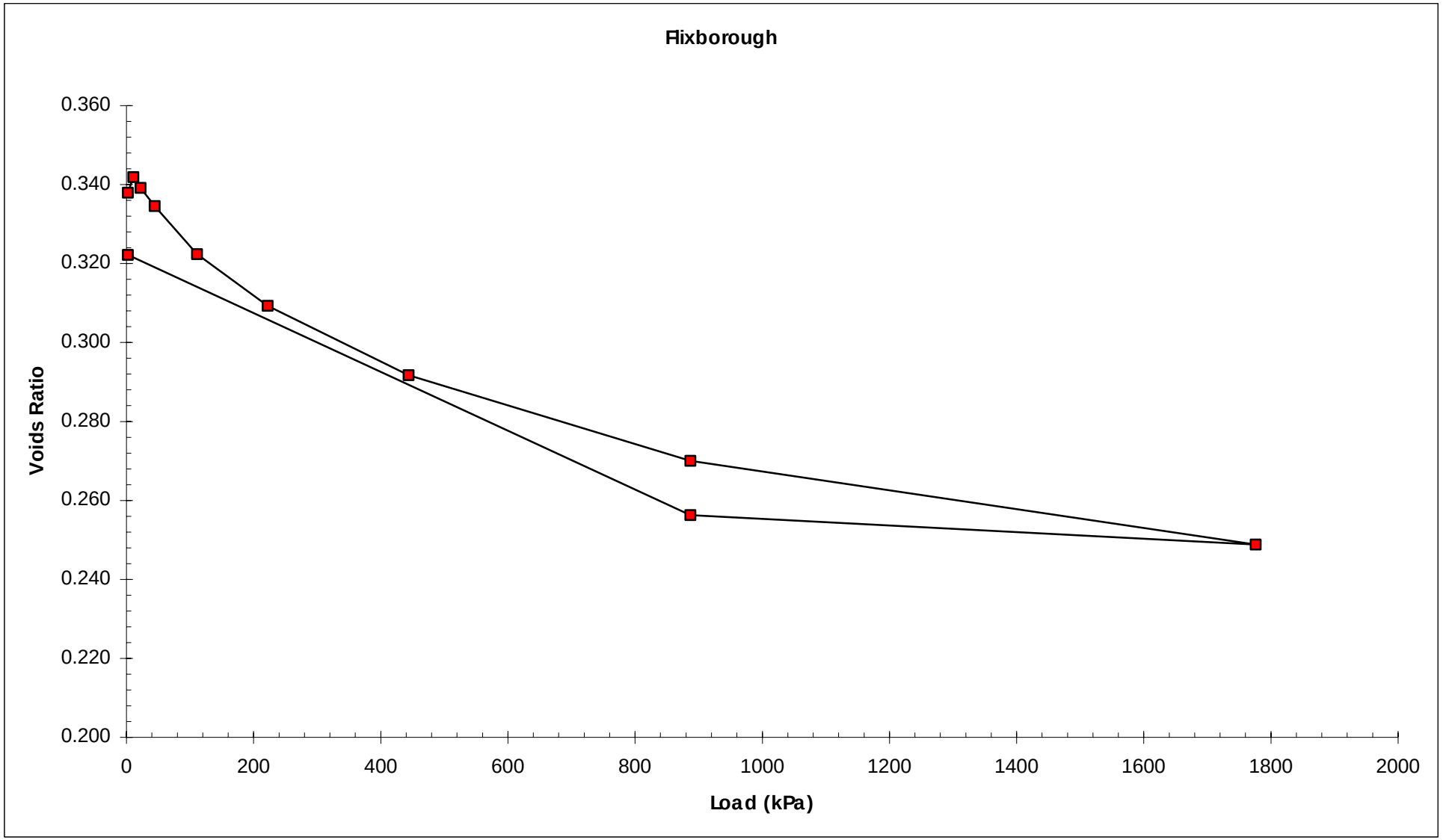
CALCULATION SHEET

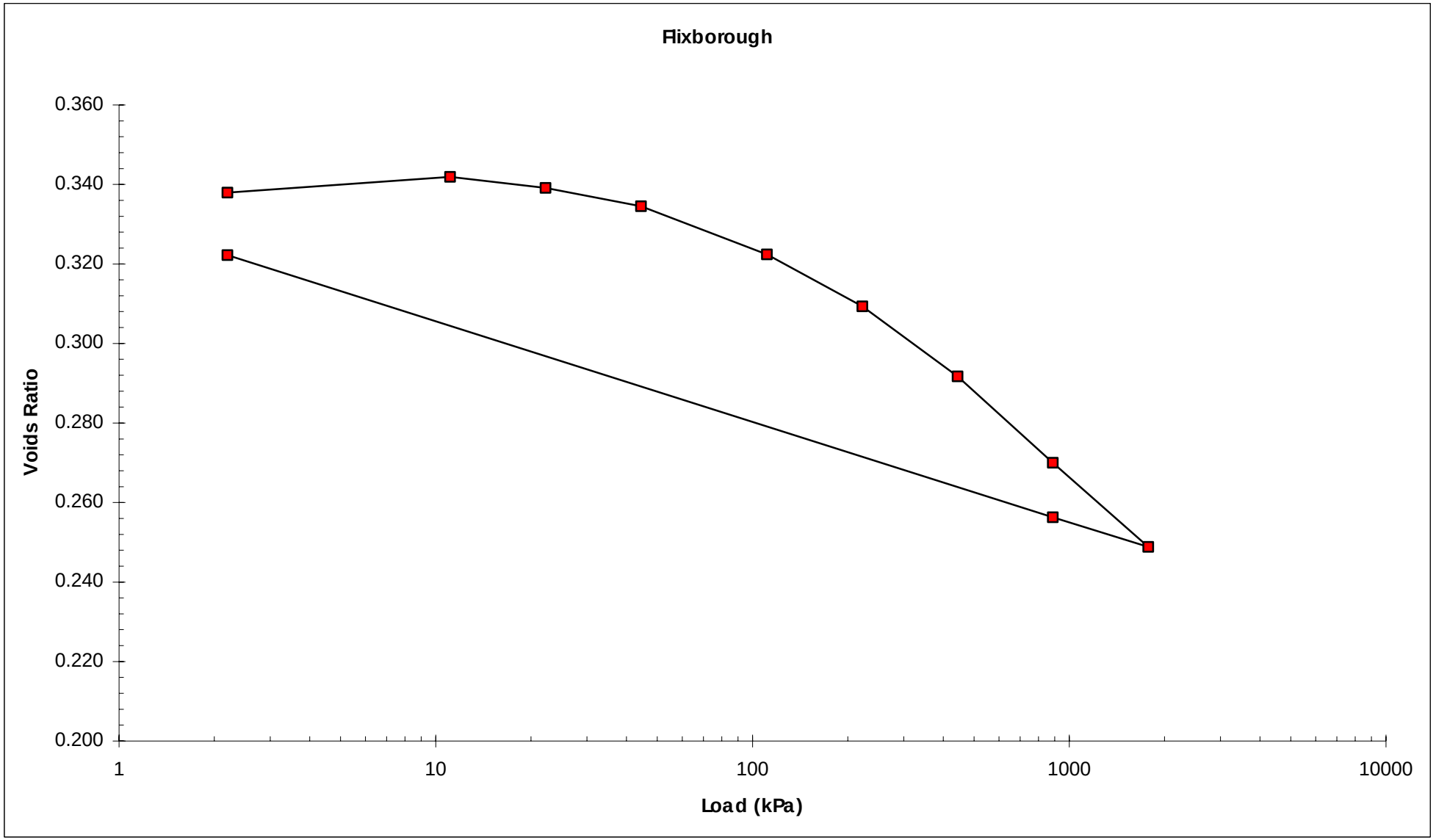
LOCATION:	Flixborough	**SOIL TYPE:**	Lias Clay
SAMPLE No.		**DEPTH:**	

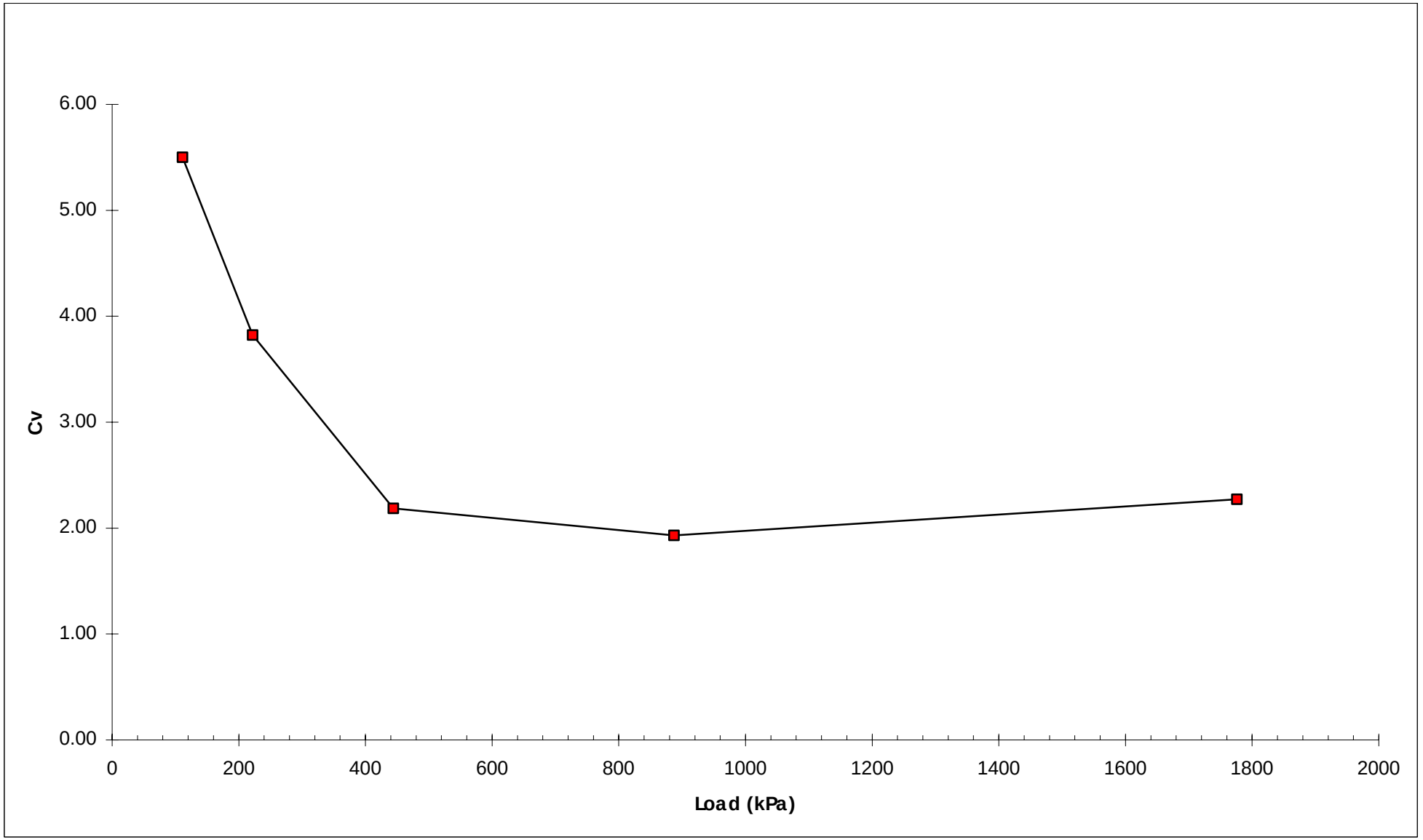
Ho	Gs	DDo	eo	F
19.1	2.7	2.018	0.338	0.070

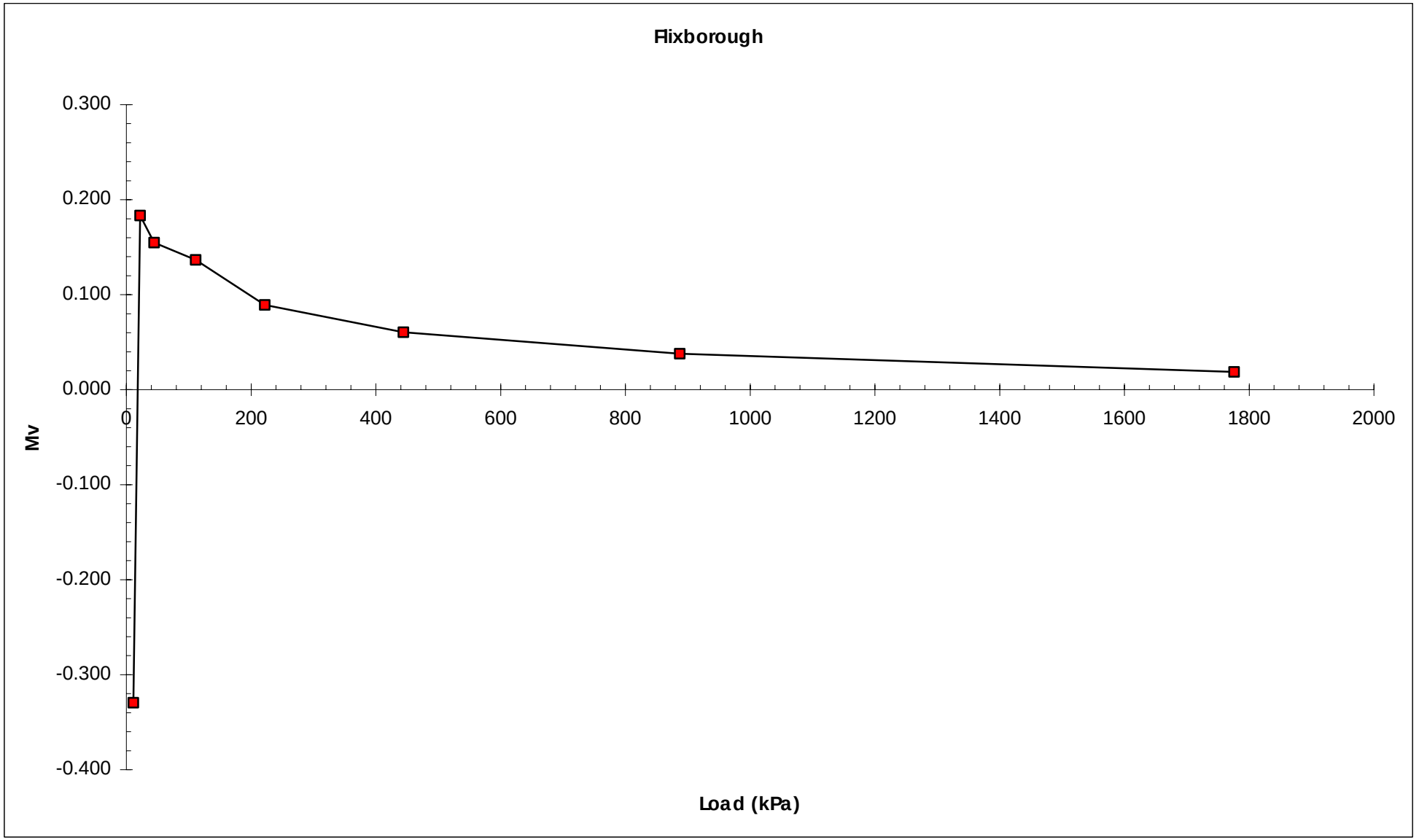
e-logP plot *Coeff. of Volume Compressibility* *Coeff. of Consolidation*

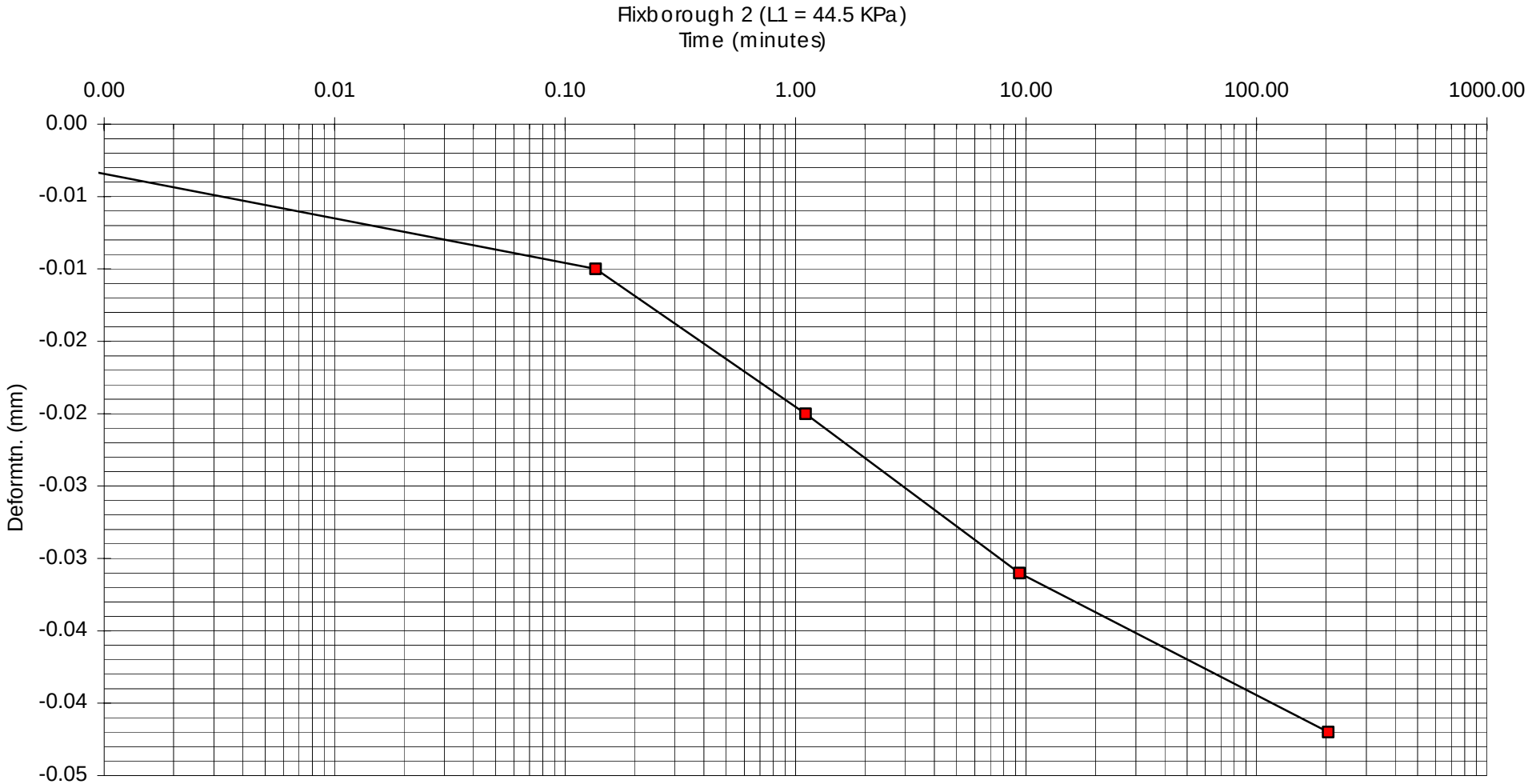
Incr. No.	Press. (kPa)	Nett Sett (mm)	Nett de	e1	Incr. de	Incr. dp (kPa)	1+e1	Mv (m2/MN)	t50 (mins)	H (mm)	Mean Ht H' (mm)	Cv (m2/yr)
				0								
	2.2	0	0.000	**0.338**						19.100		
1	**11.1**	-0.056	-0.004	**0.342**	-0.004	8.9	1.338	**-0.329**		19.156	19.128	
2	**22.2**	-0.017	-0.001	**0.339**	0.003	11.1	1.342	**0.183**		19.117	19.1365	
3	**44.5**	0.049	0.003	**0.335**	0.005	22.3	1.339	**0.155**		19.051	19.084	
4	**111**	0.222	0.016	**0.322**	0.012	66.5	1.335	**0.137**	1.7	18.878	18.9645	**5.50**
5	**222**	0.409	0.029	**0.309**	0.013	111	1.322	**0.089**	2.4	18.691	18.7845	**3.82**
6	**444**	0.66	0.046	**0.292**	0.018	222	1.309	**0.060**	4.1	18.44	18.5655	**2.19**
7	**887**	0.970	0.068	**0.270**	0.022	443	1.292	**0.038**	4.5	18.13	18.285	**1.93**
8	**1776**	1.272	0.089	**0.249**	0.021	889	1.270	**0.019**	3.7	17.828	17.979	**2.27**
9	**887**	1.166	0.082	**0.256**	-0.007	-889	1.249	**0.007**		17.934	17.881	
10	**2.2**	0.225	0.016	**0.322**	-0.066	-884.8	1.256	**0.059**		18.875	18.4045	

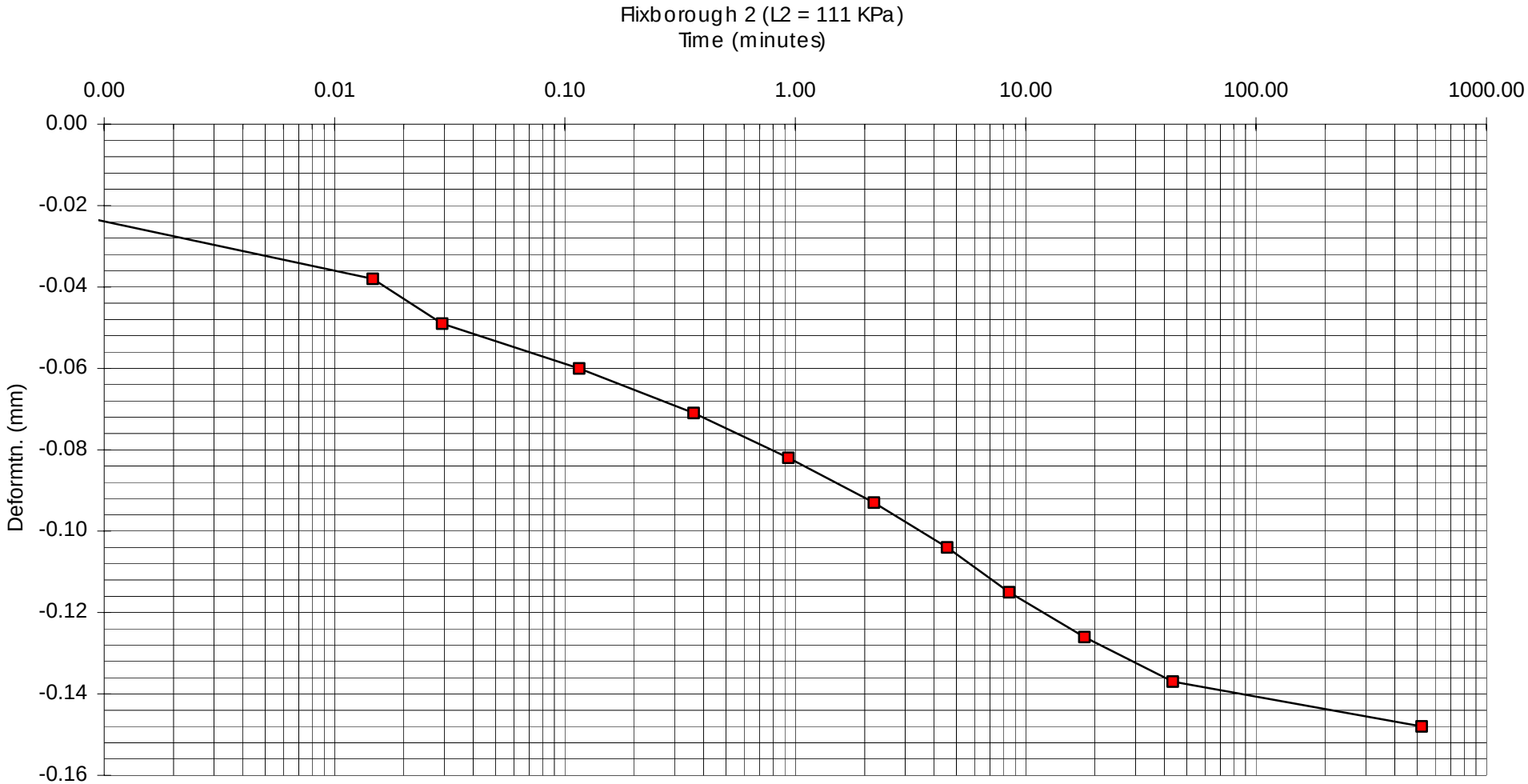

Flixborough
0.360
0.340
0.320
0.300
0.280
0.260
0.240
0.220
0.200
Voids Ratio
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Load (kPa)

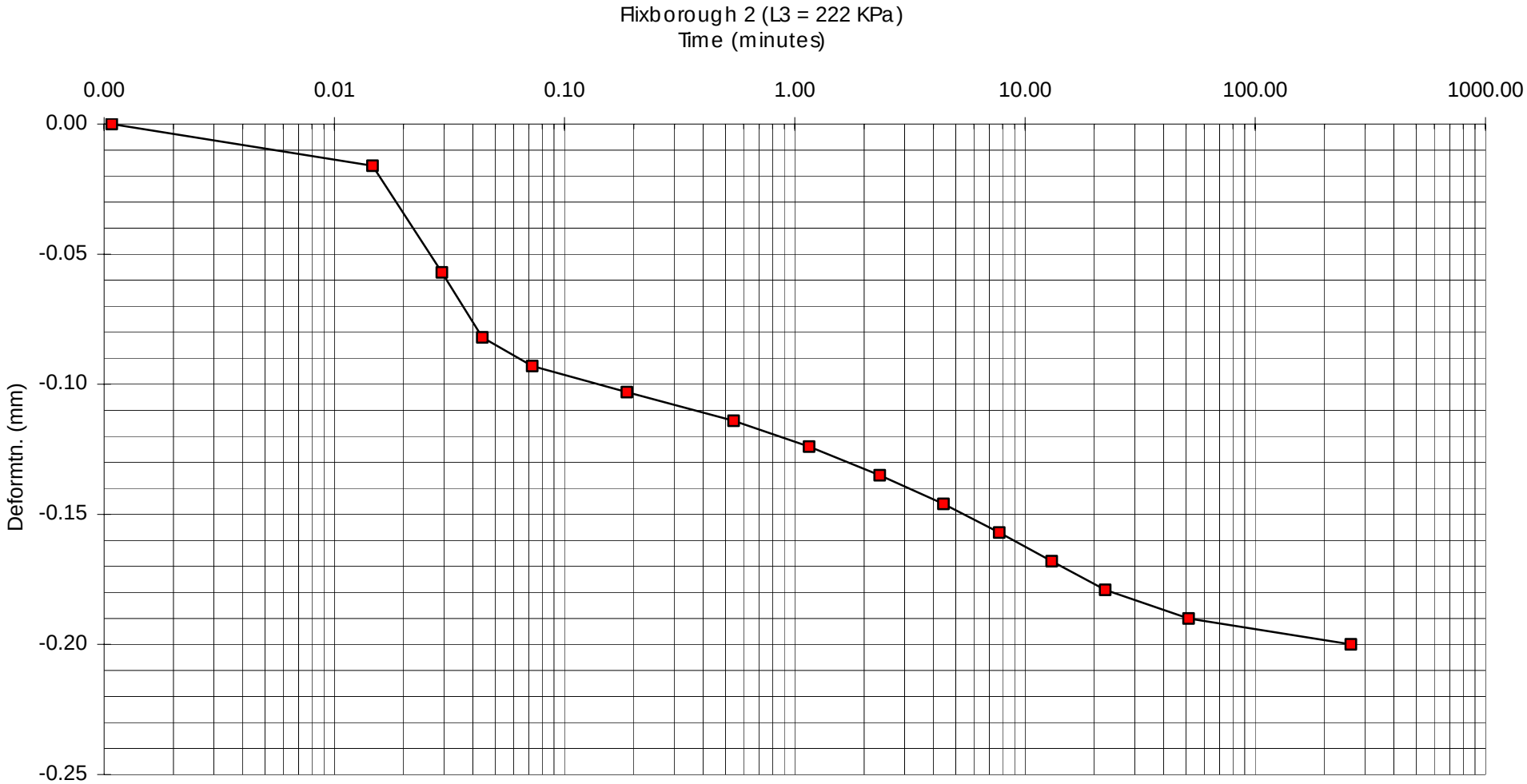

Flixborough
0.360
0.340
0.320
0.300
0.280
0.260
0.240
0.220
0.200
Voids Ratio
1
10
100
1000
10000
Load (kPa)

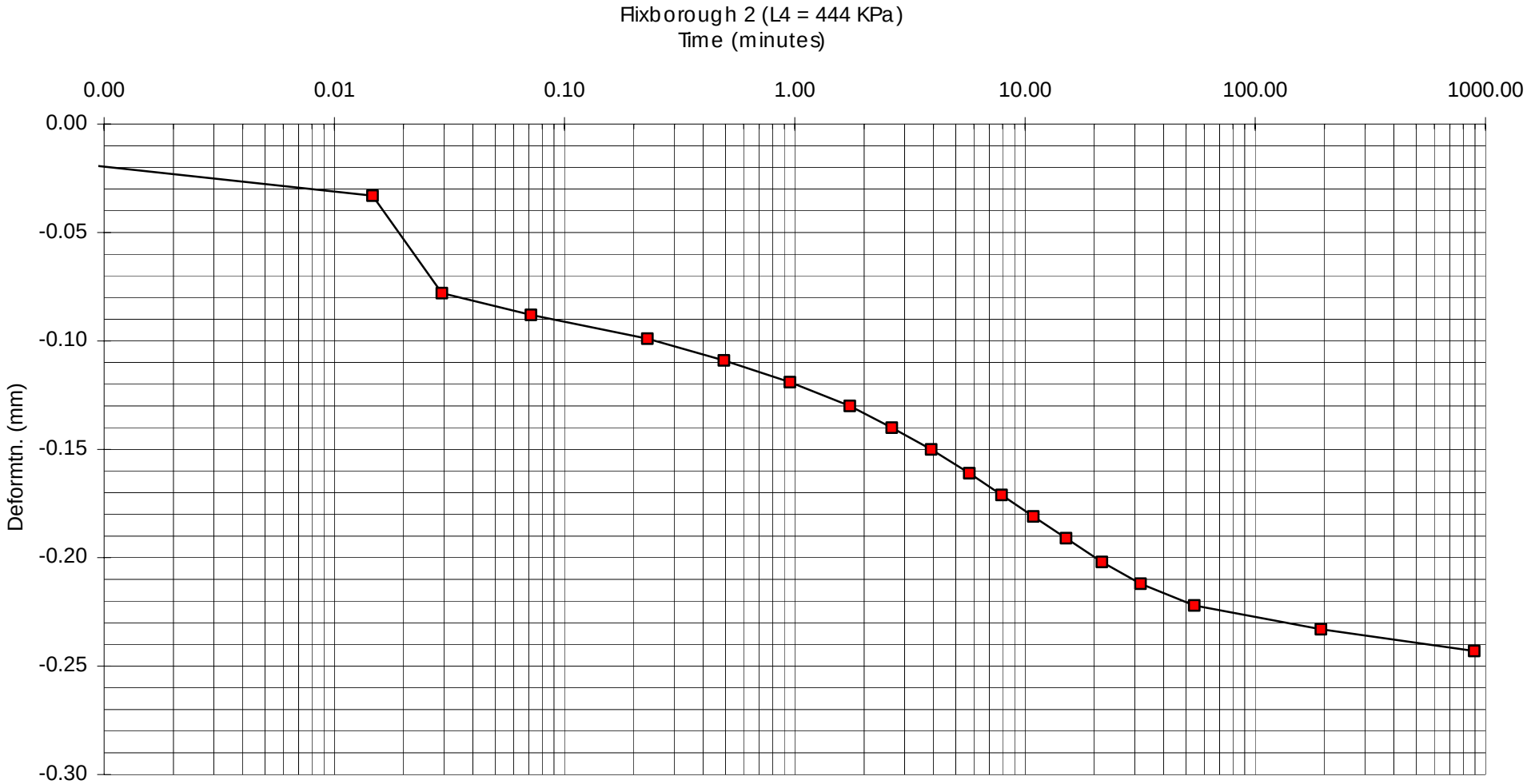

6.00
5.00
4.00
3.00
2.00
1.00
0.00
Cv
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Load (kPa)

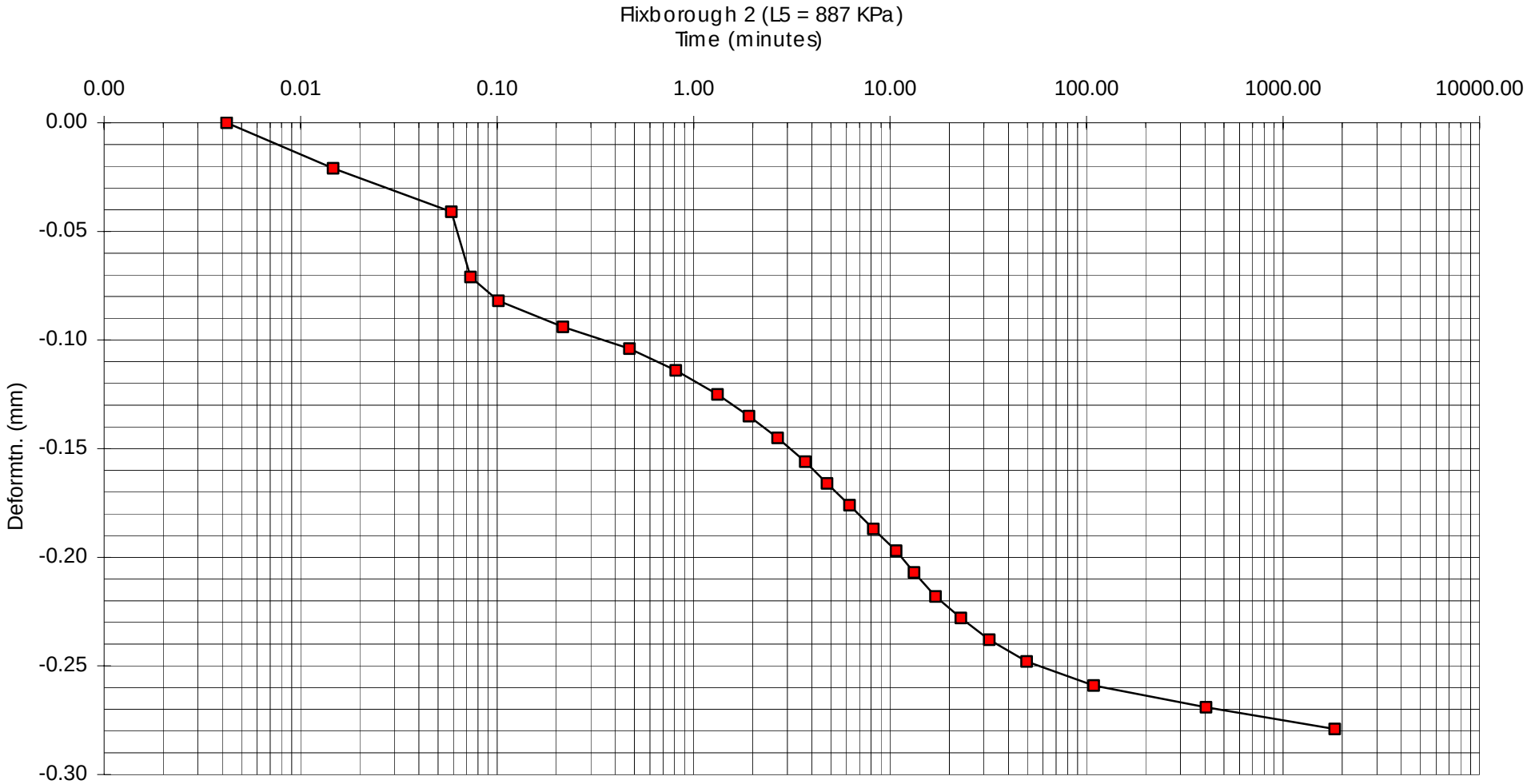

Flixborough
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
-0.400
Mv
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Load (kPa)

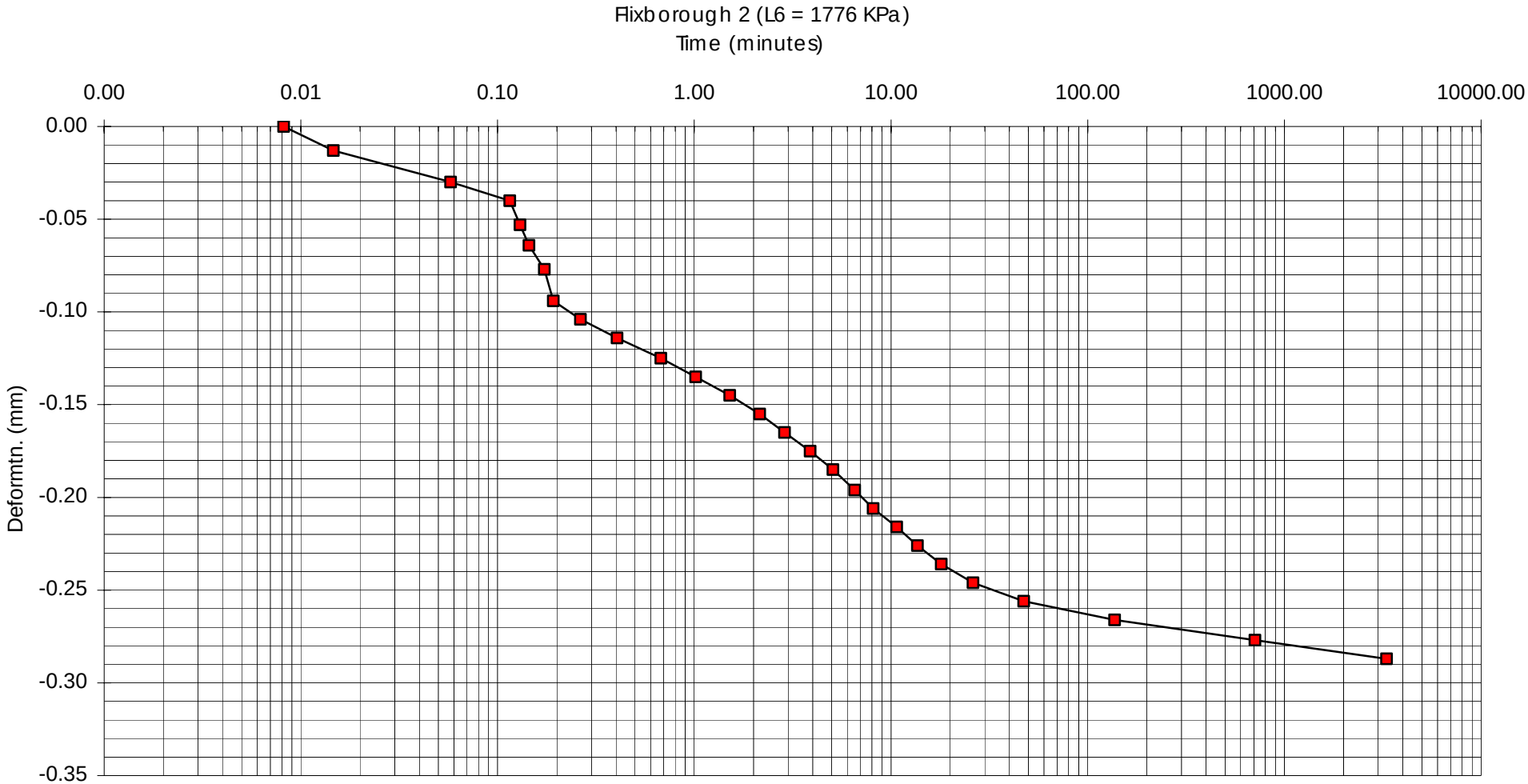

Flixborough 2 (L1 = 44.5 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.00
-0.01
-0.01
-0.02
-0.02
-0.03
-0.03
-0.04
-0.04
-0.05
Deformtn. (mm)


Flixborough 2 (L2 = 111 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
-0.16
Deformtn. (mm)


Flixborough 2 (L3 = 222 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
Deformtn. (mm)


Flixborough 2 (L4 = 444 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
Deformtn. (mm)


Flixborough 2 (L5 = 887 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
Deformtn. (mm)


Flixborough 2 (L6 = 1776 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
Deformtn. (mm)

OEDOMETER CONSOLIDATION

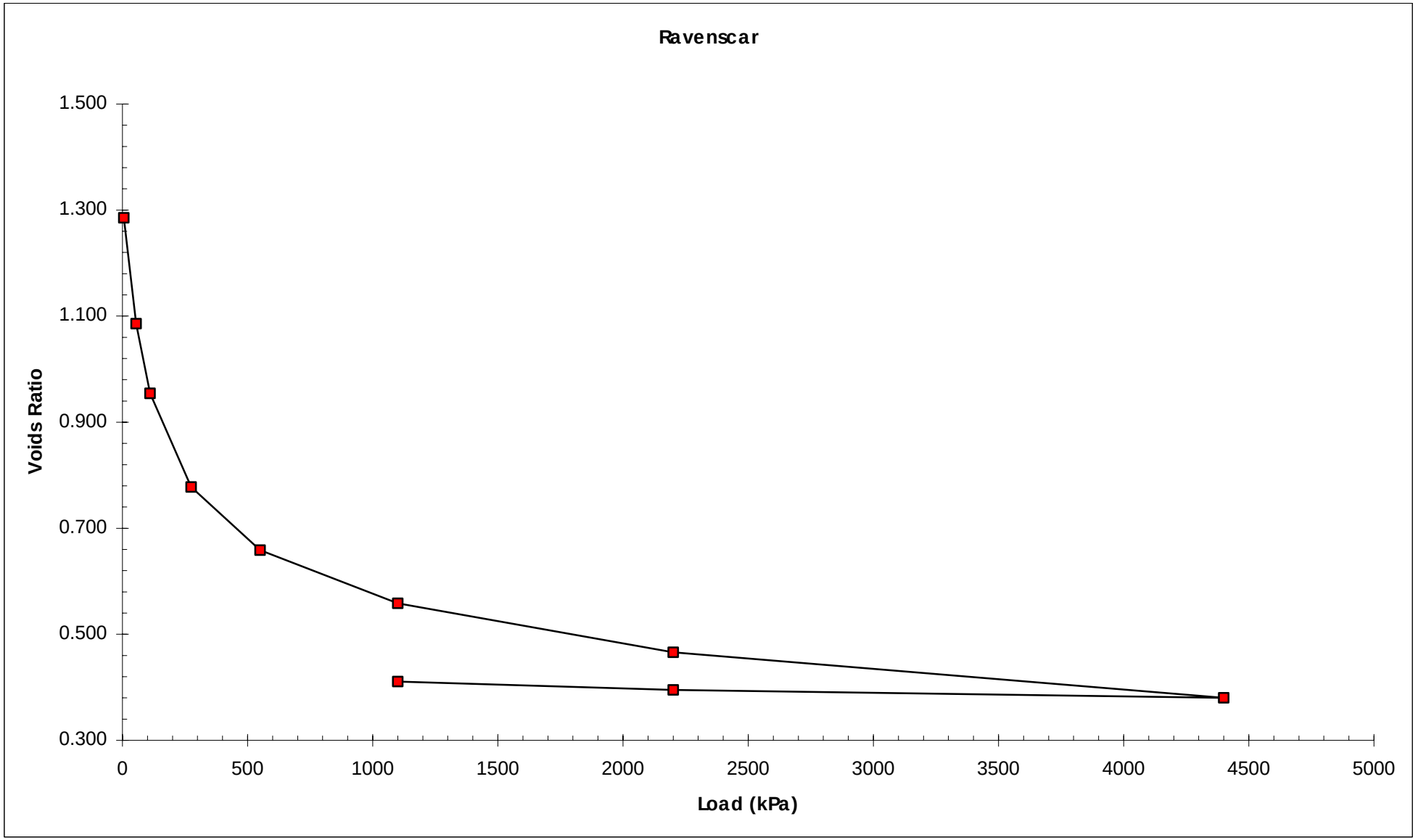
CALCULATION SHEET

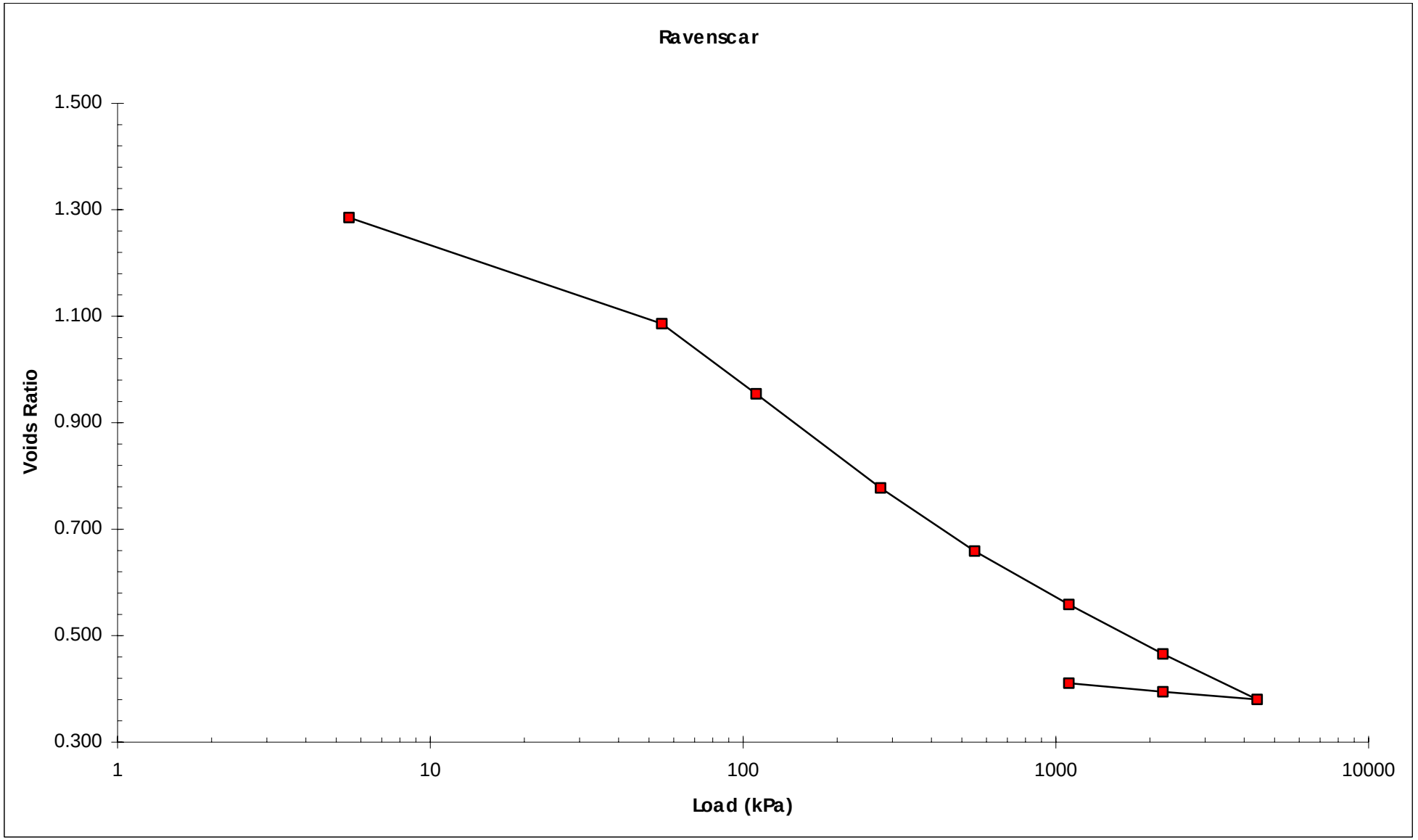
LOCATION:	Ravenscar	**SOIL TYPE:**	Lias Clay
SAMPLE No.		**DEPTH:**	

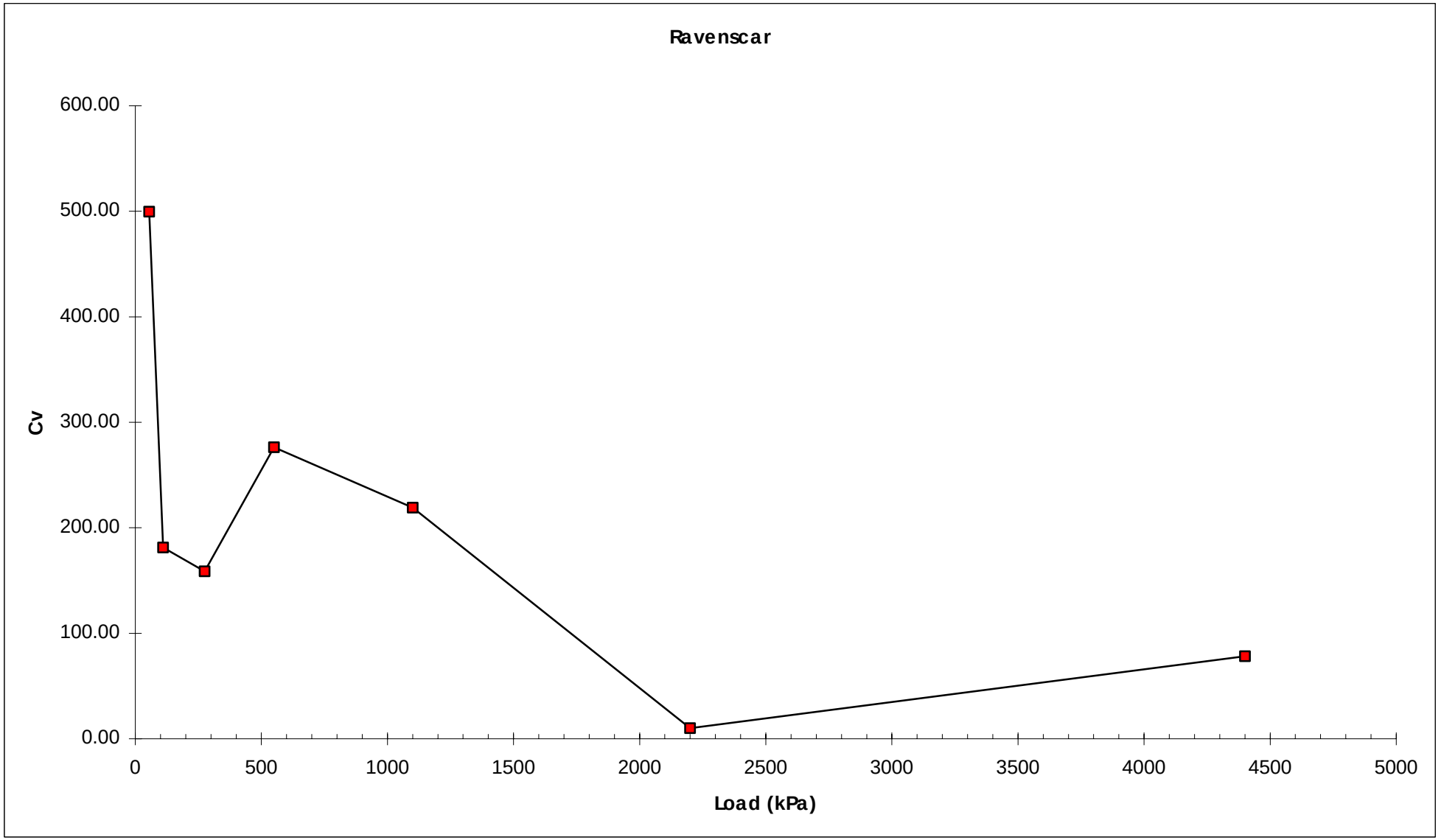
Ho	Gs	DDo	eo	F
18.9	2.69	1.177	1.285	0.121

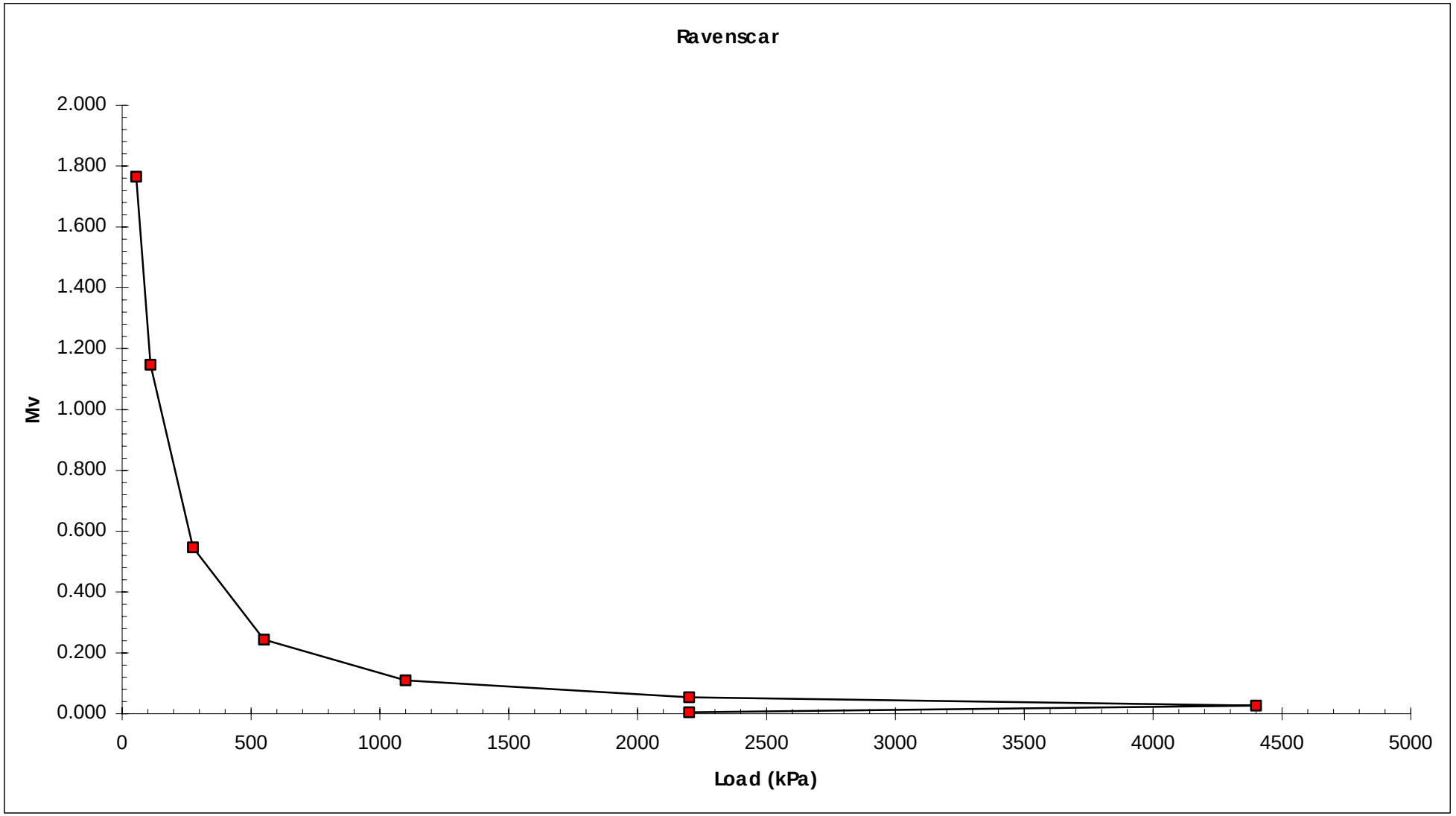
e-logP plot | *Coeff. of Volume Compressibility* | *Coeff. of Consolidation*

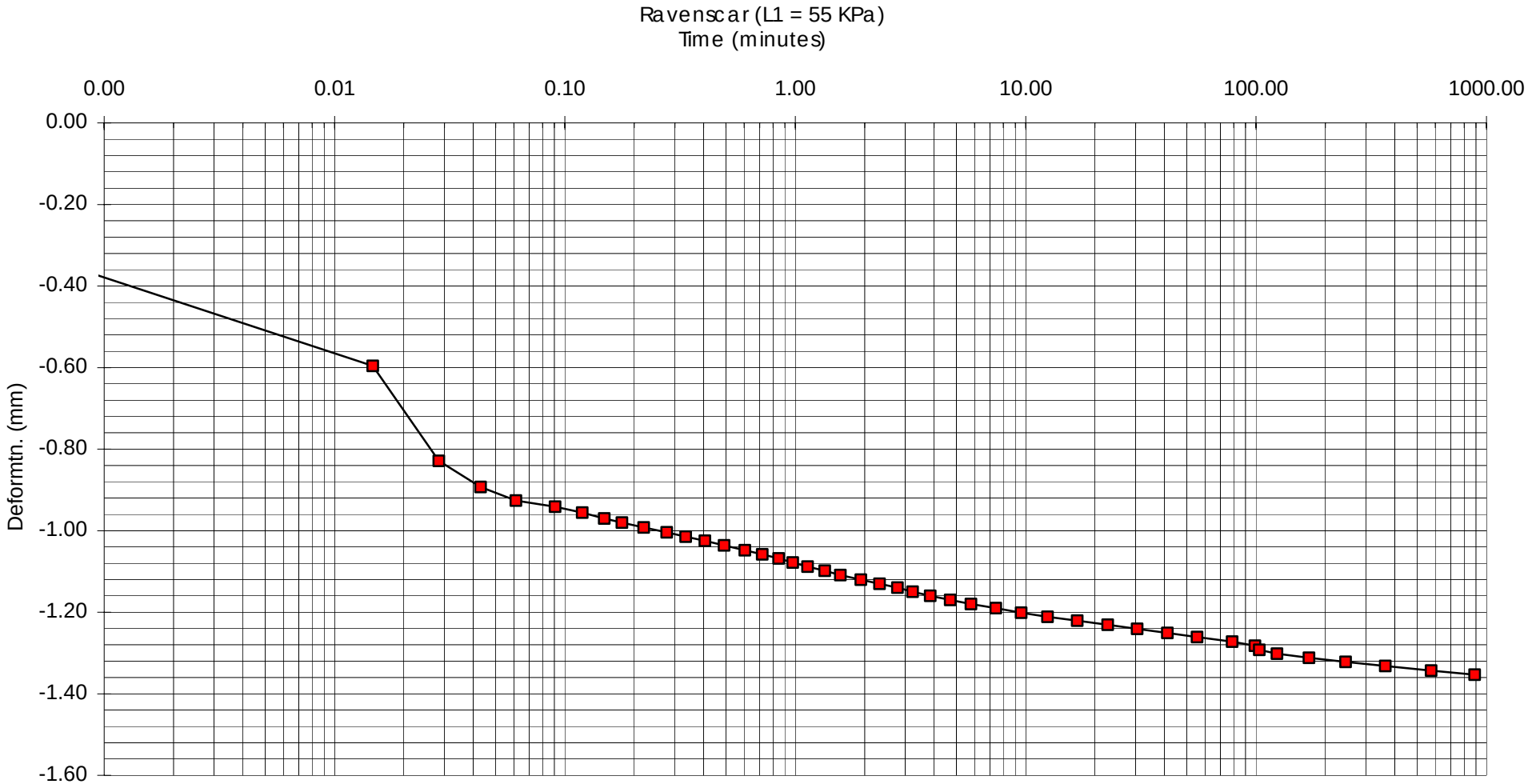
Incr. No.	Press. (kPa)	Nett Sett (mm)	Nett de	e1	Incr. de	Incr. dp (kPa)	1+e1	Mv (m2/MN)	t50 (mins)	H (mm)	Mean Ht H' (mm)	Cv (m2/yr)
				0				0				0.00
	5.5	0	0.000	**1.285**						18.900		
1	**55**	1.651	0.200	**1.086**	0.200	49.5	2.285	**1.765**	0.017	17.249	18.0745	**499.64**
2	**110**	2.739	0.331	**0.954**	0.132	55	2.086	**1.147**	0.04	16.161	16.705	**181.39**
3	**275**	4.198	0.508	**0.778**	0.176	165	1.954	**0.547**	0.039	14.702	15.4315	**158.75**
4	**550**	5.182	0.627	**0.659**	0.119	275	1.778	**0.243**	0.019	13.718	14.21	**276.32**
5	**1100**	6.011	0.727	**0.559**	0.100	550	1.659	**0.110**	0.021	12.889	13.3035	**219.12**
6	**2200**	6.778	0.820	**0.466**	0.093	1100	1.559	**0.054**	0.4	12.122	12.5055	**10.17**
7	**4400**	7.486	0.905	**0.380**	0.086	2200	1.466	**0.027**	0.046	11.414	11.768	**78.27**
8	**2200**	7.365	0.891	**0.395**	-0.015	-2200	1.380	**0.005**		11.535	11.4745	
9	**1100**	7.234	0.875	**0.411**	-0.016	-1100	1.395	**0.010**		11.666	11.6005	
10	**5.5**	0.000	0.000	**1.285**	-0.875	-1094.5	1.411	**0.567**		18.9	15.283	

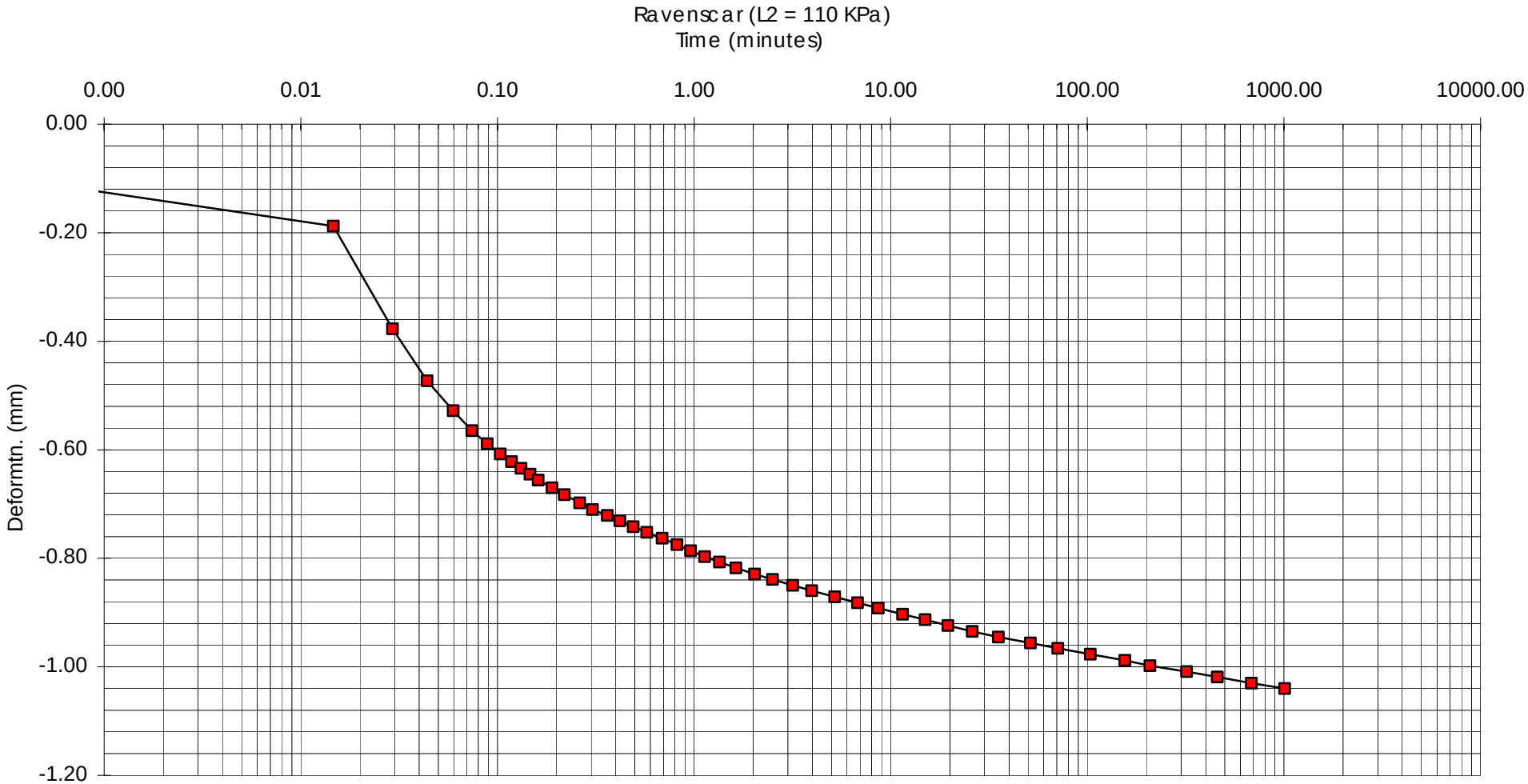

Ravenscar
1.500
1.300
1.100
0.900
0.700
0.500
0.300
Voids Ratio
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

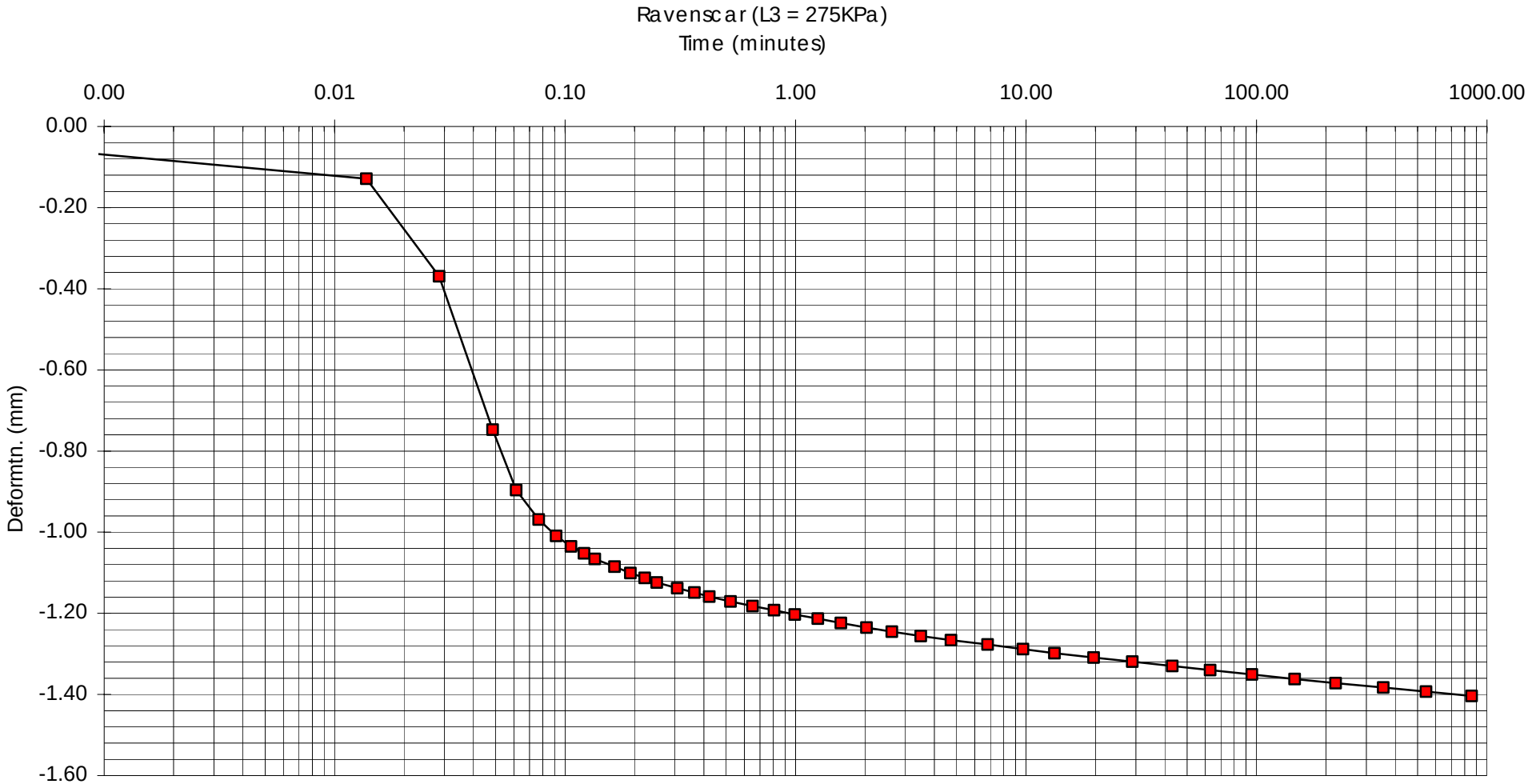

Ravenscar
1.500
1.300
1.100
0.900
0.700
0.500
0.300
Voids Ratio
1
10
100
1000
10000
Load (kPa)

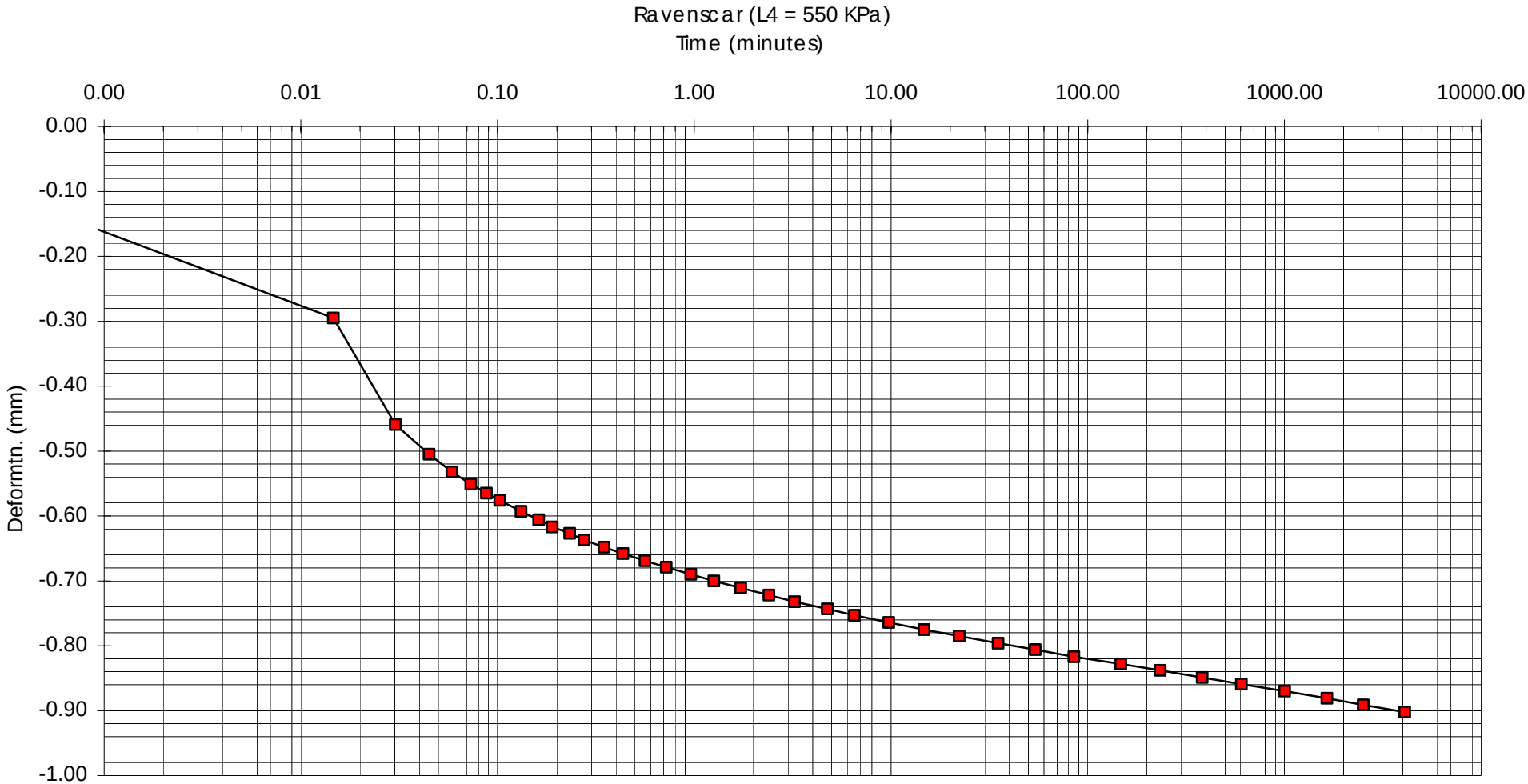

Ravenscar
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Cv
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

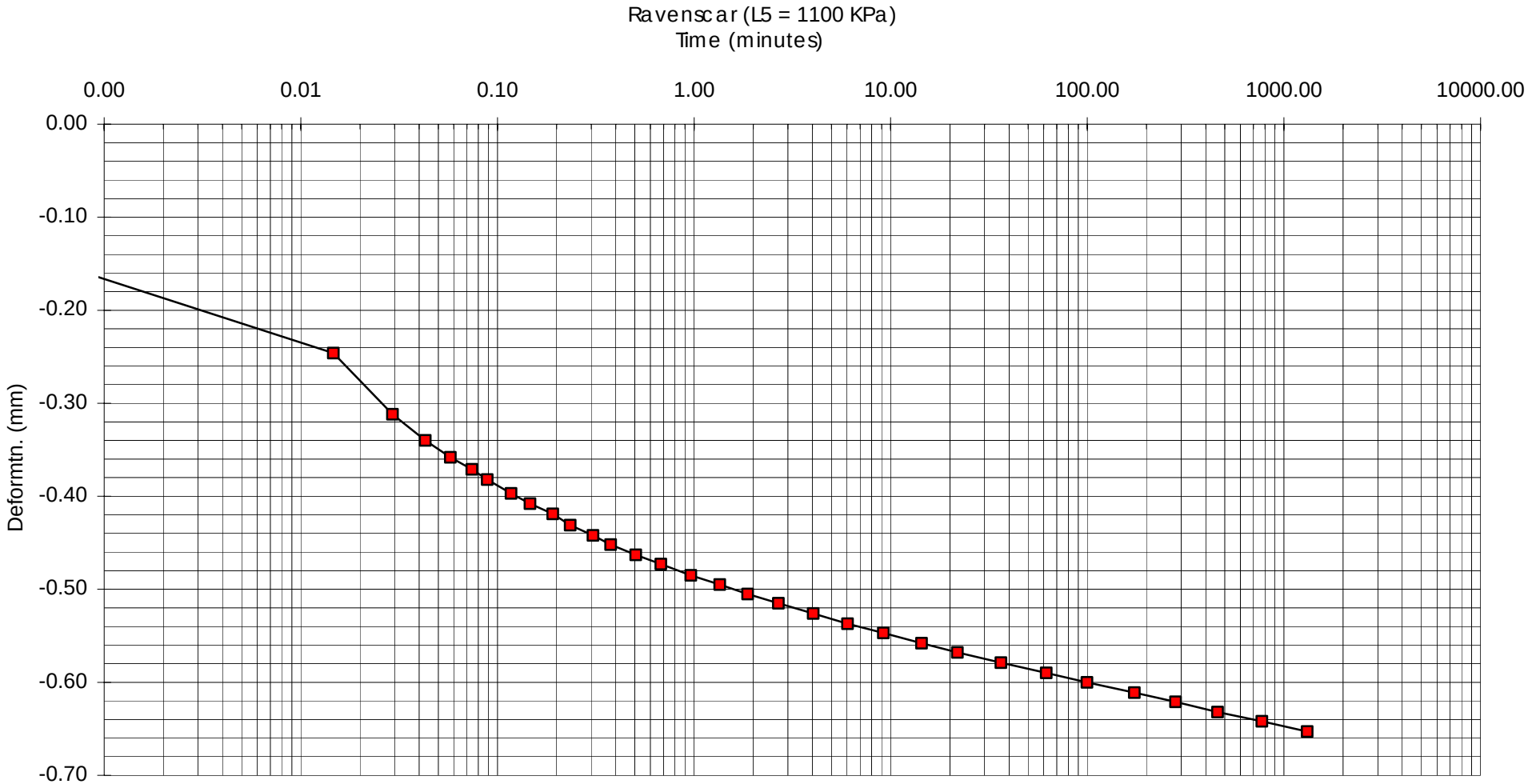

Ravenscar
2.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Mv
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

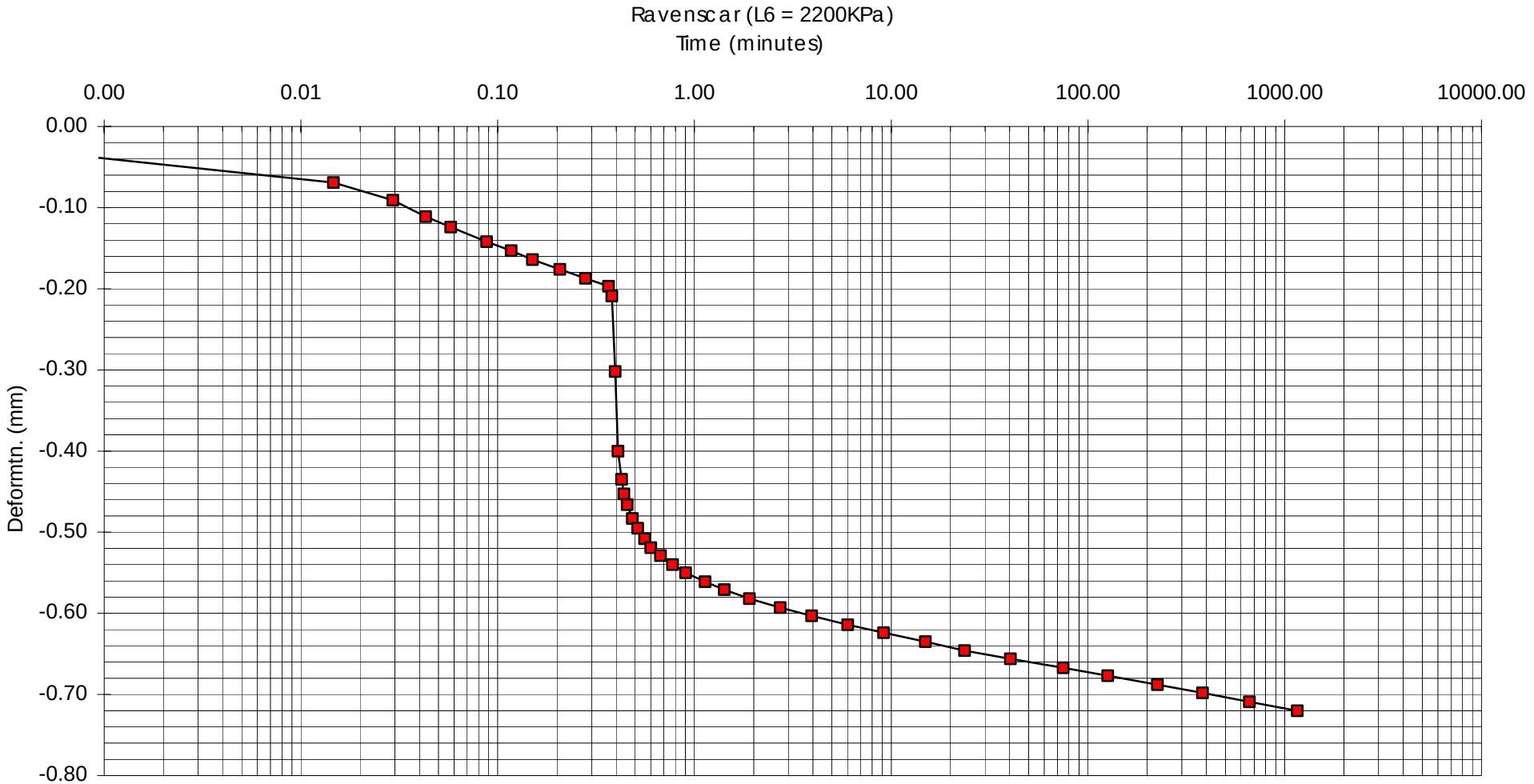

Ravenscar (L1 = 55 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
-1.40
-1.60
Deformtn. (mm)

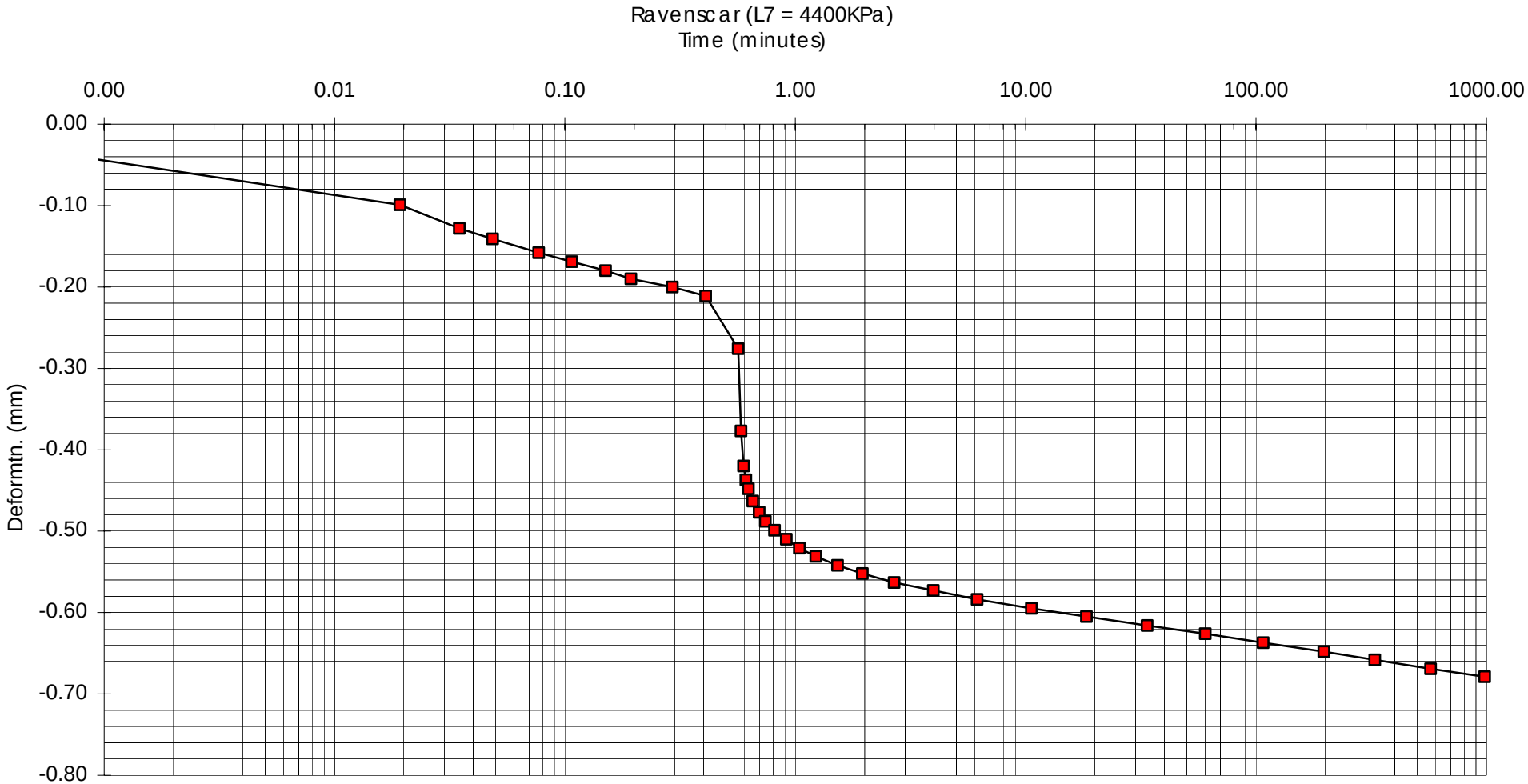

Ravenscar (L2 = 110 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
Deformtn. (mm)


Ravenscar (L3 = 275KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
Deformtn. (mm)
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
-1.40
-1.60


Ravenscar (L4 = 550 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90
-1.00
Deformtn. (mm)


Ravenscar (L5 = 1100 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
Deformtn. (mm)


Ravenscar (L6 = 2200KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
Deformtn. (mm)
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80


Ravenscar (L7 = 4400KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
Deformtn. (mm)

OEDOMETER CONSOLIDATION

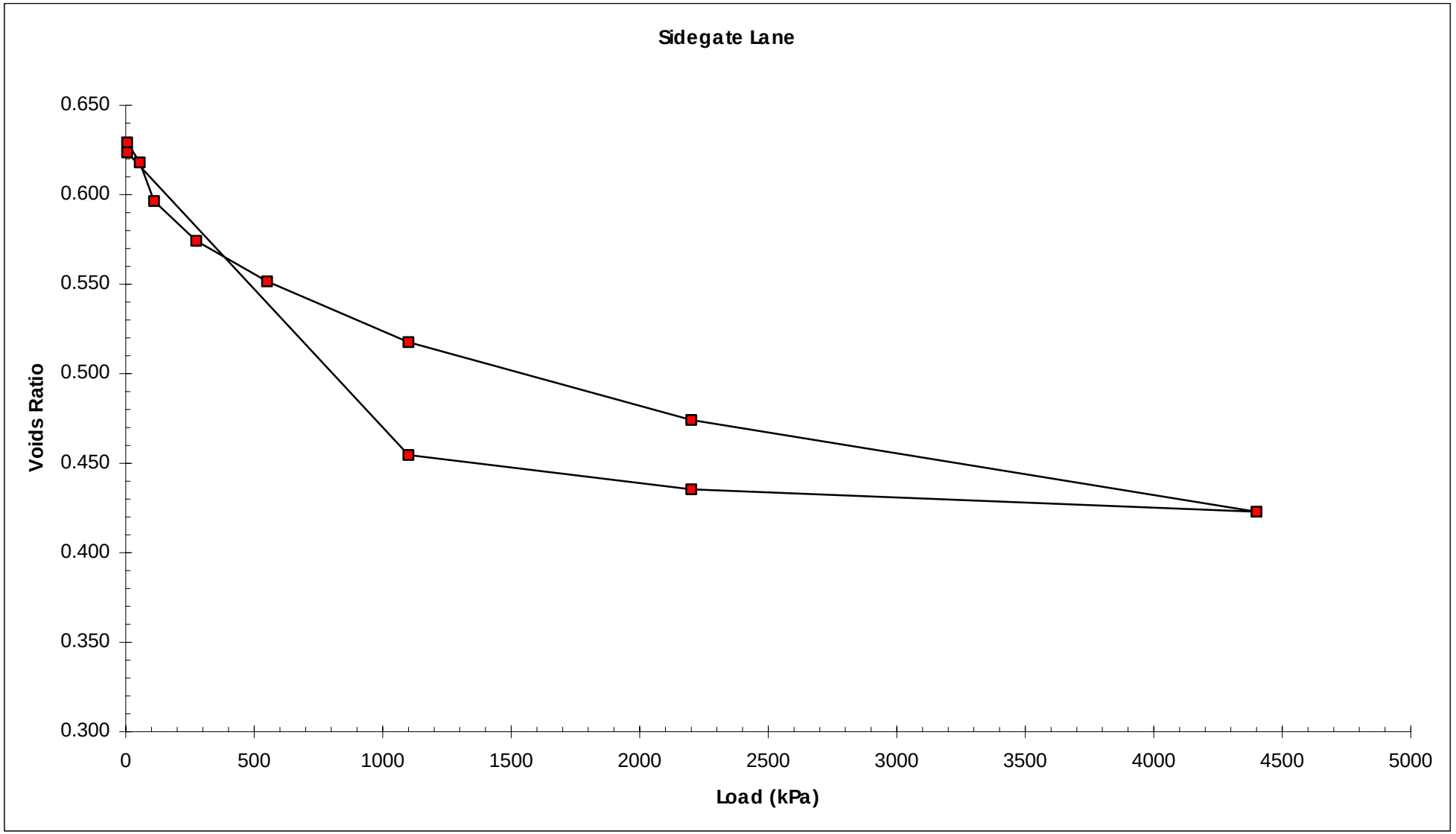
CALCULATION SHEET

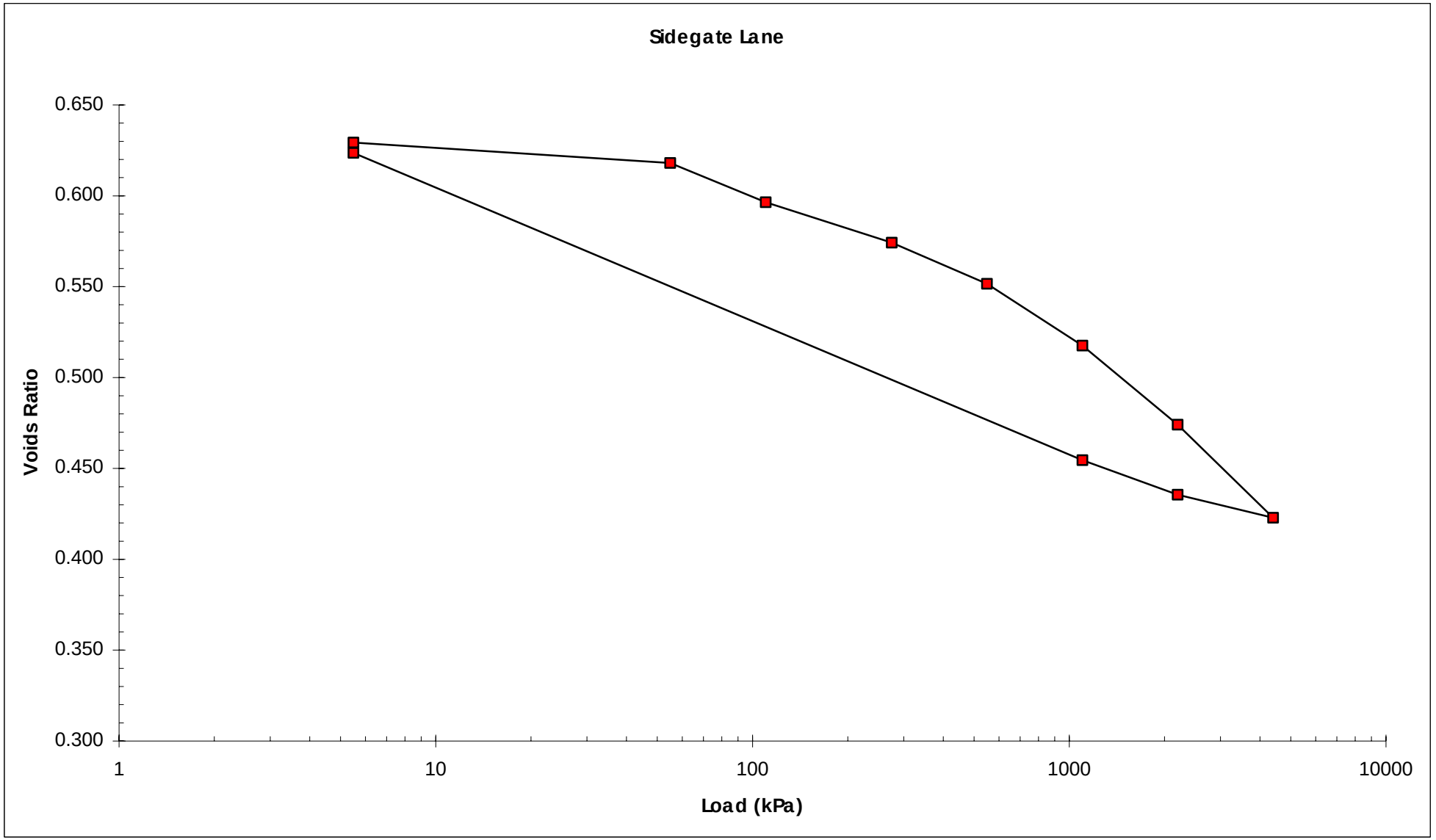
LOCATION:	Sidegate Lane	**SOIL TYPE:**	Lias Clay
SAMPLE No.		**DEPTH:**	

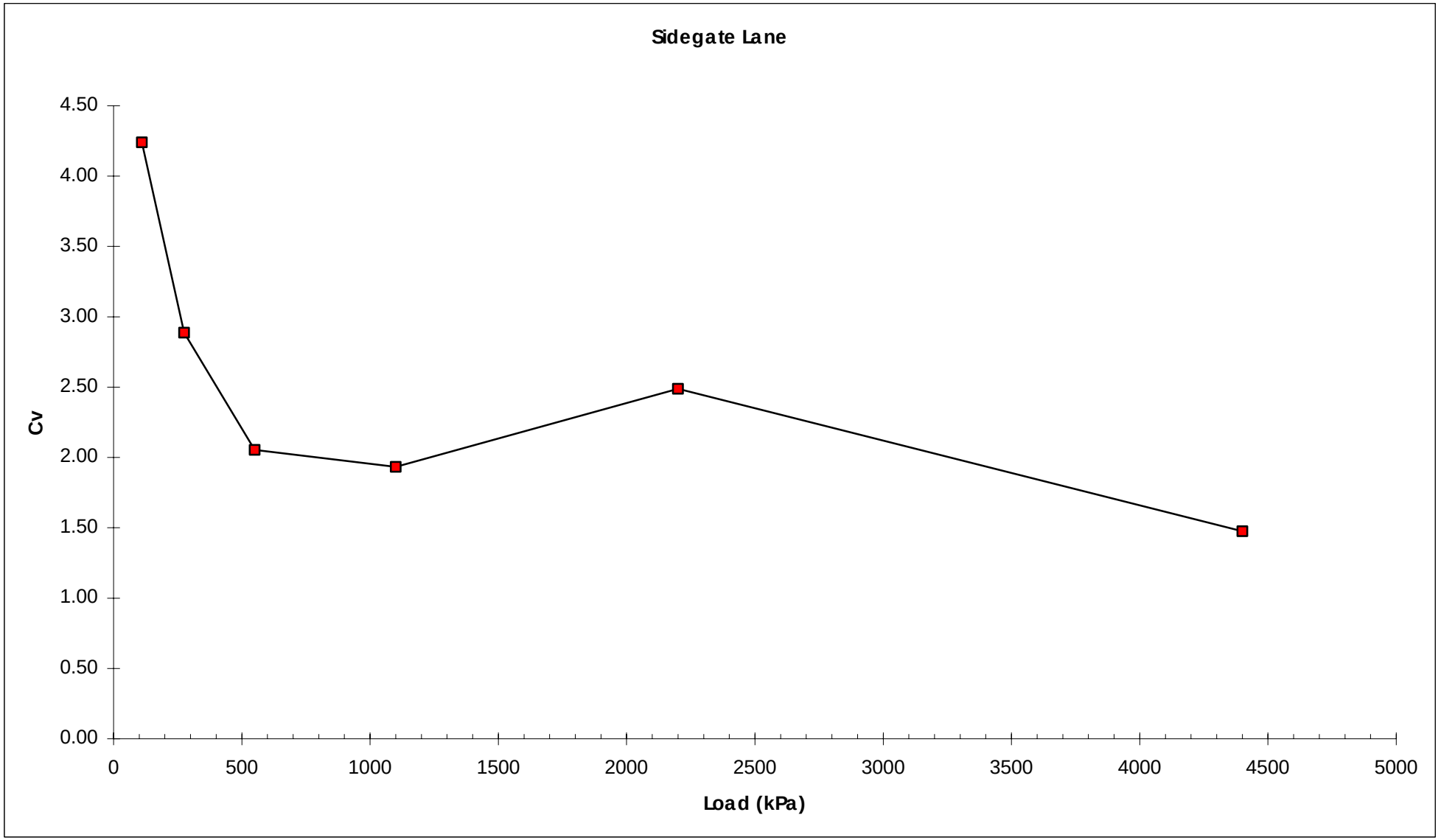
Ho	Gs	DDo	eo	F
18.8	2.83	1.737	0.629	0.087

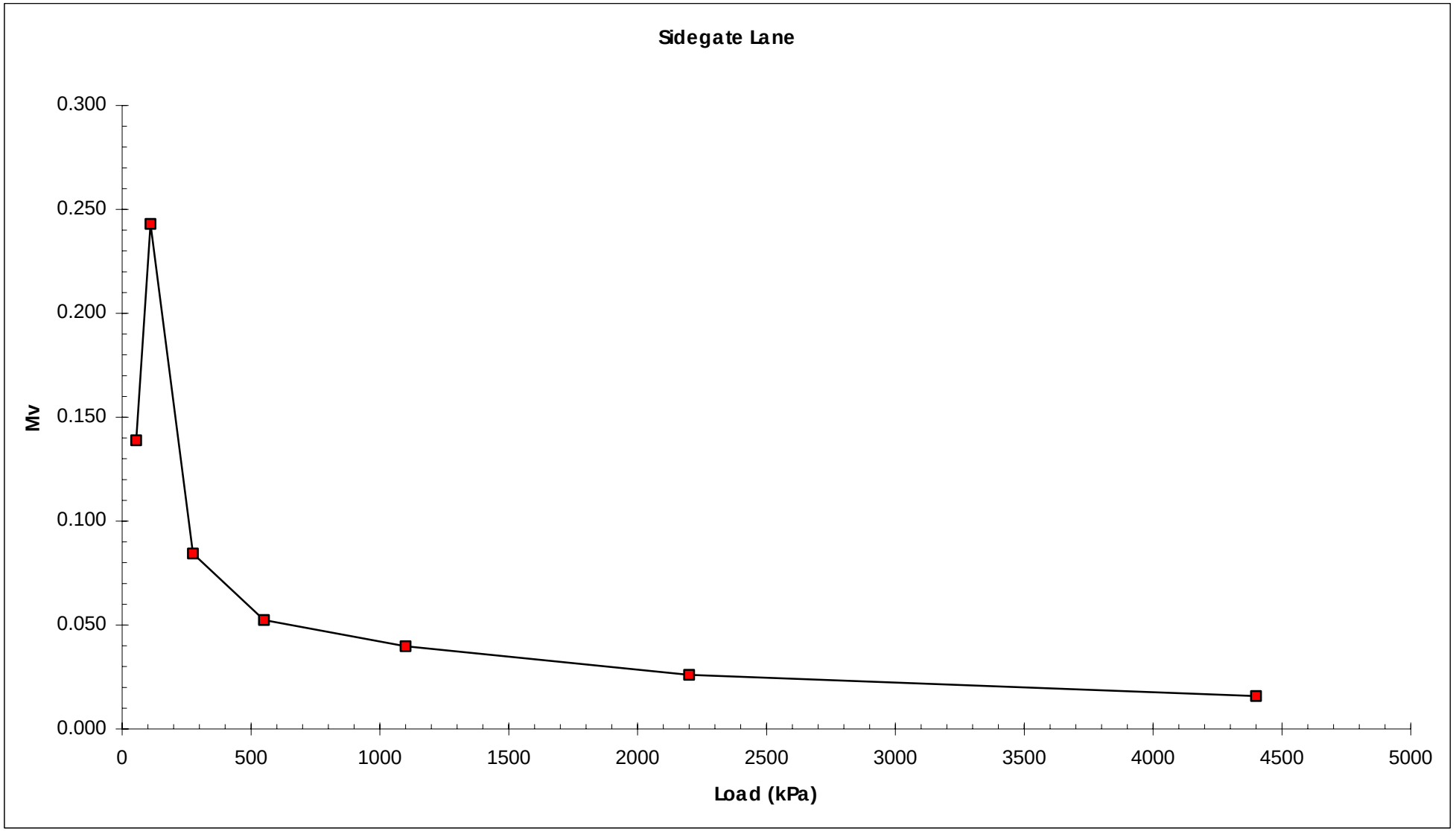
e-logP plot | *Coeff. of Volume Compressibility* | *Coeff. of Consolidation*

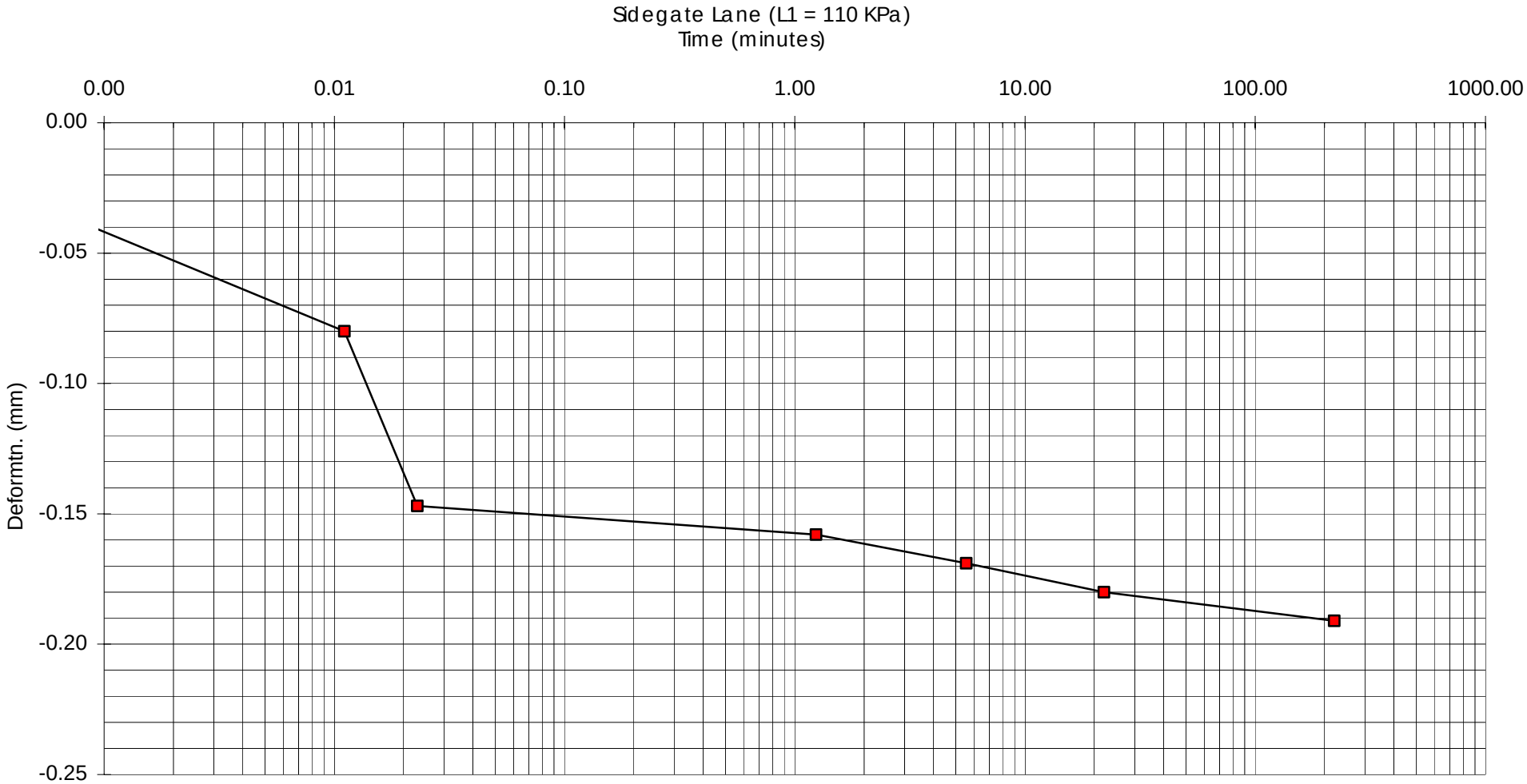
Incr. No.	Press. (kPa)	Nett Sett (mm)	Nett de	e1	Incr. de	Incr. dp (kPa)	1+e1	Mv (m2/MN)	t50 (mins)	H (mm)	Mean Ht H' (mm)	Cv (m2/yr)
				0								
	5.5	0	0.000	**0.629**						18.760		
1	**55**	0.129	0.011	**0.618**	0.011	49.5	1.629	**0.139**		18.631	18.6955	
2	**110**	0.378	0.033	**0.596**	0.022	55	1.618	**0.243**	2.1	18.382	18.5065	**4.24**
3	**275**	0.634	0.055	**0.574**	0.022	165	1.596	**0.084**	3	18.126	18.254	**2.89**
4	**550**	0.895	0.078	**0.552**	0.023	275	1.574	**0.052**	4.1	17.865	17.9955	**2.05**
5	**1100**	1.286	0.112	**0.518**	0.034	550	1.552	**0.040**	4.2	17.474	17.6695	**1.93**
6	**2200**	1.786	0.155	**0.474**	0.043	1100	1.518	**0.026**	3.1	16.974	17.224	**2.49**
7	**4400**	2.376	0.206	**0.423**	0.051	2200	1.474	**0.016**	4.9	16.384	16.679	**1.48**
8	**2200**	2.231	0.194	**0.435**	-0.013	-2200	1.423	**0.004**		16.529	16.4565	
9	**1100**	2.011	0.175	**0.455**	-0.019	-1100	1.435	**0.012**		16.749	16.639	
10	**5.5**	0.065	0.006	**0.624**	-0.169	-1094.5	1.455	**0.106**		18.695	17.722	

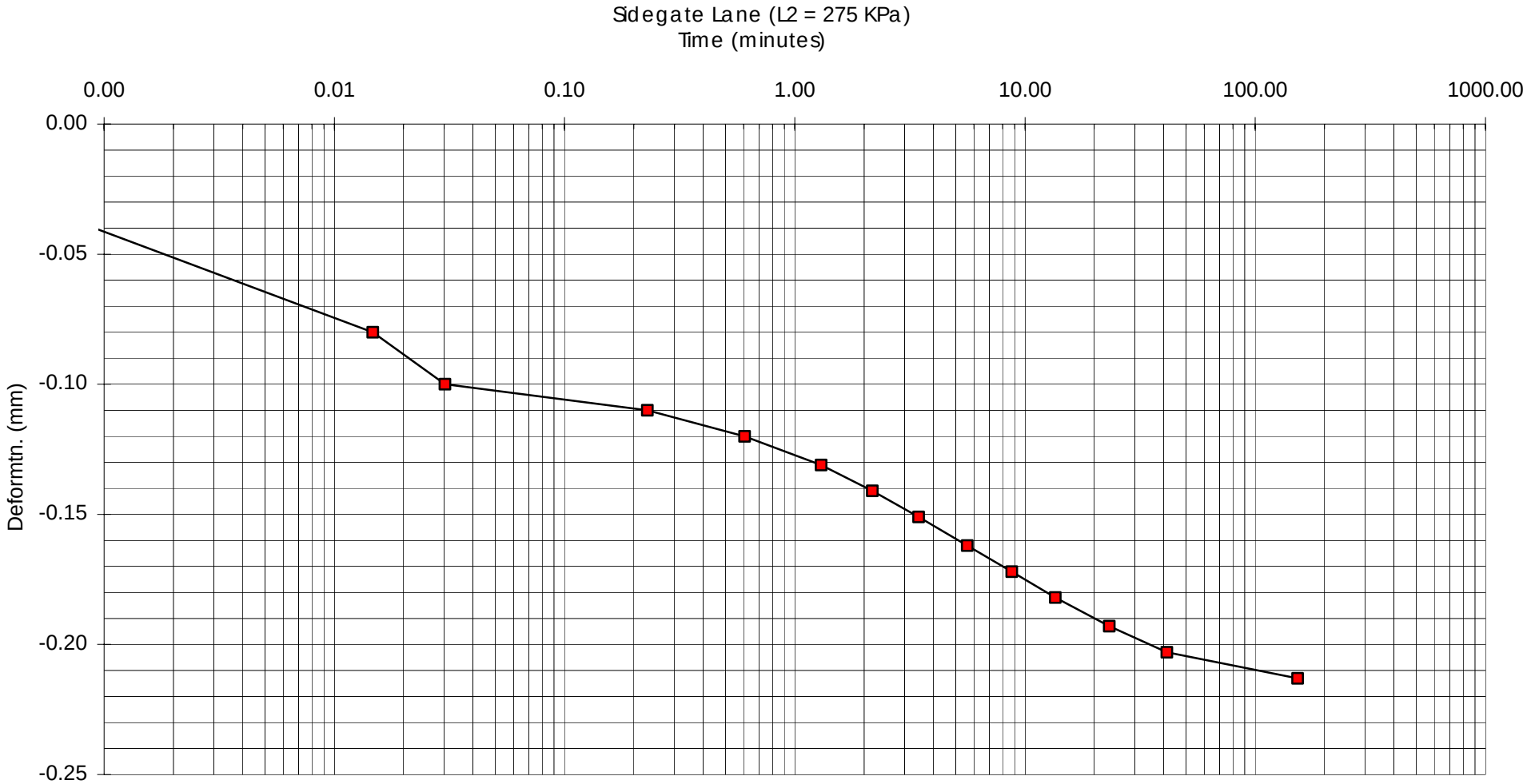

Sidegate Lane
Voids Ratio
0.650
0.600
0.550
0.500
0.450
0.400
0.350
0.300
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

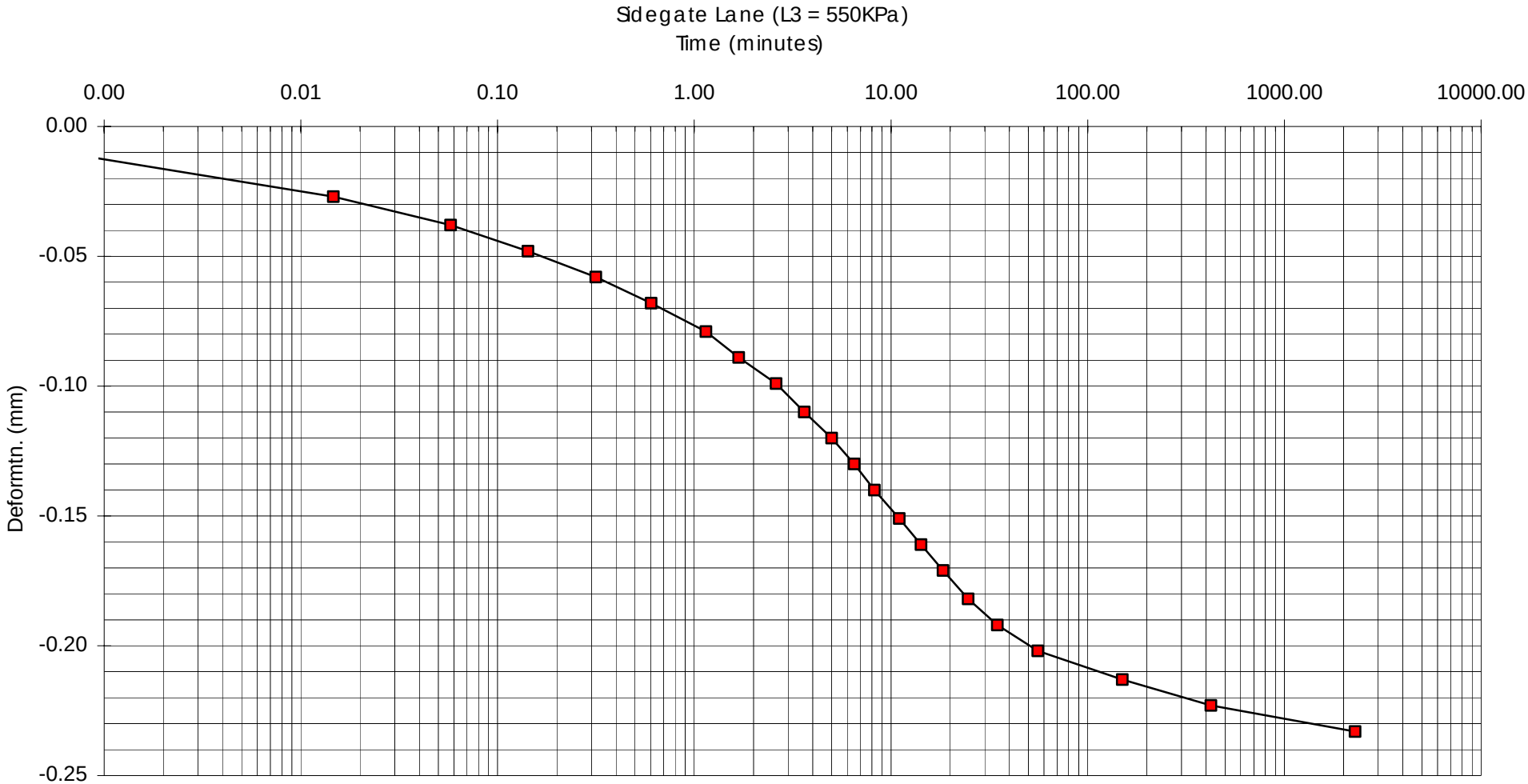

Sidegate Lane
Voids Ratio
0.650
0.600
0.550
0.500
0.450
0.400
0.350
0.300
1
10
100
1000
10000
Load (kPa)

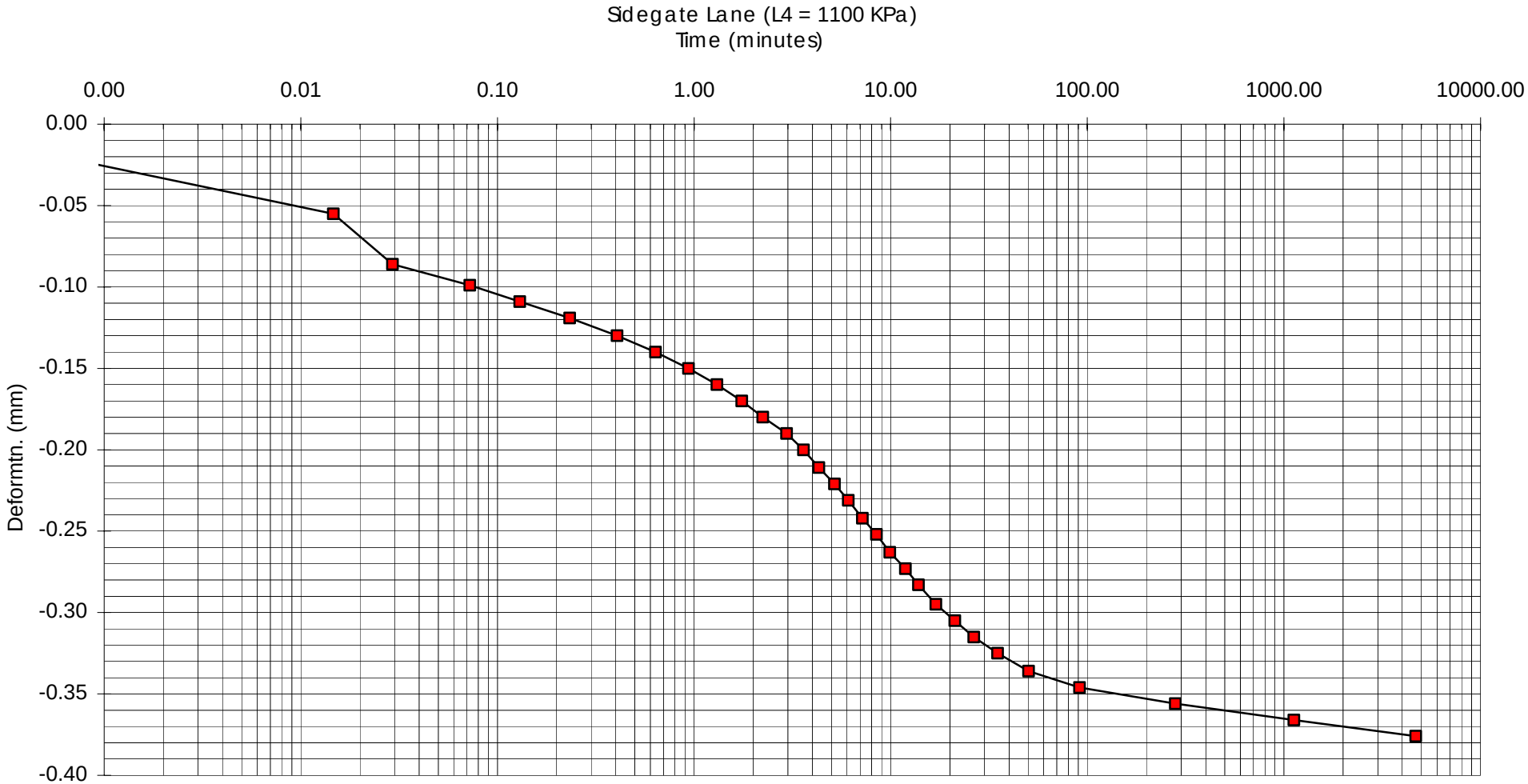

Sidegate Lane
Cv
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

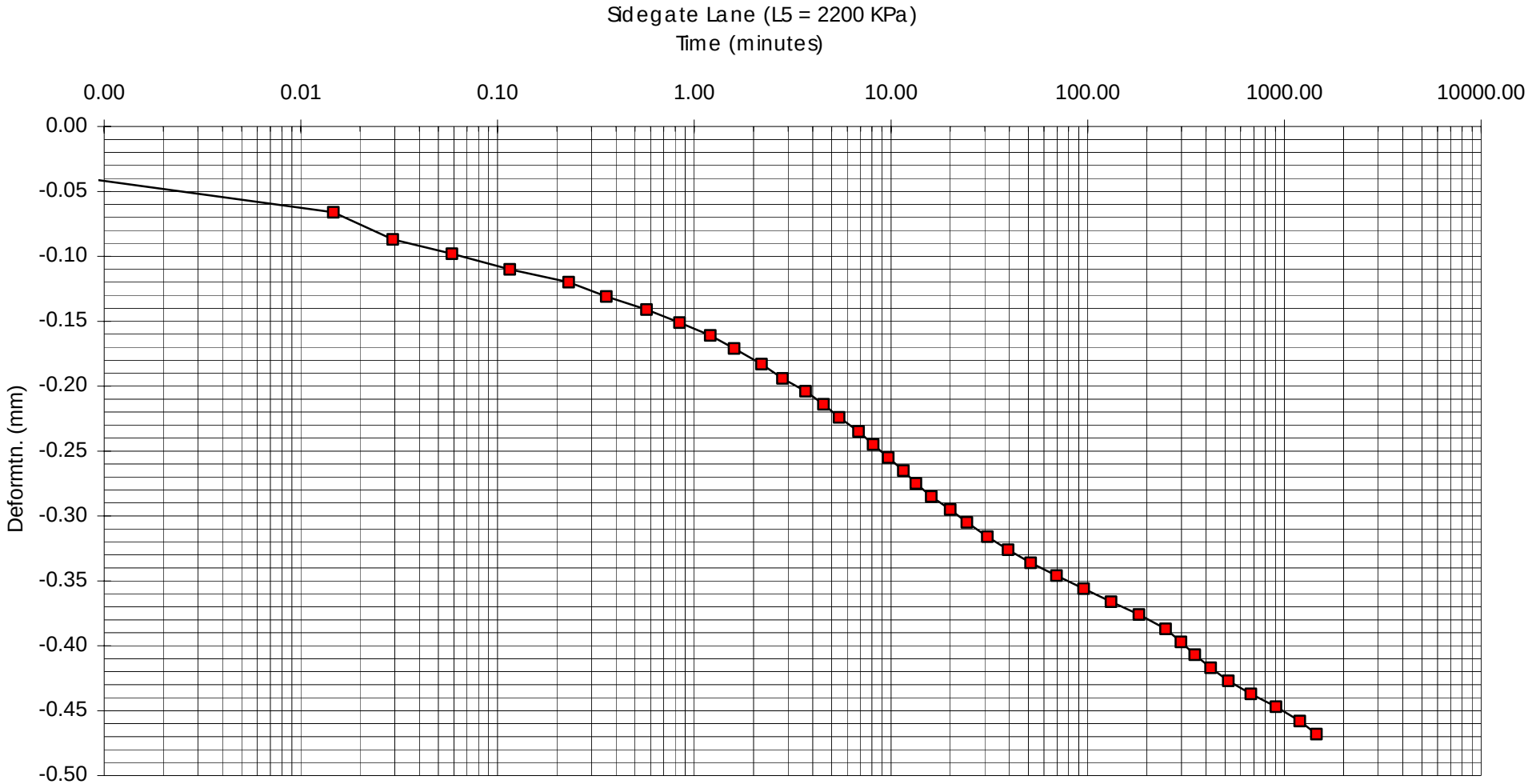

Sidegate Lane
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Mv
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

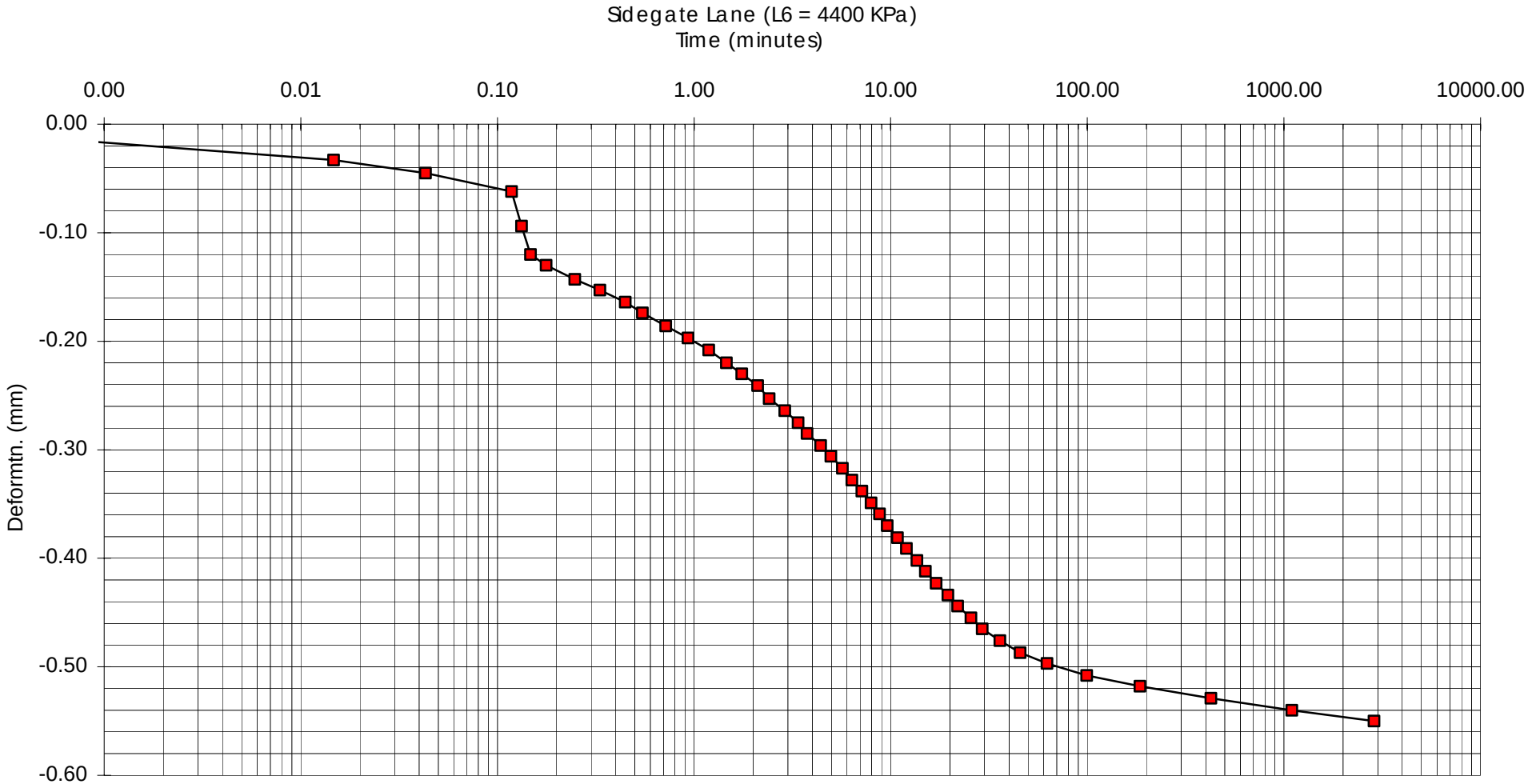

Sidegate Lane (L1 = 110 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
Deformtn. (mm)


Sidegate Lane (L2 = 275 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
Deformtn. (mm)


Sidegate Lane (L3 = 550KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
Deformtn. (mm)


Sidegate Lane (L4 = 1100 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
Deformtn. (mm)
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40


Sidegate Lane (L5 = 2200 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45
-0.50
Deformtn. (mm)


Sidegate Lane (L6 = 4400 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
Deformtn. (mm)

OEDOMETER CONSOLIDATION

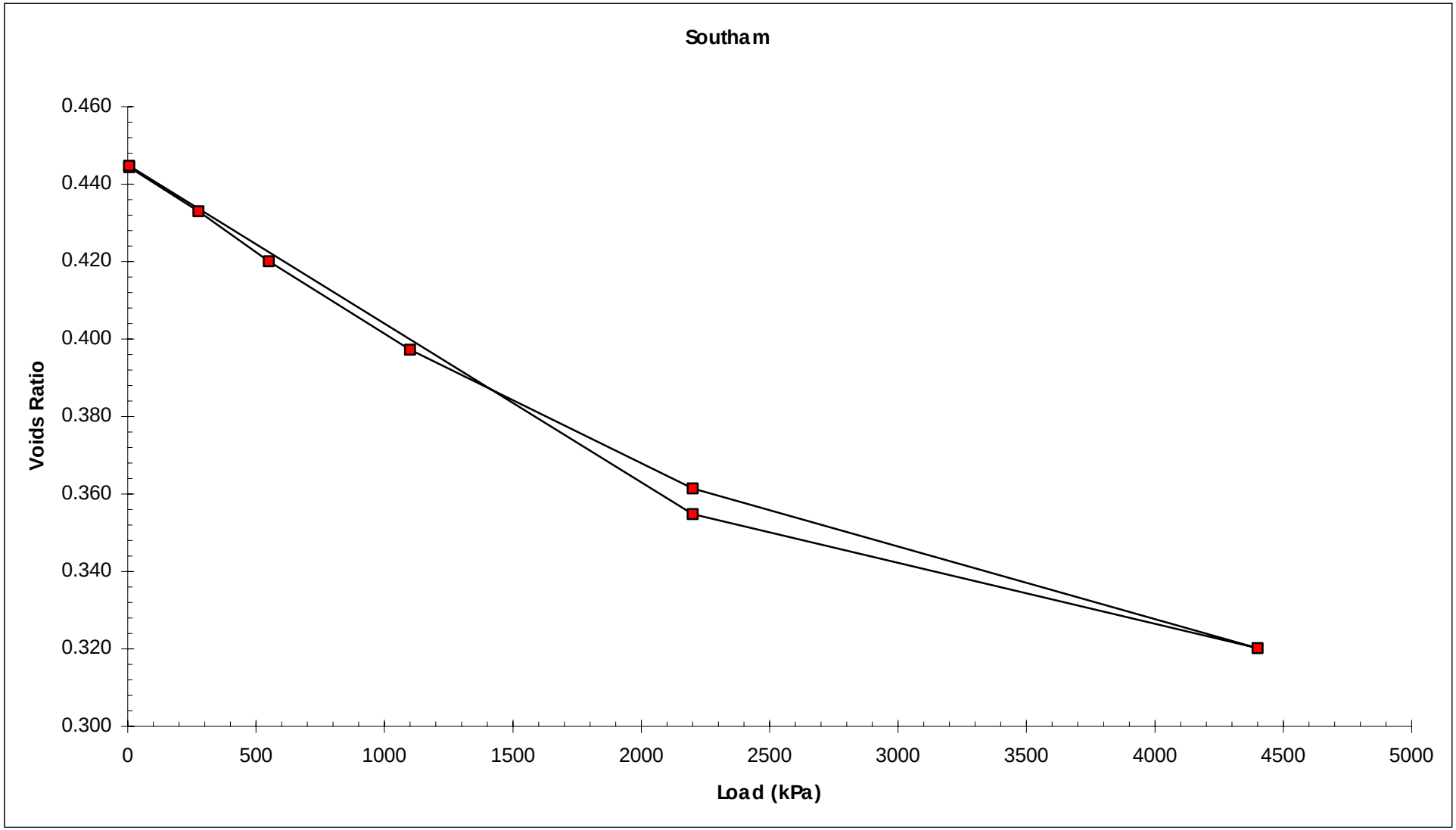
CALCULATION SHEET

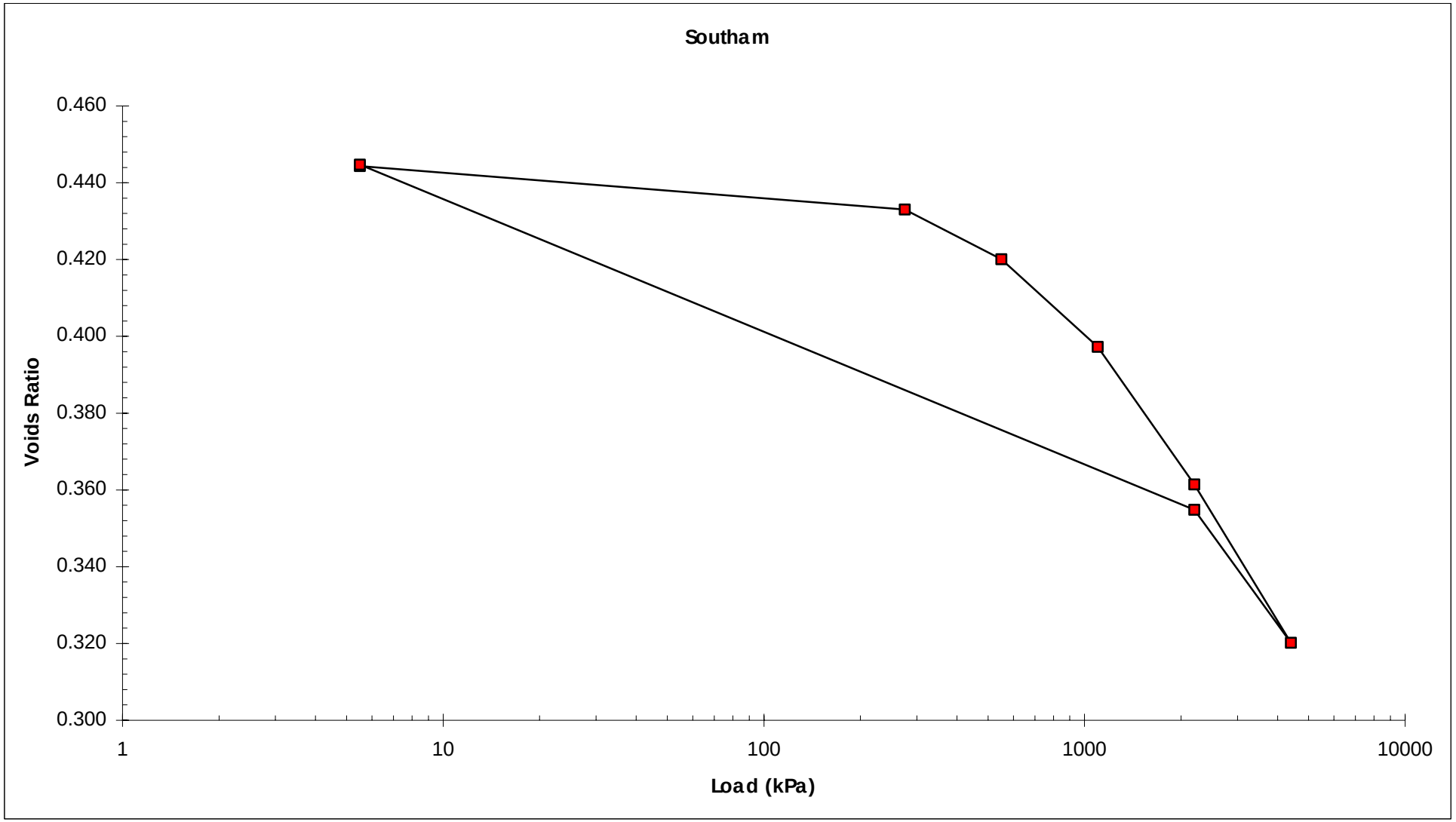
LOCATION:	Southam	**SOIL TYPE:**	Lias Clay
SAMPLE No.		**DEPTH:**	

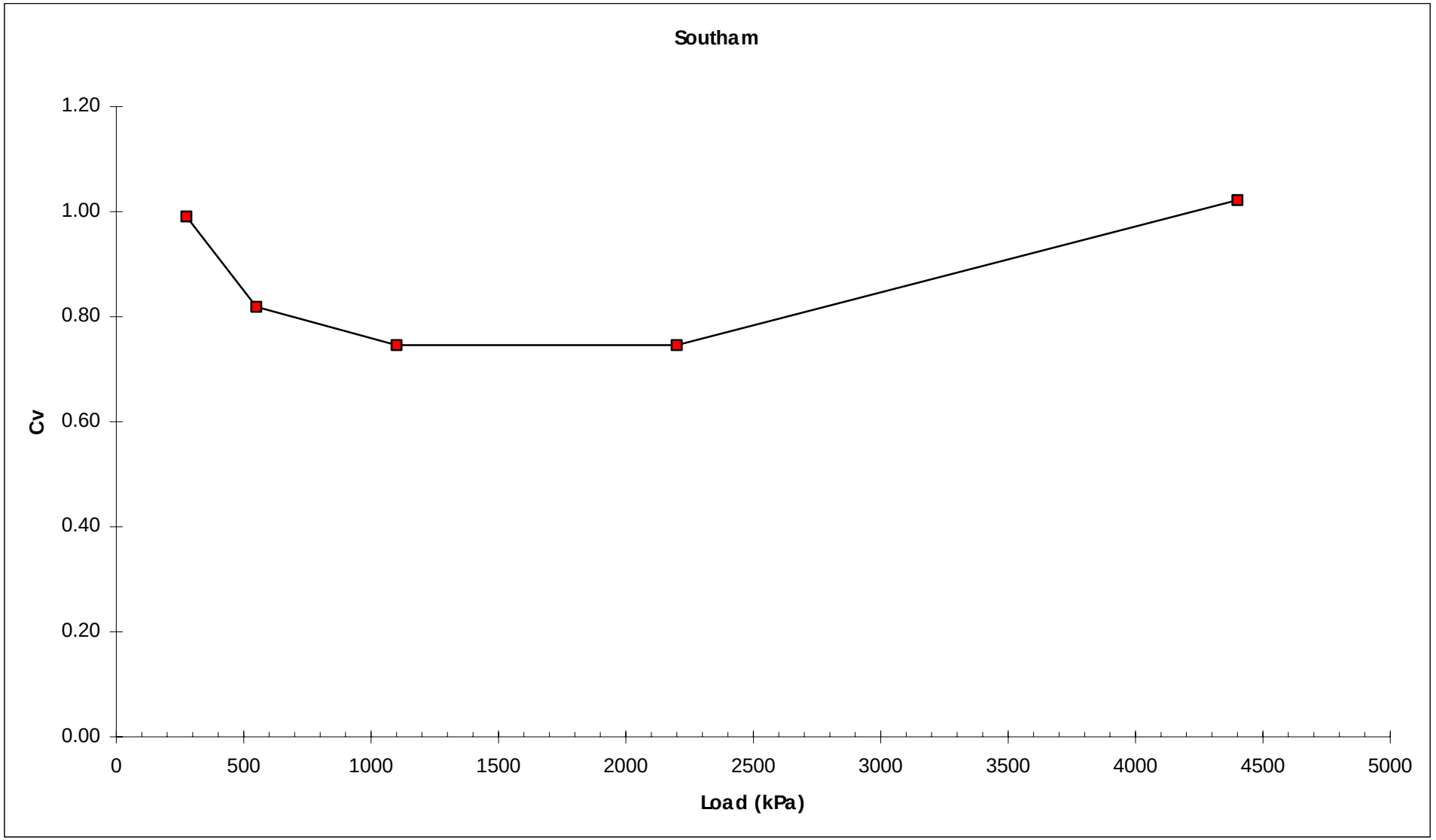
Ho	Gs	DDo	eo	F
19.1	2.77	1.918	0.444	0.076

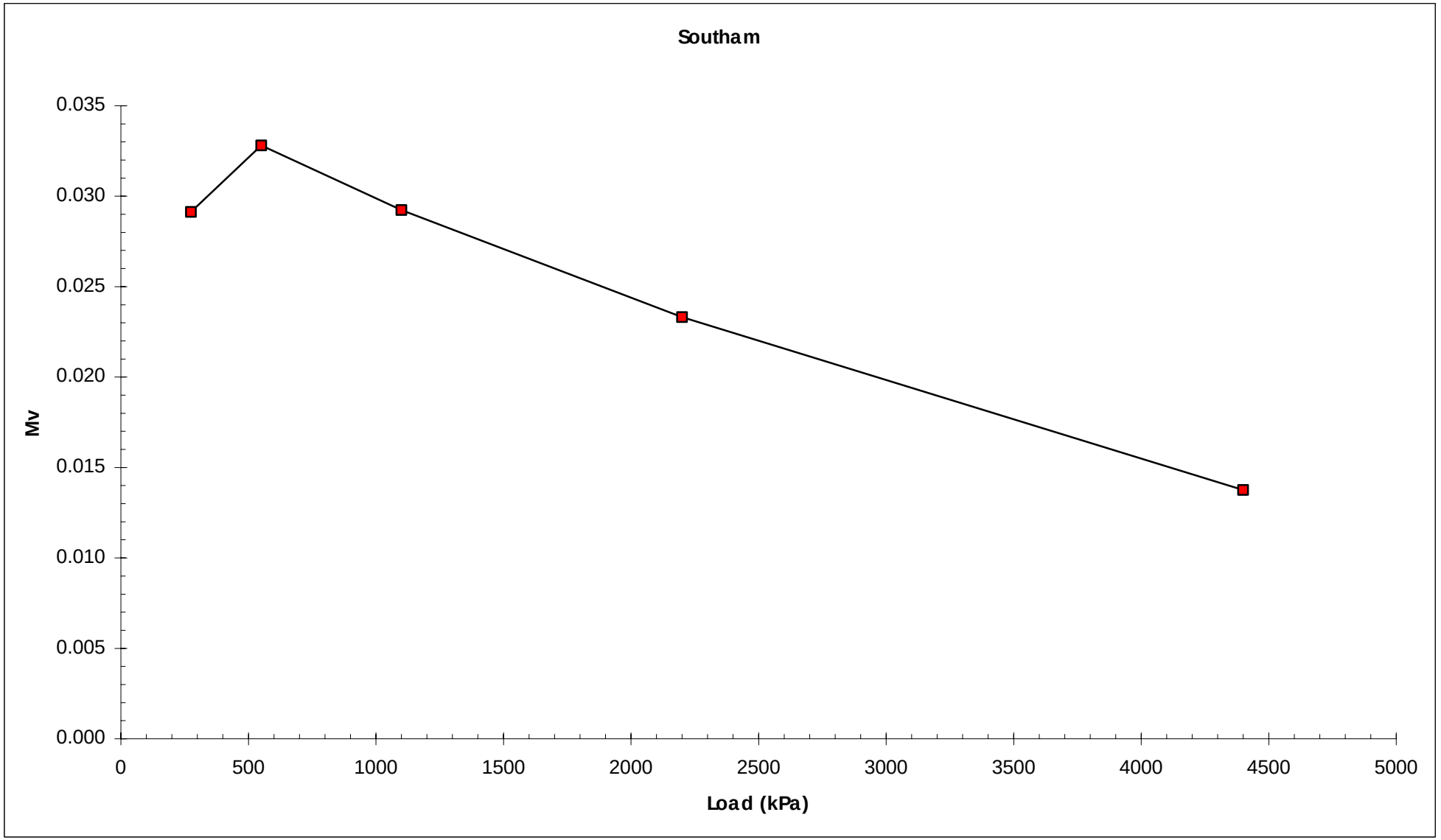
e-logP plot | *Coeff. of Volume Compressibility* | *Coeff. of Consolidation*

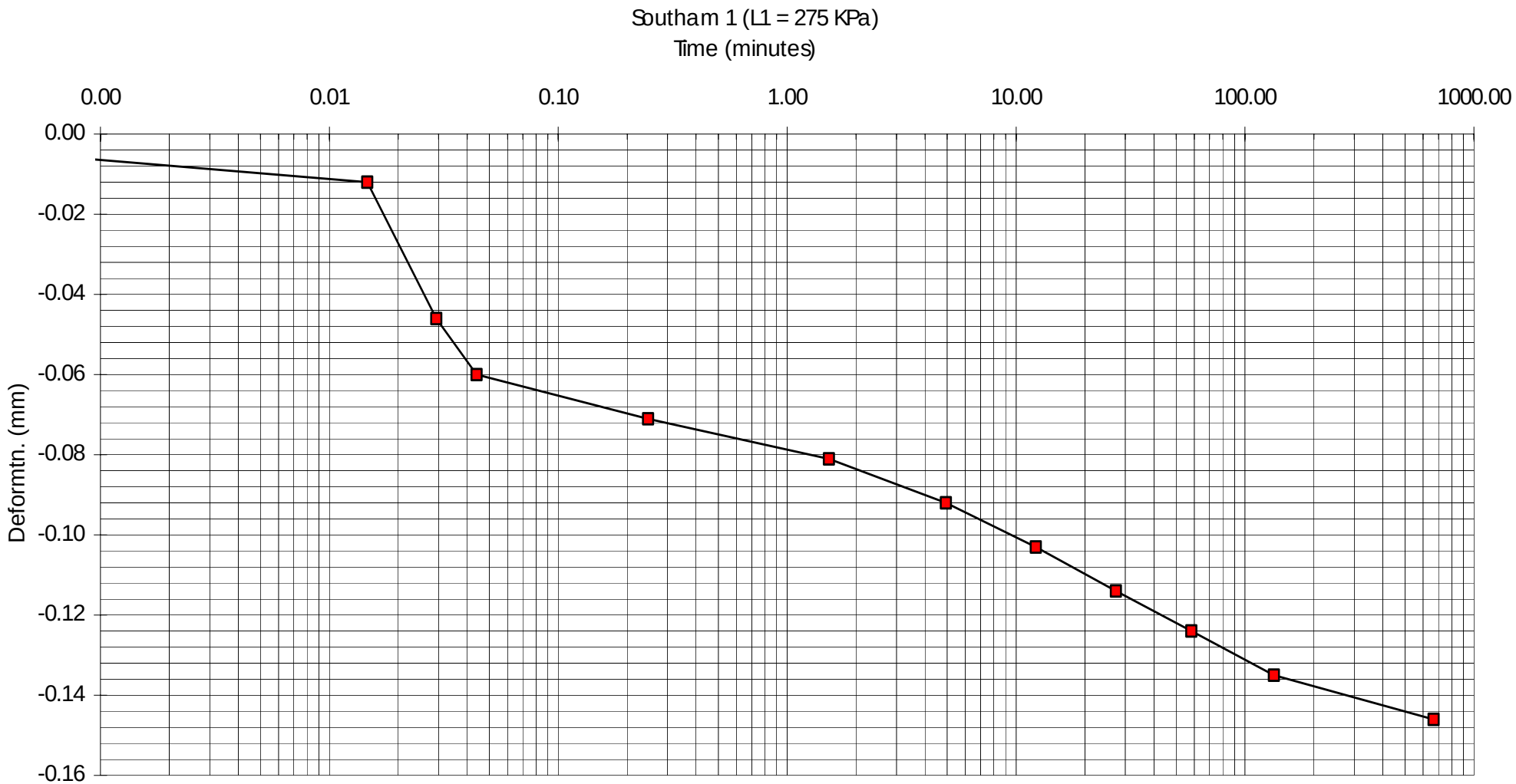
Incr. No.	Press. (kPa)	Nett Sett (mm)	Nett de	e1	Incr. de	Incr. dp (kPa)	1+e1	Mv (m2/MN)	t50 (mins)	H (mm)	Mean Ht H' (mm)	Cv (m2/yr)
				0				0				0.00
	0		0.000	**0.444**						19.100		
1	**0**		0.000	**0.444**	0.000	0	1.444			19.1	19.1	
2	**0**		0.000	**0.444**	0.000	0	1.444			19.1	19.1	
3	**5.5**	-0.002	0.000	**0.444**	0.000	5.5	1.444			19.102	19.101	
4	**275**	0.148	0.011	**0.433**	0.011	269.5	1.444	**0.029**	9.5	18.952	19.027	**0.99**
5	**550**	0.319	0.024	**0.420**	0.013	275	1.433	**0.033**	11.3	18.781	18.8665	**0.82**
6	**1100**	0.621	0.047	**0.397**	0.023	550	1.420	**0.029**	12.1	18.479	18.63	**0.75**
7	**2200**	1.095	0.083	**0.361**	0.036	1100	1.397	**0.023**	11.6	18.005	18.242	**0.75**
8	**4400**	1.64	0.124	**0.320**	0.041	2200	1.361	**0.014**	8	17.46	17.7325	**1.02**
9	**2200**	1.182	0.089	**0.355**	-0.035	-2200	1.320	**0.012**		17.918	17.689	
10	**5.5**	-0.007	-0.001	**0.445**	-0.090	-2194.5	1.355	**0.030**		19.107	18.5125	

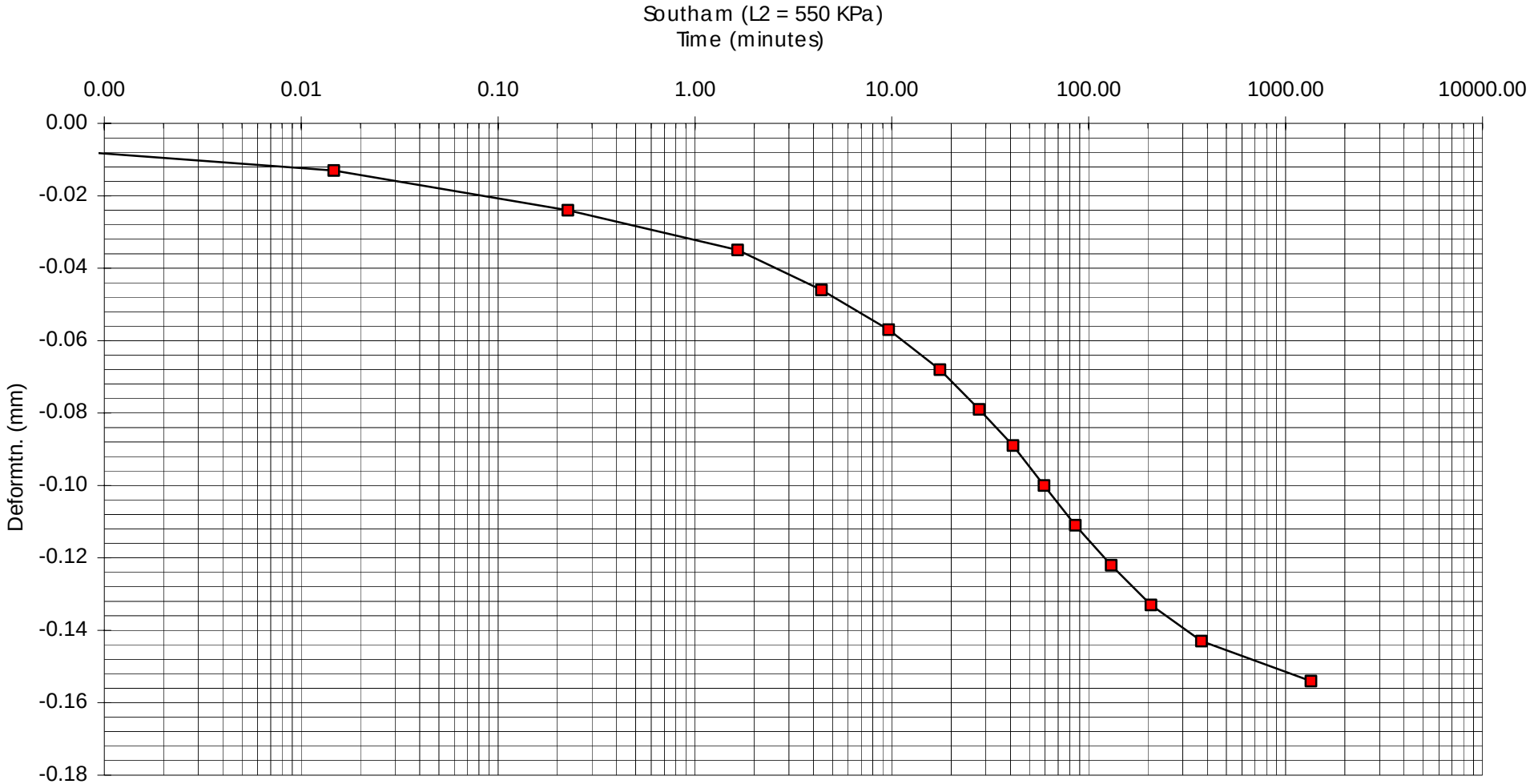

Southam
0.460
0.440
0.420
0.400
0.380
0.360
0.340
0.320
0.300
Voids Ratio
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

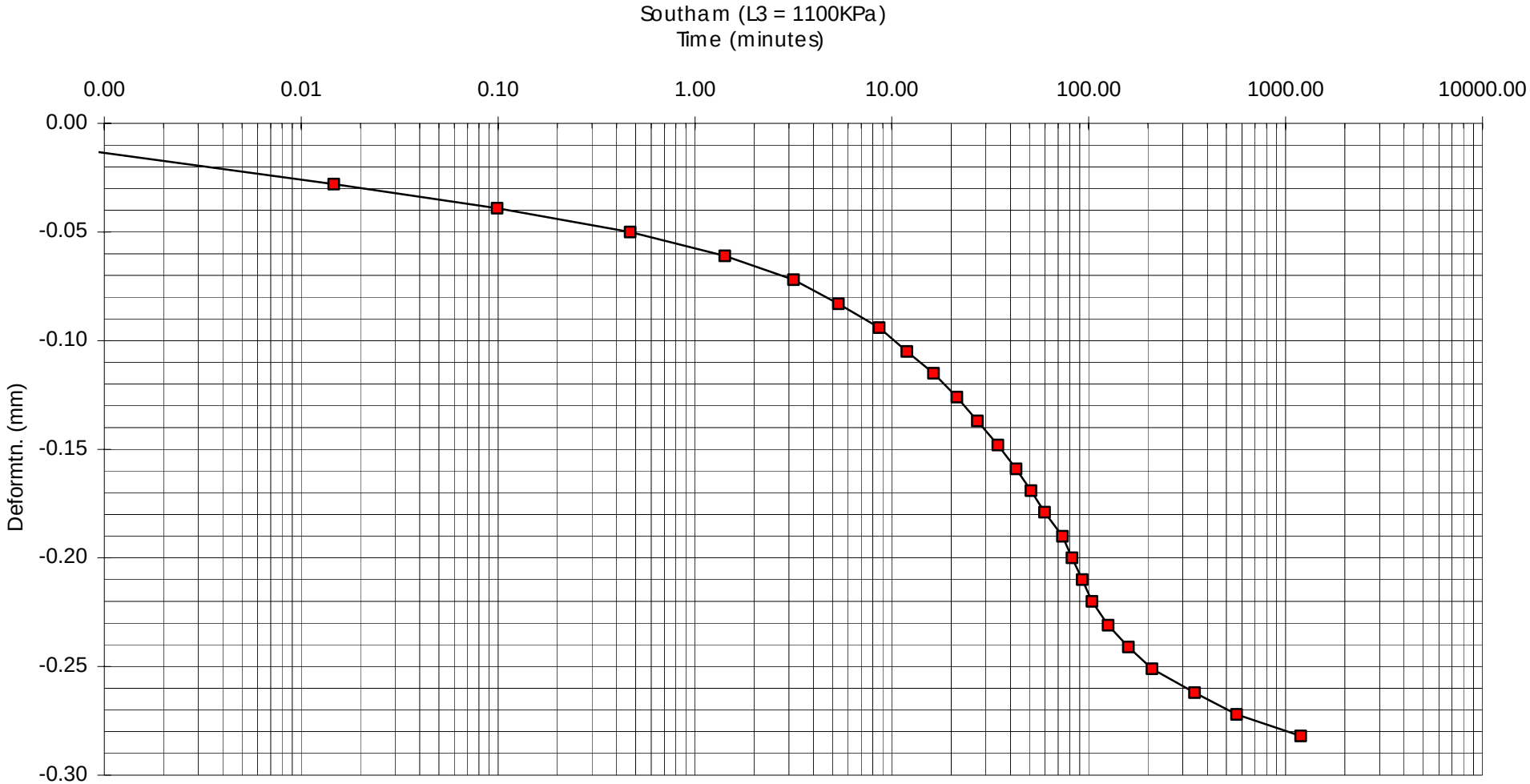

Southam
0.460
0.440
0.420
0.400
0.380
0.360
0.340
0.320
0.300
Voids Ratio
1
10
100
1000
10000
Load (kPa)

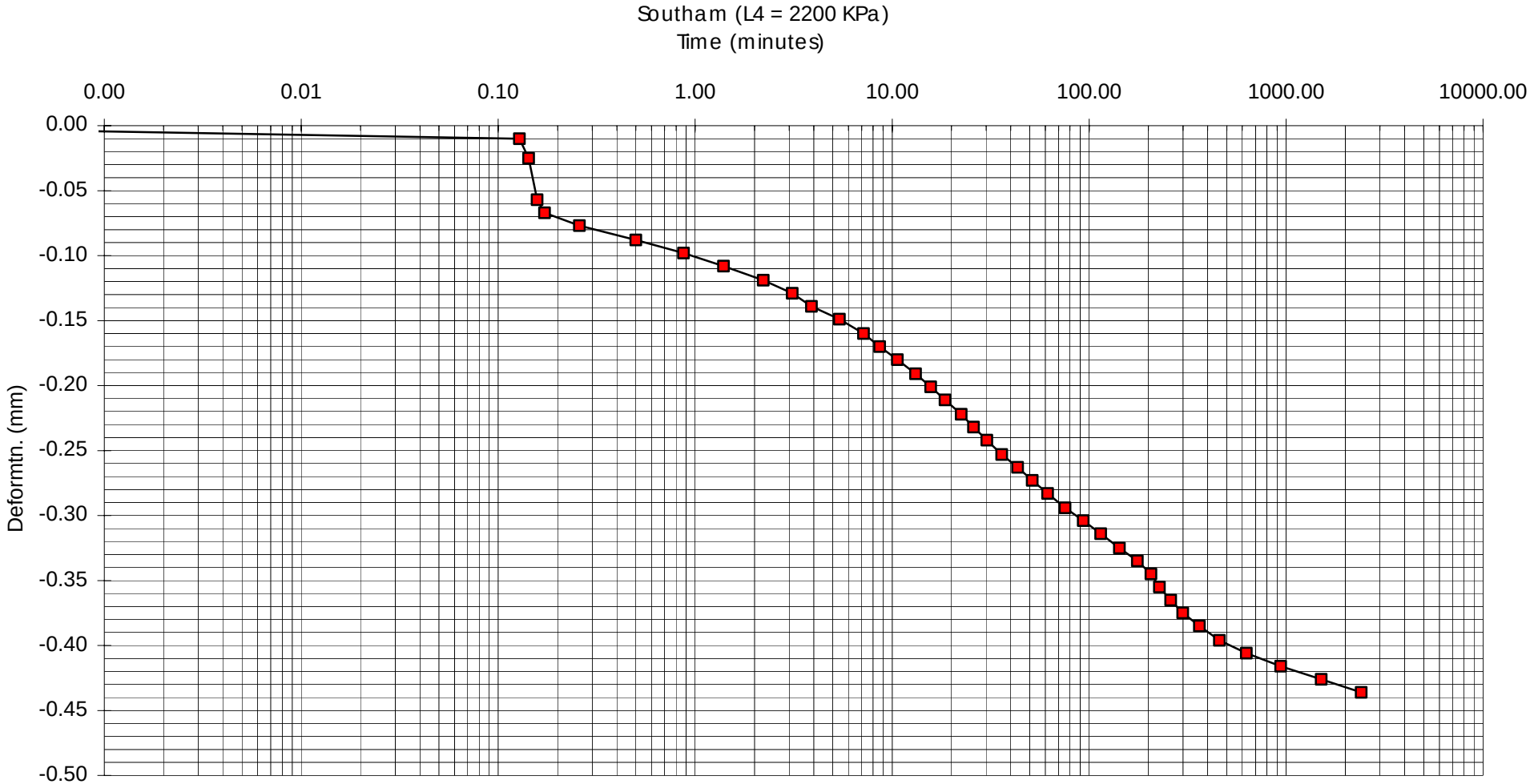

Southam
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Cv
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)

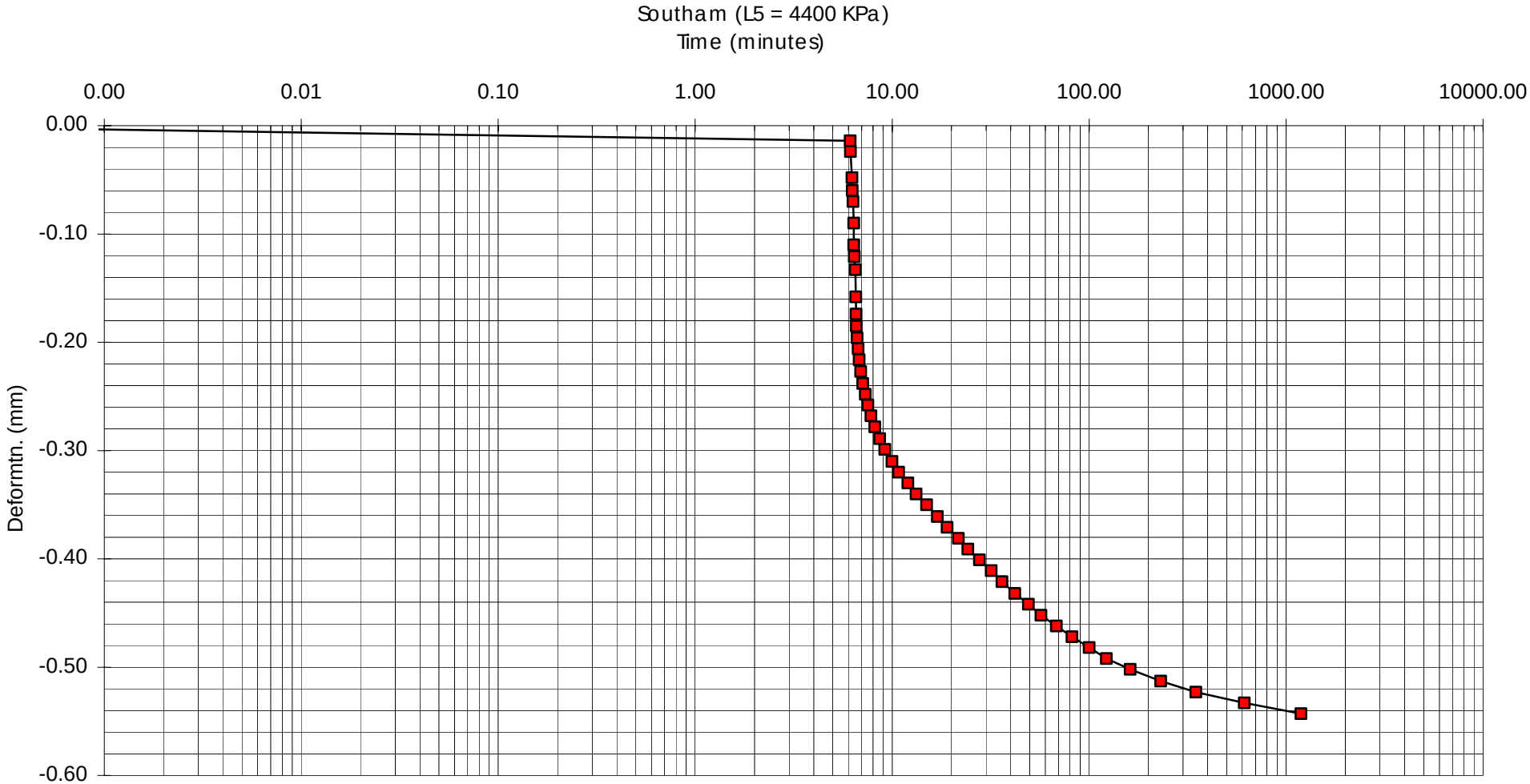

Southam
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
Mv
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load (kPa)


Southam 1 (L1 = 275 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
Deformtn. (mm)
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
-0.16


Southam (L2 = 550 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
-0.16
-0.18
Deformtn. (mm)


Southam (L3 = 1100KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
Deformtn. (mm)


Southam (L4 = 2200 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45
-0.50
Deformtn. (mm)


Southam (L5 = 4400 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
Deformtn. (mm)

OEDOMETER CONSOLIDATION

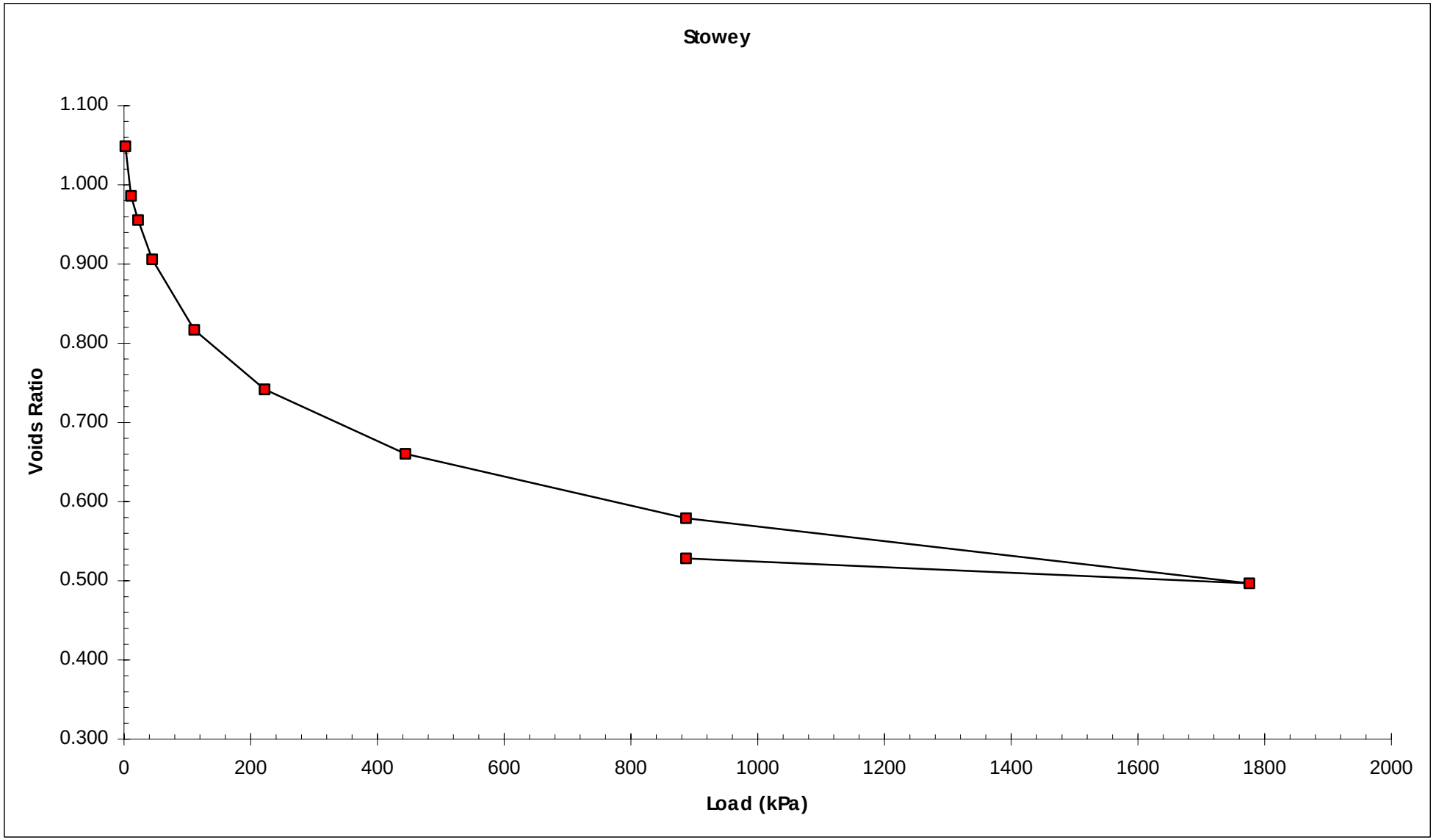
CALCULATION SHEET

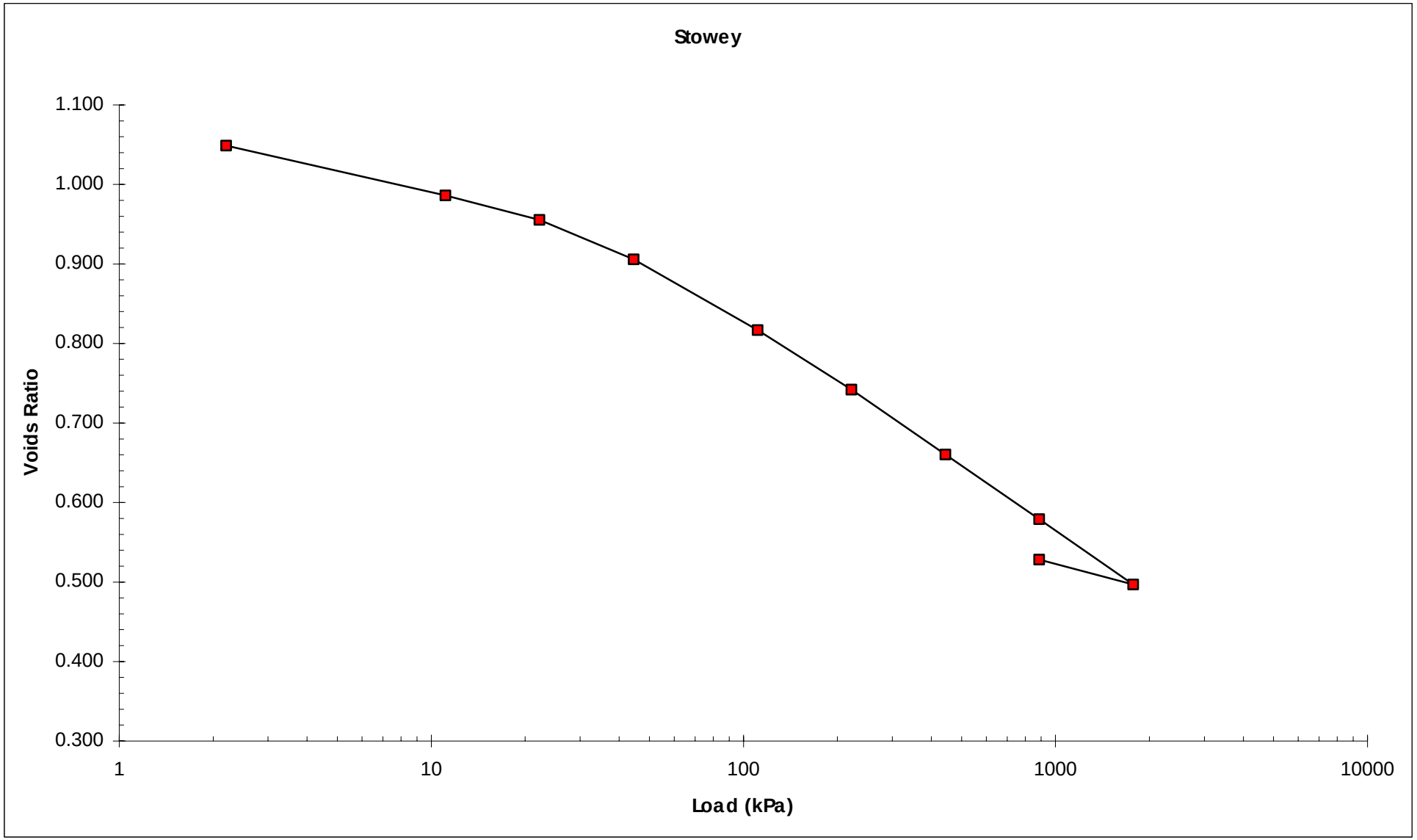
LOCATION:	Stowey	**SOIL TYPE:**	Lias Clay
SAMPLE No.		**DEPTH:**	

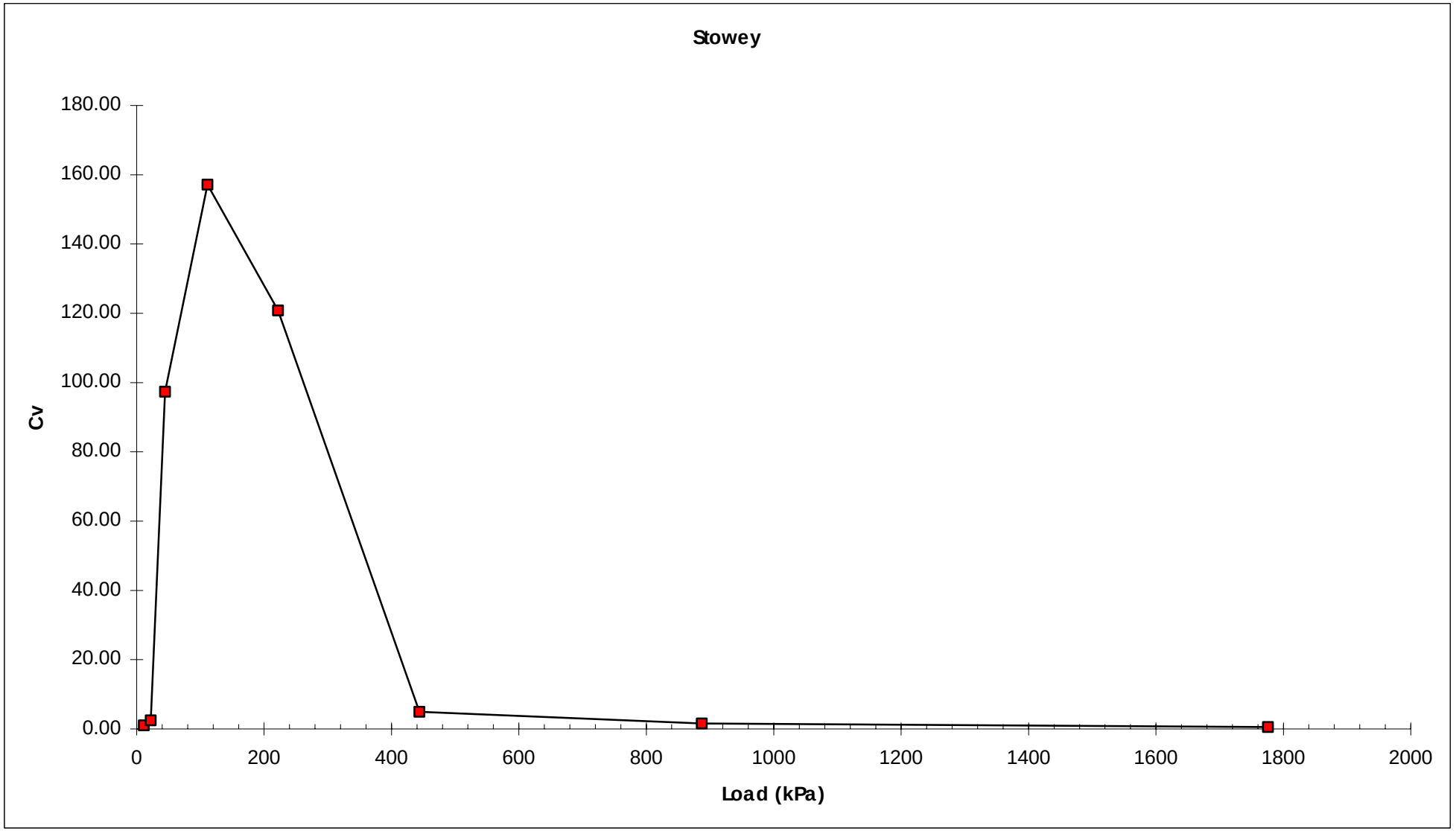
Ho	Gs	DDo	eo	F
19.7	2.69	1.313	1.049	0.104

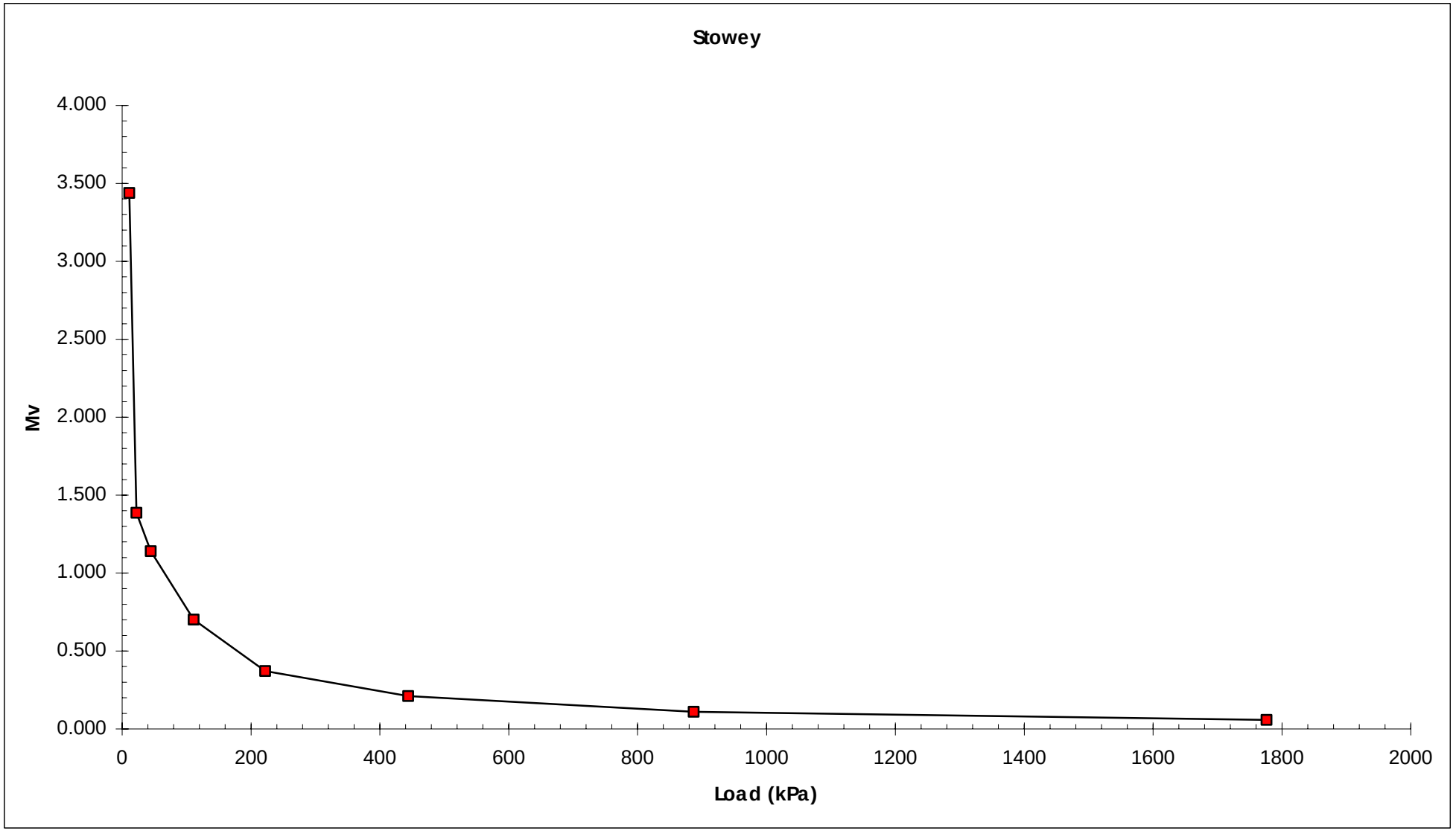
e-logP plot *Coeff. of Volume Compressibility* *Coeff. of Consolidation*

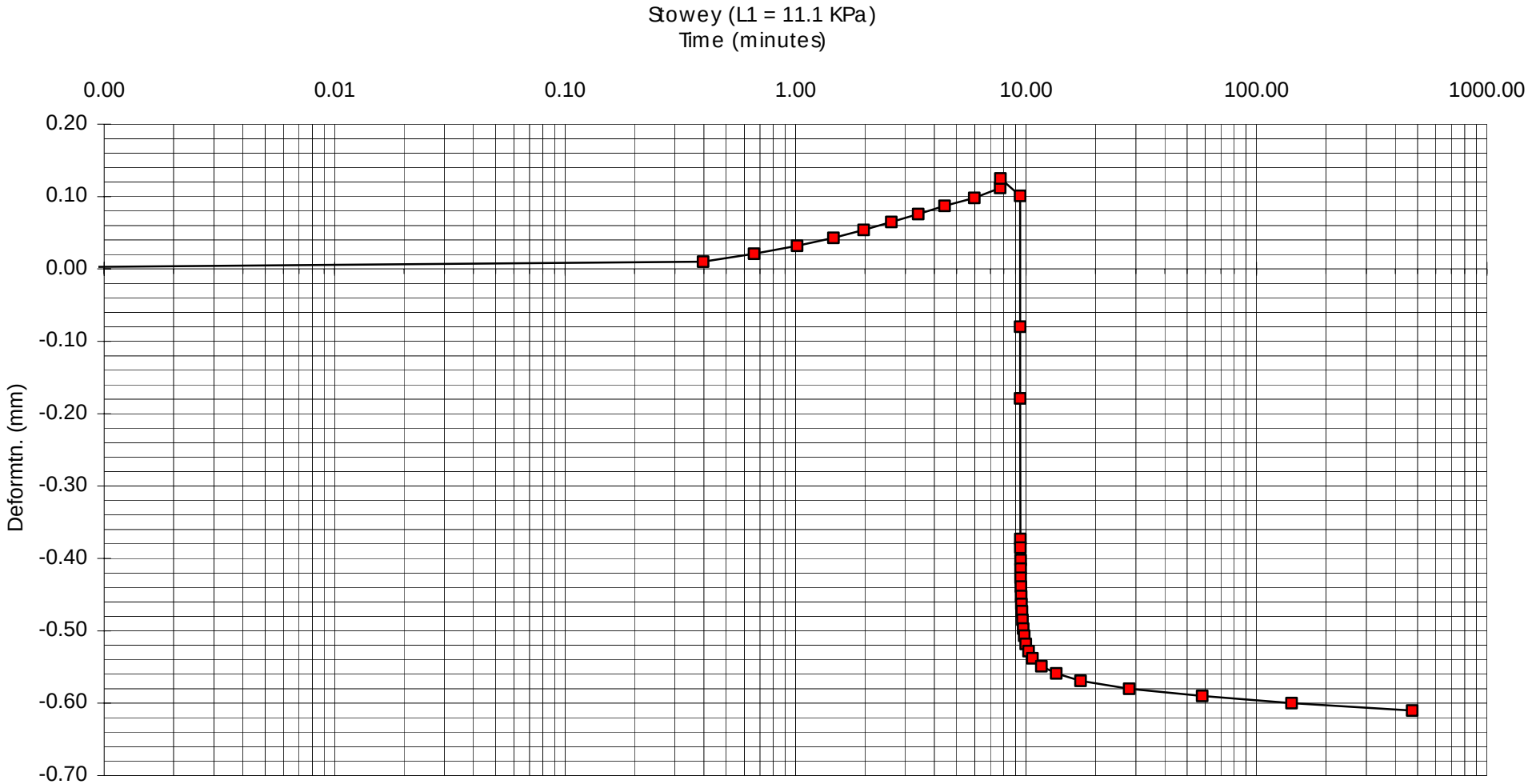
Incr. No.	Press. (kPa)	Nett Sett (mm)	Nett de	e1	Incr. de	Incr. dp (kPa)	1+e1	Mv (m2/MN)	t50 (mins)	H (mm)	Mean Ht H' (mm)	Cv (m2/yr)
	2.2		0.000	**1.049**						19.700		
1	**11.1**	0.603	0.063	**0.986**	0.063	8.9	2.049	**3.439**	9.4	19.097	19.3985	**1.04**
2	**22.2**	0.897	0.093	**0.955**	0.031	11.1	1.986	**1.387**	3.8	18.803	18.95	**2.46**
3	**44.5**	1.375	0.143	**0.906**	0.050	22.3	1.955	**1.140**	0.092	18.325	18.564	**97.39**
4	**111**	2.231	0.232	**0.817**	0.089	66.5	1.906	**0.702**	0.053	17.469	17.897	**157.13**
5	**222**	2.951	0.307	**0.742**	0.075	111	1.817	**0.371**	0.063	16.749	17.109	**120.80**
6	**444**	3.735	0.388	**0.660**	0.082	222	1.742	**0.211**	1.4	15.965	16.357	**4.97**
7	**887**	4.517	0.470	**0.579**	0.081	443	1.660	**0.111**	4	15.183	15.574	**1.58**
8	**1776**	5.307	0.552	**0.497**	0.082	889	1.579	**0.059**	10.3	14.393	14.788	**0.55**
9	**887**	5.004	0.520	**0.528**	-0.032	-889	1.497	**0.024**		14.696	14.5445	
10	**2.2**		0.000	**1.049**	-0.520	-884.8	1.528	**0.385**		19.7	17.198	

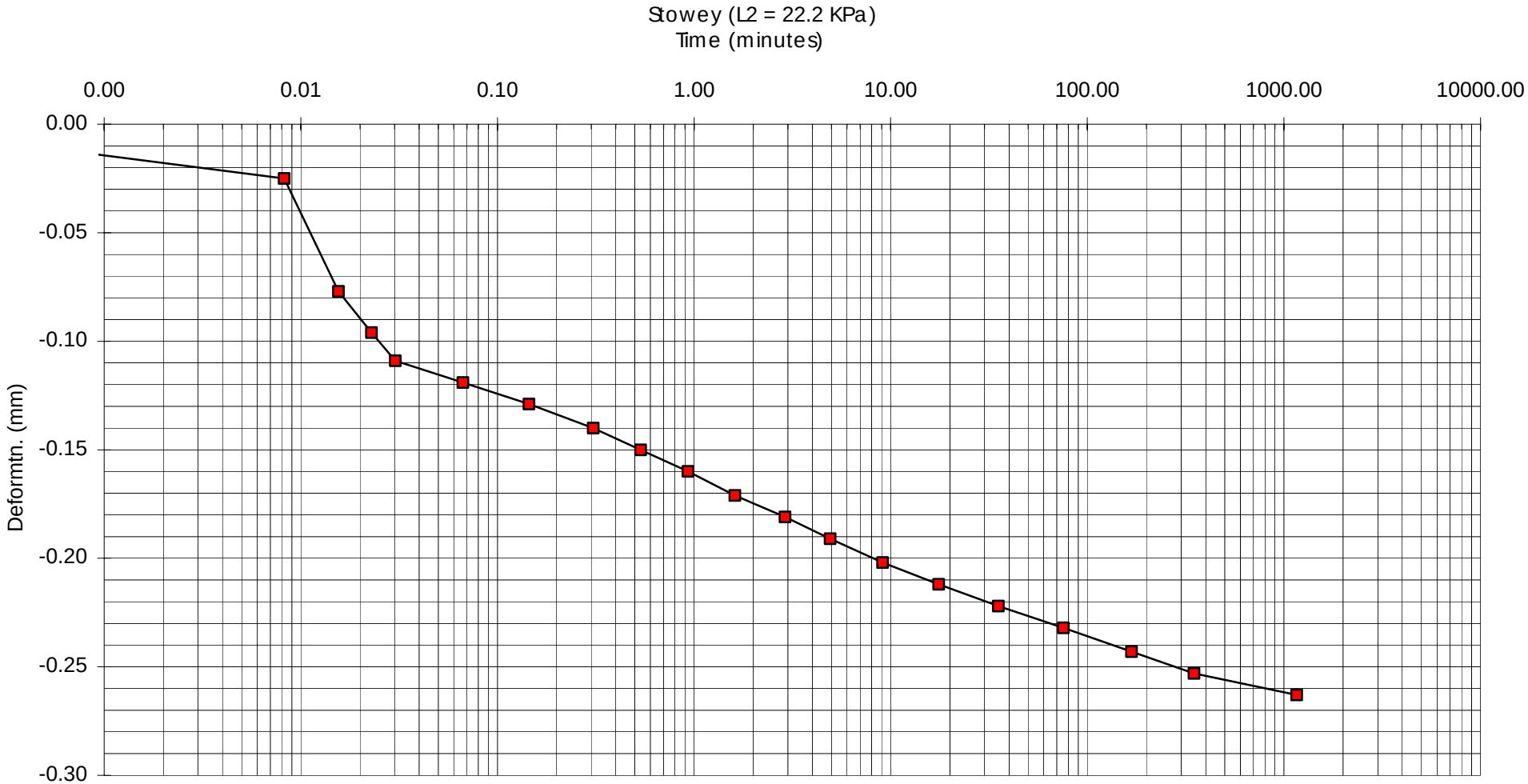

Stowey
Voids Ratio
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Load (kPa)

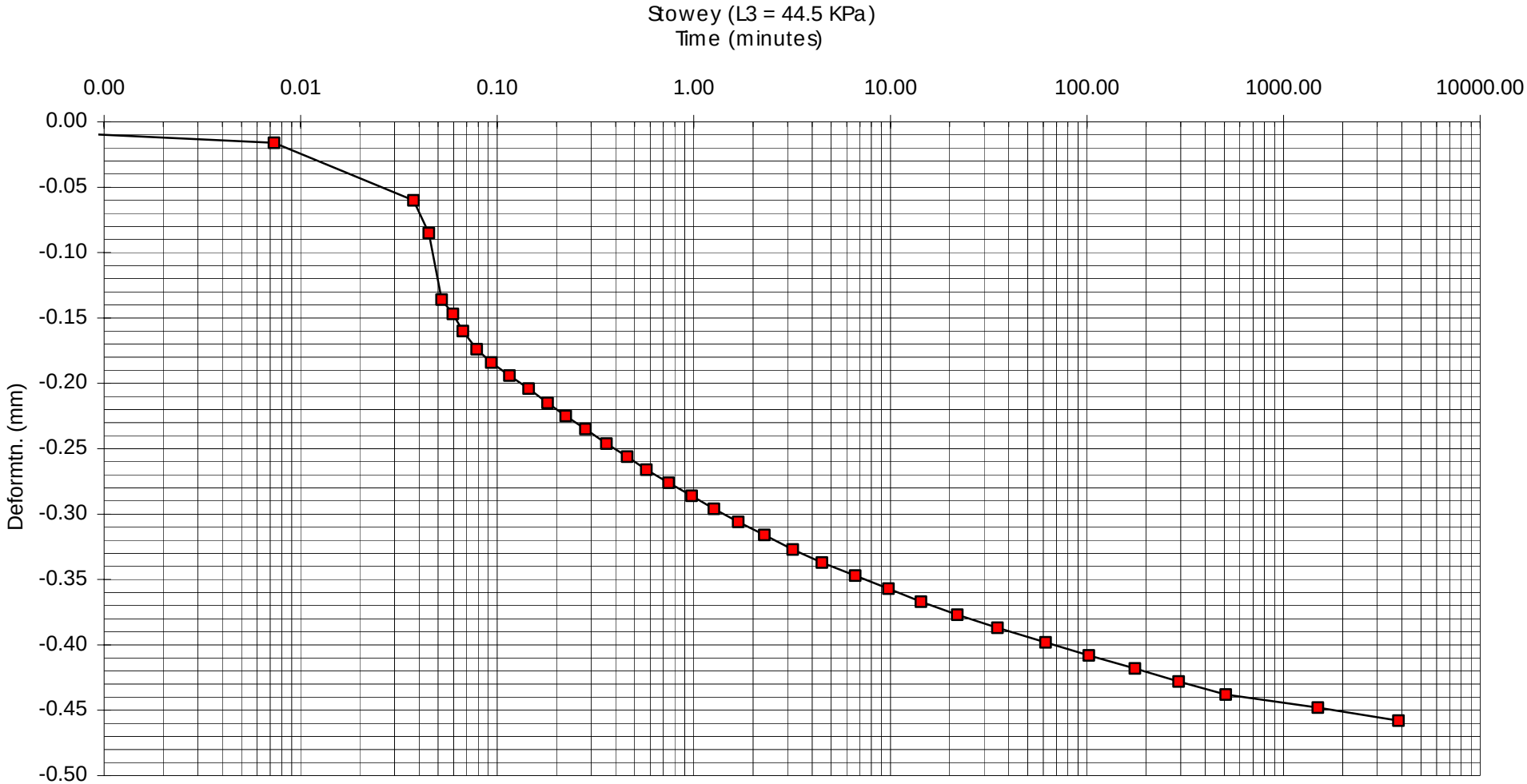

Stowey
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
Voids Ratio
1
10
100
1000
10000
Load (kPa)

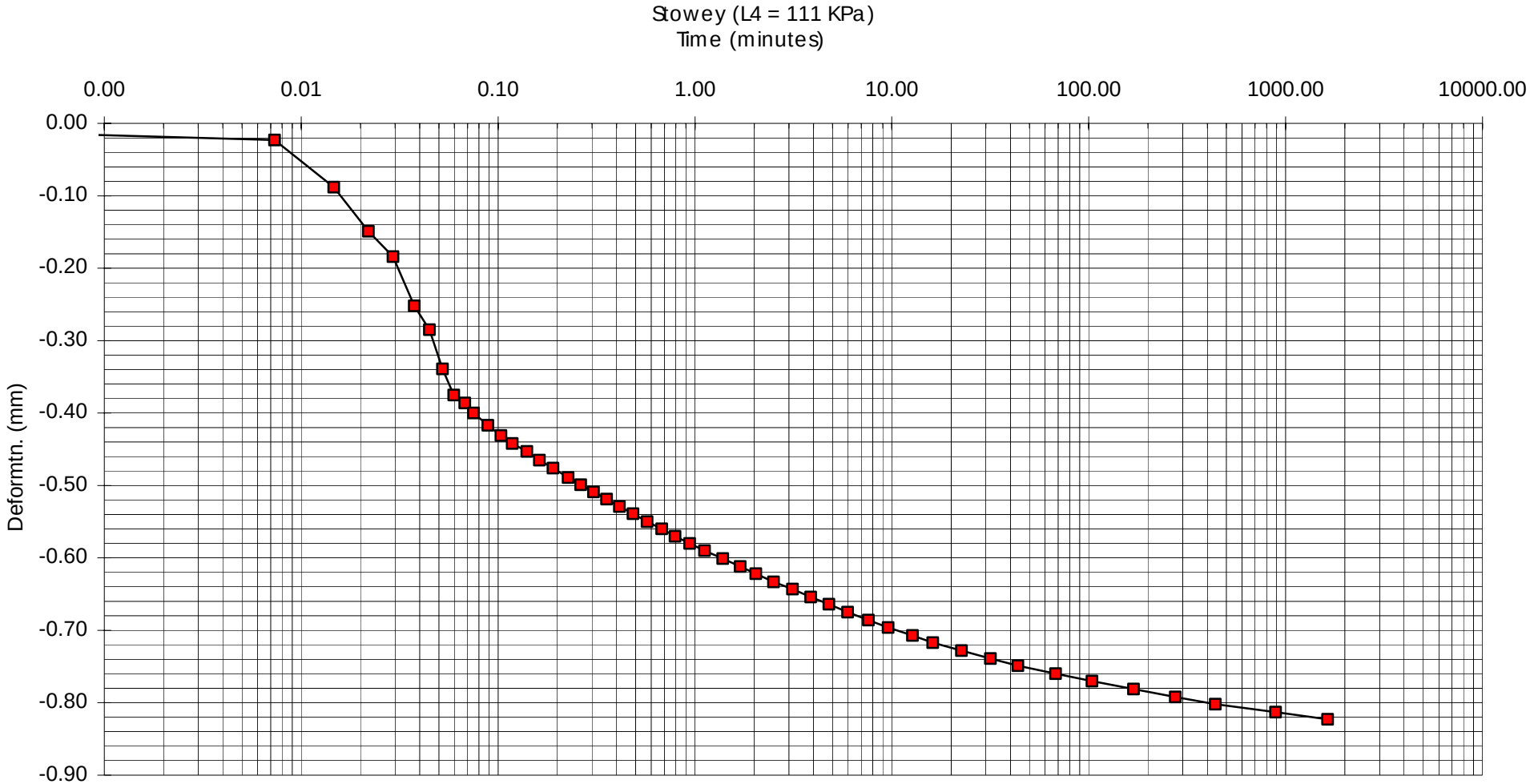

Stowey
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Cv
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Load (kPa)

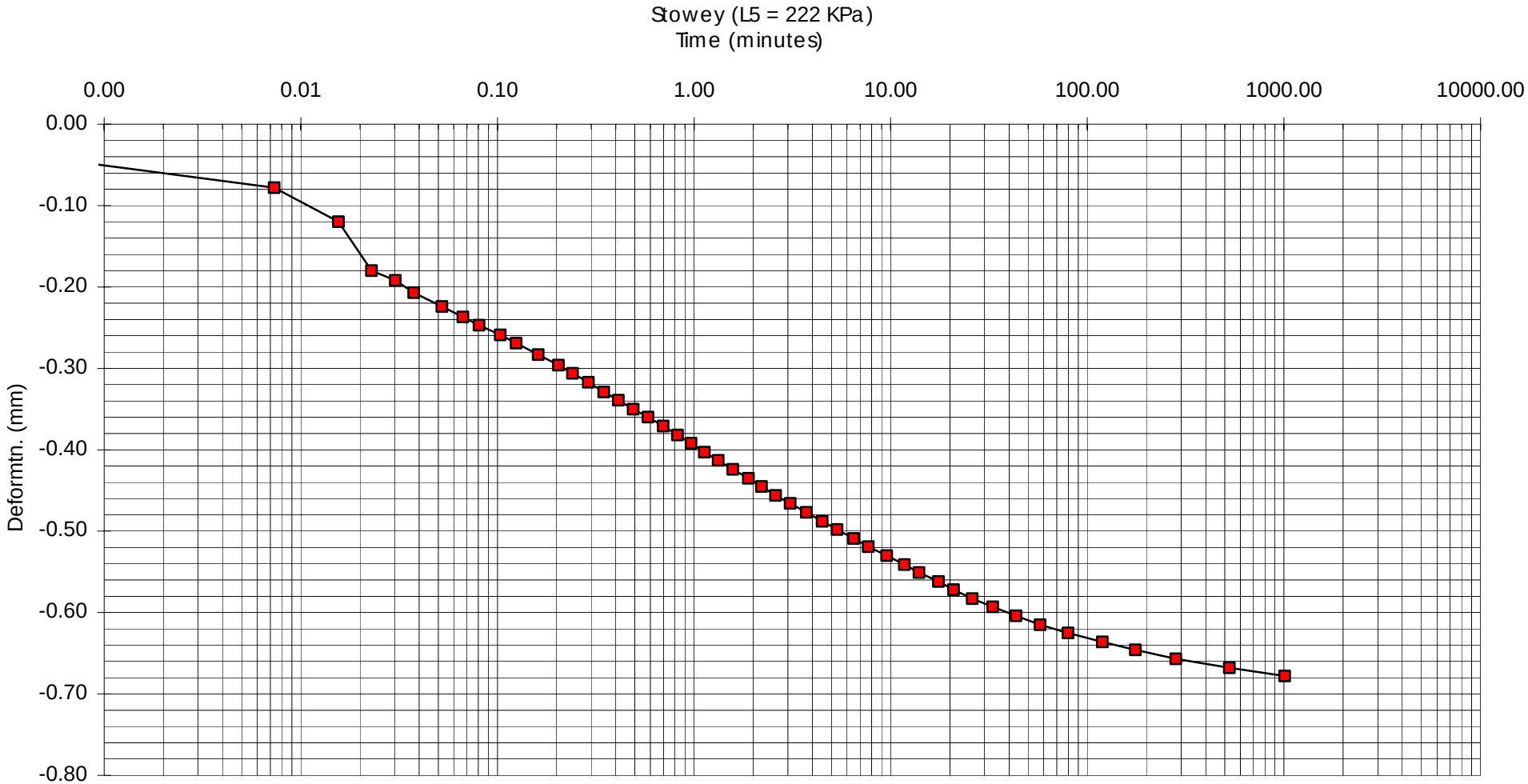

Stowey
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Mv
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Load (kPa)

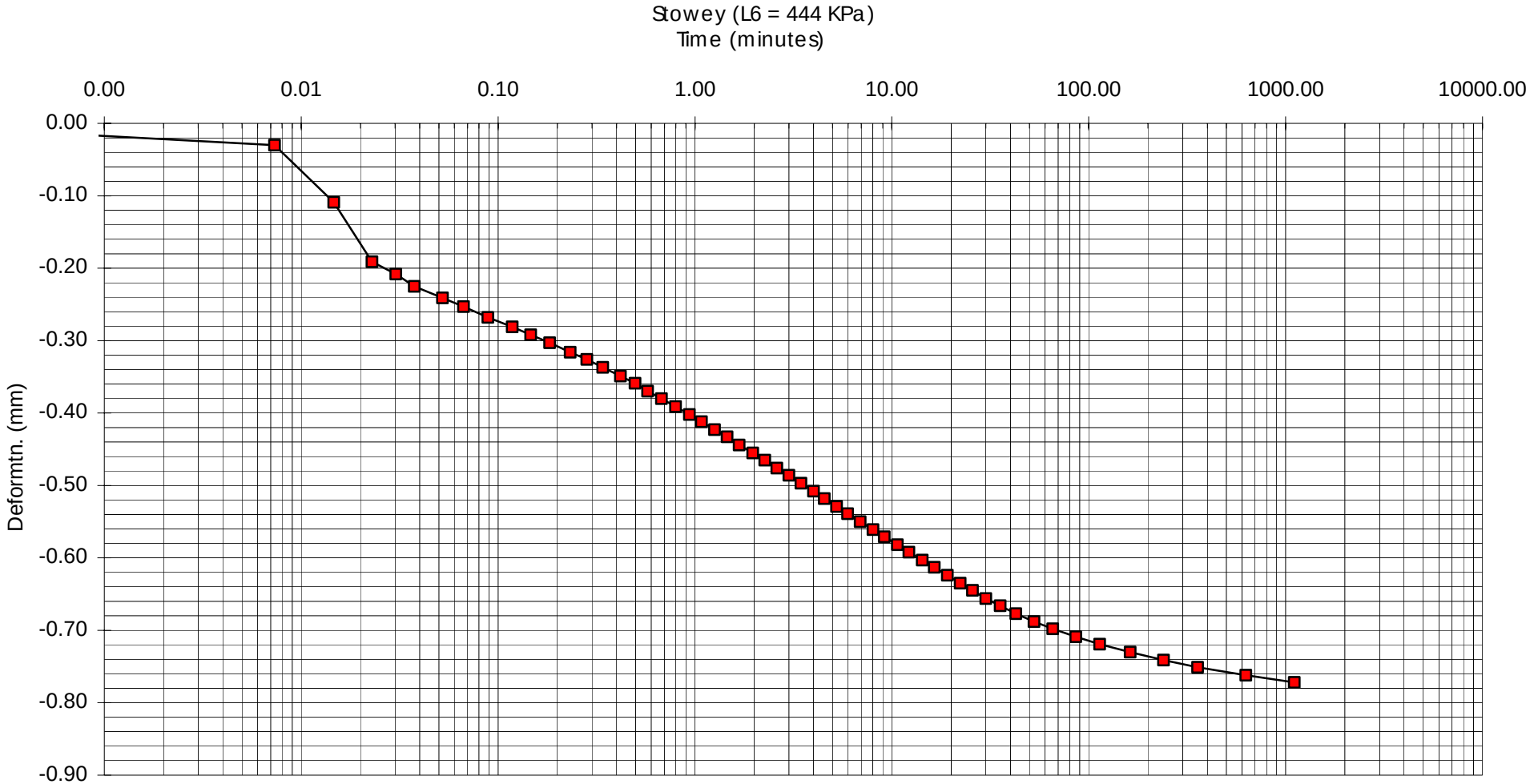

Stowey (L1 = 11.1 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
Deformtn. (mm)

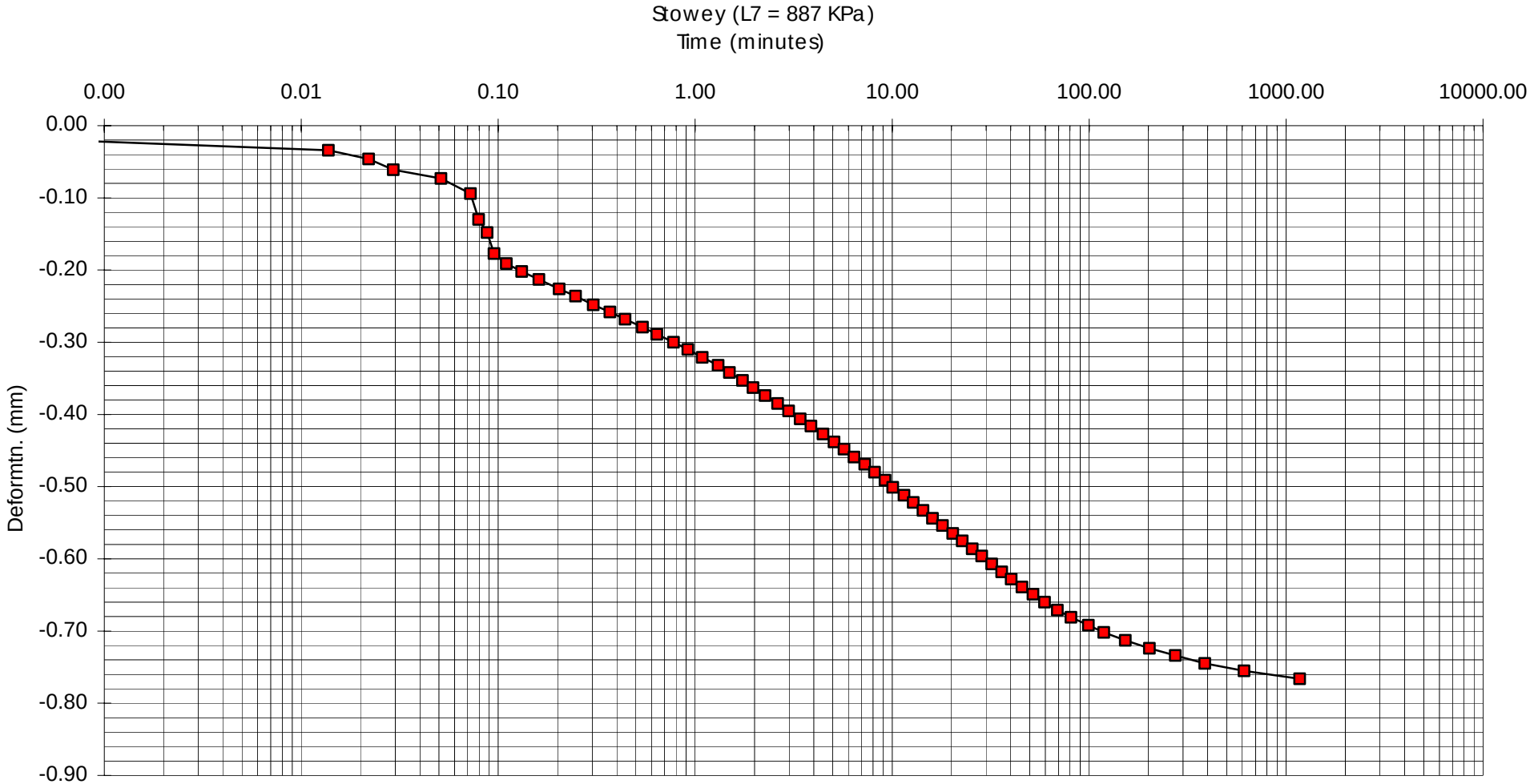

Stowey (L2 = 22.2 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
Deformtn. (mm)

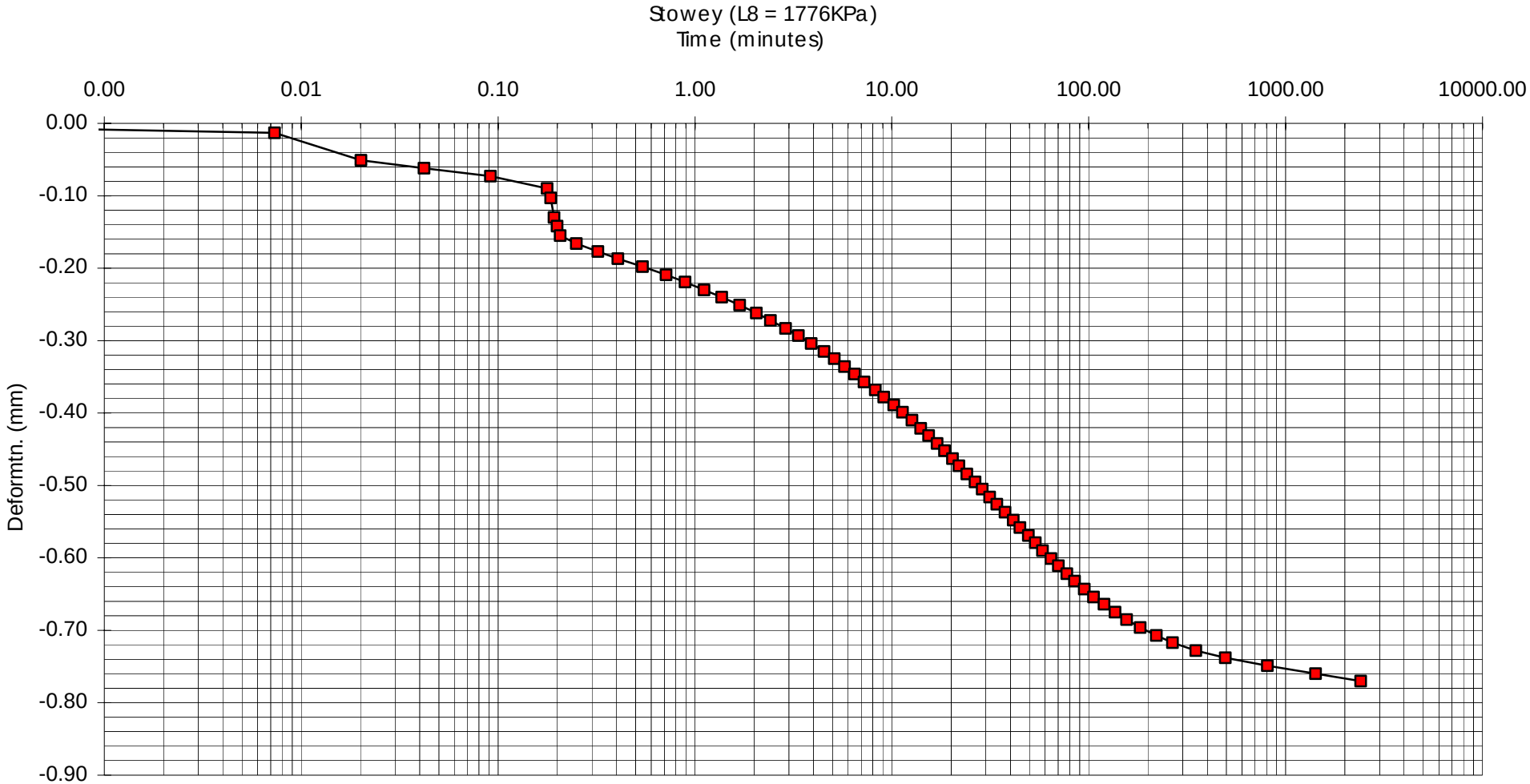

Stowey (L3 = 44.5 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
Deformtn. (mm)
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45
-0.50


Stowey (L4 = 111 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
Deformtn. (mm)
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90


Stowey (L5 = 222 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
Deformtn. (mm)


Stowey (L6 = 444 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
Deformtn. (mm)
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90


Stowey (L7 = 887 KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90
Deformtn. (mm)


Stowey (L8 = 1776KPa)
Time (minutes)
0.00
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
Deformtn. (mm)
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90