APPENDIX D

In Situ Test Results

APPENDIX D.1

Pressuremeter Test Results

TABLE D-1
Summary of Pressuremeter Tests

Boring Number	Test Number	Date Performed	Test Depth (feet)	Recovery Percent	RQD	Rock Description
R-09-Z3B2	SR710-01	1/16/2009	200.9	17	0	Wilson Quartz Diorite (Wqm)/ Granitic-type and Gneissic Rock
R-09-Z3B2	SR710-02	1/16/2009	199.4	17	0	Wilson Quartz Diorite (Wqm)/ Granitic-type and Gneissic Rock
R-09-Z3B11	SR710-03	1/17/2009	192.8	100	95	Topanga Formation (Ttsl)/ Siltstone and Mudstone
R-09-Z3B11	SR710-04	1/17/2009	191.3	100	95	Topanga Formation(Ttsl)/ Siltstone and Mudstone
R-09-Z3B2	SR710-05	1/17/2009	227	100	0	Wilson Quartz Diorite (Wqm)/ Granitic-type and Gneissic Rock
R-09-Z3B2	SR710-06	1/17/2009	225	75	0	Wilson Quartz Diorite (Wqm)/ Granitic-type and Gneissic Rock
R-09-Z3B11	SR710-07	1/18/2009	208.4	100	100	Topanga Formation (Ttsl)/ Siltstone and Mudstone
R-09-Z3B11	SR710-08	1/18/2009	206.9	100	100	Topanga Formation (Ttsl)/ Siltstone and Mudstone
R-09-Z3B2	SR710-09	1/18/2009	248	50	0	Wilson Quartz Diorite (Wqm)/ Granitic-type and Gneissic Rock
R-09-Z3B2	SR710-10	1/18/2009	246.5	92	0	Wilson Quartz Diorite (Wqm)/ Granitic-type and Gneissic Rock
R-09-Z2B1	SR710-11	1/19/2009	129	20	20	Topanga Formation (Ttsl)/ Interbedded Siltstone and Sandstone
R-09-Z2B1	SR710-12	1/19/2009	127.5	20	20	Topanga Formation (Ttsl)/ Interbedded Siltstone and Sandstone
R-09-Z2B1	SR710-13	1/20/2009	140	45	35	Topanga Formation (Ttsl)/ Interbedded Siltstone and Sandstone
R-09-Z2B1	SR710-14	1/20/2009	138.5	45	35	Topanga Formation(Ttsl)/ Interbedded Siltstone and Sandstone
R-09-Z1B7	SR710-15	1/20/2009	96.5	80	80	Puente Formation (Tpds)/ Sandy Siltstone
R-09-Z1B7	SR710-16	1/20/2009	95	80	80	Puente Formation (Tpds)/ Sandy Siltstone
R-09-Z1B7	SR710-17	1/21/2009	111.5	98	98	Puente Formation (Tpds)/ Sandy Siltstone
R-09-Z1B7	SR710-18	1/21/2009	110	98	98	Puente Formation (Tpds)/ Sandy Siltstone
R-09-Z1B7	SR710-19	1/21/2009	136	77	68	Puente Formation (Tpds)/ Sandy Siltstone
R-09-Z1B7	SR710-20	1/21/2009	134.5	77	68	Puente Formation (Tpds)/ Sandy Siltstone

TABLE D-1
Summary of Pressuremeter Tests

Boring Number	Test Number	Date Performed	Test Depth (feet)	Recovery Percent	RQD	Rock Description
R-09-Z1B3	SR710-21	1/28/2009	177.3	89	89	Puente Formation (Tpss)/ Sandstone
R-09-Z1B3	SR710-22	1/28/2009	204	83	79	Puente Formation (Tpss)/ Sandstone
R-09-Z2B2	SR710-23	1/29/2009	135.7	100	100	Fernando Formation (Tfss-cg)/ Sandstone
R-09-Z2B2	SR710-24	1/29/2009	134.2	100	100	Fernando Formation (Tfss-cg)/ Sandstone
R-09-Z2B2	SR710-25	2/4/2009	251	73	0	Fernando Formation (Tfss-cg)/ Sandstone
R-09-Z2B2	SR710-26	2/4/2009	249.5	73	0	Fernando Formation (Tfss-cg)/ Sandstone
R-09-Z1B6	SR710-27	2/4/2009	203	90	75	Puente Formation (Tpsl)/ Siltstone with interbedded Sandstone
R-09-Z1B6	SR710-28	2/5/2009	245	100	92	Puente Formation (Tpsl)/ Siltstone with interbedded Sandstone
R-09-Z3B7	ST710-29	2/6/2009	225.8	100	60	Topanga Formation (Ttss)/ Sandstone with Interbedded Siltstone
R-09-Z3B7	SR710-30	2/6/2009	224.3	100	60	Topanga Formation (Ttss)/ Sandstone with Interbedded Siltstone
R-09-Z1B6	SR710-31	2/6/2009	332	100	100	Puente Formation (Tpsl)/ Siltstone with interbedded Sandstone
R-09-Z1B6	SR710-32	2/6/2009	330.5	100	100	Puente Formation (Tpsl)/ Siltstone with interbedded Sandstone
R-09-Z3B7	SR710-33	2/10/2009	252.5	97	50	Topanga Formation (Ttss)/ Sandstone with Interbedded Siltstone
R-09-Z3B7	SR710-34	2/10/2009	251	100	40	Topanga Formation (Ttss)/ Sandstone with Interbedded Siltstone
R-09-Z3B7	SR710-35	2/10/2009	271.6	93	0	Topanga Formation (Ttss)/ Sandstone with Interbedded Siltstone
R-09-Z3B7	SR710-36	2/10/2009	270.1	93	0	Topanga Formation (Ttss)/ Sandstone with Interbedded Siltstone
R-09-Z1B5	SR710-37	2/19/2009	278	100	100	Puente Formation (Tpss)/ Sandstone
R-09-Z1B5	SR710-38	2/19/2009	276.5	100	100	Puente Formation (Tpss)/ Sandstone

TABLE D-1
Summary of Pressuremeter Tests

Boring Number	Test Number	Date Performed	Test Depth (feet)	Recovery Percent	RQD	Rock Description
R-09-Z1B4	SR710-39	2/19/2009	332**	-	-	Puente Formation (Tpss)/ Sandstone and Siltstone
R-09-Z1B4	SR710-40	2/19/2009	330.5**	-	-	Puente Formation (Tpss)/ Sandstone and Siltstone
R-09-Z1B5	SR710-41	2/20/2009	347	20	20	Puente Formation (Tpss)/ Sandstone
R-09-Z1B5	SR710-42	2/20/2009	345.5	20	20	Puente Formation (Tpss)/ Sandstone
R-09-Z3B6	SR710-43	2/20/2009	132	20	8	Topanga Formation(Ttcg)/ Conglomerate
R-09-Z1B5	SR710-44	2/23/2009	398	100	90	Puente Formation (Tpss)/ Sandstone and Siltstone
R-09-Z1B5	SR710-45	2/23/2009	396.5	100	90	Puente Formation (Tpss)/ Sandstone and Siltstone
R-09-Z3B6	SR710-46	2/23/2009	168	44	0	Topanga Formation(Ttcg)/ Conglomerate
R-09-Z3B6	SR710-47	2/23/2009	166.5	44	0	Topanga Formation(Ttcg)/ Conglomerate
R-09-Z3B6	SR710-48	2/24/2009	188.2	98	30	Topanga Formation(Ttcg)/ Conglomerate

**Pressuremeter test conducted below target total depth of 325 feet.

Final Report of
In Situ Pressuremeter Geotechnical Testing

Conducted for:

SR-710 Tunnel Technical Study
Los Angeles County, California

Submitted to:

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In Situ Engineering Project Number 812
CH2M Hill Project Number 378312.04.13

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FIGURES

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APPENDICES

1.0 INTRODUCTION

This report presents the results of a pressuremeter study, conducted from the 16th of January to 24th of February, 2009, in eleven boreholes within the SR-710 Tunnel Technical Study zones. The pressuremeter testing (PMT) was conducted by In Situ Engineering, Snohomish, WA under contract to CH2M Hill, Santa Ana, California. The drilling and deployment of the pressuremeter was accomplished by two groups; CalTrans, Sacramento, CA, using a CME 85 rig and Cascade Drilling, La Habra, CA using an Ingersoll Rand A-400 and a Failing Speedstar 30K drill rig. In total, 48 pressuremeter tests were attempted, of which 46 produced PMT data. The borehole name, test depths and preliminary material descriptions are presented in Table 1.

2.0 PURPOSE

The purpose of this study was to evaluate the *in-situ* modulus of the geologic formations as part of the SR-710 Tunnel Technical Study.

3.0 PRESSUREMETER

The pressuremeter used for this study was a pre-bored monocell pressuremeter. Three electronic displacement sensors, spaced 120 degrees apart are located at the center of the pressuremeter. The flexible membrane is placed over the sensors, and clamped at each end. The membrane is covered by a protective sheet of stainless steel strips. The unit is pressurized using compressed nitrogen to deform the adjacent material. The electronic signals from displacement sensors and the pressure sensor are transmitted by cable to the surface. During the test, the average expansion versus pressure is displayed on a computer screen. The pressuremeter is expanded by regulating the flow of compressed nitrogen to the PMT unit.

Fig.1 presents the essential details of the pressuremeter.

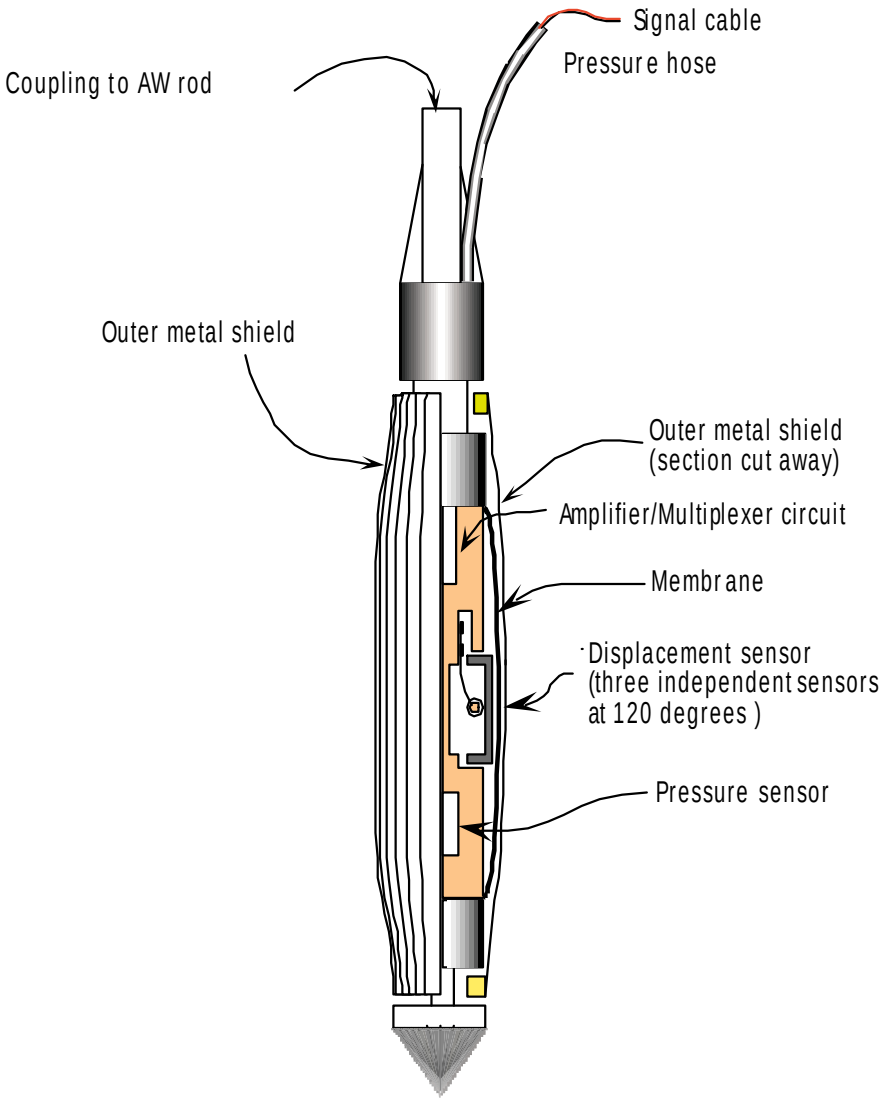

Fig. 1. Schematic details of the pressuremeter

4.0 HOLE FORMATION

The Cascade Drilling group used a PQ wireline system to advance the borehole. This allowed the hole to be continuously cased. A 5 to 6 foot test pocket for the pressuremeter was drilled using a 2 $^{15}/_{16}$ tricone bit, or NQ core barrel which was able to fit through the PQ core bit. The Caltrans system used an HQ wireline system to advance the main hole. This string had to be withdrawn from the hole and the bit changed to a casing bit to allow a 2 $^{15}/_{16}$ tricone bit, or a NQ core barrel to be used to drill the test pocket for the pressuremeter.

In general the aim is to attempt two pressuremeter tests in the one test pocket. The tests are preformed 18 inches apart. In this manner it is possible to assess the quality of the tests.

The details of the test depth and the initial sample description are given in Table 1. The RQD, percent recovery and rock description provided by CH2M Hill. It should be noted that the preliminary boring numbers shown on the plots in the appendices are different than the final boring numbers shown in the Tables of this report. The final numbers have had a prefix (R-09) added to the number and a dash removed from the final sequence. For instance the final boring number R-09-Z3B2 in Table 1 below is the same as boring number Z3-B2 in the Appendices.

Table 1 Pressuremeter Test depth and Material Description: Tests 1-48

Boring Number	Test Number	Date Performed	Test Depth (feet)	Recovery Percent	RQD	Rock Description
R-09-Z3B2	SR710-01	1/16/2009	200.9	17	0	Wilson Quartz Diorite (Wqm)/ Granitic and Gneissic Rock
R-09-Z3B2	SR710-02	1/16/2009	199.4	17	0	Wilson Quartz Diorite (Wqm)/ Granitic and Gneissic Rock
R-09-Z3B11	SR710-03	1/17/2009	192.8	100	95	Topanga Formation (Ttsl)/ Siltstone and Mudstone
R-09-Z3B11	SR710-04	1/17/2009	191.3	100	95	Topanga Formation(Ttsl)/ Siltstone and Mudstone
R-09-Z3B2	SR710-05	1/17/2009	227	100	0	Wilson Quartz Diorite (Wqm)/ Granitic and Gneissic Rock
R-09-Z3B2	SR710-06	1/17/2009	225	75	0	Wilson Quartz Diorite (Wqm)/ Granitic and Gneissic Rock
R-09-Z3B11	SR710-07	1/18/2009	208.4	100	100	Topanga Formation (Ttsl)/ Siltstone and Mudstone
R-09-Z3B11	SR710-08	1/18/2009	206.9	100	100	Topanga Formation (Ttsl)/ Siltstone and Mudstone
R-09-Z3B2	SR710-09	1/18/2009	248	50	0	Wilson Quartz Diorite (Wqm)/ Granitic and Gneissic Rock

Boring Number	Test Number	Date Performed	Test Depth (feet)	Recovery Percent	RQD	Rock Description
R-09-Z3B2	SR710-10	1/18/2009	246.5	92	0	Wilson Quartz Diorite (Wqm)/ Granitic and Gneissic Rock
R-09-Z2B1	SR710-11	1/19/2009	129	20	20	Topanga Formation (Ttsl)/ Interbedded Siltstone and Sandstone
R-09-Z2B1	SR710-12	1/19/2009	127.5	20	20	Topanga Formation (Ttsl)/ Interbedded Siltstone and Sandstone
R-09-Z2B1	SR710-13	1/20/2009	140	45	35	Topanga Formation (Ttsl)/ Interbedded Siltstone and Sandstone
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R-09-Z1B7	SR710-15	1/20/2009	96.5	80	80	Puente Formation (Tpds)/ Sandy Siltstone
R-09-Z1B7	SR710-16	1/20/2009	95	80	80	Puente Formation (Tpds)/ Sandy Siltstone
R-09-Z1B7	SR710-17	1/21/2009	111.5	98	98	Puente Formation (Tpds)/ Sandy Siltstone
R-09-Z1B7	SR710-18	1/21/2009	110	98	98	Puente Formation (Tpds)/ Sandy Siltstone
R-09-Z1B7	SR710-19	1/21/2009	136	77	68	Puente Formation (Tpds)/ Sandy Siltstone
R-09-Z1B7	SR710-20	1/21/2009	134.5	77	68	Puente Formation (Tpds)/ Sandy Siltstone
R-09-Z1B3	SR710-21	1/28/2009	177.3	89	89	Puente Formation (Tpss)/ Sandstone
R-09-Z1B3	SR710-22	1/28/2009	204	83	79	Puente Formation (Tpss)/ Sandstone
R-09-Z2B2	SR710-23	1/29/2009	135.7	100	100	Fernando Formation (Tfss-cg)/ Sandstone
R-09-Z2B2	SR710-24	1/29/2009	134.2	100	100	Fernando Formation (Tfss-cg)/ Sandstone
R-09-Z2B2	SR710-25	2/4/2009	251	73	0	Fernando Formation (Tfss-cg)/ Sandstone
R-09-Z2B2	SR710-26	2/4/2009	249.5	73	0	Fernando Formation (Tfss-cg)/ Sandstone
R-09-Z1B6	SR710-27	2/4/2009	203	90	75	Puente Formation (Tpsl)/ Siltstone with interbedded Sandstone
R-09-Z1B6	SR710-28	2/5/2009	245	100	92	Puente Formation (Tpsl)/ Siltstone with interbedded Sandstone
R-09-Z3B7	ST710-29	2/6/2009	225.8	100	60	Topanga Formation (Ttss)/ Sandstone with Interbedded Siltstone

Boring Number	Test Number	Date Performed	Test Depth (feet)	Recovery Percent	RQD	Rock Description
R-09-Z3B7	SR710-30	2/6/2009	224.3	100	60	Topanga Formation (Ttss)/ Sandstone with Interbedded Siltstone
R-09-Z1B6	SR710-31	2/6/2009	332	100	100	Puente Formation (Tpsl)/ Siltstone with interbedded Sandstone
R-09-Z1B6	SR710-32	2/6/2009	330.5	100	100	Puente Formation (Tpsl)/ Siltstone with interbedded Sandstone
R-09-Z3B7	SR710-33	2/10/2009	252.5	97	50	Topanga Formation (Ttss)/ Sandstone with Interbedded Siltstone
R-09-Z3B7	SR710-34	2/10/2009	251	100	40	Topanga Formation (Ttss)/ Sandstone with Interbedded Siltstone
R-09-Z3B7	SR710-35	2/10/2009	271.6	93	0	Topanga Formation (Ttss)/ Sandstone with Interbedded Siltstone
R-09-Z3B7	SR710-36	2/10/2009	270.1	93	0	Topanga Formation (Ttss)/ Sandstone with Interbedded Siltstone
R-09-Z1B5	SR710-37	2/19/2009	278	100	100	Puente Formation (Tpss)/ Sandstone
R-09-Z1B5	SR710-38	2/19/2009	276.5	100	100	Puente Formation (Tpss)/ Sandstone
R-09-Z1B4	SR710-39	2/19/2009	332**	100	50	Puente Formation (Tpss)/ Sandstone and Siltstone
R-09-Z1B4	SR710-40	2/19/2009	330.5**	100	50	Puente Formation (Tpss)/ Sandstone and Siltstone
R-09-Z1B5	SR710-41	2/20/2009	347	20	20	Puente Formation (Tpss)/ Sandstone
R-09-Z1B5	SR710-42	2/20/2009	345.5	20	20	Puente Formation (Tpss)/ Sandstone
R-09-Z3B6	SR710-43	2/20/2009	132	20	8	Topanga Formation(Ttcg)/ Conglomerate
R-09-Z1B5	SR710-44	2/23/2009	398	100	90	Puente Formation (Tpss)/ Sandstone and Siltstone
R-09-Z1B5	SR710-45	2/23/2009	396.5	100	90	Puente Formation (Tpss)/ Sandstone and Siltstone
R-09-Z3B6	SR710-46	2/23/2009	168	44	0	Topanga Formation(Ttcg)/ Conglomerate
R-09-Z3B6	SR710-47	2/23/2009	166.5	44	0	Topanga Formation(Ttcg)/ Conglomerate
R-09-Z3B6	SR710-48	2/24/2009	188.2	98	30	Topanga Formation(Ttcg)/ Conglomerate

5.0 TEST PROCEDURE

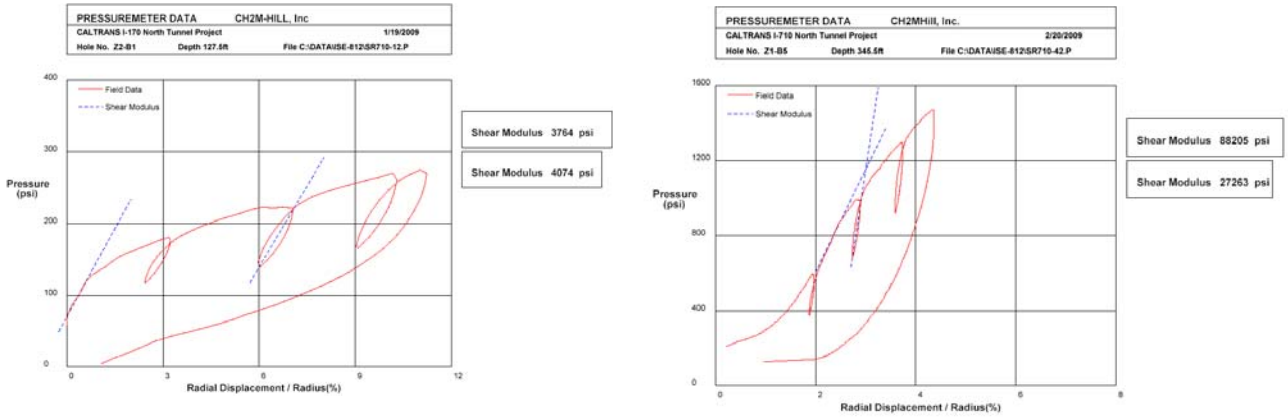
The membrane was expanded by controlling the flow of compressed nitrogen into the pressuremeter, increasing the pressure in small steps until the membrane starts to expand against the borehole wall. Once the average strain of the borehole wall was greater than about 1.5% the pressure is reduced to no more than 40% of the maximum past pressure, then increased again.

The resulting unload-reload loop can be used to evaluate the elastic behavior of the material. In materials which behave in a linear manner, the loops will exhibit little hysteretic behavior. That is, the linear unloading path will follow the reloading path. The loops will be very tight.

The pressure is then advanced in steps until the strain is increased a further 3% before completing a second unload-reload cycle. In many tests the procedure is repeated until a third unload-reload loop is completed. If the disturbance is small, the slope of the loops will tend to be parallel. Figure 2, Test SR710-12, is a typical example.

After the strain exceeds 12%, the pressure is reduced to zero. Adjustments are made for the location of the unload-reload loops as well as the ending strain and pressure for each test based on the expertise of the field operator.

In strong materials such as that shown as SR710-42 (on the right in Fig. 2) the pressure is increased in pressure increments of about 300 to 400 psi.



Test SR710-12 SR710-42

Fig. 2. Test SR710-12 and Tests SR710-42

(Test SR710-12 in R-09-Z2B1 at 127.5 ft and Test SR710-42 in R-09-Z1B5 at 345.5 ft)

6.0 QUALITY OF THE DATA

In general, the pressuremeter testing should reflect the material being tested. If the materials being tested are relatively uniform then adjacent tests should be similar in form. If adjacent tests are distinctly different, then either the material has changed, or some disturbance within the borehole has been encountered while performing the test.

Hence in a qualitative manner the results can be assessed as to whether the data reflects the *in-situ* material properties. In Figure 3 are two adjacent tests at 345.5 and 347 ft in Hole Z1-B5, in the same test pocket.

The maximum pressure reached in both tests is similar; in the order of 1,400 psi after a strain of about 3%. The shape of the final unloading curve, which is less influenced by the initial disturbance, is also similar in the two tests. Both these pieces of data would suggest the material at both locations is similar.

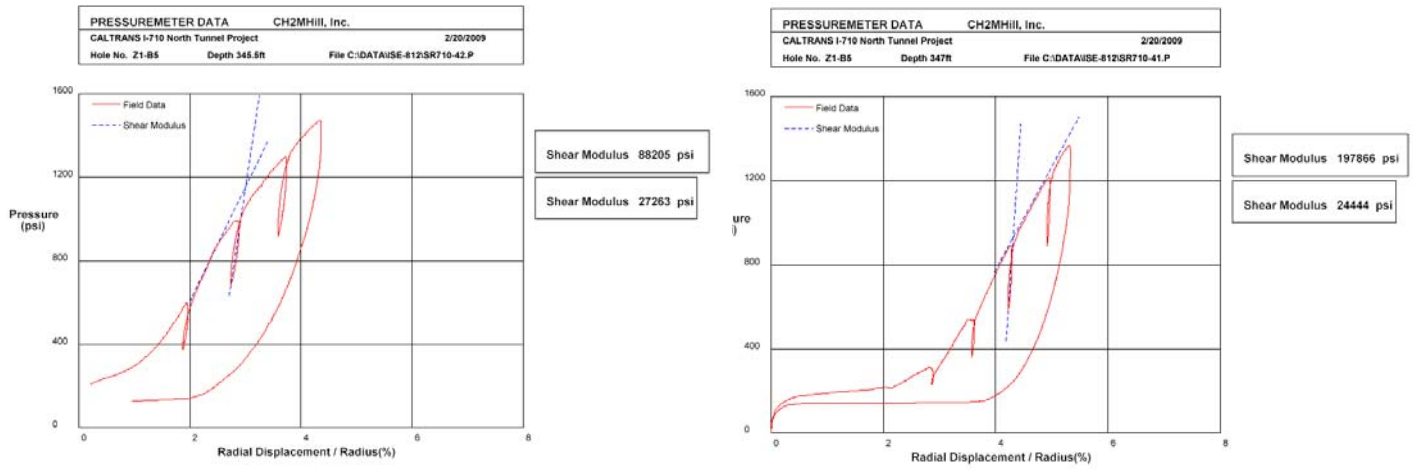


Fig. 3. Adjacent pressuremeter tests in same pilot hole

(SR710-42 at 345.5 ft and SR710-41 at 347 ft)

7.0 RANGE OF DATA

A variety of material types have been tested in this study. Typical tests examples of the strong and the weak materials are shown in Figure 4. For comparative purposes these tests have all been plotted to the same scale. The shear modulus, as represented by the slopes of the unload-reload loops (Section 9), is 90,000 psi, and 5,000 psi respectively. In terms of stiffness, these materials tested range over 18 to 1. The maximum range in this study ranges from 600,000 psi for Test 6 to 3,000 for Test 11; that is a 200 to 1 range.

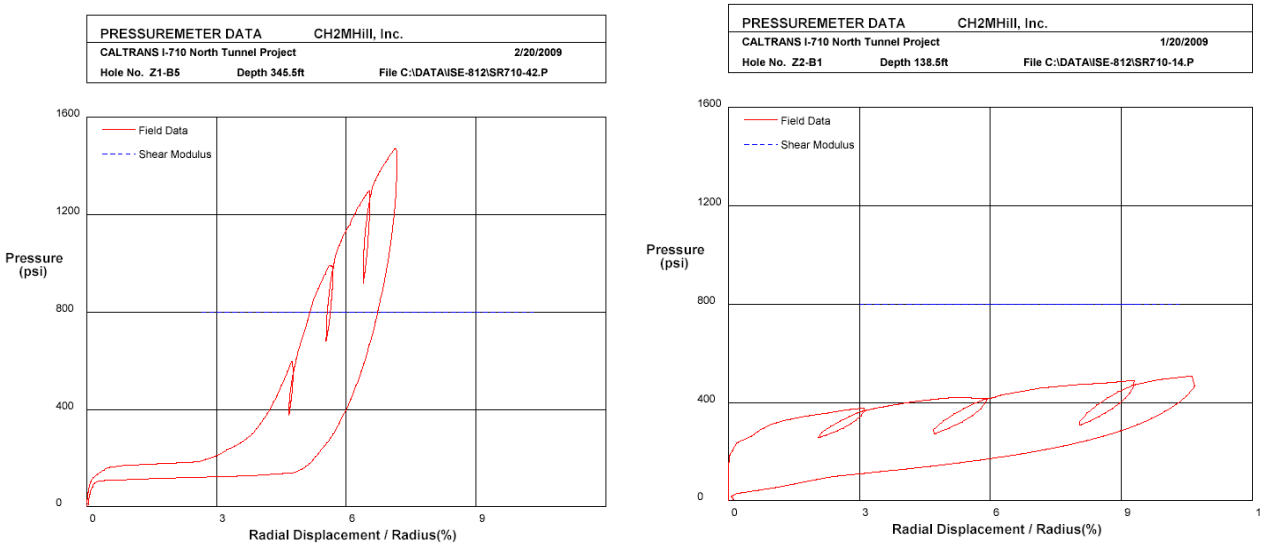


Fig. 4. Test in Sandstone (SR710-42) and Fractured Diorite (SR710-14)

8.0 STANDARD METHOD OF ANALYSIS OF THE SHEAR MODULUS

If the material surrounding the pressuremeter is assumed to extend to infinity, and assumed to behave as an idealized linear elastic, homogeneous material, which does not fail under shear or tension, then the displacement on the boundary of the pressuremeter, u_a, for a given pressure, P, is given by:

$$u_a = P(a)\,(1+\mu) / E \qquad 1)$$

where “E” is the Young’s Modulus, “a” the radius of the pressuremeter cavity, and “μ" the Poisson’s ratio. As the shear modulus, “G”, and the Young’s modulus, “E”, are related by the following relationship:

$$E=2(G)(1+\mu) \qquad 2)$$

Equation 1 reduces to:

$$u_a = 0.5P(a) / G \qquad 3)$$

Hence, the shear modulus G is given by:

$$G = 0.5 * \Delta \text{ Pressure} / \Delta(\text{radial displacement/radius}) \qquad 4)$$

The modulus for the average slope of the initial part of the pressuremeter curve (A-B in Fig.5) expressed as a Young’s modulus (assuming a Poisson's ratio of 0.33) is the same as the “pressuremeter modulus” defined in the American Society for Testing and Materials (ASTM) D4719, Section 9.5. In many tests a straight section in this part of the curve is not defined well enough to enable the modulus to be determined. However, the modulus determined from the unload-reload loops, which is often higher than the initial loading modulus, is more accurately defined and is probably more representative of the *in-situ* modulus for the material. This data is summarized in Table 2.

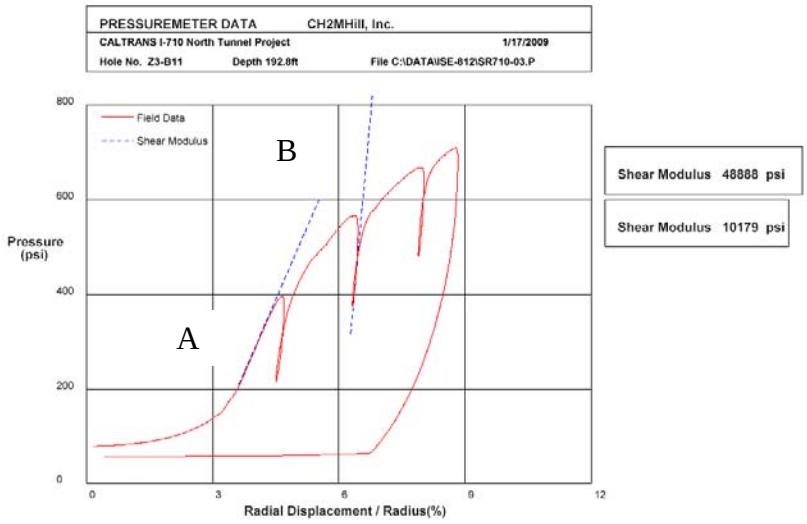


Fig. 5. Modulus determination for Test SR710-03

9.0 DETERMINATION OF THE LIMIT PRESSURE

From a visual inspection of the typical pressuremeter curve in the clay shown in Fig. 3, the pressure tends to a limit. For Test SR710-03 (Fig. 6) this limit pressure is in the range of 700 psi. To make this limit pressure a quantitative measurement, the limit pressure is defined as that pressure which occurs when the volume of the pressuremeter has doubled. However, few pressuremeter tests ever actually expand this far before reaching the limit of the strain sensing system. The pressuremeters used in this investigation will only expand to about 20% before the displacement limit is reached.

If the material being tested is assumed to behave as an elastic cohesive material, then the equation governing the pressure-displacement curve is given by:

$$P = P_L + (c)\log_e (u_a/_a) \qquad 5)$$

$$P_L = P_o + c + (c)\log_e [G/c] \qquad 6)$$

Where:

P_L" is the theoretical limit pressure at infinite expansion

"c" is the undrained cohesive strength,

"P_O" is the total *in-situ* lateral stress, and "G" is the shear modulus.

From Equation 5, a plot of pressure P against the log of u_a/a will be a straight line, provided the shear strength remains constant with strain. The slope of this line will provide a measure of the undrained shear strength, c. The Limit Pressure, as defined by the ASTM code D4719, Section 10.6, is the pressure at which the cavity has doubled in size. This doubling in size occurs when u_a/a is equal to 41%. (The origin of the strain used in the log/normal plots is the assumed origin at the *in-situ* stress state). If any disturbance is present, the above method of determining the cohesive strength usually provides an overly optimistic value. In Fig. 6, Test SR710-03 is plotted in the above manner. The above method applies to cohesive materials. However it can be used in granular materials to give an indication of the maximum or limit pressure that can be applied to the ground for the design of foundations. The shear strength determined by this method is not appropriate in granular materials.

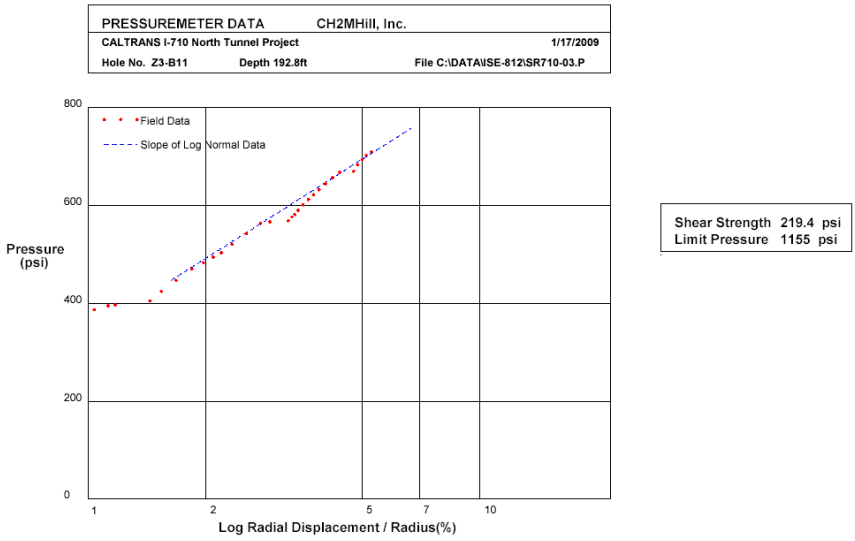


Fig. 6. Limit Pressure determination for Test SR710-03

Table 2 Limit Pressure shear modulus and Shear strength (log method): Tests 1-26

Test	Depth (ft)	Hole	Limit Pressure (psi)	Initial Shear modulus (psi)	Unload-reload Shear modulus (psi)	Shear strength (log method) (psi)
SR710-1	200.9	R-09-Z3B2	800	7,000	74,000	160
SR710-2	199.4	R-09-Z3B2	850	5,500	47,000	180
SR710-5	227	R-09-Z3B2	2,400	22,400	160,000	420
SR710-6	225	R-09-Z3B2	3,700	30,000	590,000	800
SR710-9	248	R-09-Z3B2	3,200	32,000	273,000	600
SR710-10	246.5	R-09-Z3B2	2,500	34,000	332,000	470
SR710-3	192.8	R-09-Z3B11	1,150	9,700	46,000	220
SR710-4	191.3	R-09-Z3B11	1,100	7,000	44,000	220
SR710-7	208.4	R-09-Z3B11	660	5,500	16,000	118
SR710-8	206.9	R-09-Z3B11	640	5,500	14,000	100
SR710-11	129	R-09-Z2B1	315	3,000	3,000	45
SR710-12	127.5	R-09-Z2B1	320	4,000	3,800	51
SR710-13	140	R-09-Z2B1	600	na	5,500	40
SR710-14	138.5	R-09-Z2B1	560	4,800	5,200	70
SR710-15	96.5	R-09-Z1B7	1,700	8,900	41,400	380
SR710-16	95	R-09-Z1B7	1,350	6,500	30,000	330
SR710-17	111.5	R-09-Z1B7	835	6,300	31,000	137
SR710-18	110	R-09-Z1B7	920	4,000	20,000	220
SR710-19	136	R-09-Z1B7	1,300	6,500	50,000	270
SR710-20	134.5	R-09-Z1B7	2,300	15,000	60,000	590
SR710-21	177.3	R-09-Z1B3	3,500	24,000	107,000	700
SR710-22	204	R-09-Z1B3	3,870	35,000	110,000	755
SR710-23	135.7	R-09-Z2B2	650	10,000	8,000	120
SR710-24	134.2	R-09-Z2B2	430	1,600	3,600	90
SR710-25	251	R-09-Z2B2	1,100	20,000	14,000	170
SR710-26	249.5	R-09-Z2B2	1,550	14,000	32,000	350

Table 2 cont. Limit Pressure shear modulus and Shear strength (log method): Tests 27-48

Test	Depth (ft)	Hole	Limit Pressure (psi)	Initial Shear modulus (psi)	Unload-reload Shear modulus (psi)	Shear strength (log method) (psi)
SR710-27	203	R-09-Z1B6	1,830	14,000	70,000	310
SR710-28	245	R-09-Z1B6	2,600	56,000	140,000	370
SR710-31	332	R-09-Z1B6	3,000	48,000	130,000	470
SR710-32	330.5	R-09-Z1B6	2,800	34,000	80,000	540
SR710-29	225.8	R-09-Z3B7	1,550	8,600	97,000	320
SR710-30	224.3	R-09-Z3B7	1,500	5,200	57,000	350
SR710-33	252.5	R-09-Z3B7	2,500	15,000	225,000	470
SR710-34	251	R-09-Z3B7	1,600	7,800	74,000	354
SR710-35	271.6	R-09-Z3B7	1,400	9,000	76,000	290
SR710-36	270.1	R-09-Z3B7	1,600	7,000	45,000	330
SR710-37	278	R-09-Z1B5	6,000	47,000	250,000	1,280
SR710-38	276.5	R-09-Z1B5		hole too large		
SR710-41	347	R-09-Z1B5	3,700	24,000	200,000	830
SR710-42	345.5	R-09-Z1B5	3,200	27,000	88,000	670
SR710-44	398	R-09-Z1B5	2,300	16,000	84,000	500
SR710-45	396.5	R-09-Z1B5		hole too large		
SR710-39	332	R-09-Z1B4	4,500	45,000	225,000	1,000
SR710-40	330.5	R-09-Z1B4	5,000	39,000	220,000	930
SR710-43	132	R-09-Z3B6	3,700	26,000	283,000	750
SR710-46	168	R-09-Z3B6	>2,000	69,000	450,000	>1,000
SR710-47	166.5	R-09-Z3B6	7,000	56,000	280,000	1,600
SR710-48	188.2	R-09-Z3B6	6,500	61,000	323,000	1,400

10.0 DETERMINATION OF THE STRENGTH PROPERTIES

The PMT data can sometimes be used directly to determine the *in-situ* material properties such as the cohesive strength and the friction angle. To do so, a material model and failure mechanism must be assumed. If it is assumed that the material behaves in an ideal manner, in that the material deforms at constant volume throughout the test, i.e. it does not consolidate or dilate, and the shear strength remains constant, the pressuremeter curve can be interpreted by simple analytical means. The slope of the plot of pressure against the log of the strain can be used to give a direct measure of the shear strength, as discussed in Section 8. Unfortunately, real materials do not quite behave in this manner, and the shear strength determined by this method may not be accurate, particularly in disturbed material, in materials which degrade or partial tests in an enlarged hole. The shear strength determined by plotting on a log scale is not appropriate in frictional materials. However, this method of analysis often forms a basis of rating all materials.

A more realistic method of determining the shear strength in clays is to compare the field PMT data with an ideal model pressuremeter curve based on an assumed set of material parameters. If, for instance, the material is assumed to be cohesive and fails at constant shear strength and at constant volume, then the material parameters required for this model are the shear strength, lateral stress, and shear modulus. Adjustments can be made to those three parameters until a mathematical curve can be fitted to the field data. (Fig. 7 is an example for test SR710-14) Judgment is required to adjust these three parameters to determine the best fit to the data, particularly if there is disturbance present.

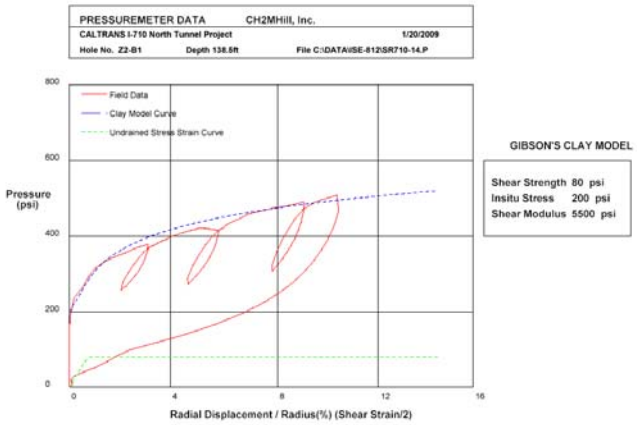


Fig. 7. Simple constant shear strength model analysis for test SR710-14

In the frictional materials, if it is assumed that it has a constant friction angle and no cohesion, then a simple model can be used to compare with the field data. Test SR710-03 which is probably a frictional material and not a cohesive material is analyzed in this manner in Fig. 8.

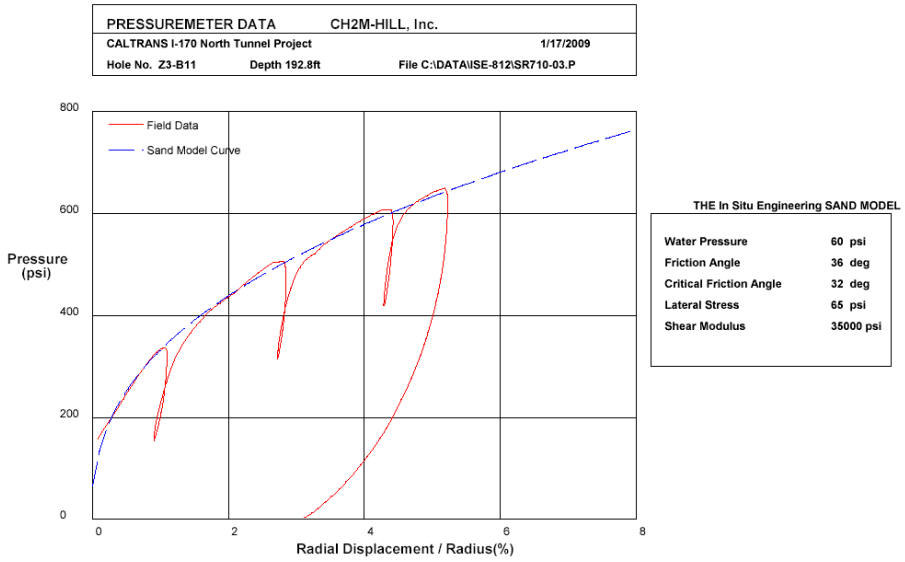


Fig. 8. Frictional Model for Test SR710-03

In rock, if it is assumed to be a cohesive material, then a possible model can be developed which uses the initial modulus, as illustrated in Fig 9a. This gives a shear strength of 420 psi. The strength determined in this manner is above that derived by the log method, which give a strength of 380 psi. In dense clays a better modulus to use is the modulus derived from the unload-reload curve. The ideal pressuremeter curve derived for this model is a poor fit to the field data (Fig 9b). However, the strength is lower; it has a minimum value of 240 psi. Hence to gain some understanding of the shear strength, the tests have been analyzed with three methods; the log method and two model methods using the initial shear modulus and the unload-reload shear modulus. Shear Strength values and friction angles are presented in Table 3.

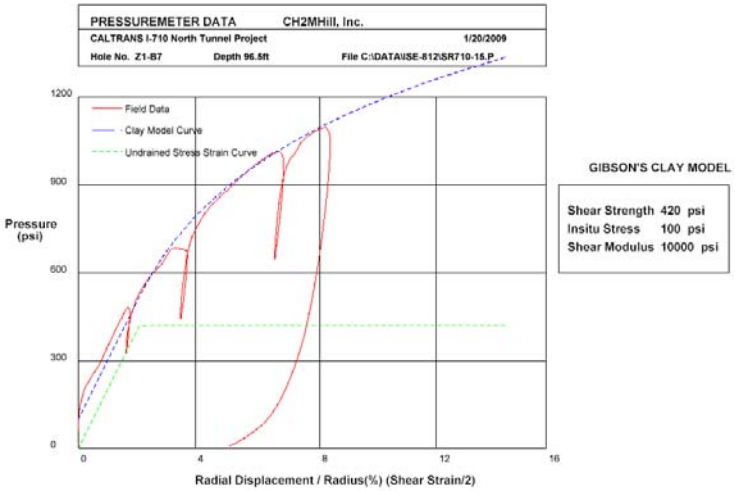


Fig 9a Initial shear modulus

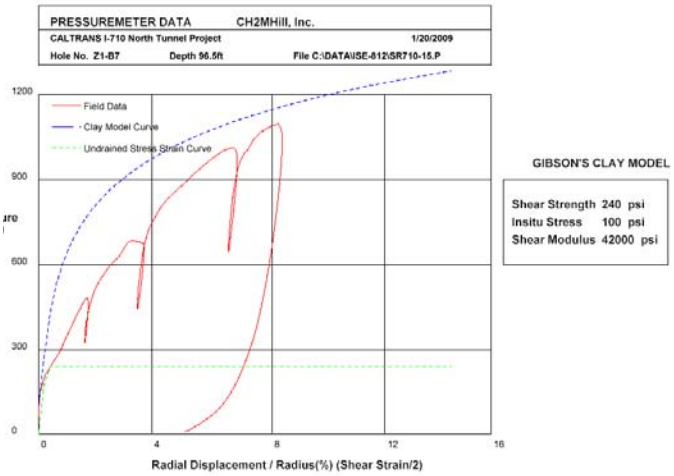


Fig 9b Unload-reload shear modulus

Fig. 9. Cohesive Models for Test SR710-15

Table 3 Material properties from Model Analysis: Tests 1-26

Test	Depth (ft)	Hole	Shear strength (model initial modulus) (psi) (Maximum)	Shear strength (model unloading modulus) (psi) (Minimum)	Shear strength log method) (psi)	Friction (model)
SR710-1	200.9	R-09-Z3B2	120	50	160	
SR710-2	199.4	R-09-Z3B2	120	50	180	
SR710-5	227	R-09-Z3B2	550	220	420	
SR710-6	225	R-09-Z3B2	900	250	800	
SR710-9	248	R-09-Z3B2	700	250	600	
SR710-10	246.5	R-09-Z3B2	400	170	470	
SR710-3	192.8	R-09-Z3B11	230	140	220	36
SR710-4	191.3	R-09-Z3B11	230	130	220	
SR710-7	208.4	R-09-Z3B11	100	50	118	
SR710-8	206.9	R-09-Z3B11	100	50	100	
SR710-11	129	R-09-Z2B1	45	na	45	
SR710-12	127.5	R-09-Z2B1	50	na	51	
SR710-13	140	R-09-Z2B1	60	na	40	
SR710-14	138.5	R-09-Z2B1	80	na	70	
SR710-15	96.5	R-09-Z1B7	420	240	380	
SR710-16	95	R-09-Z1B7	400	200	330	40
SR710-17	111.5	R-09-Z1B7	190	90	137	
SR710-18	110	R-09-Z1B7	250	110	220	
SR710-19	136	R-09-Z1B7	280	150	270	
SR710-20	134.5	R-09-Z1B7	>600	na	590	
SR710-21	177.3	R-09-Z1B3	800	400	700	
SR710-22	204	R-09-Z1B3	850	450	755	
SR710-23	135.7	R-09-Z2B2	110	na	120	
SR710-24	134.2	R-09-Z2B2	80	na	90	
SR710-25	251	R-09-Z2B2	200	na	170	
SR710-26	249.5	R-09-Z2B2	350	250	350	

Table 3 cont. Material properties from Model Analysis: Tests 27-48

Test	Depth (ft)	Hole	Shear strength (model initial modulus) (psi) (Maximum)	Shear strength (model unloading modulus) (psi) (Minimum)	Shear strength log method) (psi)	Friction (model)
SR710-27	203	R-09-Z1B6	>600	na	310	
SR710-28	245	R-09-Z1B6	400	320	370	
SR710-31	332	R-09-Z1B6	600	300	470	
SR710-32	330.5	R-09-Z1B6	525	350	540	
SR710-29	225.8	R-09-Z3B7	450	170	320	
SR710-30	224.3	R-09-Z3B7	370	150	350	
SR710-33	252.5	R-09-Z3B7	700	250	470	
SR710-34	251	R-09-Z3B7	450	150	354	
SR710-35	271.6	R-09-Z3B7			290	35
SR710-36	270.1	R-09-Z3B7			330	
SR710-37	278	R-09-Z1B5	1,200	na	1,280	
SR710-38	276.5	R-09-Z1B5				
SR710-41	347	R-09-Z1B5	1,000	na	830	
SR710-42	345.5	R-09-Z1B5	700	na	670	42
SR710-44	398	R-09-Z1B5	650	250	500	
SR710-45	396.5	R-09-Z1B5				
SR710-39	332	R-09-Z1B4	800	na	1,000	39
SR710-40	330.5	R-09-Z1B4	1,100	na	930	
SR710-43	132	R-09-Z3B6	900	400	750	
SR710-46	168	R-09-Z3B6	1,000	350	>1,000	
SR710-47	166.5	R-09-Z3B6	750	350	1,600	
SR710-48	188.2	R-09-Z3B6	750	na	1,400	

11.0 CONCLUSIONS

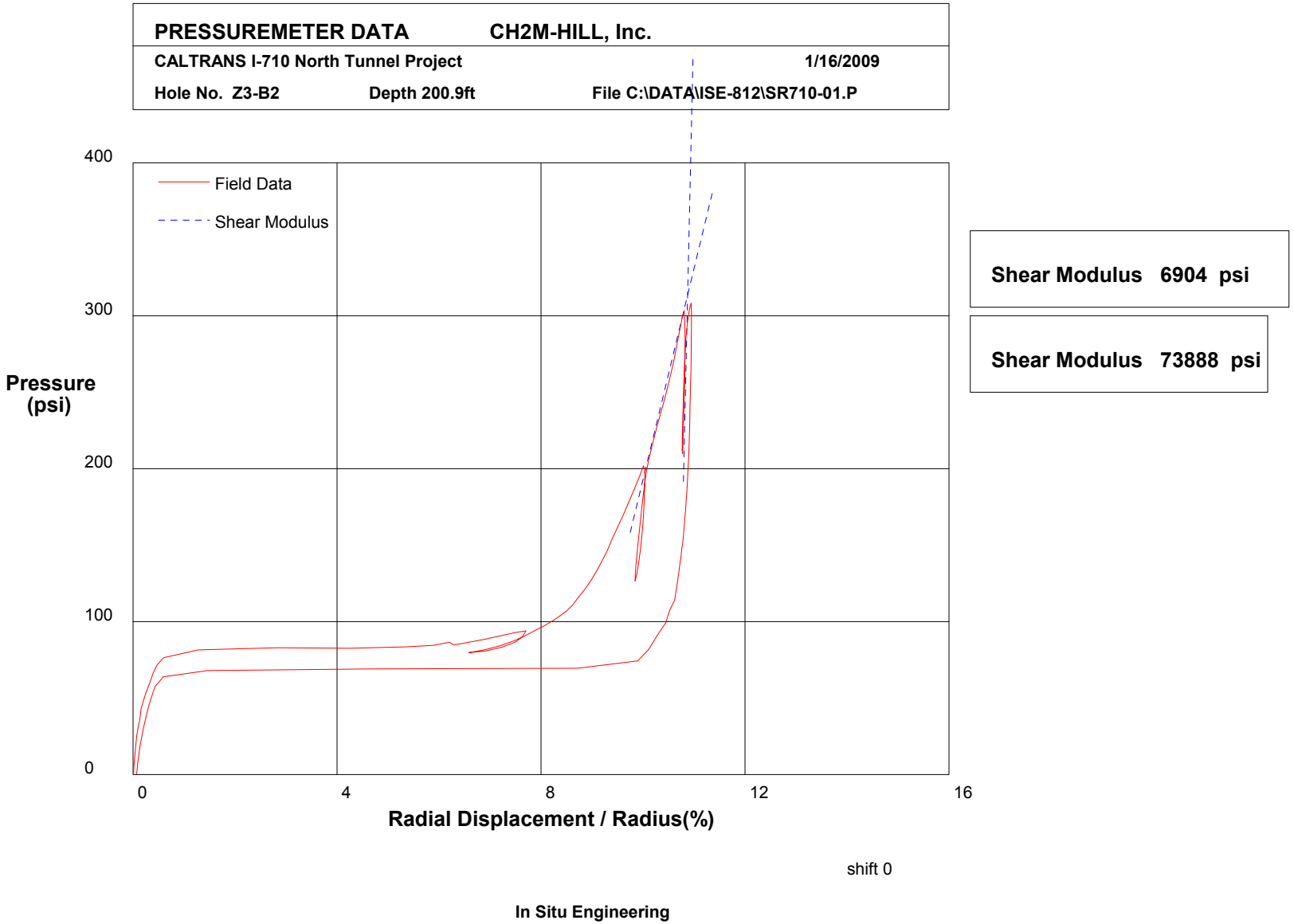
The objective of this study was to examine the rock properties over an extensive area of proposed routes for the North Tunnel for Interstate I-710. In this analysis the modulus has been considered for each test and some indication of the shear strength has been obtained based on a simple model. In materials that seem to be behaving in a frictional manner, a friction angle has been determined. Once the tunnel alignment has been selected, further analysis could be undertaken to obtain a more complete understanding of the material behavior for tests within range.

12.0 REFERENCES

Mair, R.J. and Wood, D.M. 1987. Pressuremeter testing: methods and interpretation. CIRIA Ground Engineering Report. Butterworths, London.

ASTM D4719. 2007. Standard tests method for pressuremeter testing in soils.

Appendix I - Pressuremeter Data and Standard Interpretation

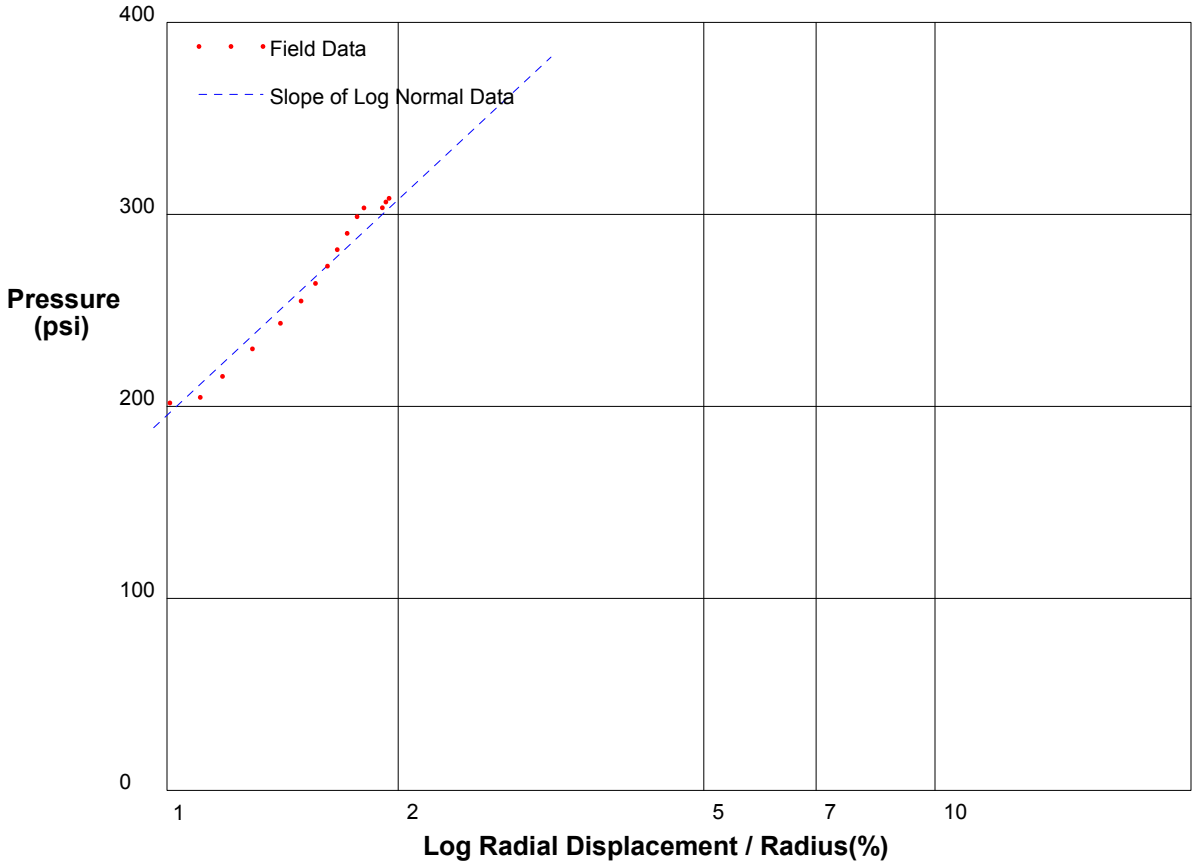


Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/16/2009**

Hole No. Z3-B2 **Depth 200.9ft** **File C:\DATA\ISE-812\SR710-01.P**



Shear Strength 162 psi
Limit Pressure 797 psi

shift 9

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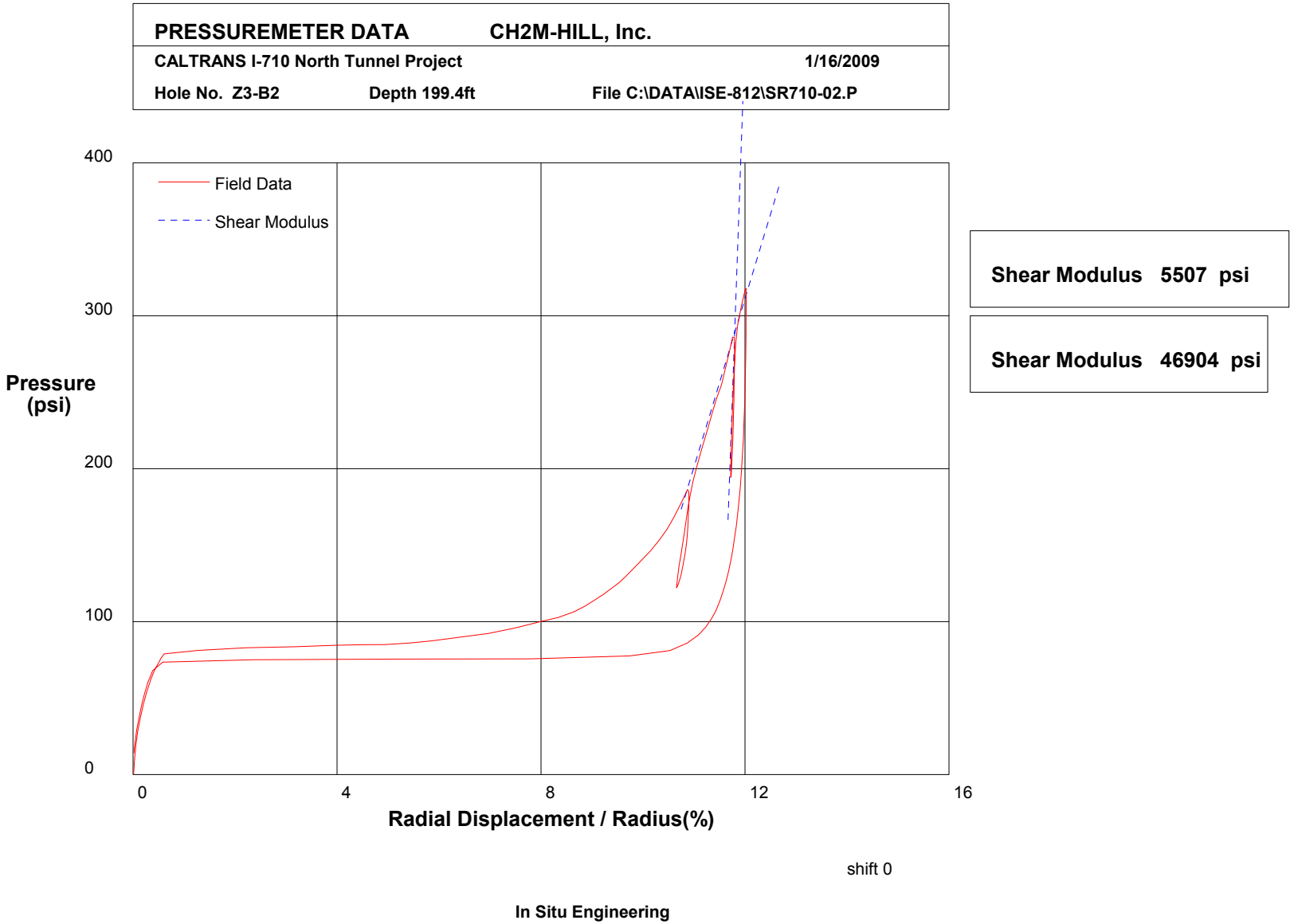
Appendix I - Pressuremeter Data and Standard Interpretation

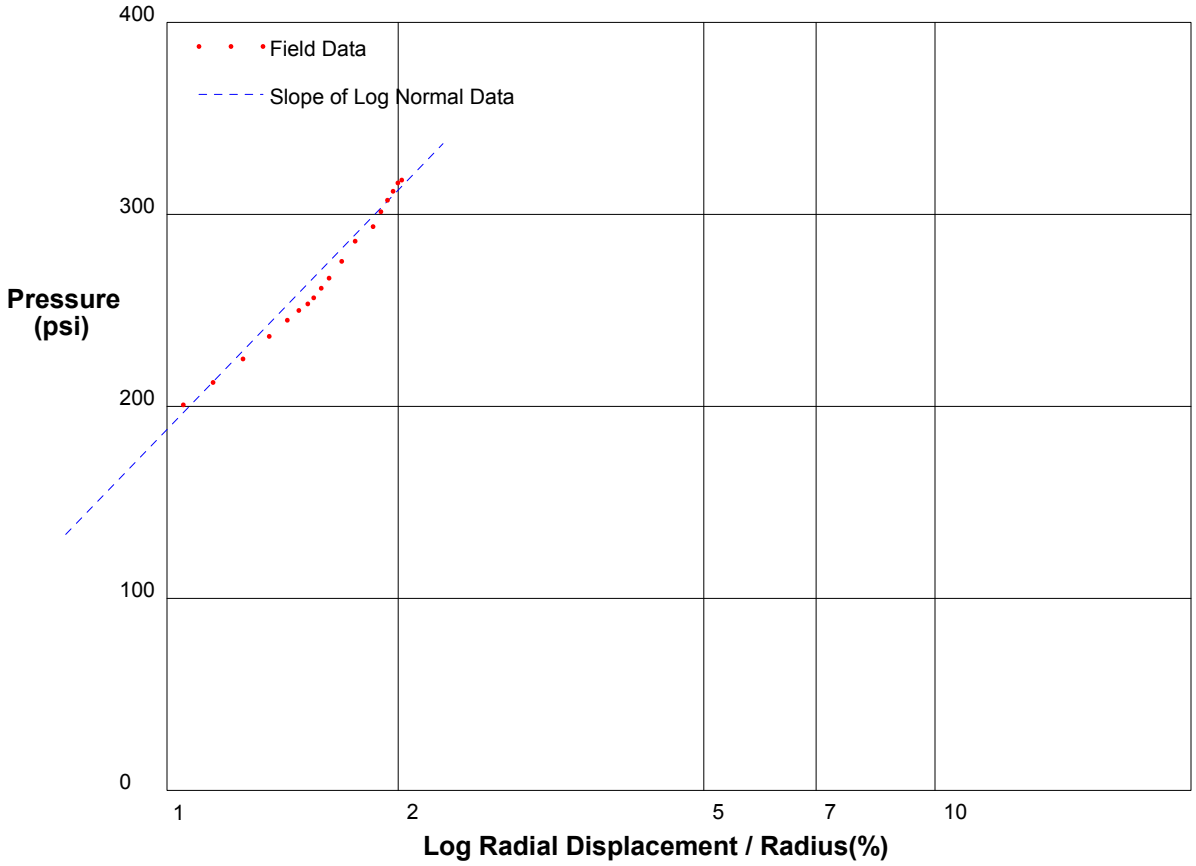


Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/16/2009**

Hole No. Z3-B2 **Depth 199.4ft** **File C:\DATA\ISE-812\SR710-02.P**



Shear Strength 179.8 psi
Limit Pressure 855 psi

shift 10

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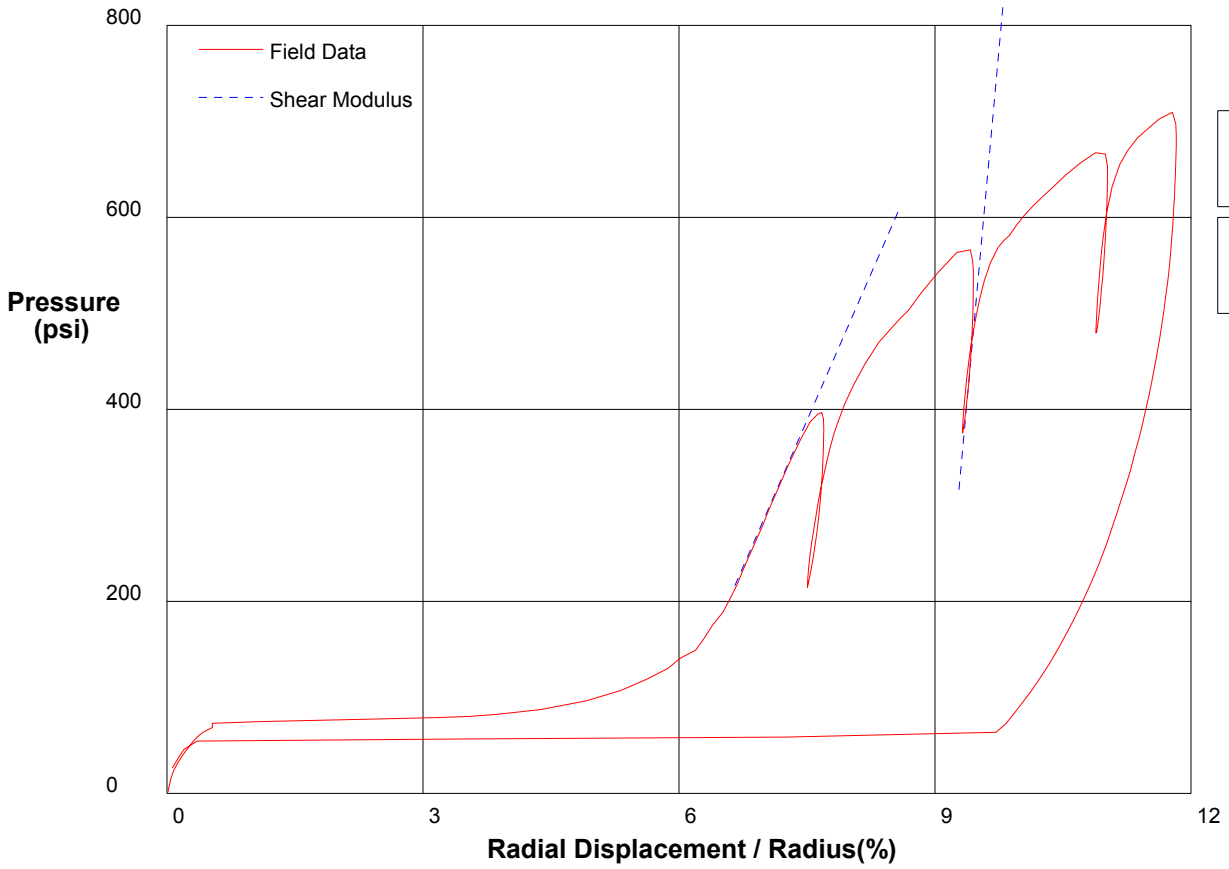
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-170 North Tunnel Project **1/17/2009**

Hole No. Z3-B11 **Depth 192.8ft** **File C:\DATA\ISE-812\SR710-03.P**



Shear Modulus 48888 psi

Shear Modulus 10179 psi

shift 0

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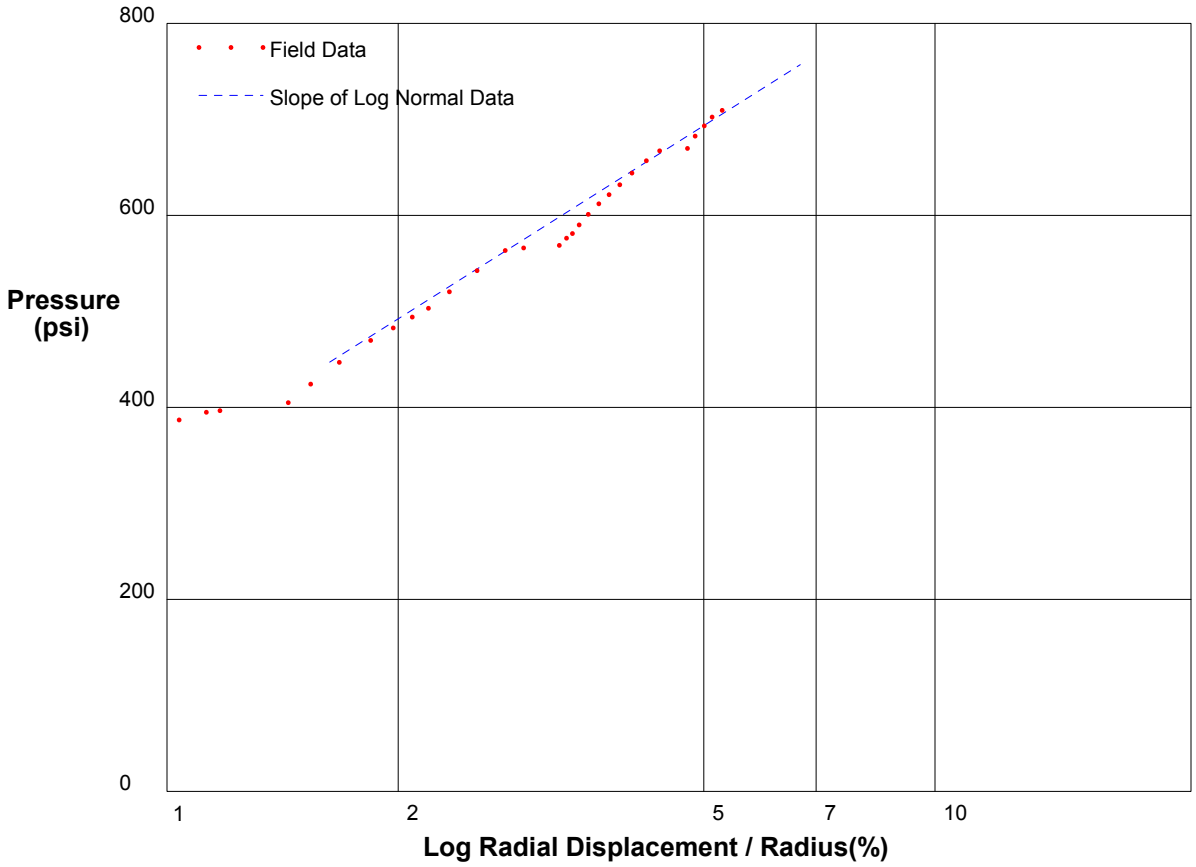
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/17/2009**

Hole No. Z3-B11 **Depth 192.8ft** **File C:\DATA\ISE-812\SR710-03.P**



Shear Strength 219.4 psi
Limit Pressure 1155 psi

shift 6.5

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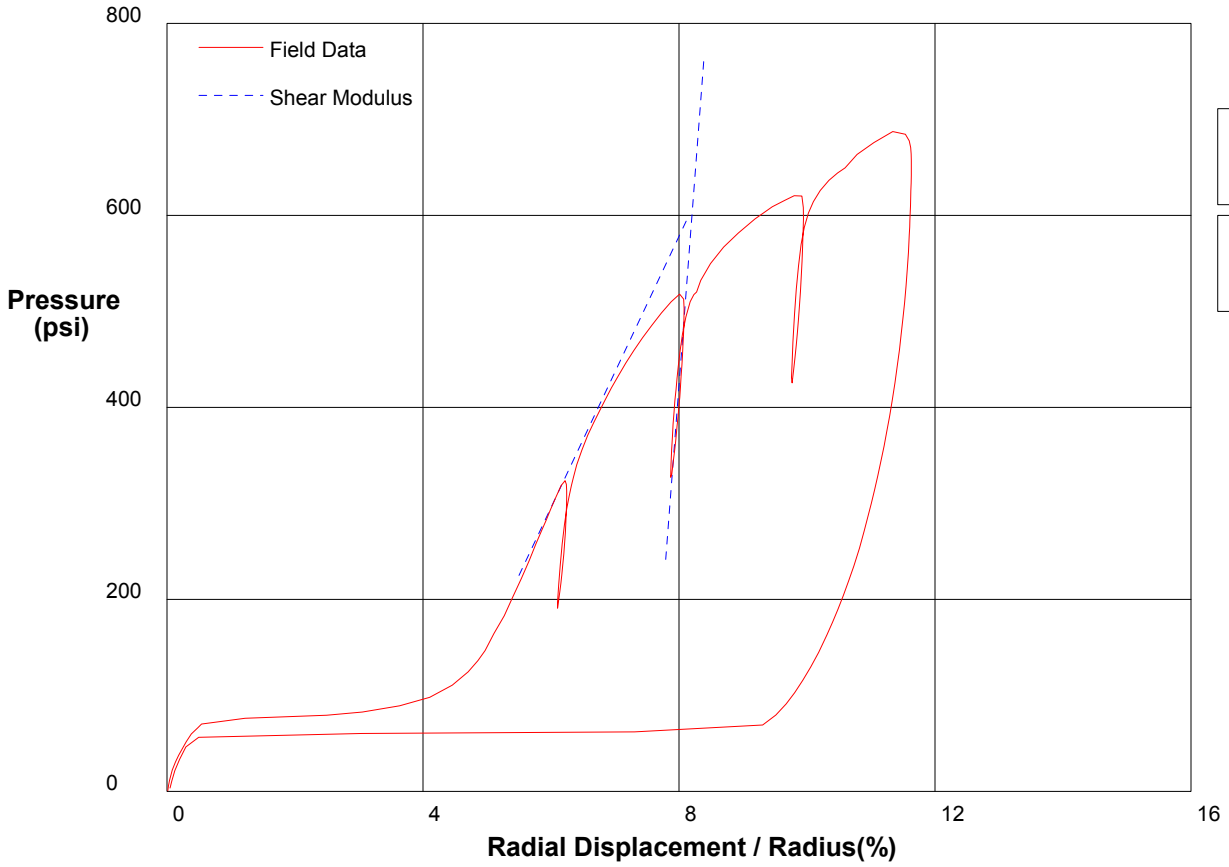
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **1/17/2009**

Hole No. Z3-B11 **Depth 191.3ft** **File C:\DATA\ISE-812\SR710-04.P**



Shear Modulus 7060 psi

Shear Modulus 43563 psi

shift 0

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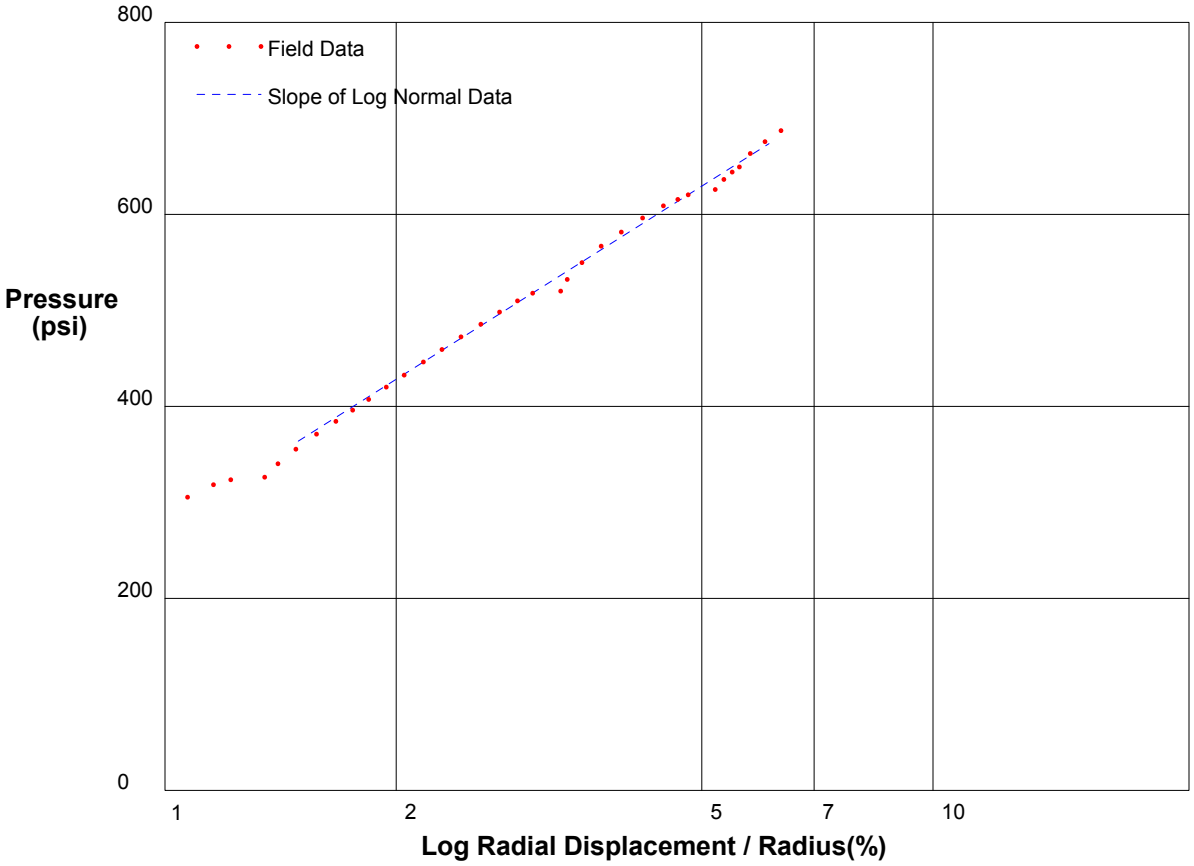
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/17/2009**

Hole No. Z3-B11 **Depth 191.3ft** **File C:\DATA\ISE-812\SR710-04.P**



Shear Strength 219.4 psi
Limit Pressure 1091 psi

shift 5

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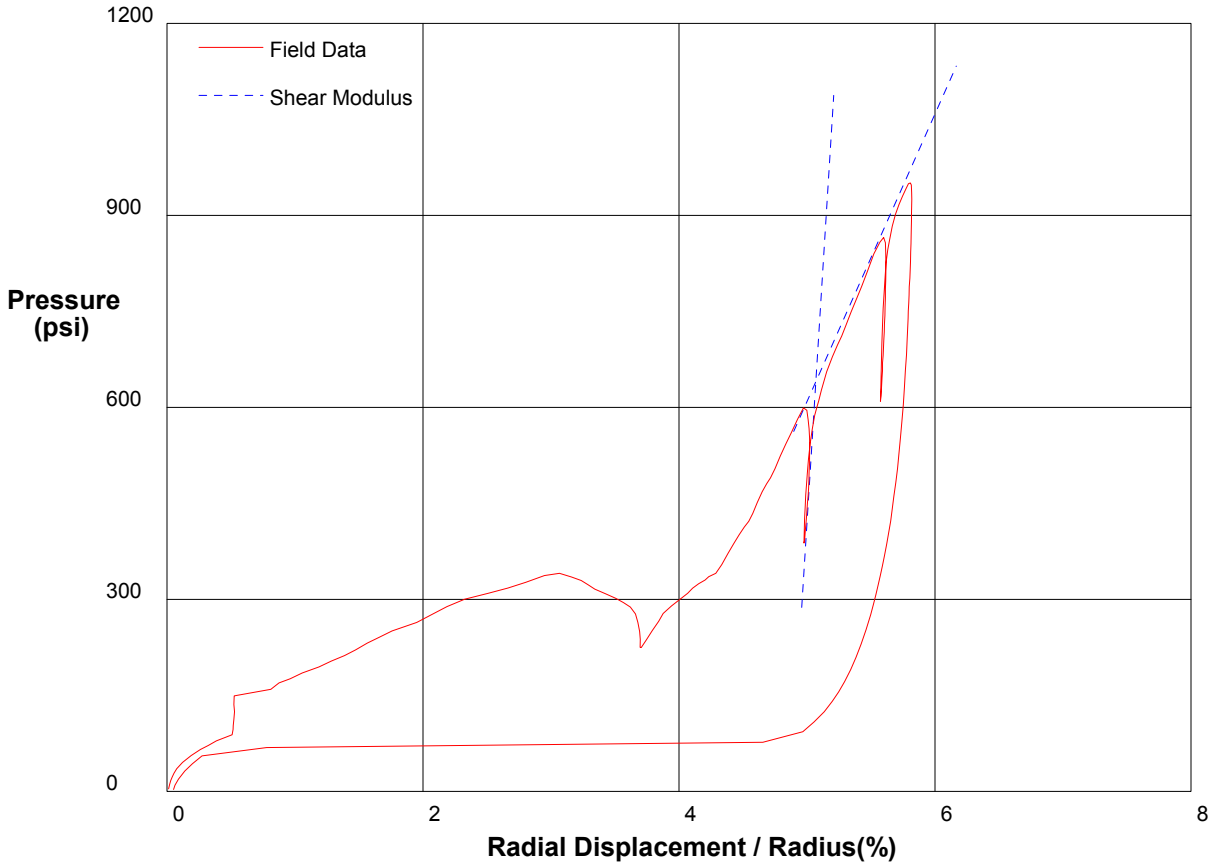
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **1/17/2009**

Hole No. Z3-B2 **Depth 227ft** **File C:\DATA\ISE-812\SR710-05.P**



Shear Modulus 22459 psi

Shear Modulus 160000 psi

shift 0

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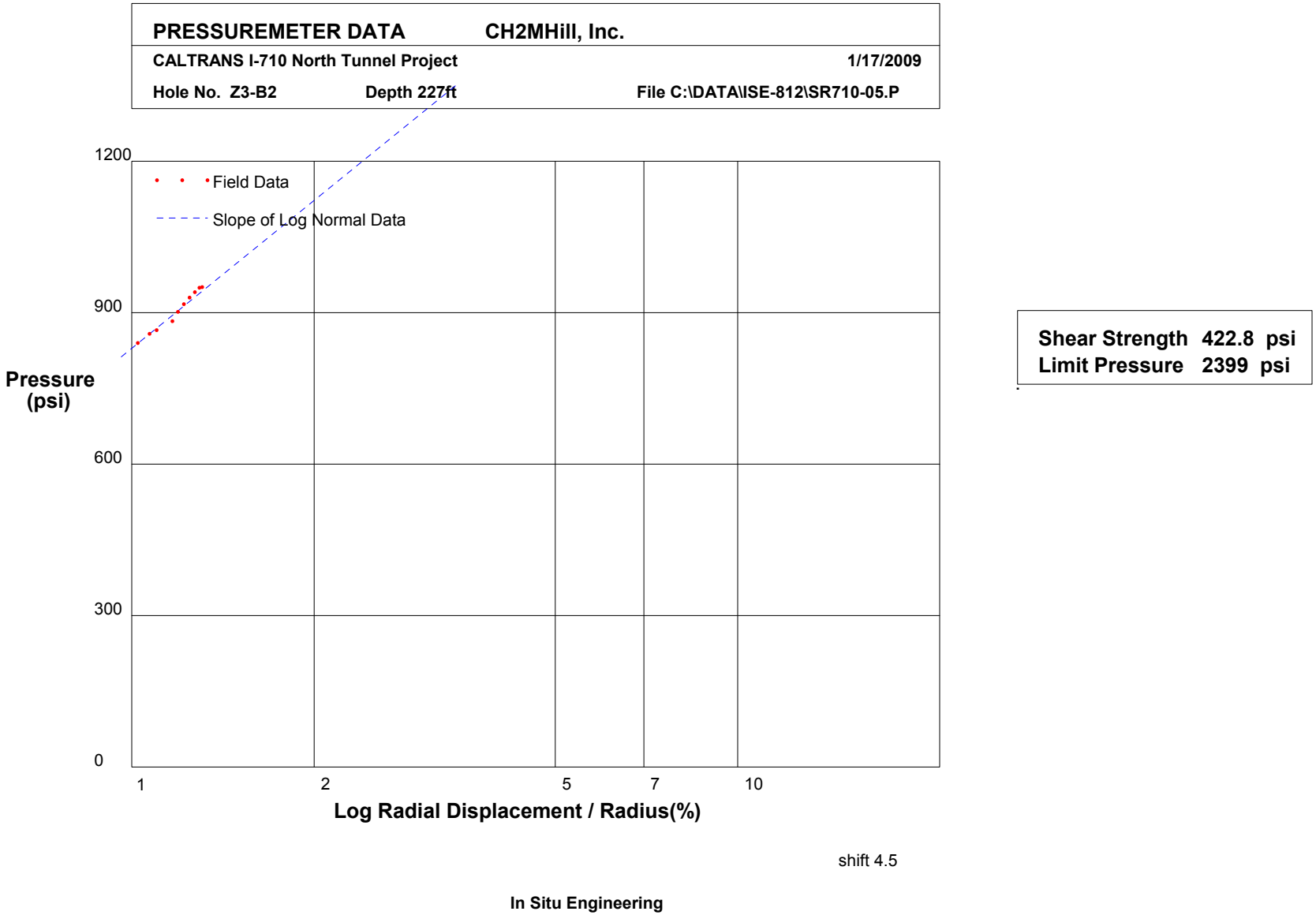
Appendix I - Pressuremeter Data and Standard Interpretation

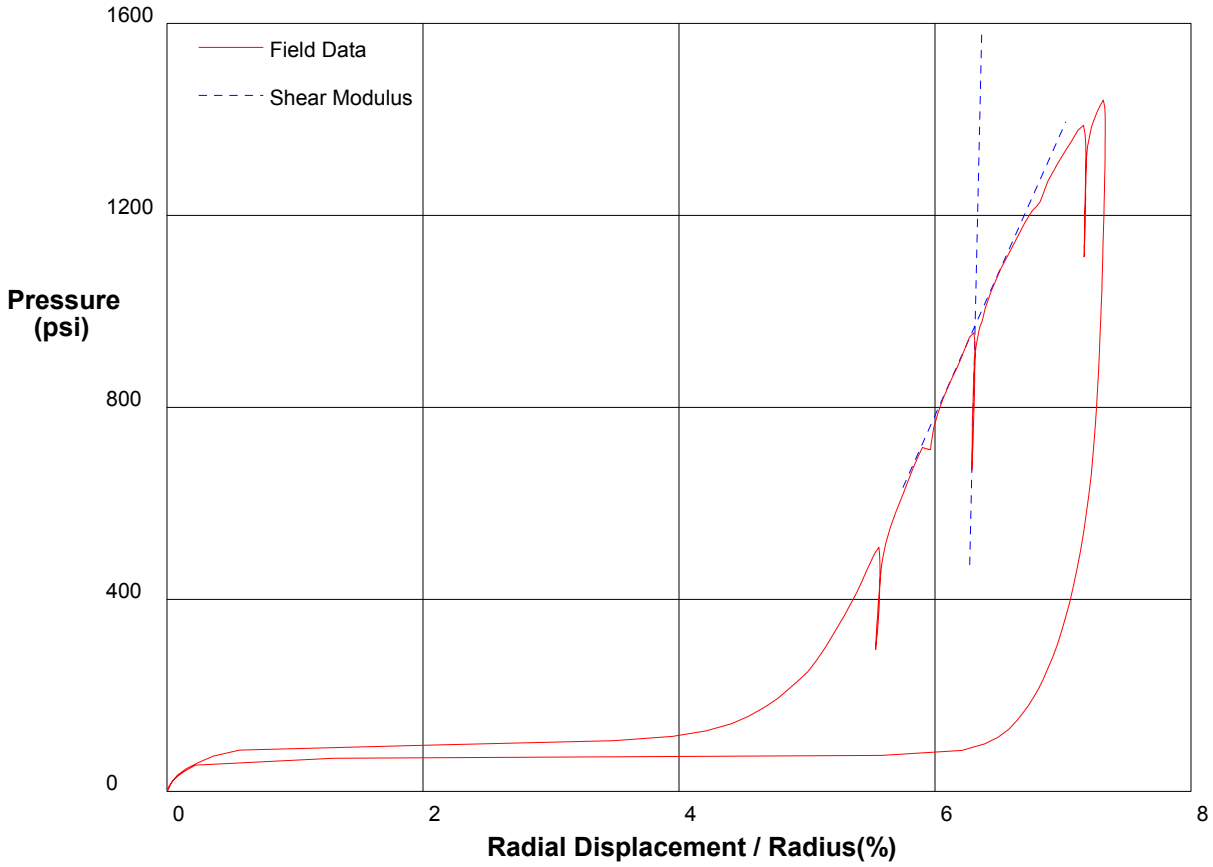


Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **1/17/2009**

Hole No. Z3-B2 **Depth 225ft** **File C:\DATA\ISE-812\SR710-06.P**



Shear Modulus 29945 psi

Shear Modulus 591111 psi

shift 0

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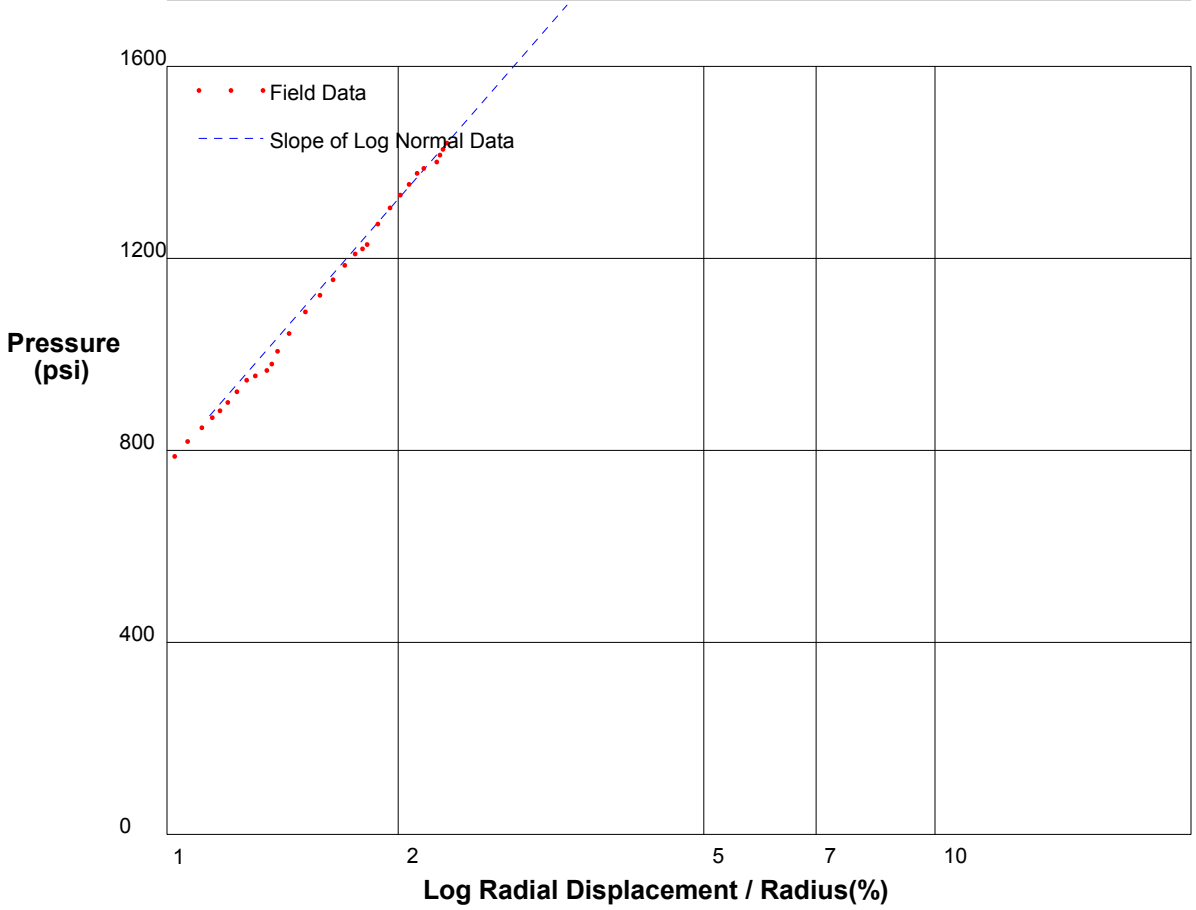
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/17/2009**

Hole No. Z3-B2 **Depth 225ft** **File C:\DATA\ISE-812\SR710-06.P**



Shear Strength 798.5 psi
Limit Pressure 3735 psi

shift 5

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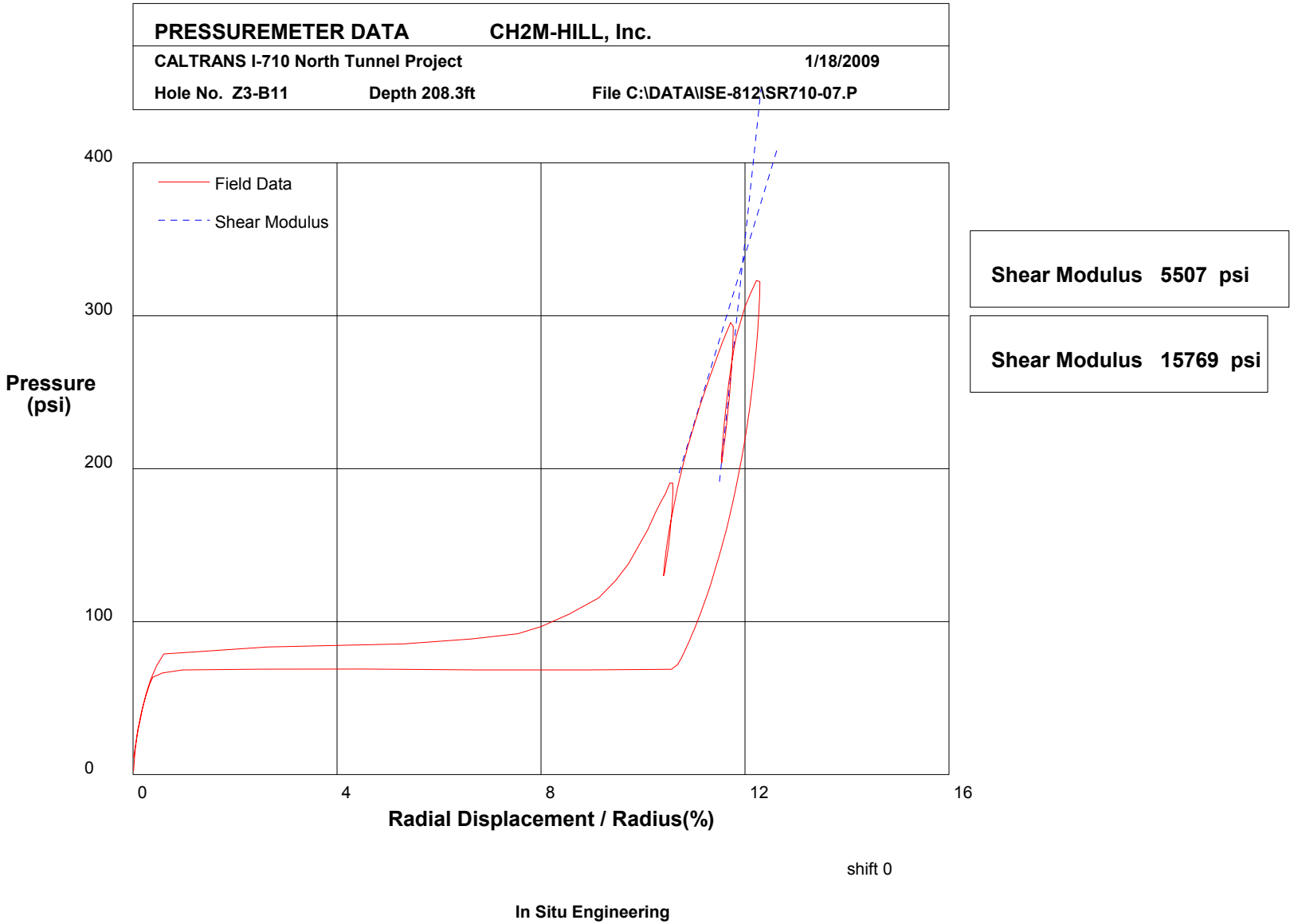
Appendix I - Pressuremeter Data and Standard Interpretation

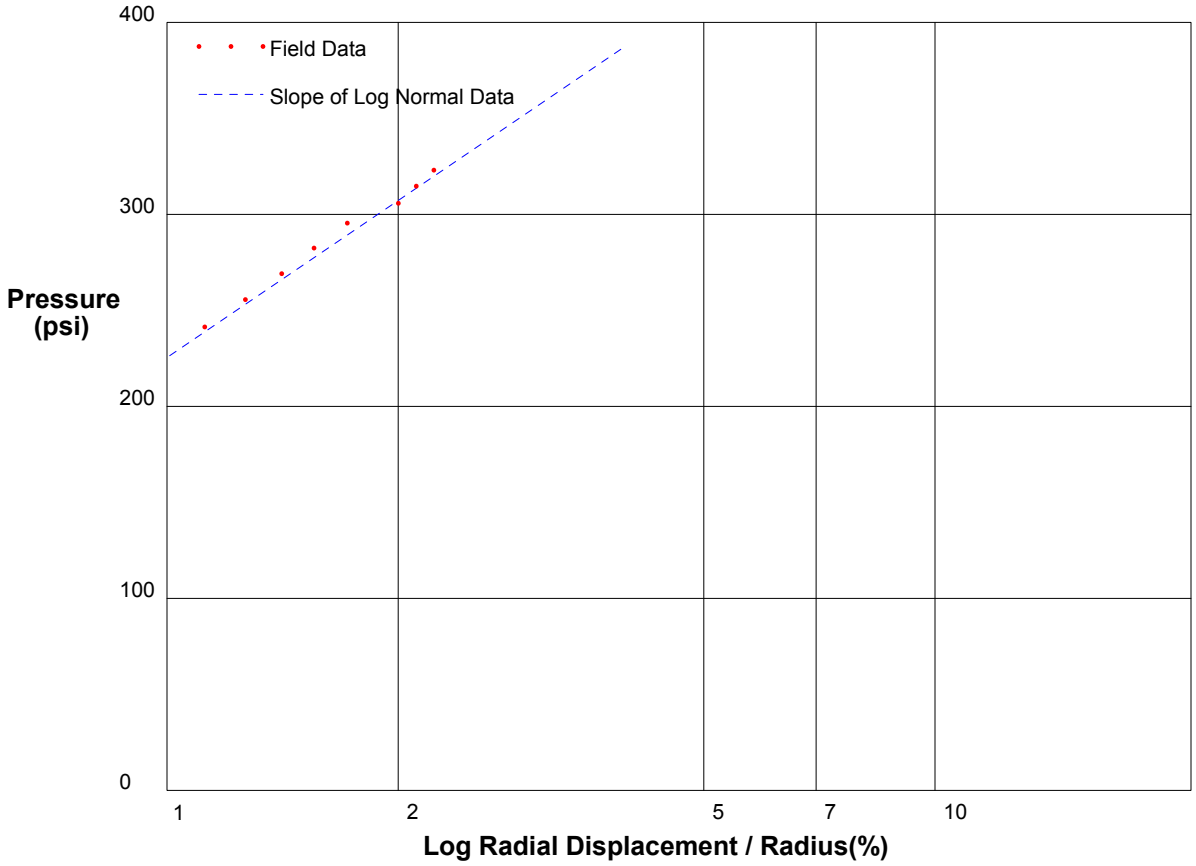


Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/18/2009**

Hole No. Z3-B11 **Depth 208.3ft** **File C:\DATA\ISE-812\SR710-07.P**



Shear Strength 118 psi
Limit Pressure 663 psi

shift 10

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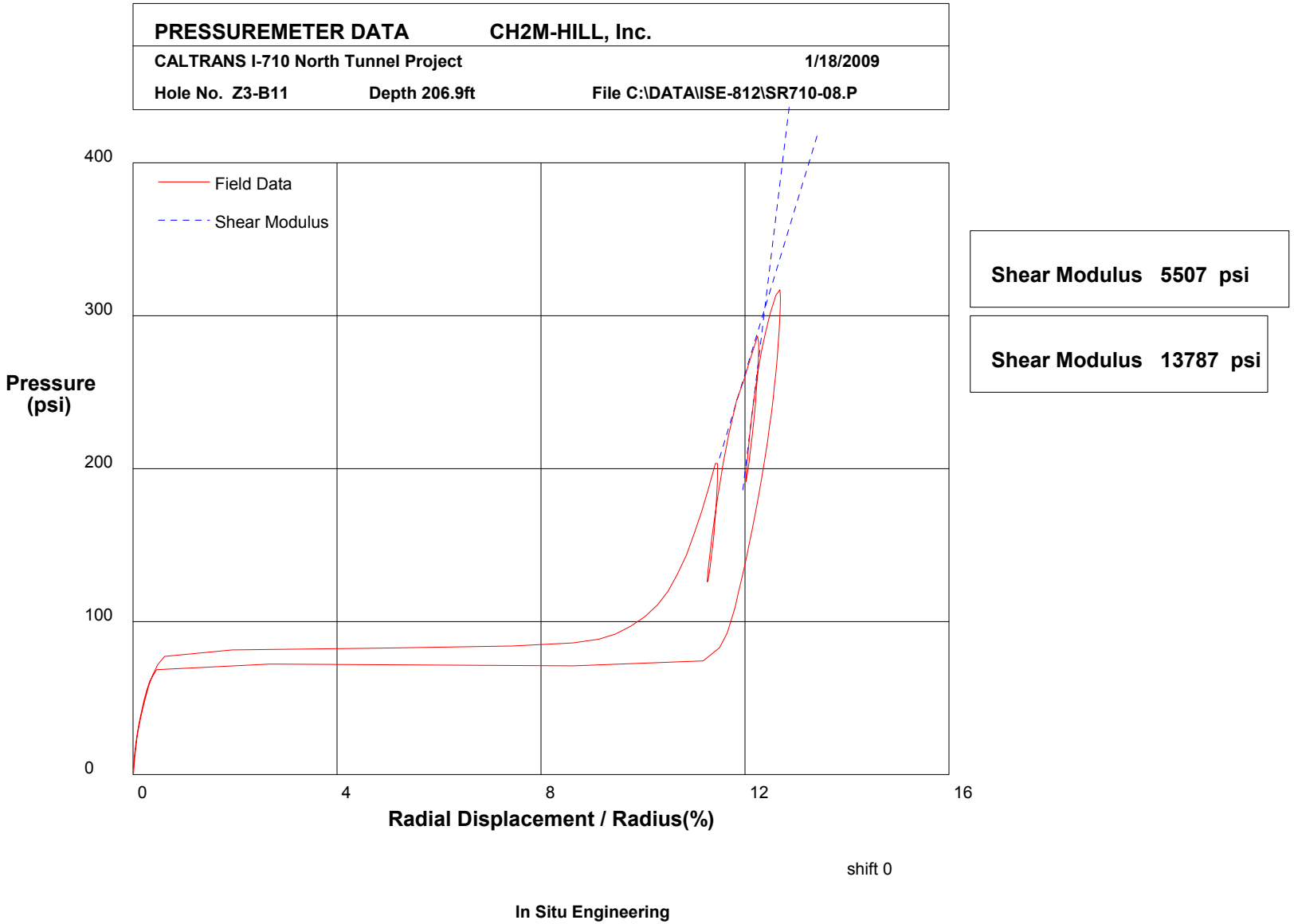
Appendix I - Pressuremeter Data and Standard Interpretation

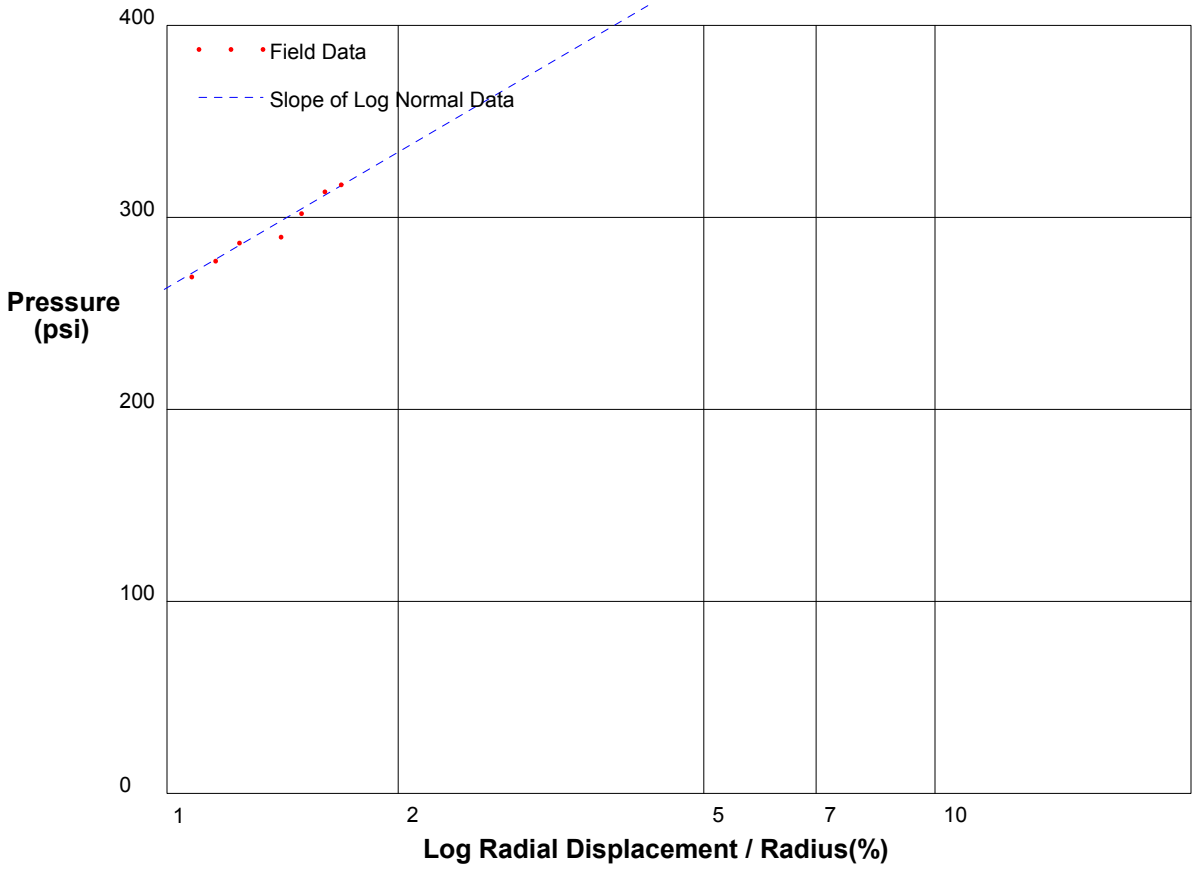


Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/18/2009**

Hole No. Z3-B11 **Depth 206.9ft** **File C:\DATA\ISE-812\SR710-08.P**



Shear Strength 101.9 psi
Limit Pressure 641 psi

shift 11

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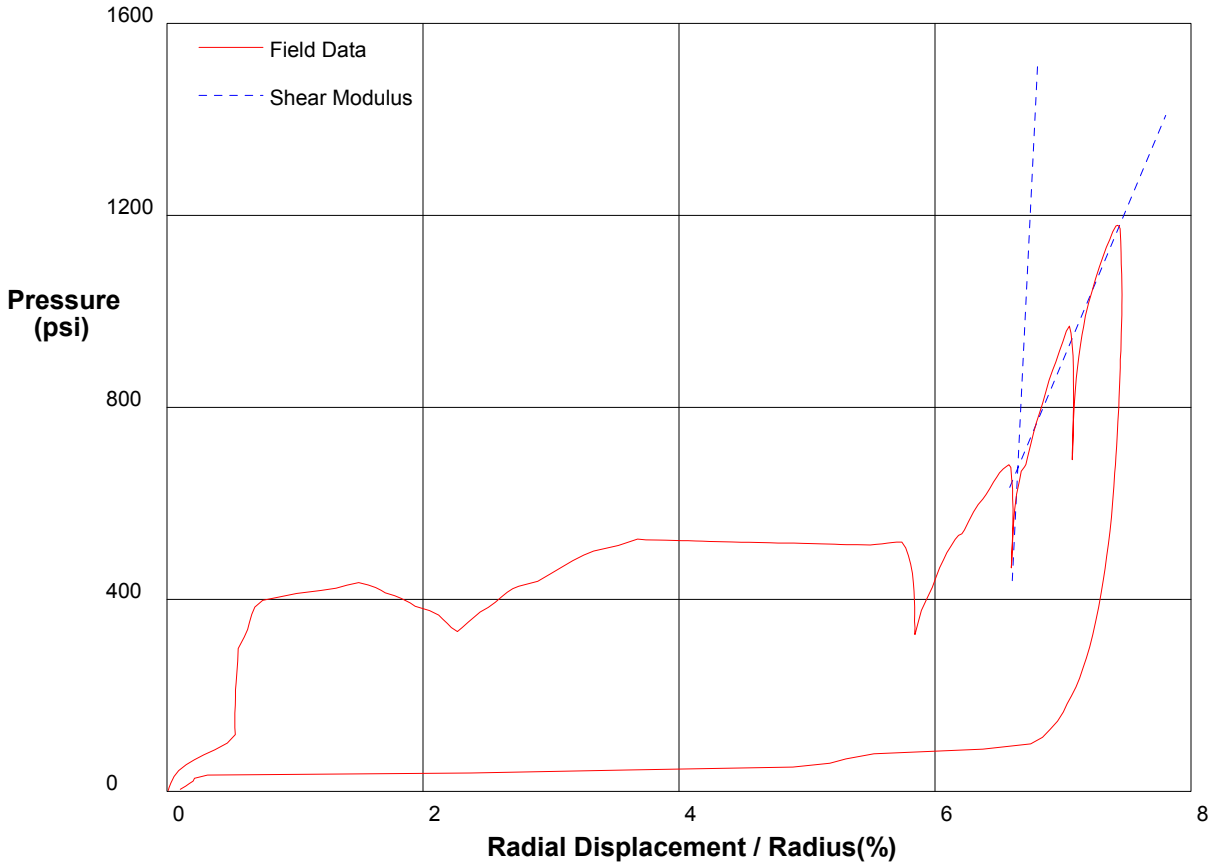
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **1/18/2009**

Hole No. Z3-B2 **Depth 248ft** **File C:\DATA\ISE-812\SR710-09.P**



Shear Modulus 31794 psi

Shear Modulus 272982 psi

shift 0

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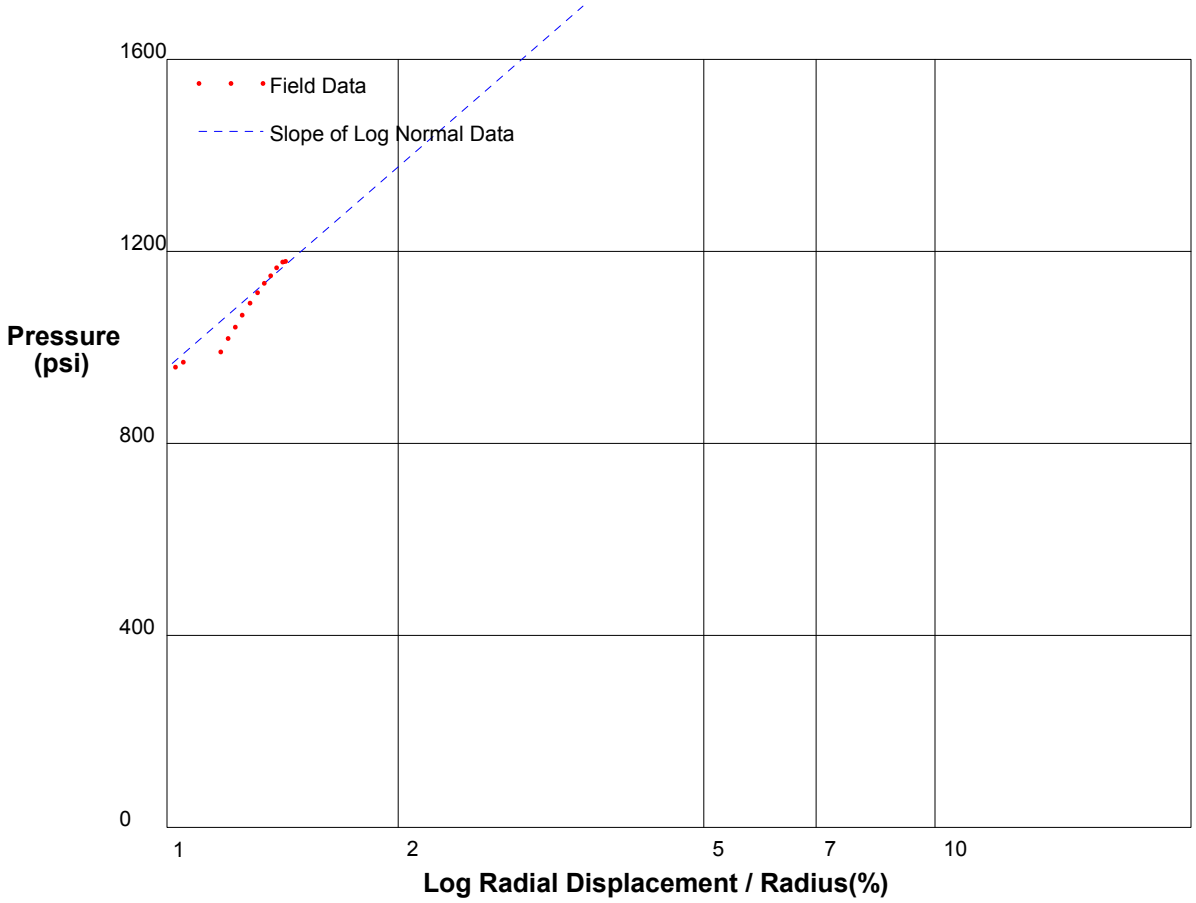
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/18/2009**

Hole No. Z3-B2 **Depth 248ft** **File C:\DATA\ISE-812\SR710-09.P**

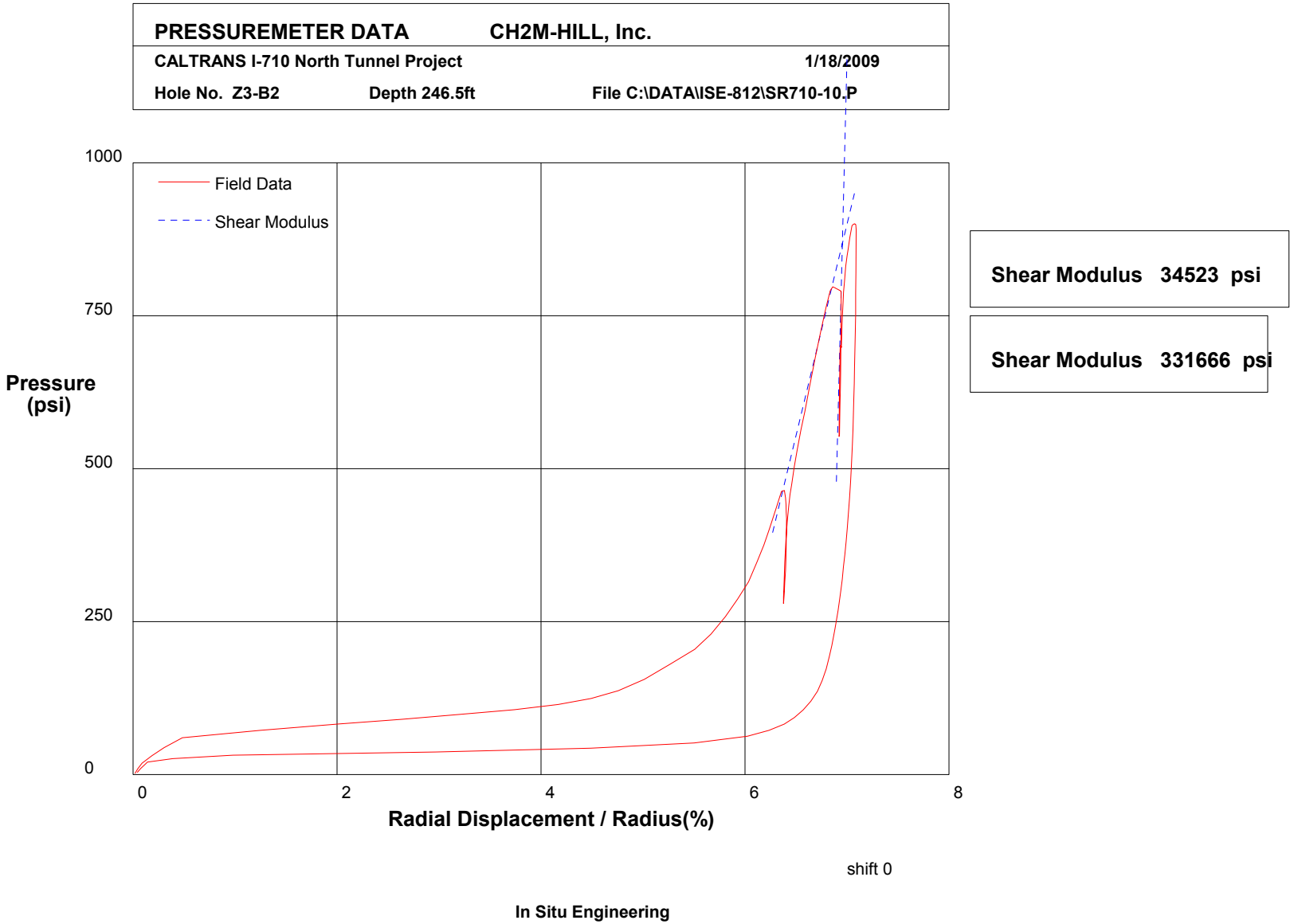


Shear Strength 604.6 psi
Limit Pressure 3202 psi

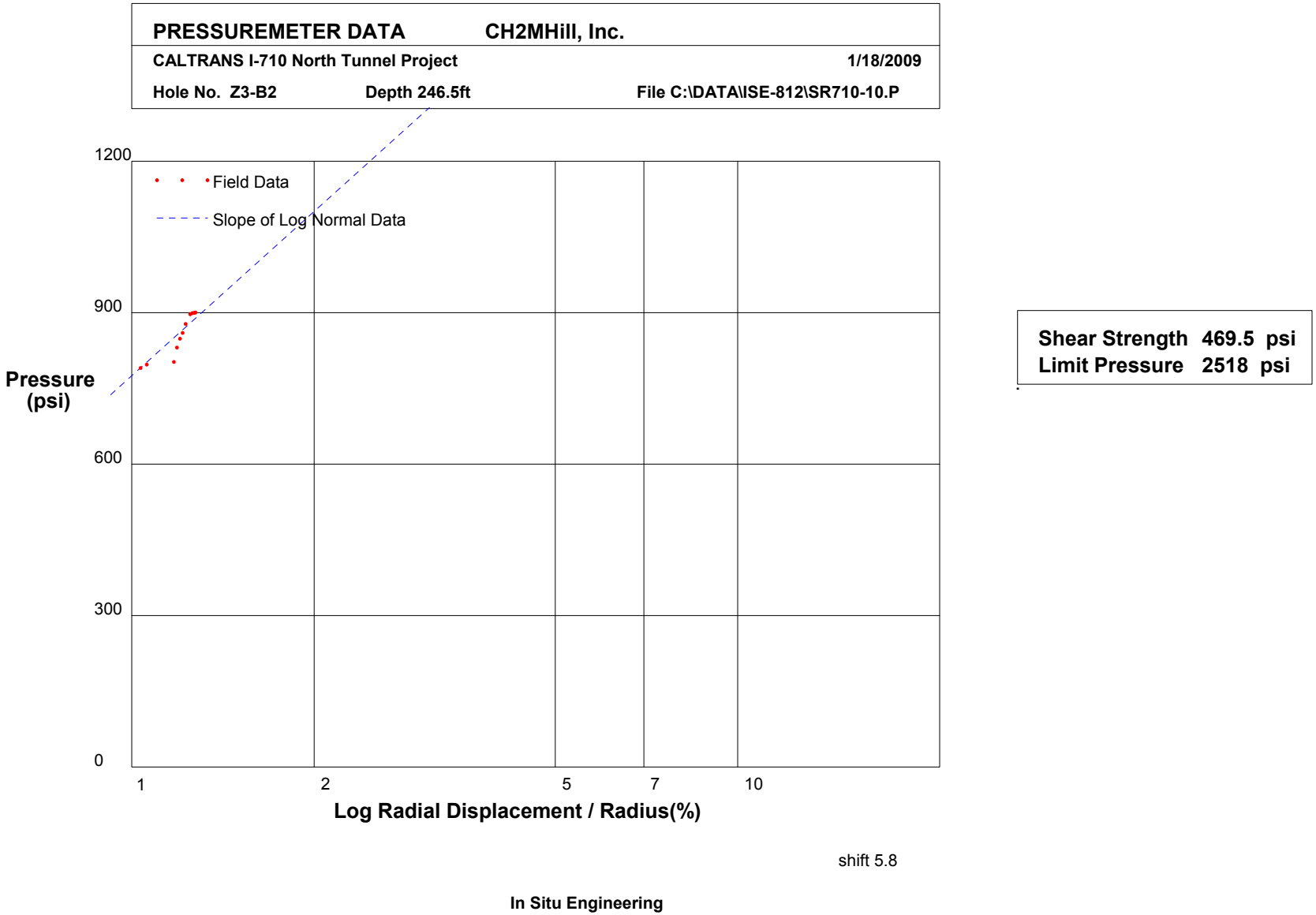
shift 6

In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation



Appendix I - Pressuremeter Data and Standard Interpretation

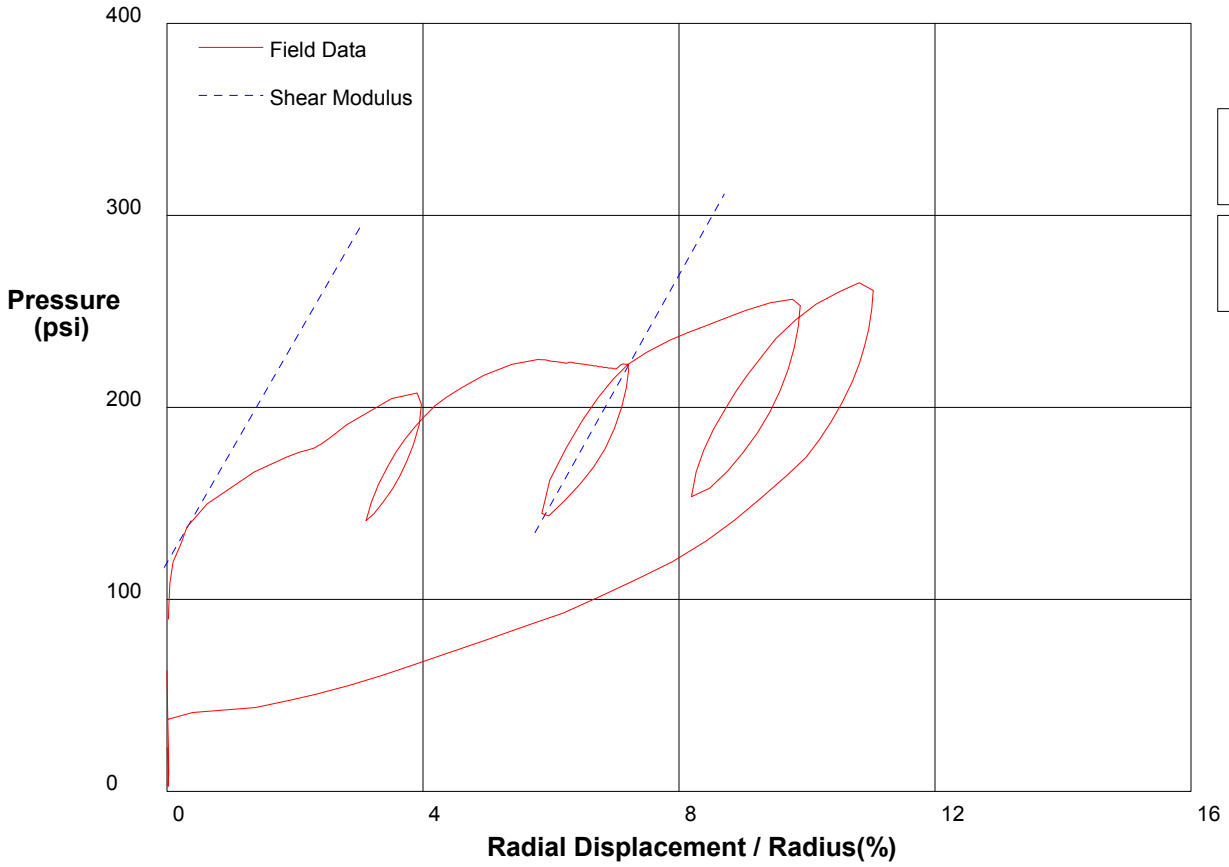


Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/19/2009**

Hole No. Z2-B1 **Depth 129ft** **File C:\DATA\ISE-812\SR710-11.P**



Shear Modulus 2981 psi

Shear Modulus 2897 psi

shift 0

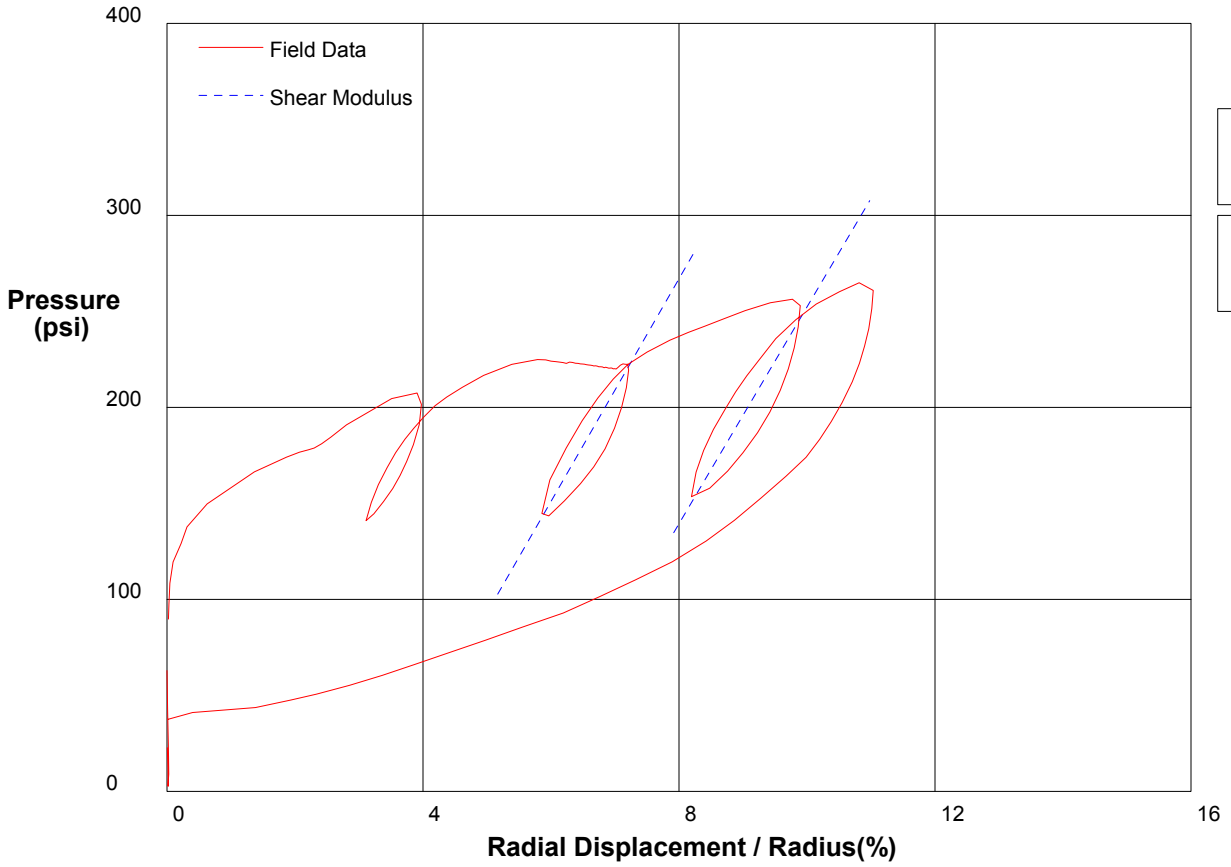
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **1/19/2009**

Hole No. Z2-B1 **Depth 129ft** **File C:\DATA\ISE-812\SR710-11.P**



Shear Modulus 2823 psi

Shear Modulus 2897 psi

shift 0

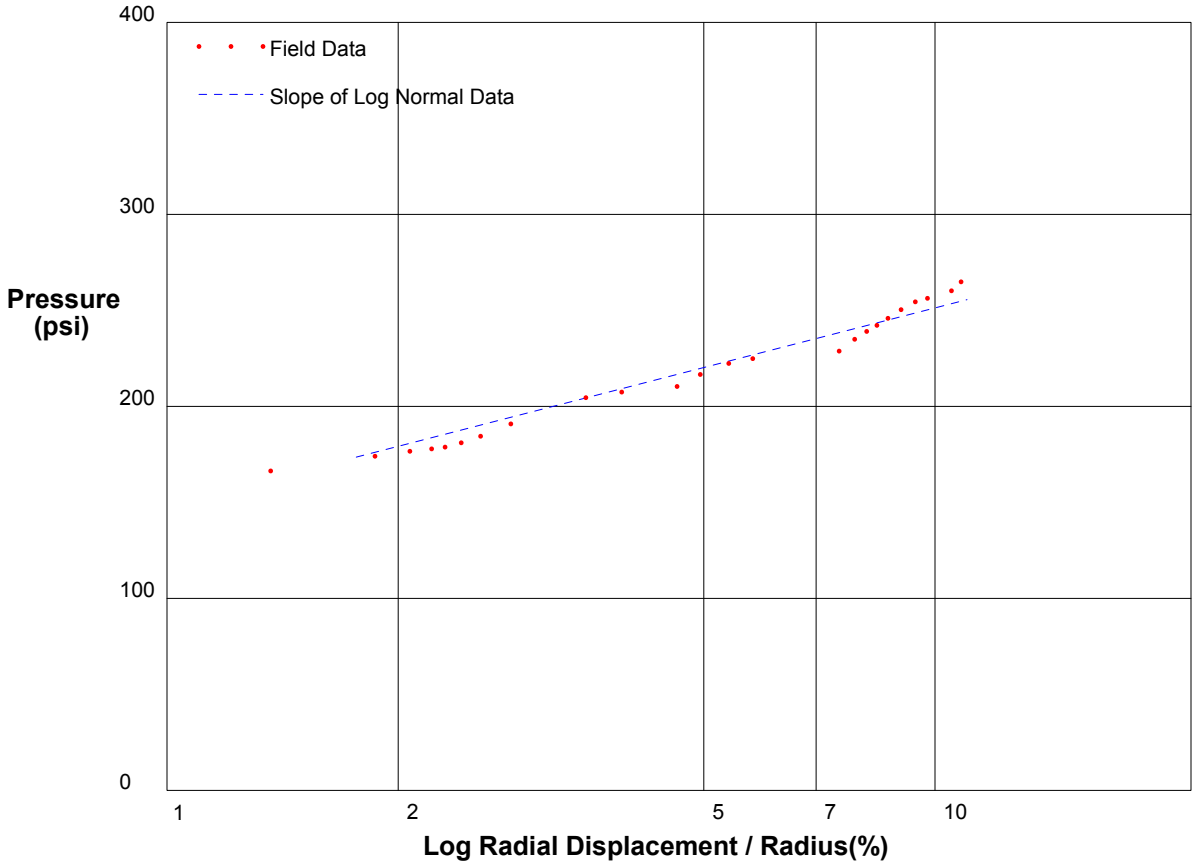
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/19/2009**

Hole No. Z2-B1 **Depth 129ft** **File C:\DATA\ISE-812\SR710-11.P**



Shear Strength 44.7 psi
Limit Pressure 314 psi

shift 0

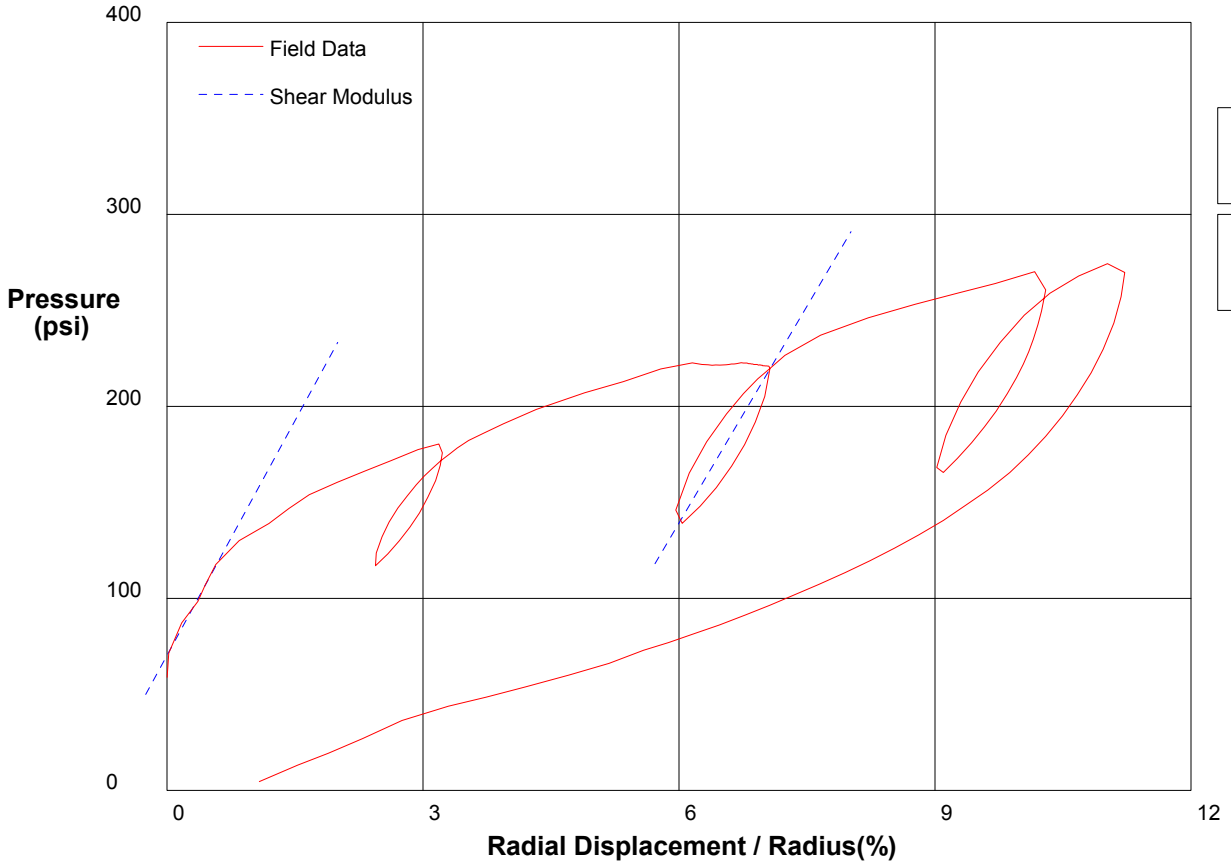
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc**

CALTRANS I-170 North Tunnel Project **1/19/2009**

Hole No. Z2-B1 **Depth 127.5ft** **File C:\DATA\ISE-812\SR710-12.P**



Shear Modulus 3764 psi

Shear Modulus 4074 psi

shift 0

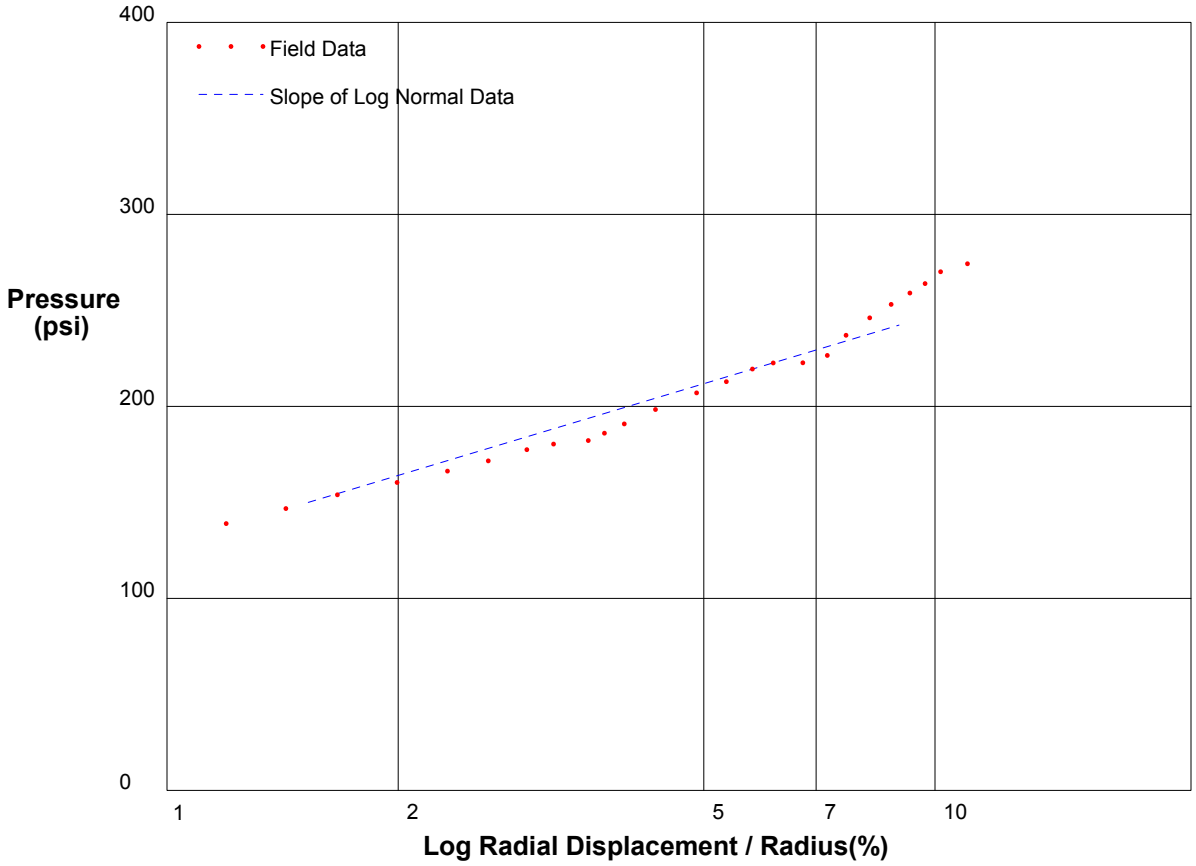
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/19/2009**

Hole No. Z2-B1 **Depth 127.5ft** **File C:\DATA\ISE-812\SR710-12.P**



Shear Strength 52.1 psi
Limit Pressure 321 psi

shift 0

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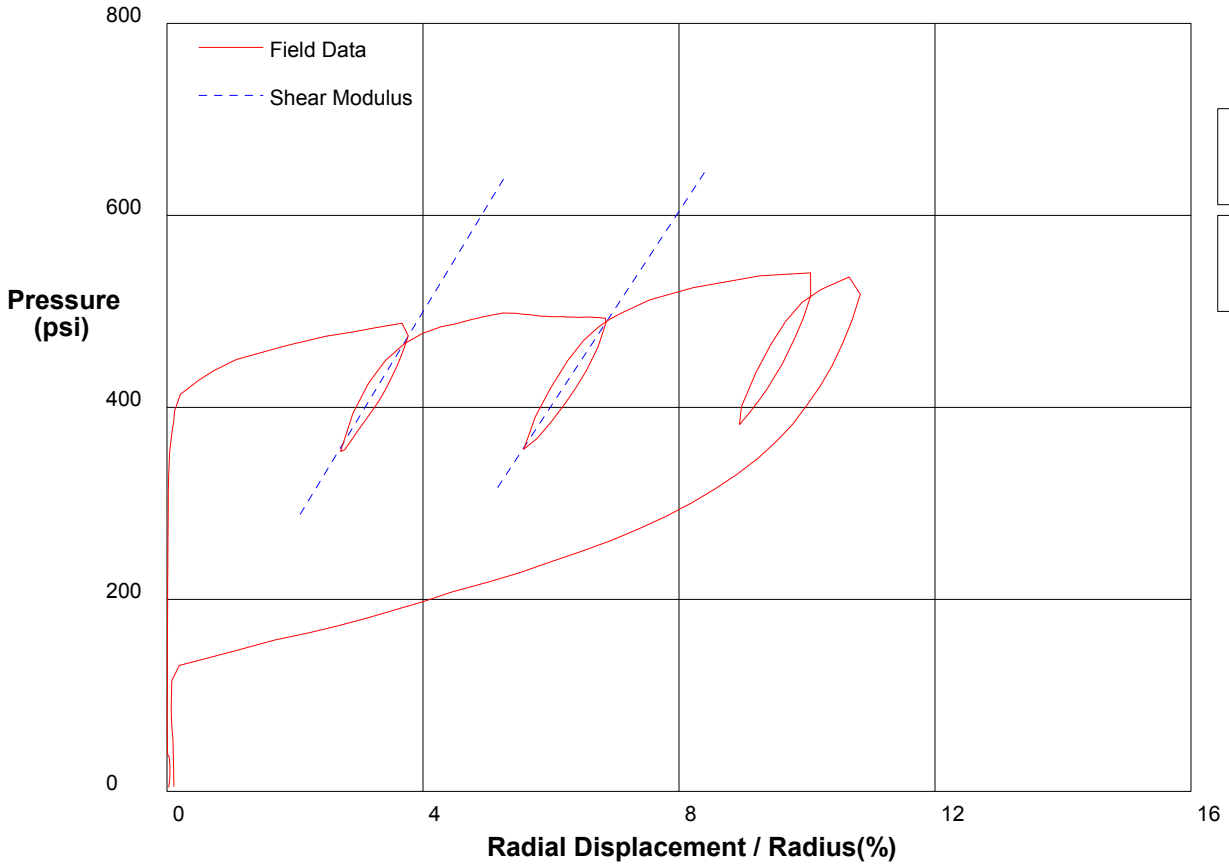
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **1/20/2009**

Hole No. Z2-B1 **Depth 140ft** **File C:\DATA\ISE-812\SR710-13.P**



Shear Modulus 5074 psi

Shear Modulus 5497 psi

shift 0

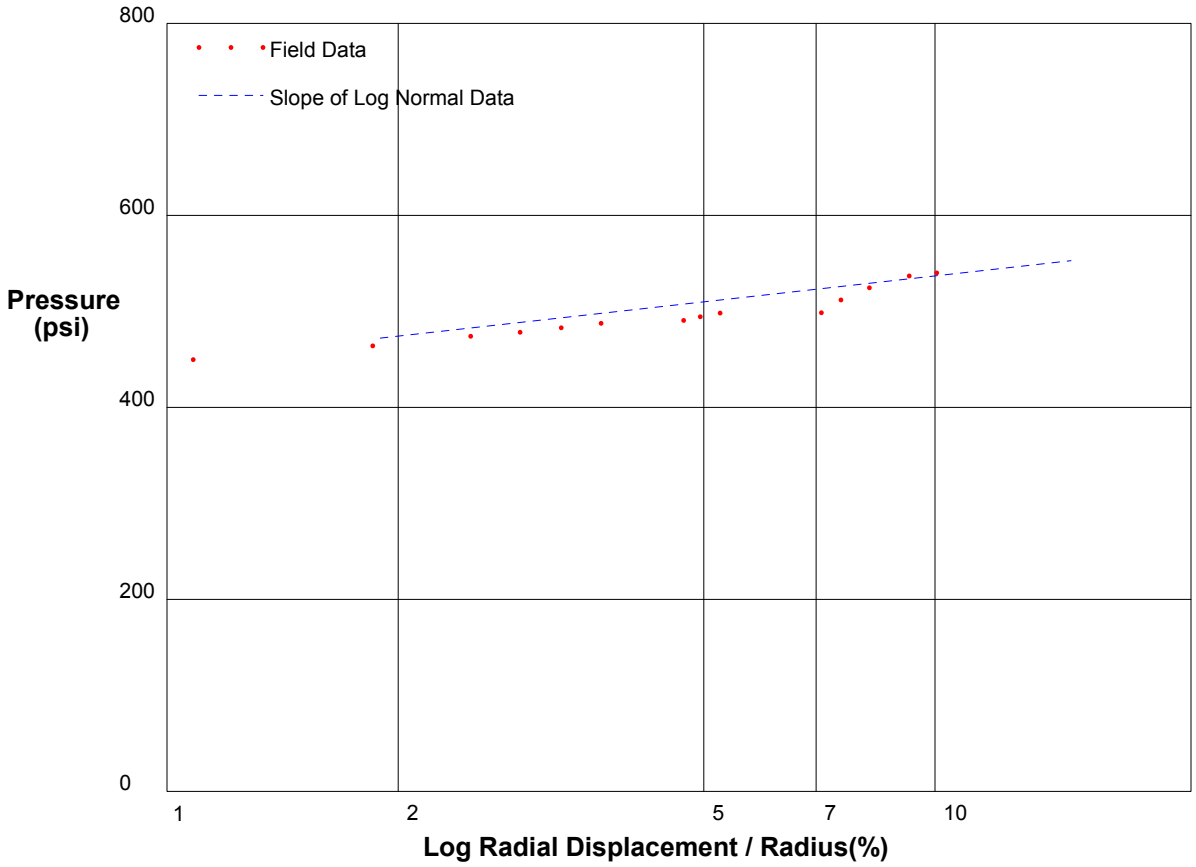
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/20/2009**

Hole No. Z2-B1 **Depth 140ft** **File C:\DATA\ISE-812\SR710-13.P**

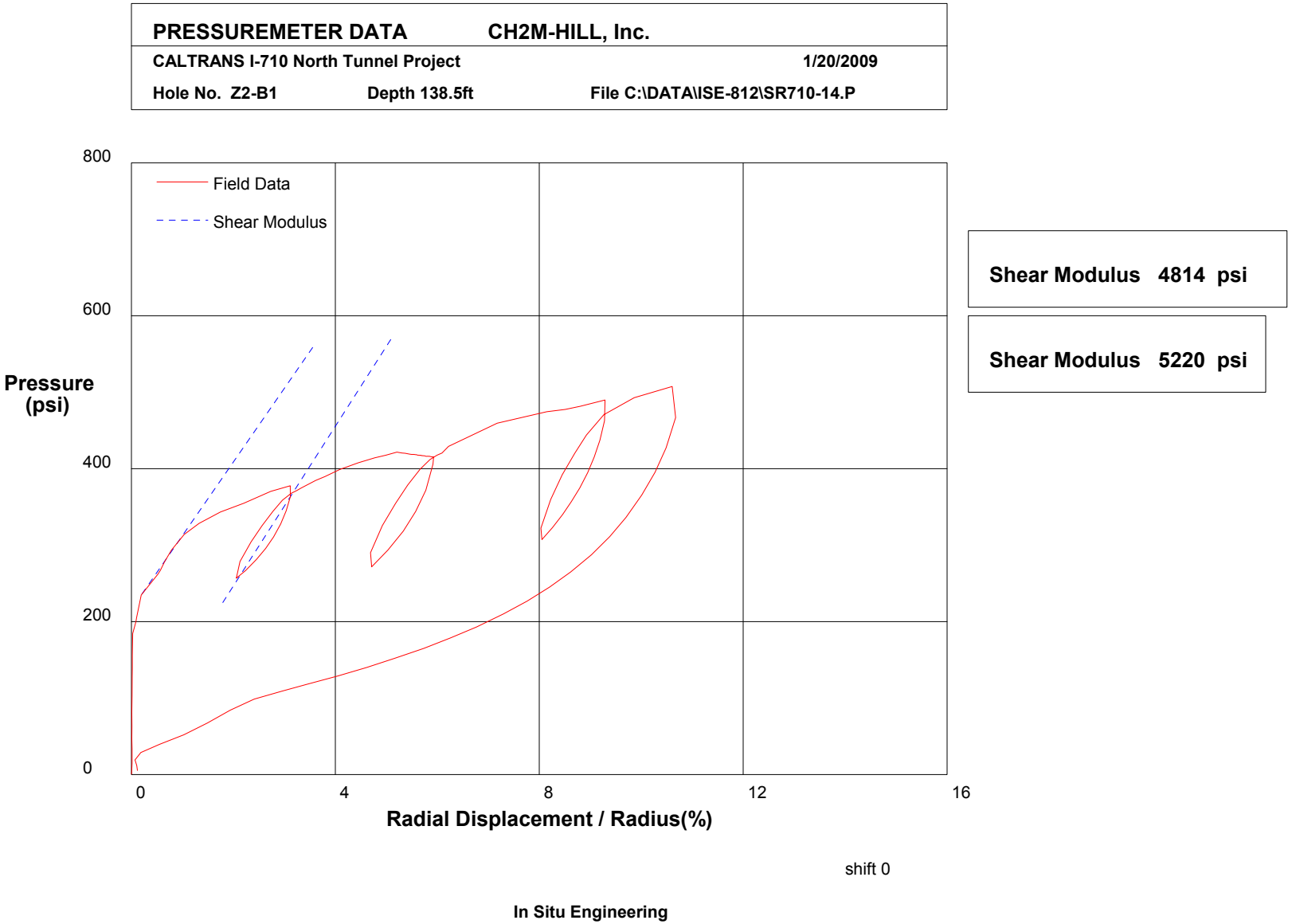


Shear Strength 38.9 psi
Limit Pressure 591 psi

shift 0

In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

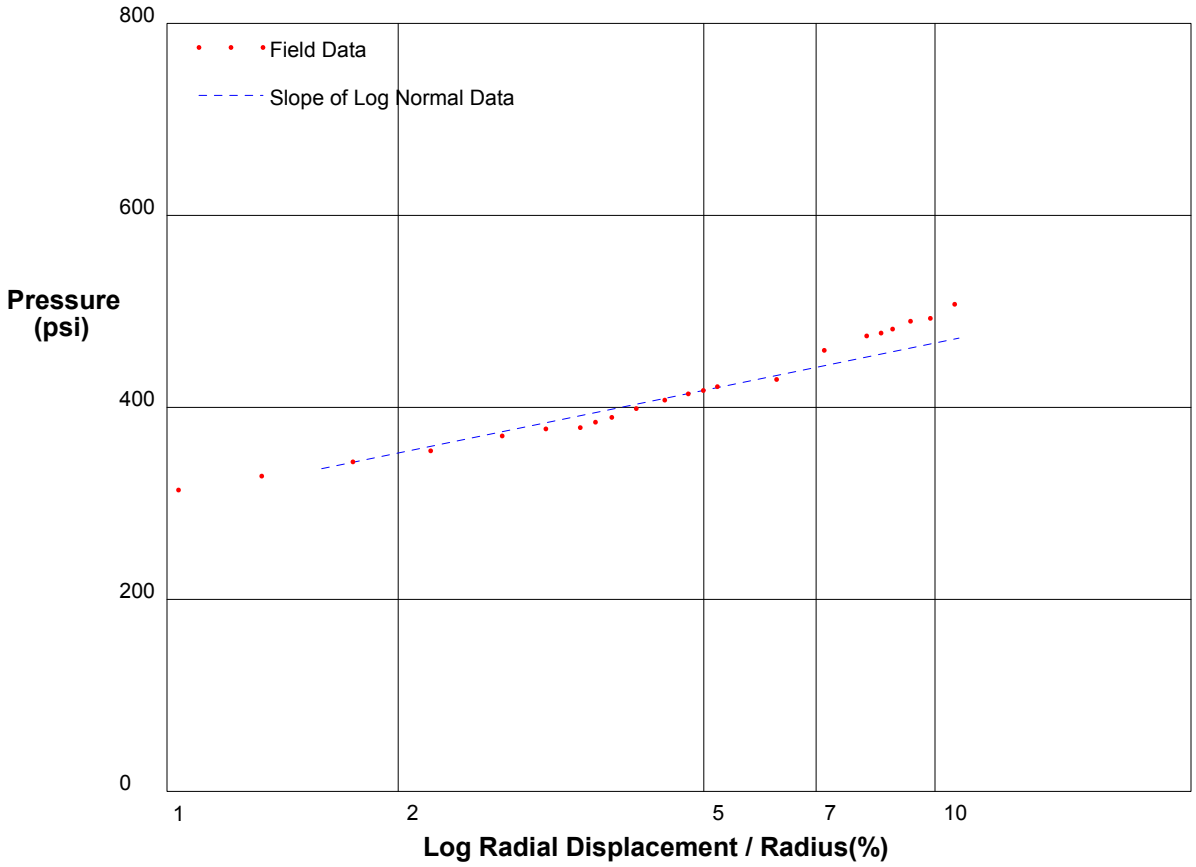


Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/20/2009**

Hole No. Z2-B1 **Depth 138.5ft** **File C:\DATA\ISE-812\SR710-14.P**



Shear Strength 71.2 psi
Limit Pressure 567 psi

shift 0

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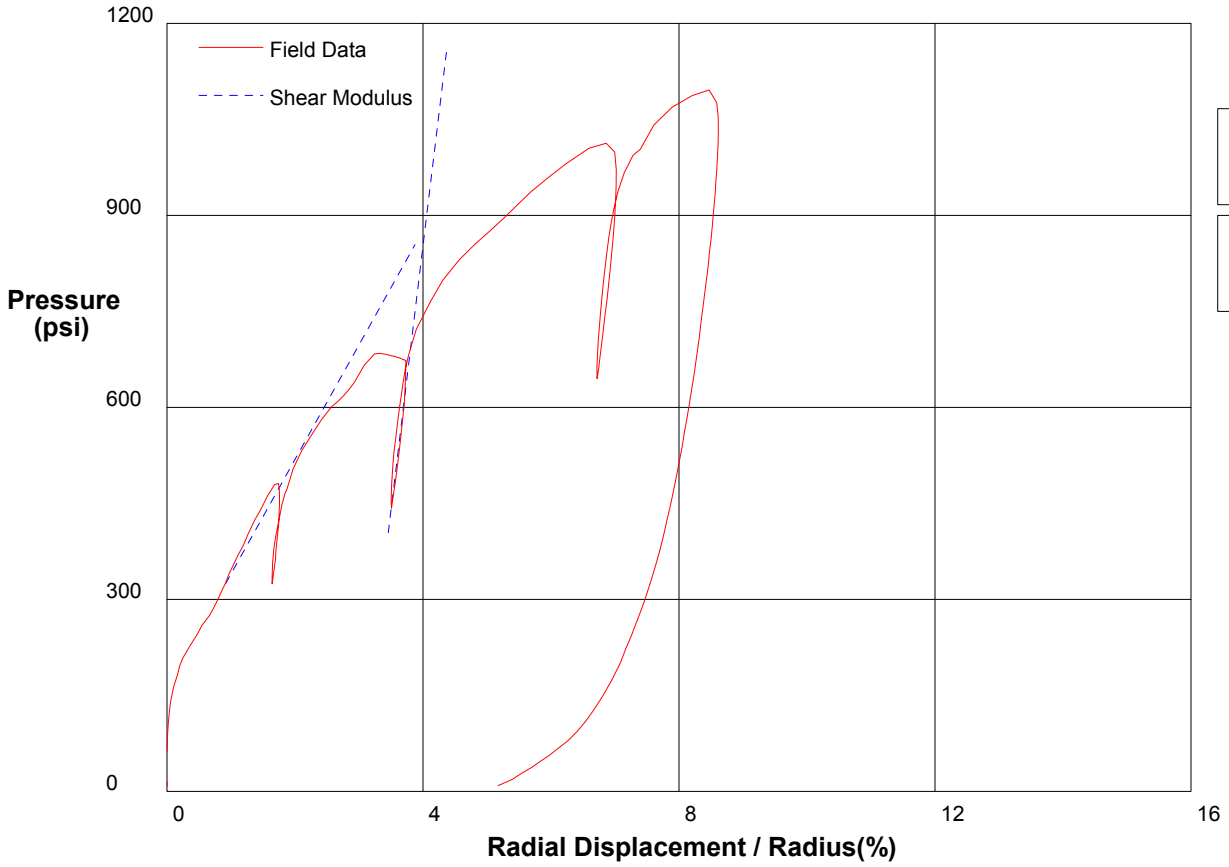
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **1/20/2009**

Hole No. Z1-B7 **Depth 96.5ft** **File C:\DATA\ISE-812\SR710-15.P**



Shear Modulus 8943 psi

Shear Modulus 41363 psi

shift 0

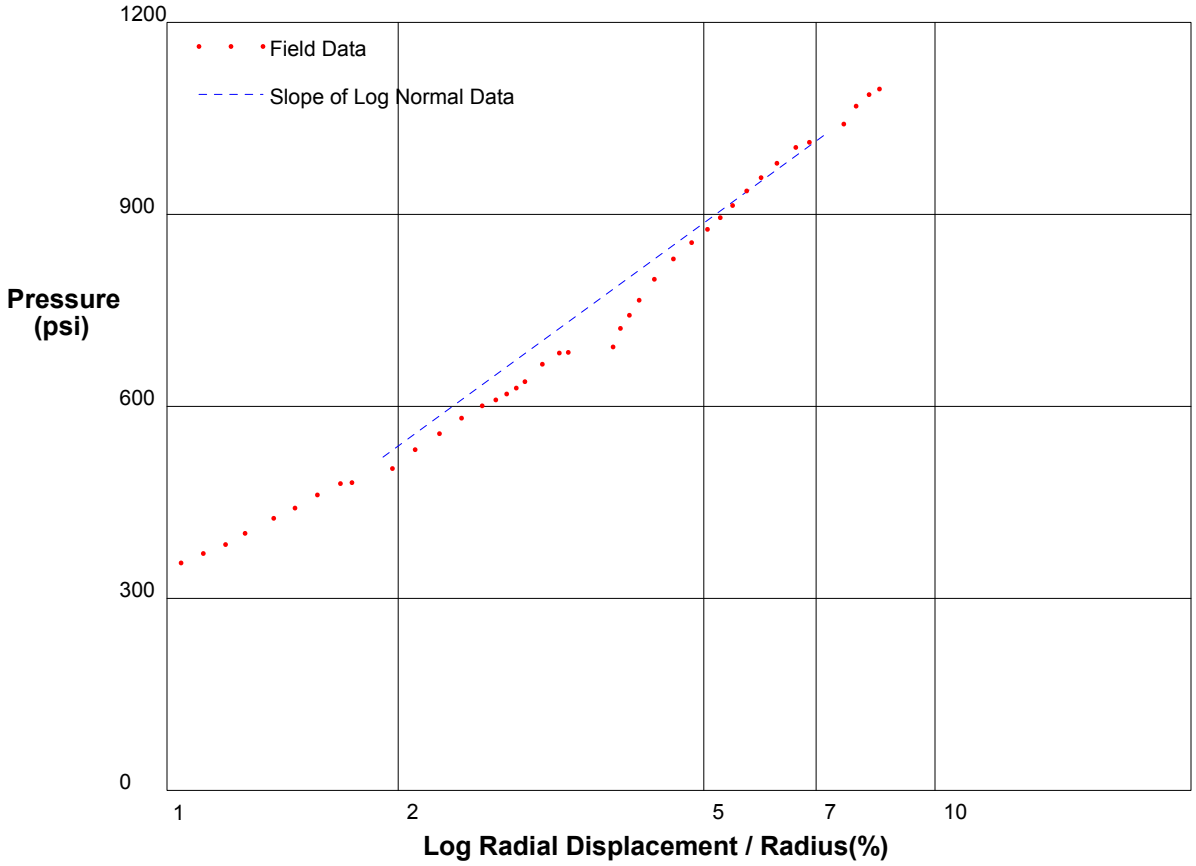
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/20/2009**

Hole No. Z1-B7 **Depth 96.5ft** **File C:\DATA\ISE-812\SR710-15.P**



Shear Strength 380.3 psi
Limit Pressure 1686 psi

shift 0

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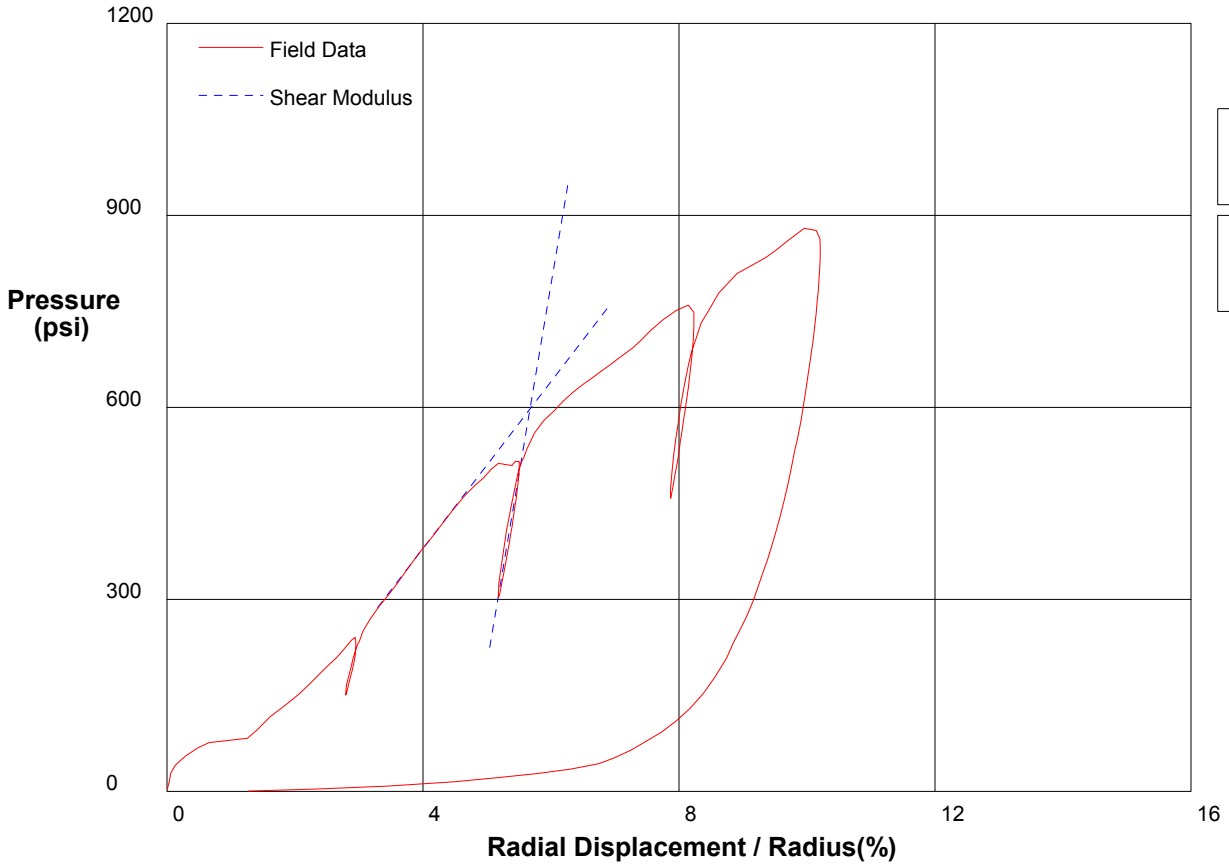
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **1/20/2009**

Hole No. Z1-B7 **Depth 95ft** **File C:\DATA\ISE-812\SR710-16.P**



Shear Modulus 6511 psi

Shear Modulus 29576 psi

shift 0

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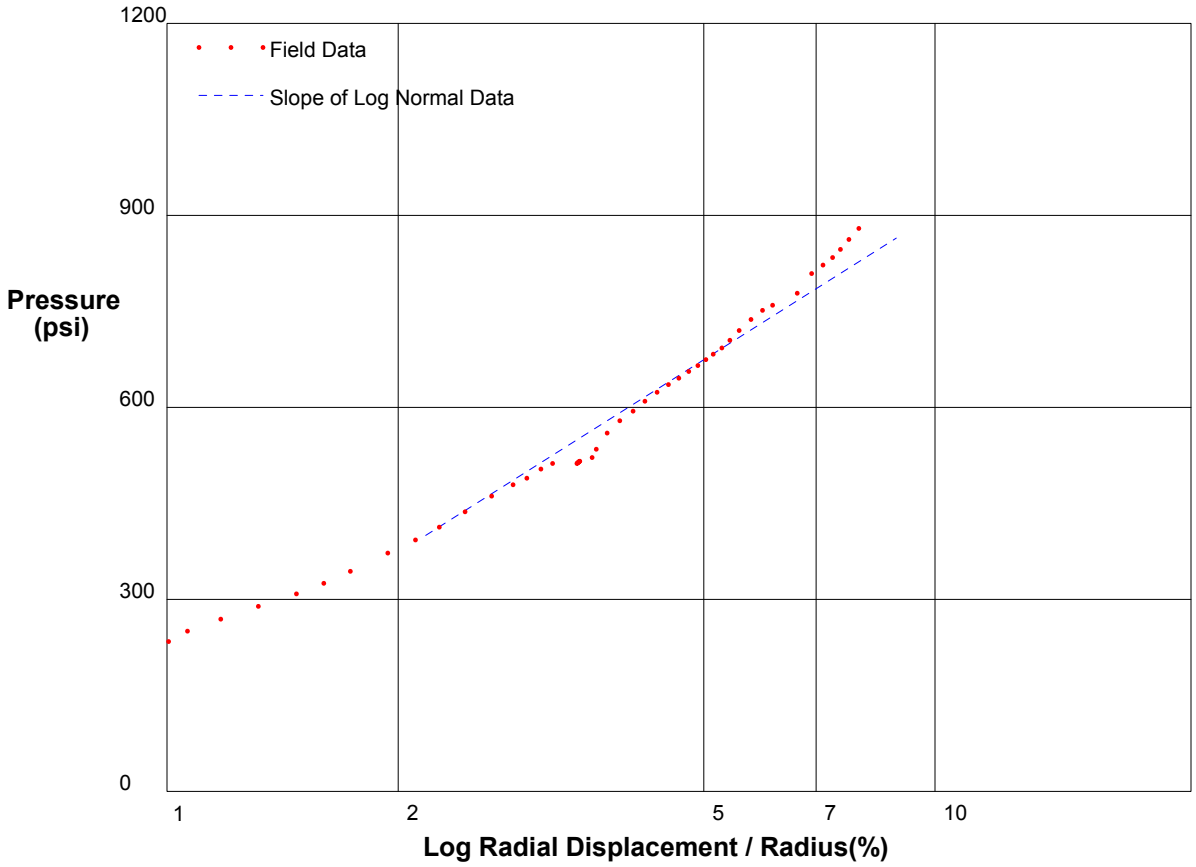
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/20/2009**

Hole No. Z1-B7 **Depth 95ft** **File C:\DATA\ISE-812\SR710-16.P**



Shear Strength 329.2 psi
Limit Pressure 1367 psi

shift 2

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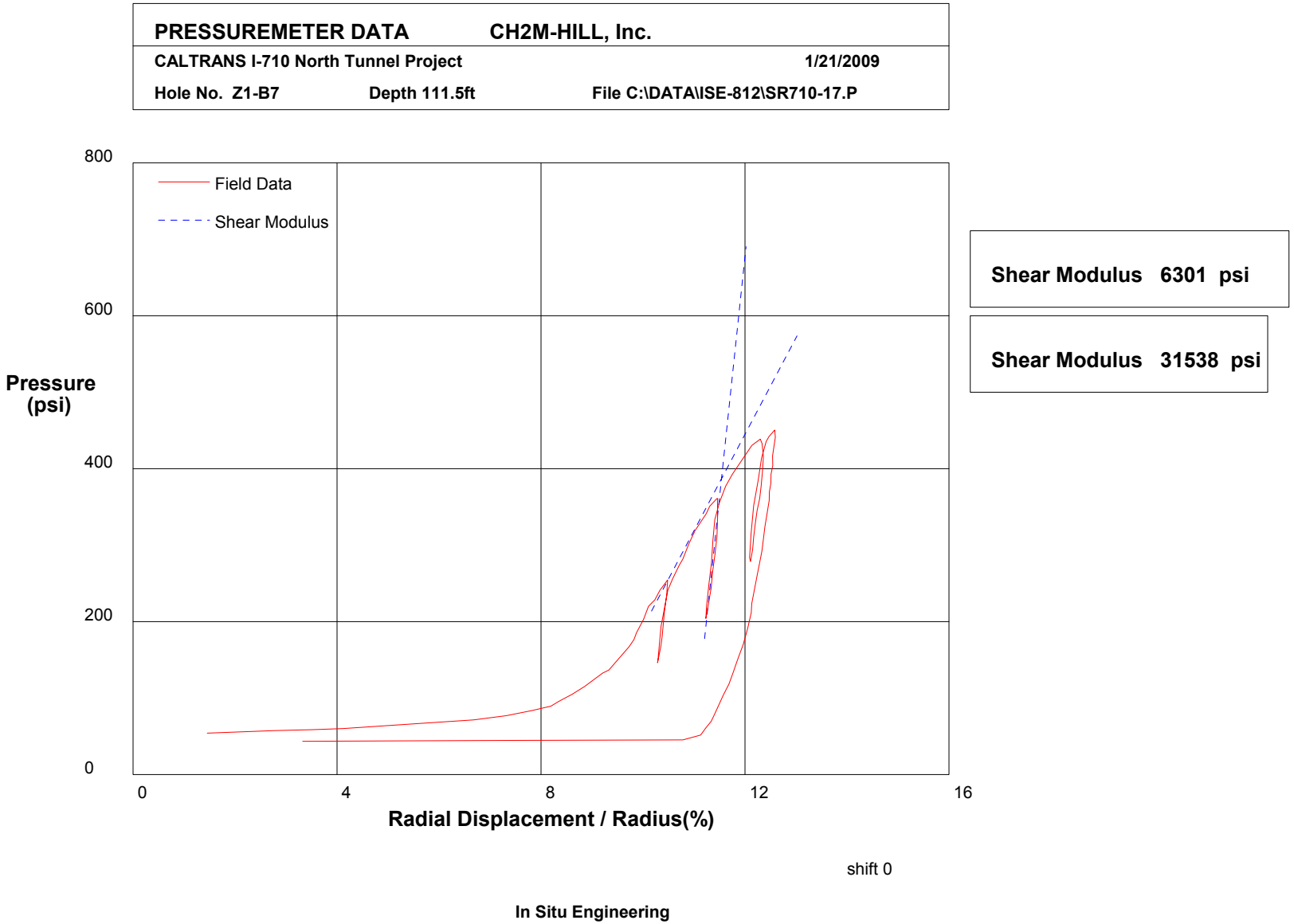
Appendix I - Pressuremeter Data and Standard Interpretation

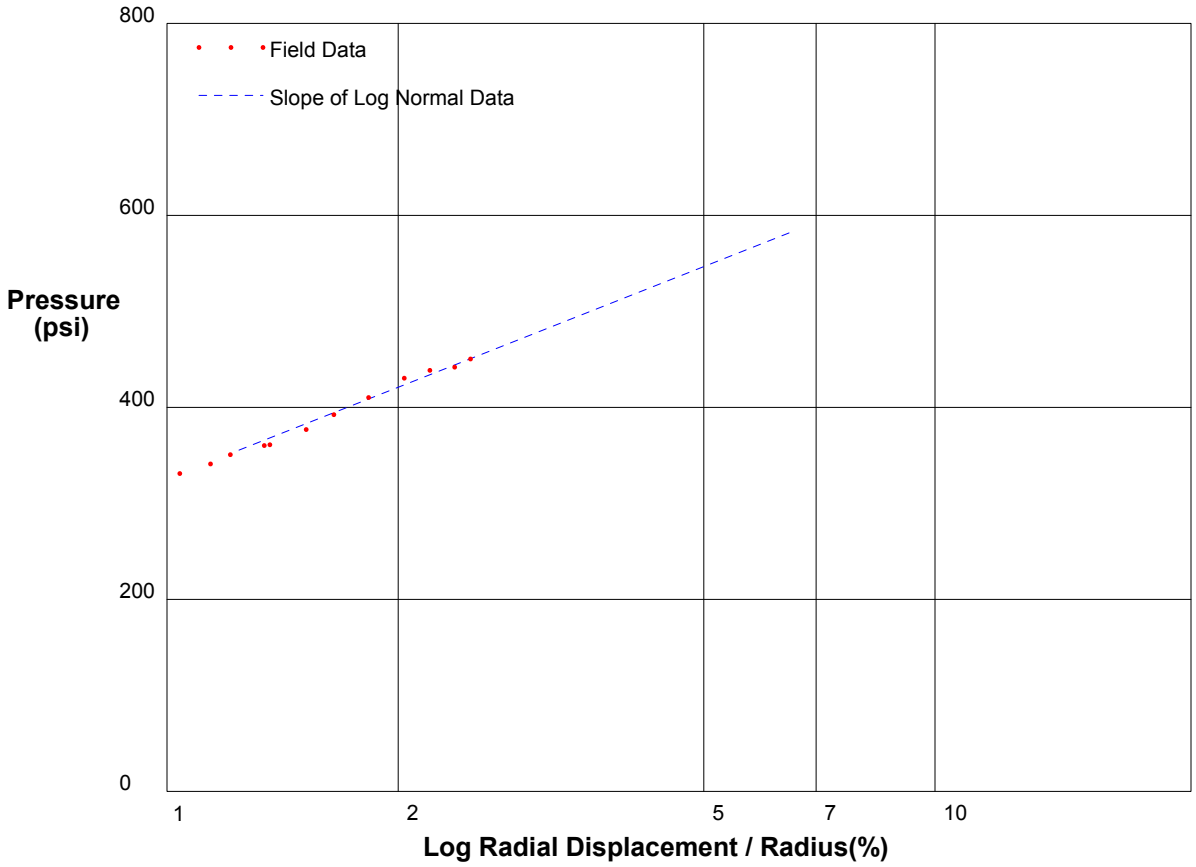


Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/21/2009**

Hole No. Z1-B7 **Depth 111.5ft** **File C:\DATA\ISE-812\SR710-17.P**



Shear Strength 137.1 psi
Limit Pressure 835 psi

shift 10.1

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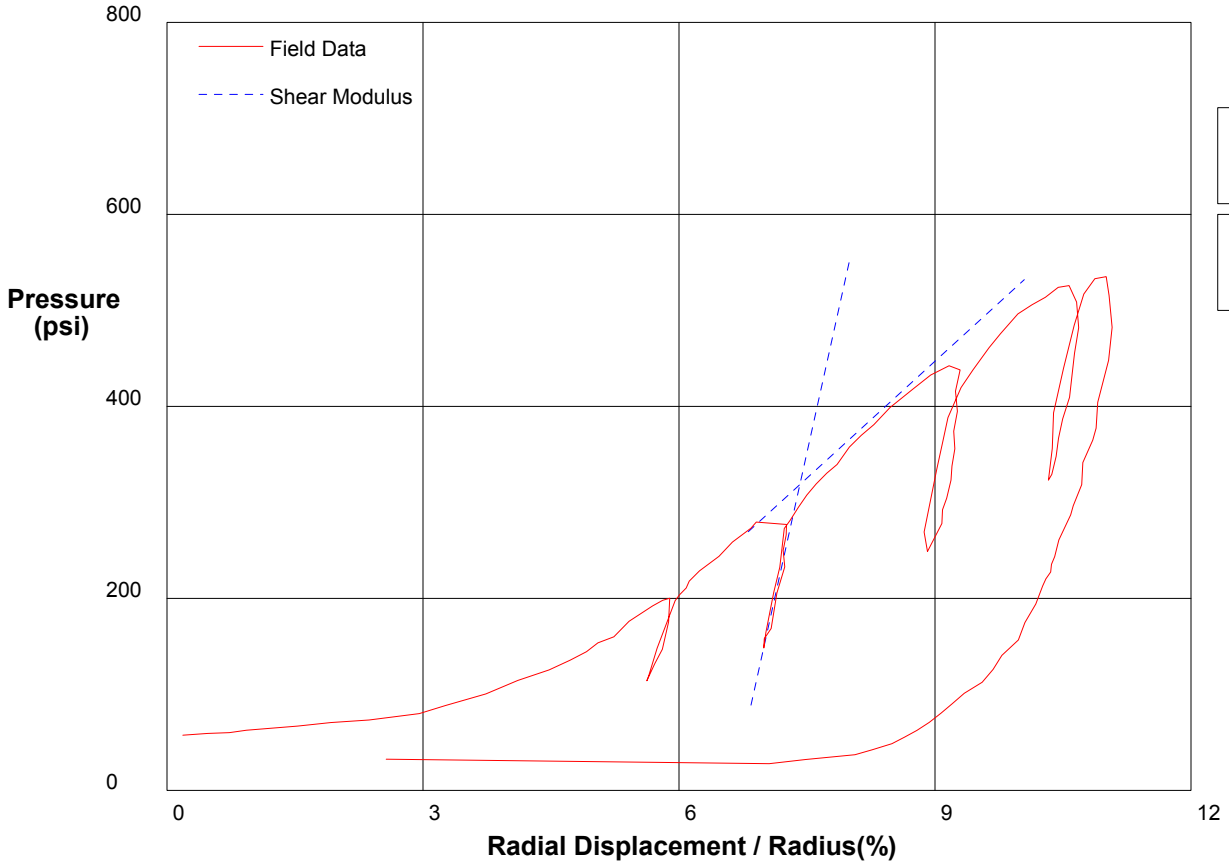
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **1/21/2009**

Hole No. Z1-B7 **Depth 110ft** **File C:\DATA\ISE-812\SR710-18.P**



Shear Modulus 4057 psi

Shear Modulus 20060 psi

shift 0

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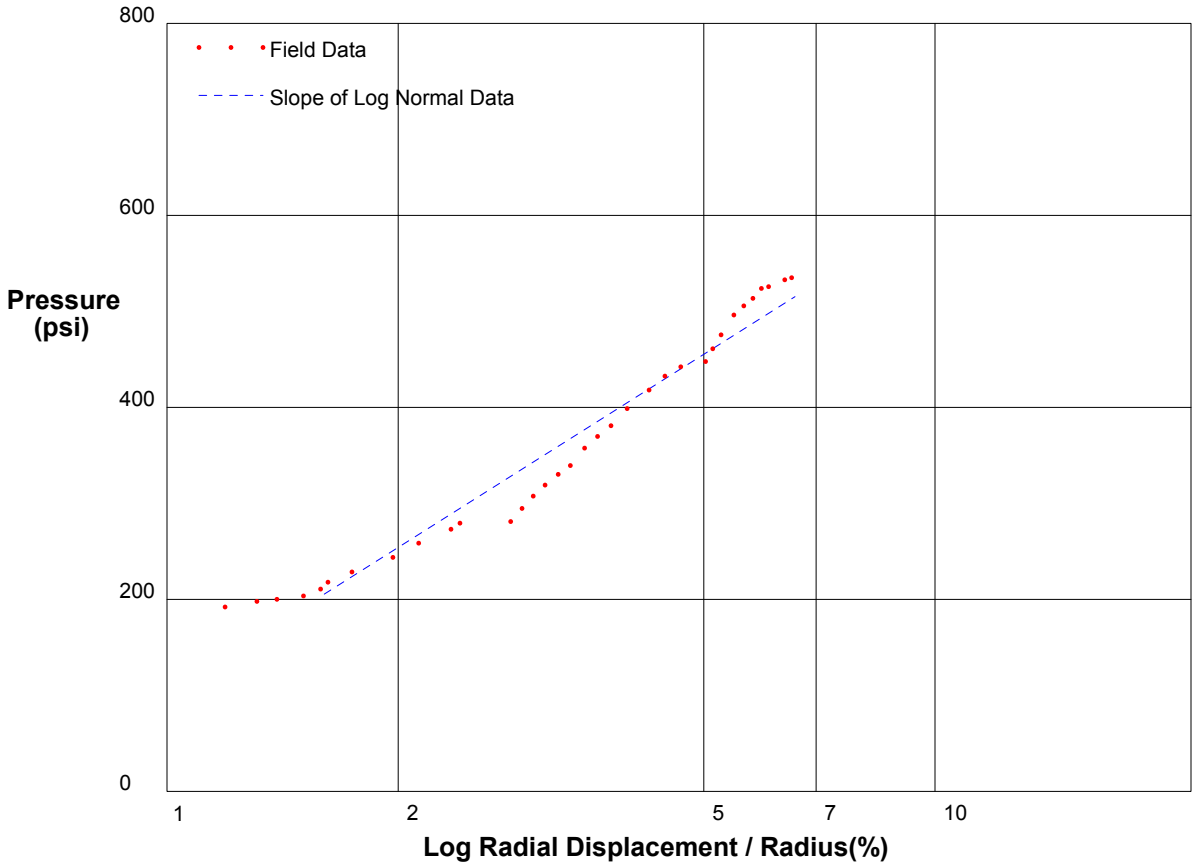
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/21/2009**

Hole No. Z1-B7 **Depth 110ft** **File C:\DATA\ISE-812\SR710-18.P**



Shear Strength 219.4 psi
Limit Pressure 917 psi

shift 4.5

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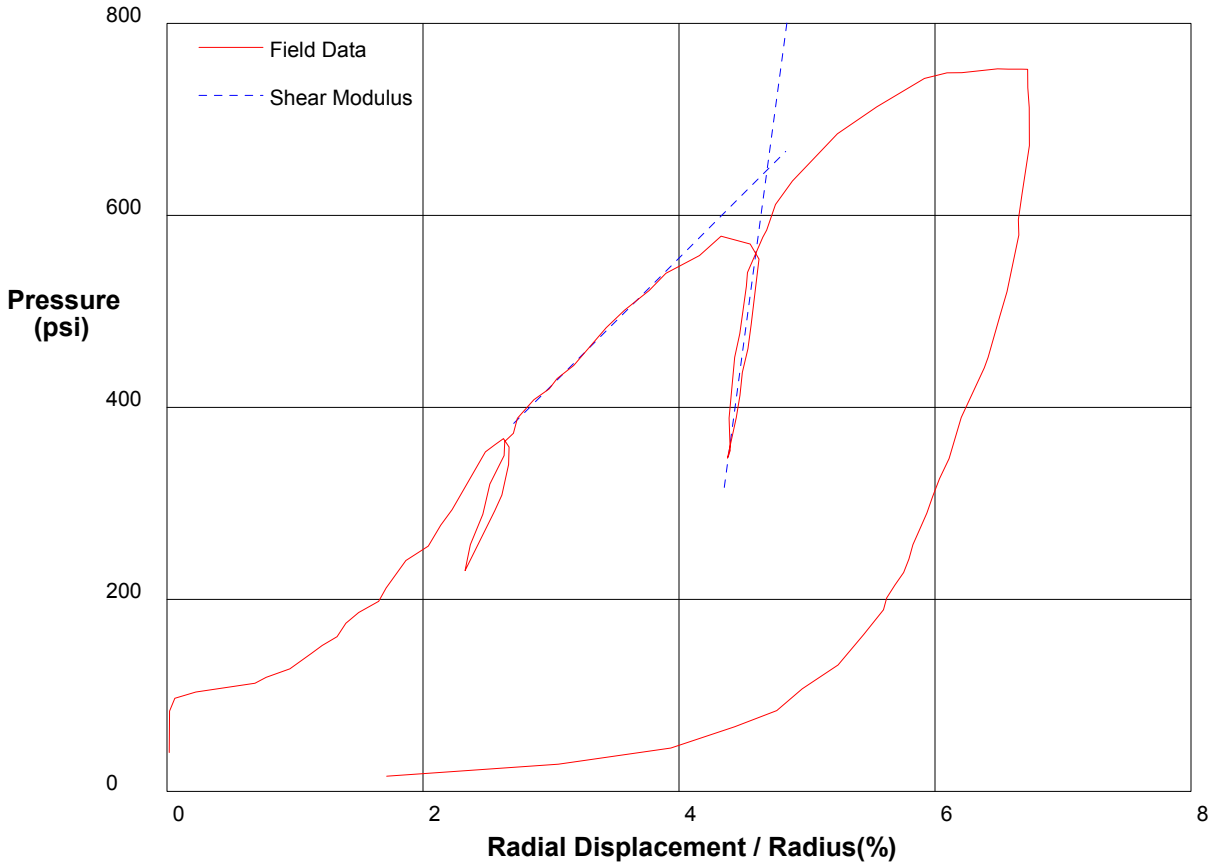
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **1/21/2009**

Hole No. Z1-B7 **Depth 136ft** **File C:\DATA\ISE-812\SR710-19.P**



Shear Modulus 49503 psi

Shear Modulus 6666 psi

shift 0

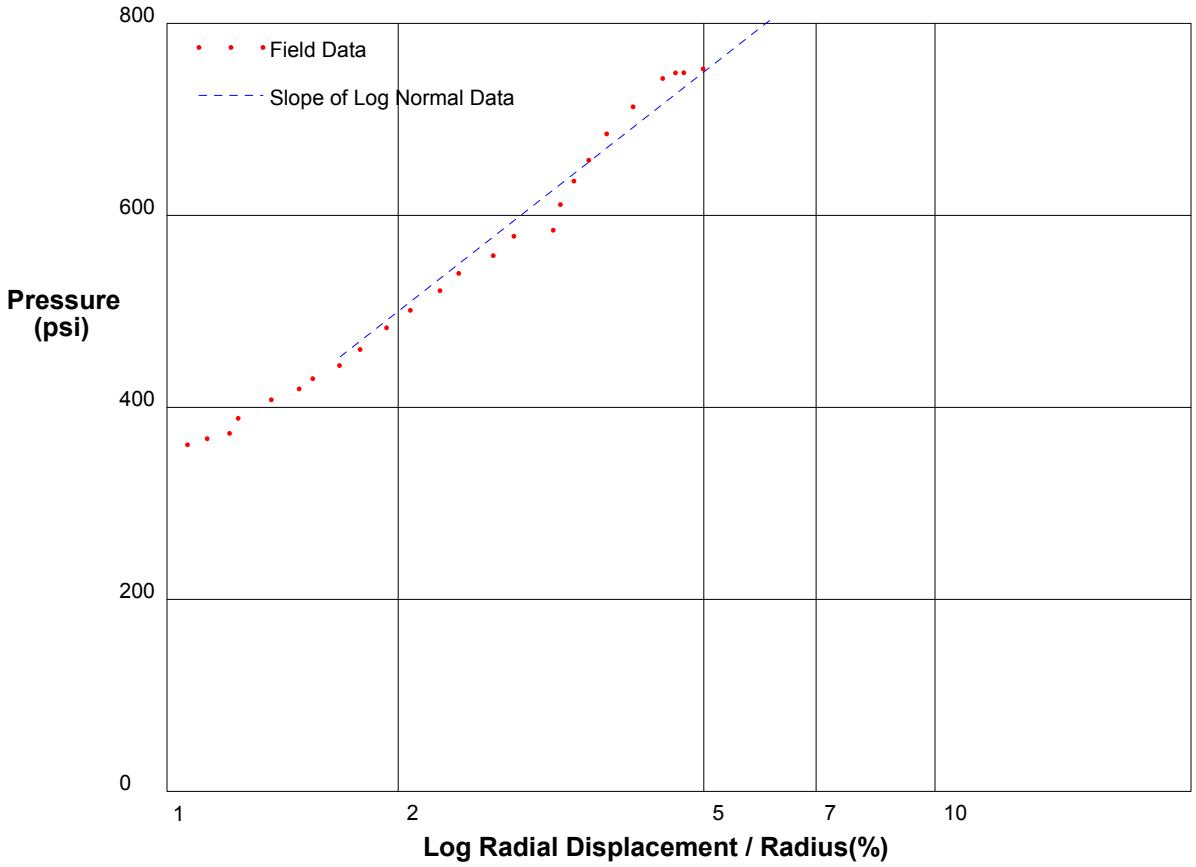
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/21/2009**

Hole No. Z1-B7 **Depth 136ft** **File C:\DATA\ISE-812\SR710-19.P**



Shear Strength 272.1 psi
Limit Pressure 1321 psi

shift 1.5

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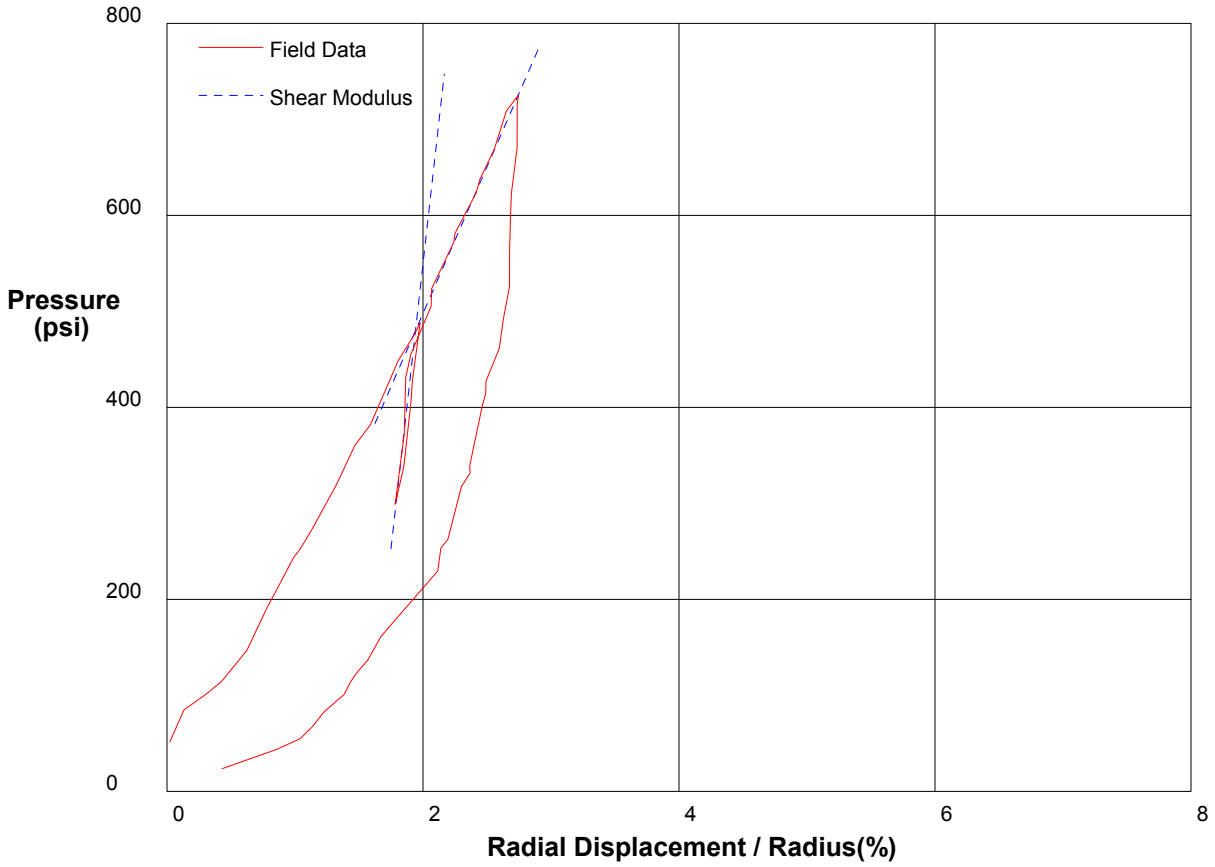
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **1/21/2009**

Hole No. Z1-B7 **Depth 135ft** **File C:\DATA\ISE-812\SR710-20.P**



Shear Modulus 59333 psi

Shear Modulus 15268 psi

shift 0

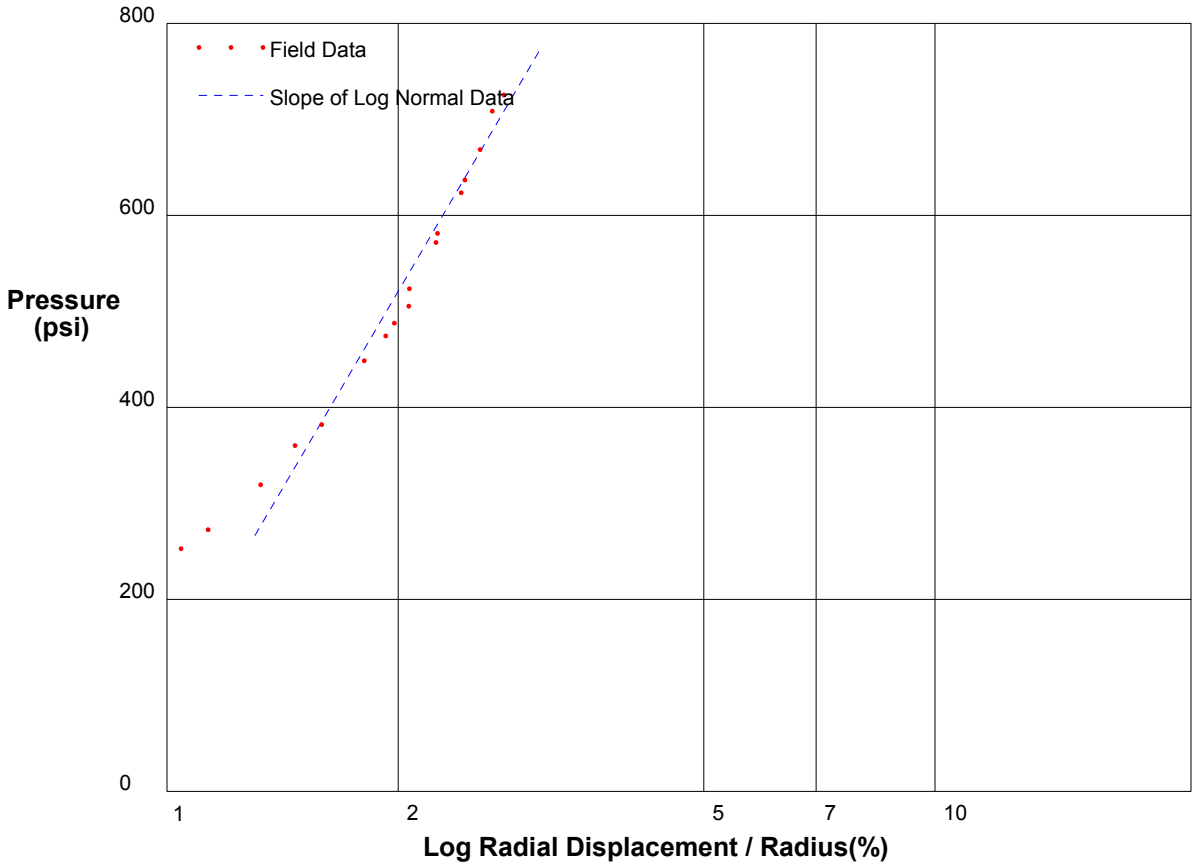
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/21/2009**

Hole No. Z1-B7 **Depth 135ft** **File C:\DATA\ISE-812\SR710-20.P**



Shear Strength 592.1 psi
Limit Pressure 2309 psi

shift 0

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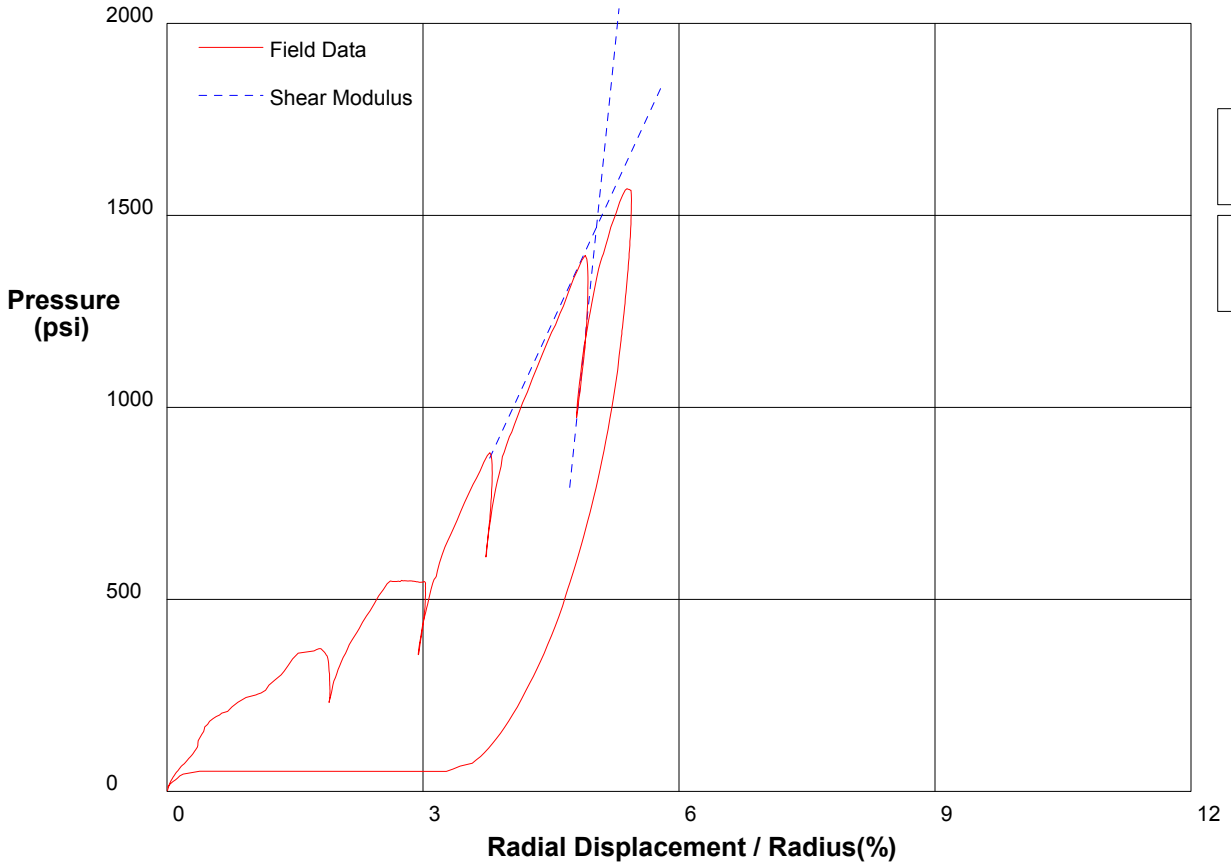
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/28/2009**

Hole No. Z1-B3 **Depth 177.3ft** **File C:\DATA\ISE-812\SR710-21.P**



Shear Modulus 107807 psi

Shear Modulus 24031 psi

shift 0

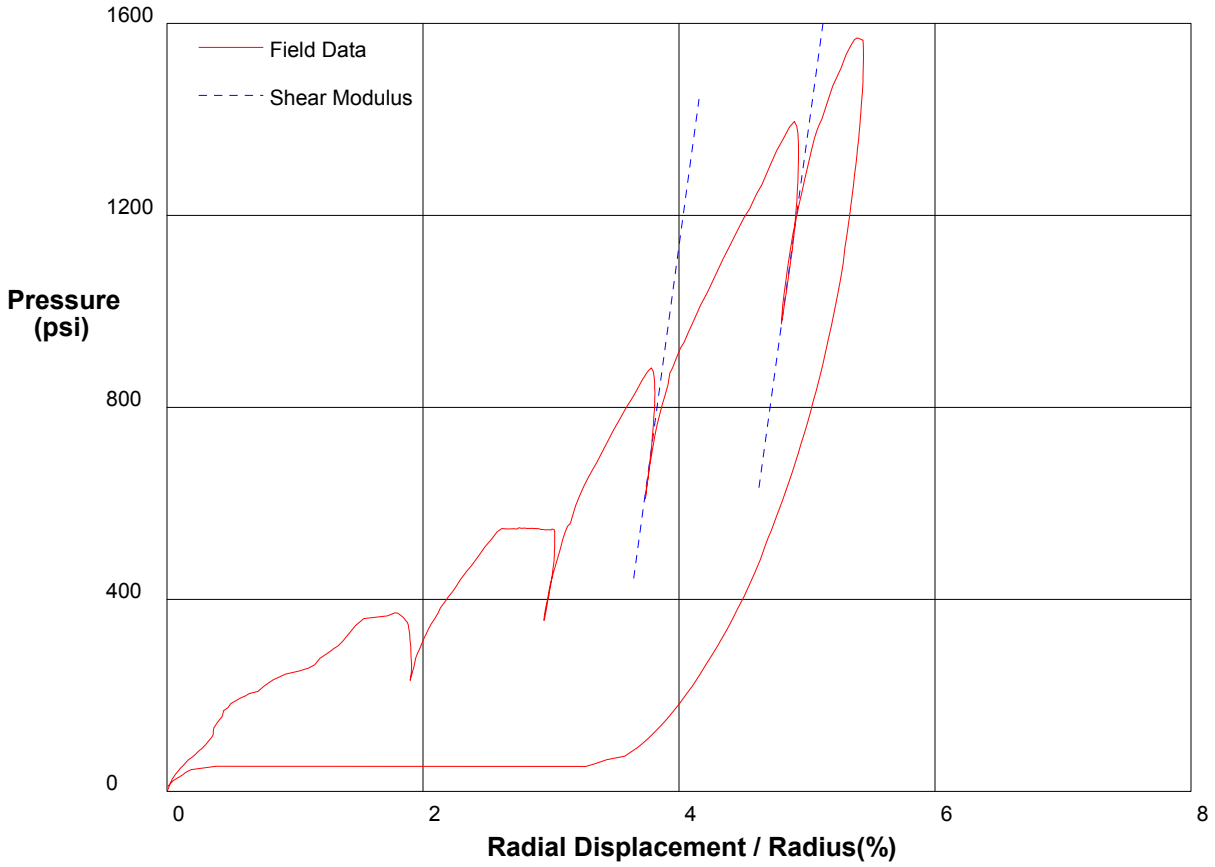
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **1/28/2009**

Hole No. Z1-B3 **Depth 177.3ft** **File C:\DATA\ISE-812\SR710-21.P**



Shear Modulus 96666 psi

Shear Modulus 97687 psi

shift 0

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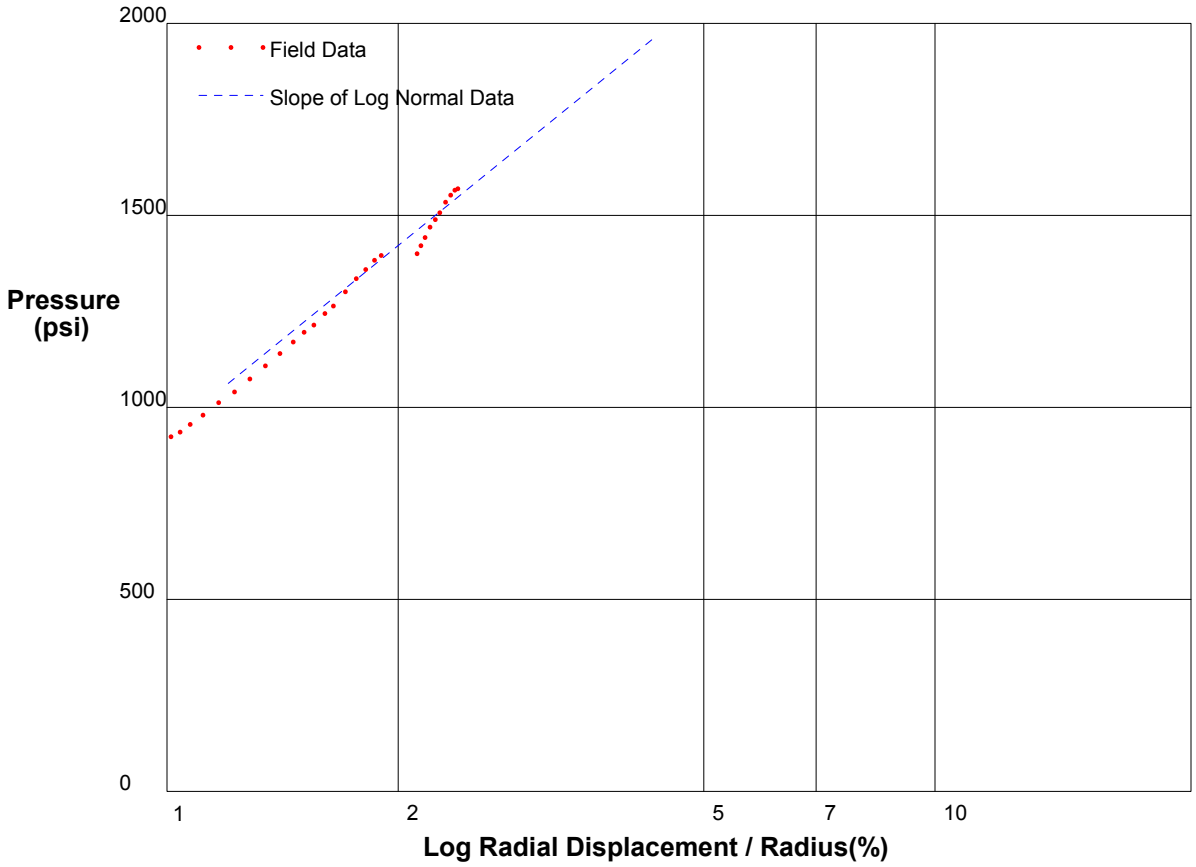
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/28/2009**

Hole No. Z1-B3 **Depth 177.3ft** **File C:\DATA\ISE-812\SR710-21.P**



Shear Strength 704.7 psi
Limit Pressure 3549 psi

shift 3

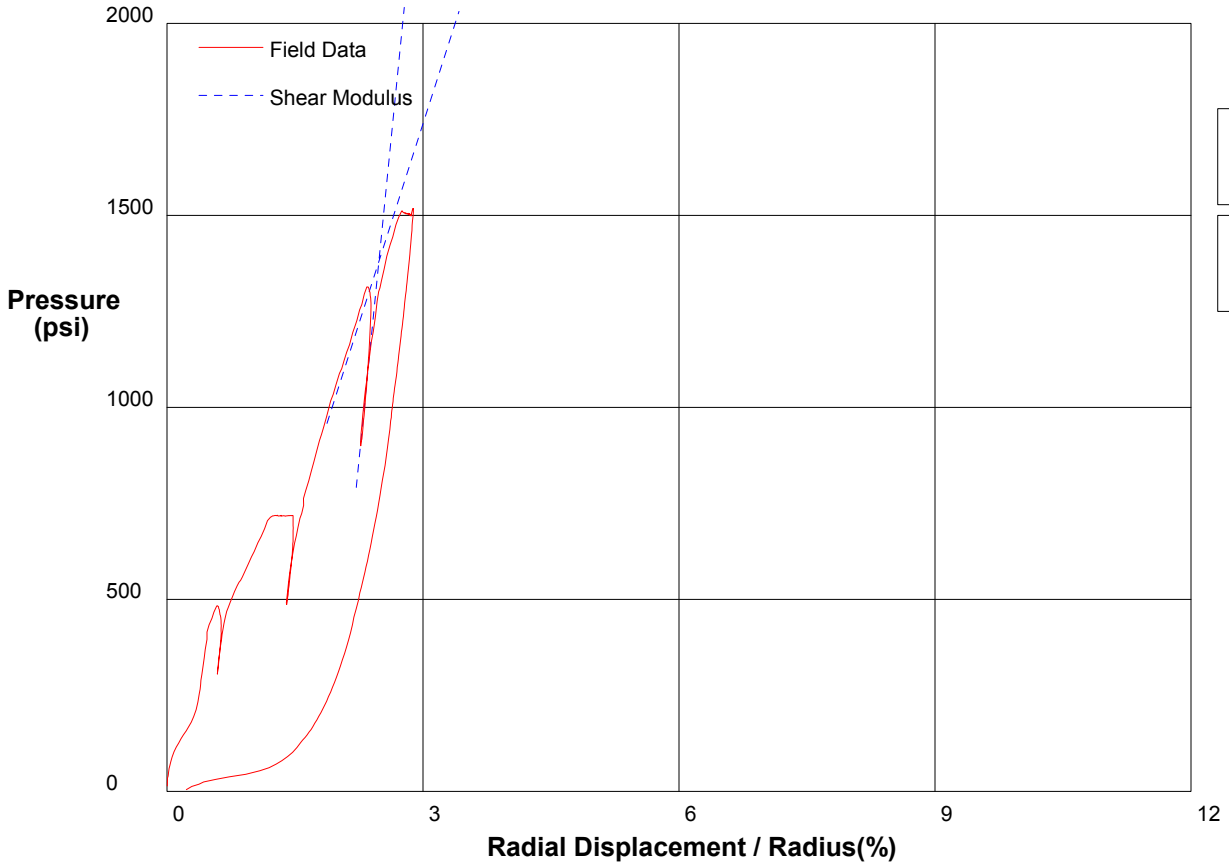
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/28/2009**

Hole No. Z1-B3 **Depth 204ft** **File C:\DATA\ISE-812\SR710-22.P**



Shear Modulus 111111 psi

Shear Modulus 34680 psi

shift 0

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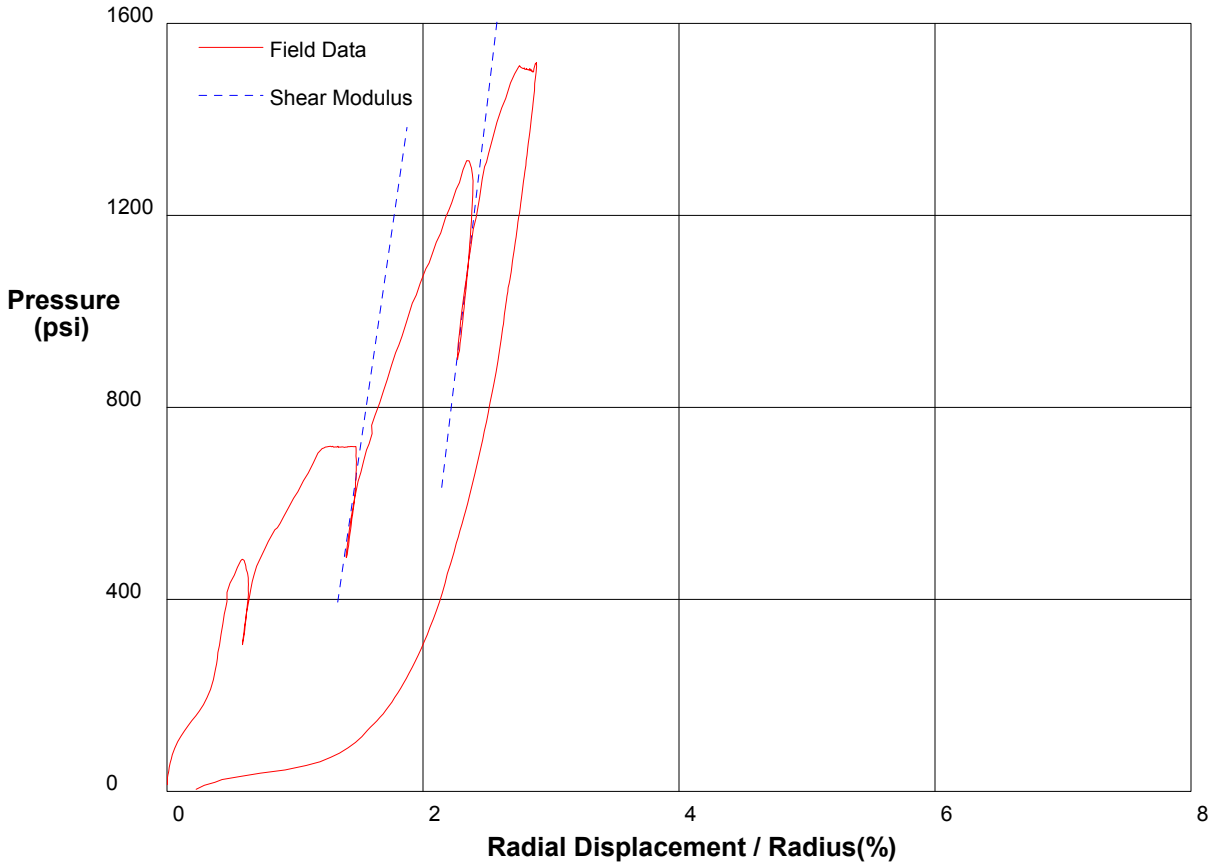
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **1/28/2009**

Hole No. Z1-B3 **Depth 204ft** **File C:\DATA\ISE-812\SR710-22.P**



Shear Modulus 112380 psi

Shear Modulus 91282 psi

shift 0

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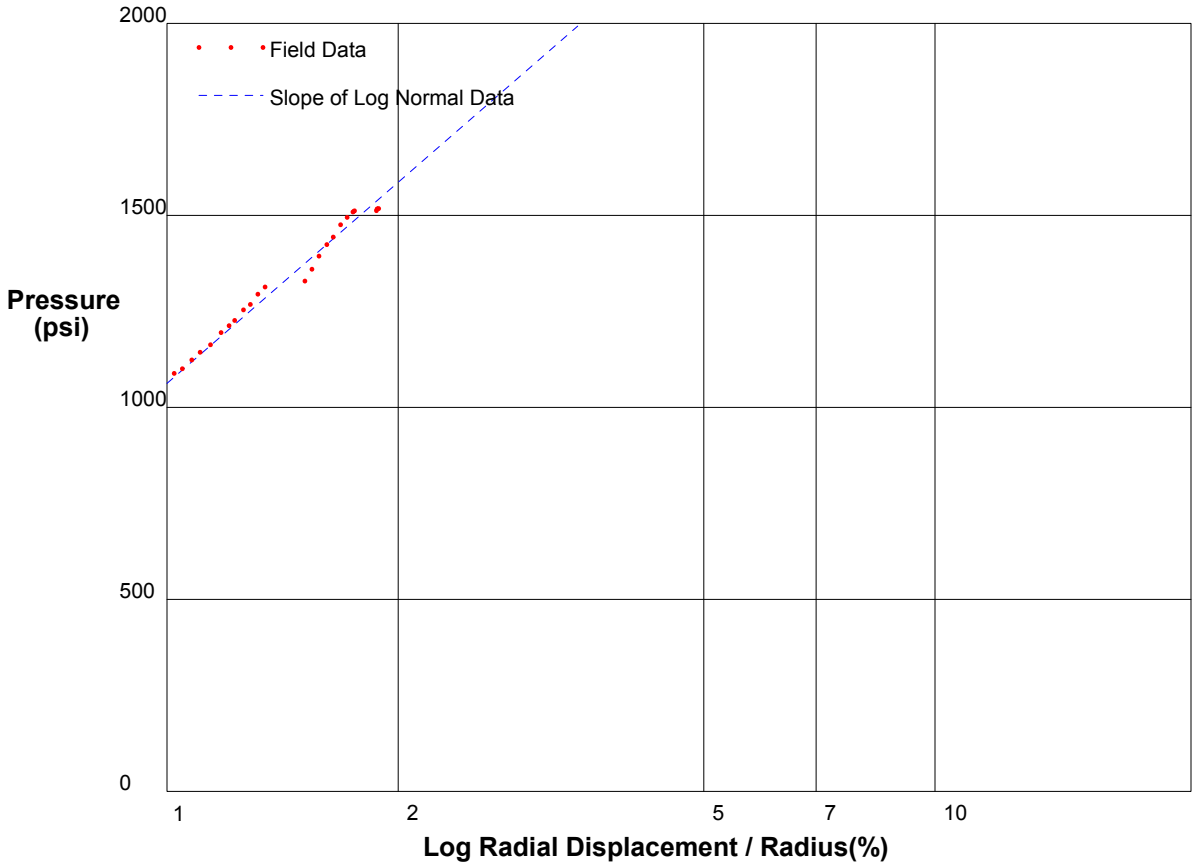
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/28/2009**

Hole No. Z1-B3 **Depth 204ft** **File C:\DATA\ISE-812\SR710-22.P**



Shear Strength 755.7 psi
Limit Pressure 3869 psi

shift 1

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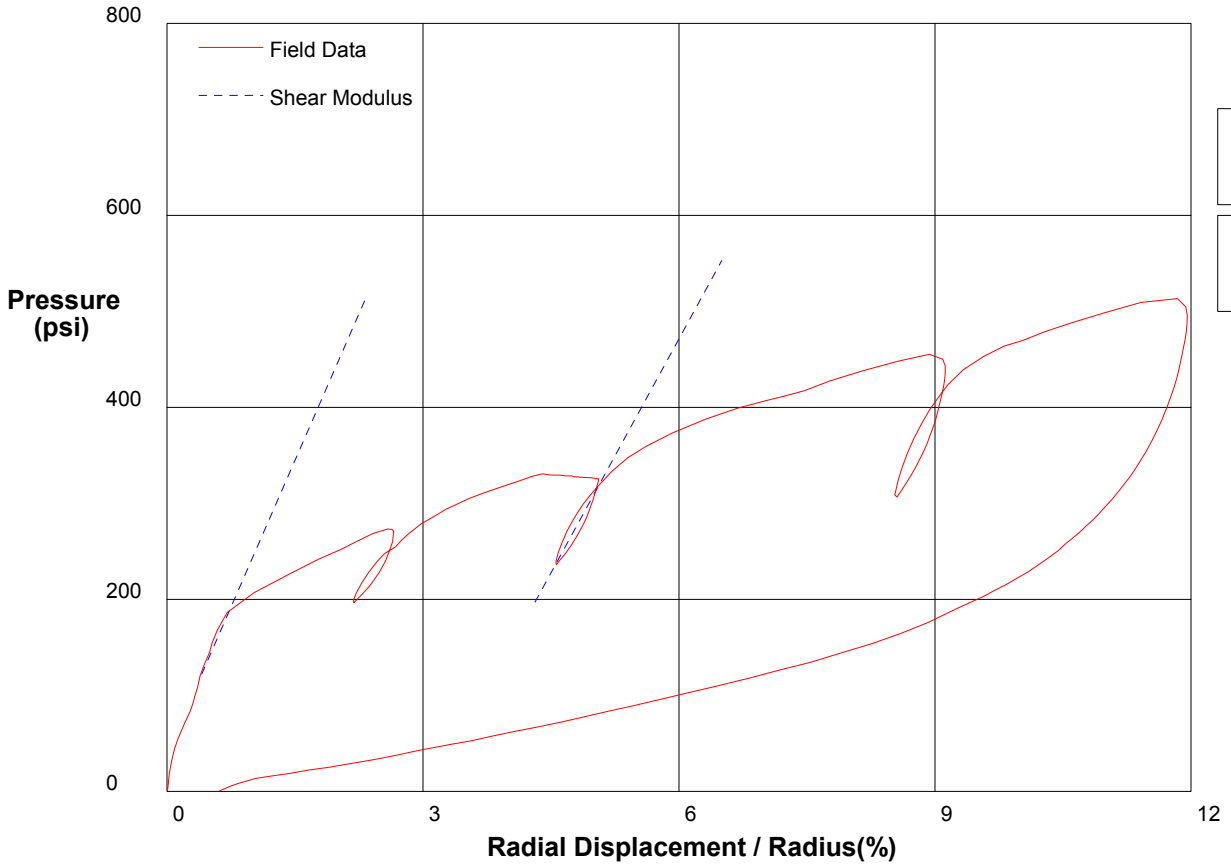
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/29/2009**

Hole No. Z2-B2 **Depth 135.7ft** **File C:\DATA\ISE-812\SR710-23.P**



Shear Modulus 8126 psi

Shear Modulus 10179 psi

shift 0

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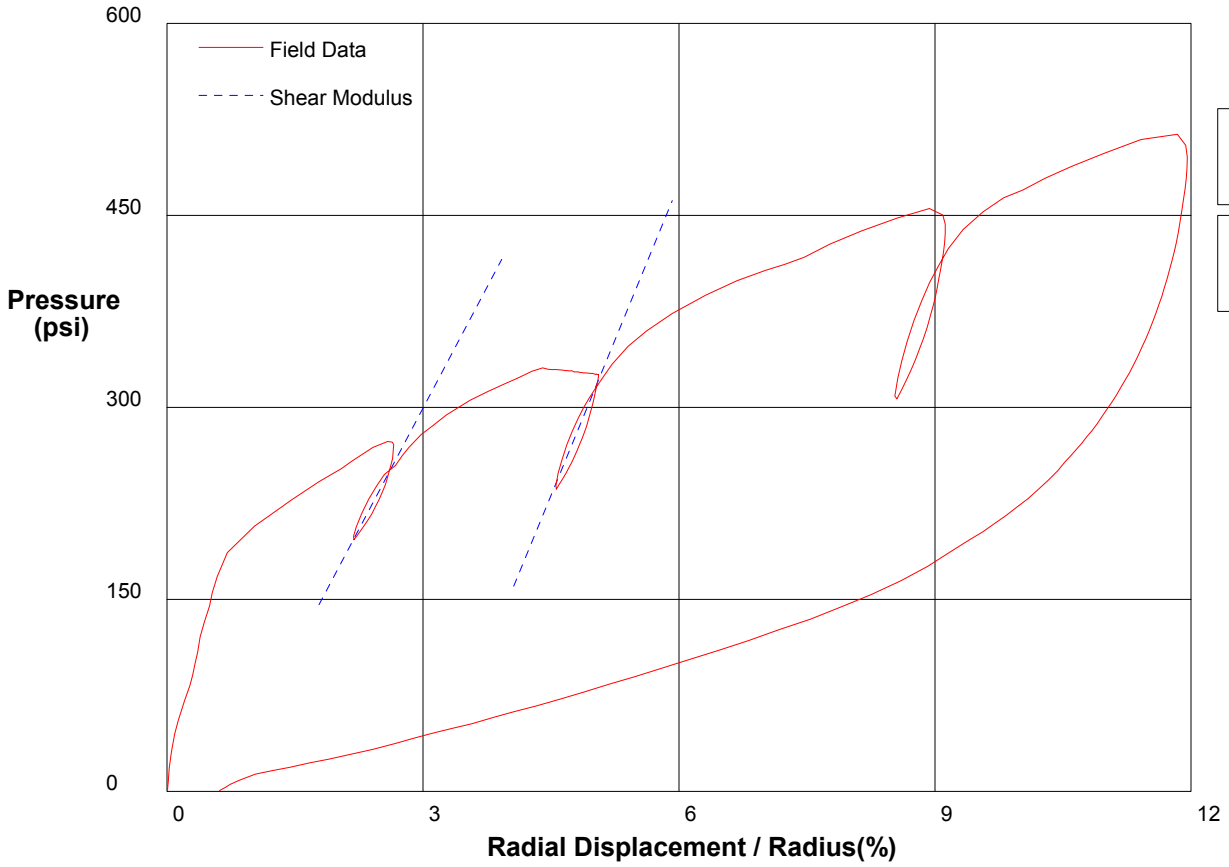
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **1/29/2009**

Hole No. Z2-B2 **Depth 135.7ft** **File C:\DATA\ISE-812\SR710-23.P**



Shear Modulus 6301 psi

Shear Modulus 8095 psi

shift 0

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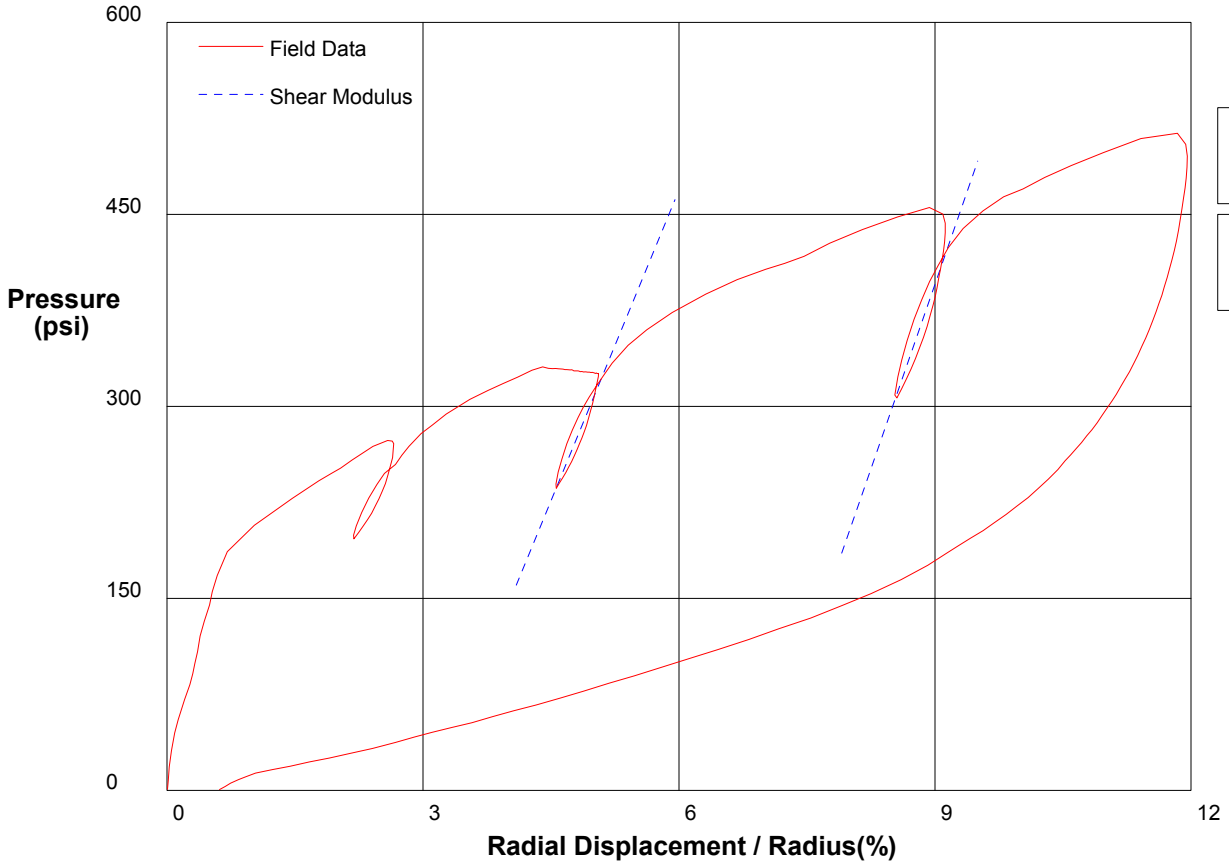
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **1/29/2009**

Hole No. Z2-B2 **Depth 135.7ft** **File C:\DATA\ISE-812\SR710-23.P**



Shear Modulus 9607 psi

Shear Modulus 8095 psi

shift 0

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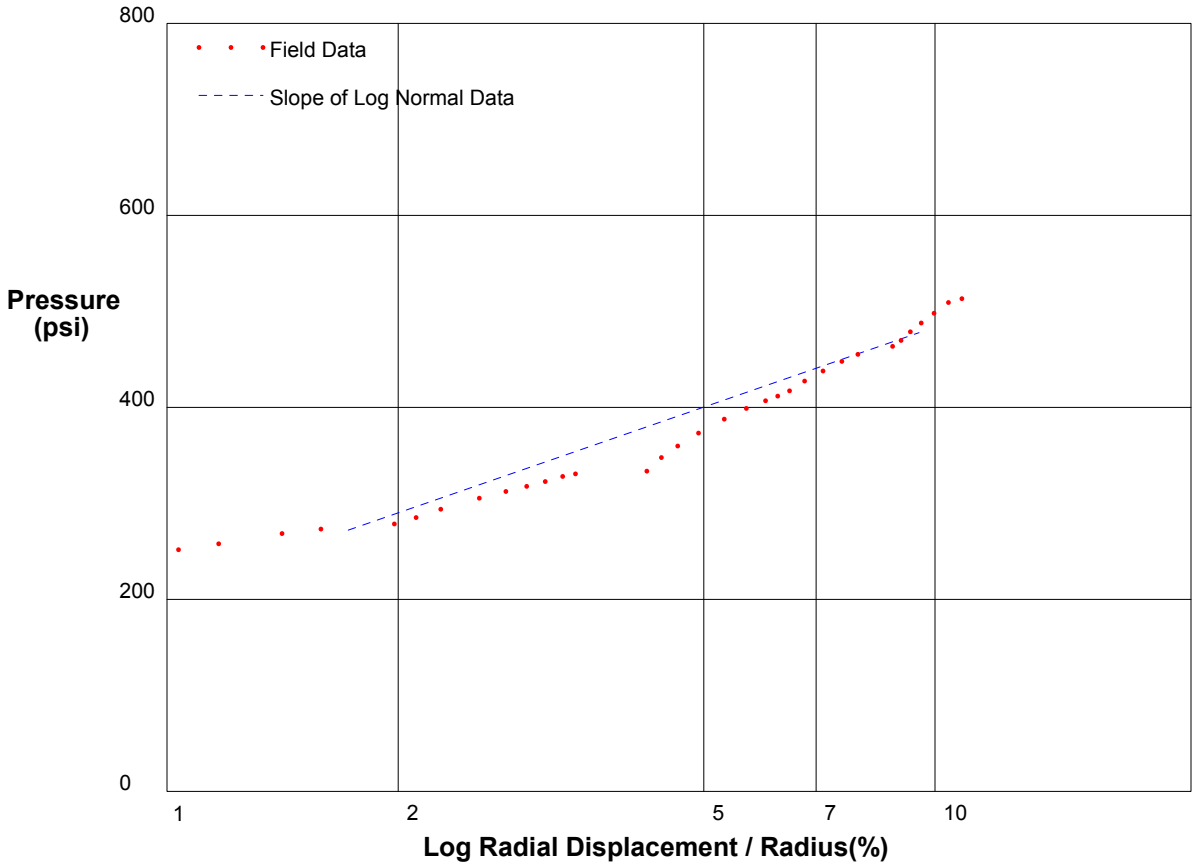
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/29/2009**

Hole No. Z2-B2 **Depth 135.7ft** **File C:\DATA\ISE-812\SR710-23.P**



Shear Strength 120.1 psi
Limit Pressure 653 psi

shift 1

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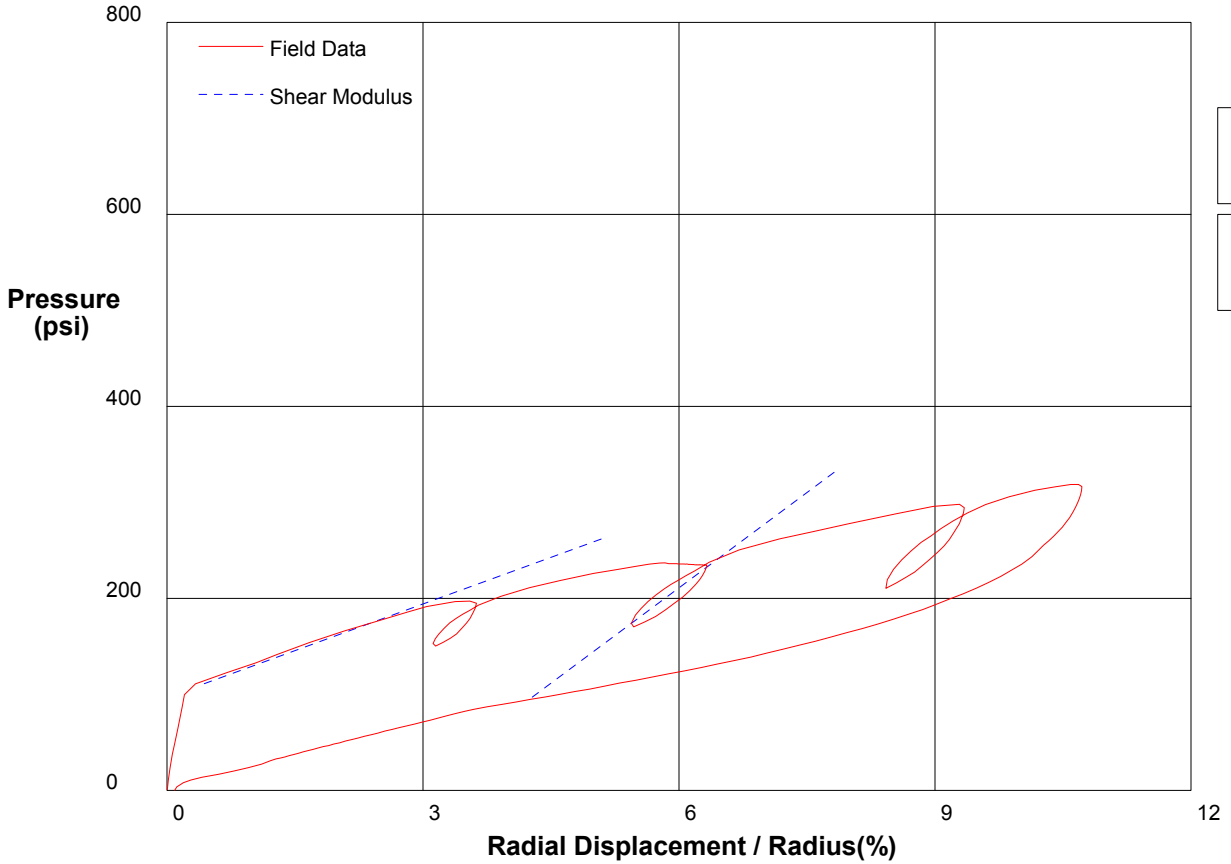
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/29/2009**

Hole No. Z2-B2 **Depth 134.2ft** **File C:\DATA\ISE-812\SR710-24.P**



Shear Modulus 3308 psi

Shear Modulus 1620 psi

shift 0

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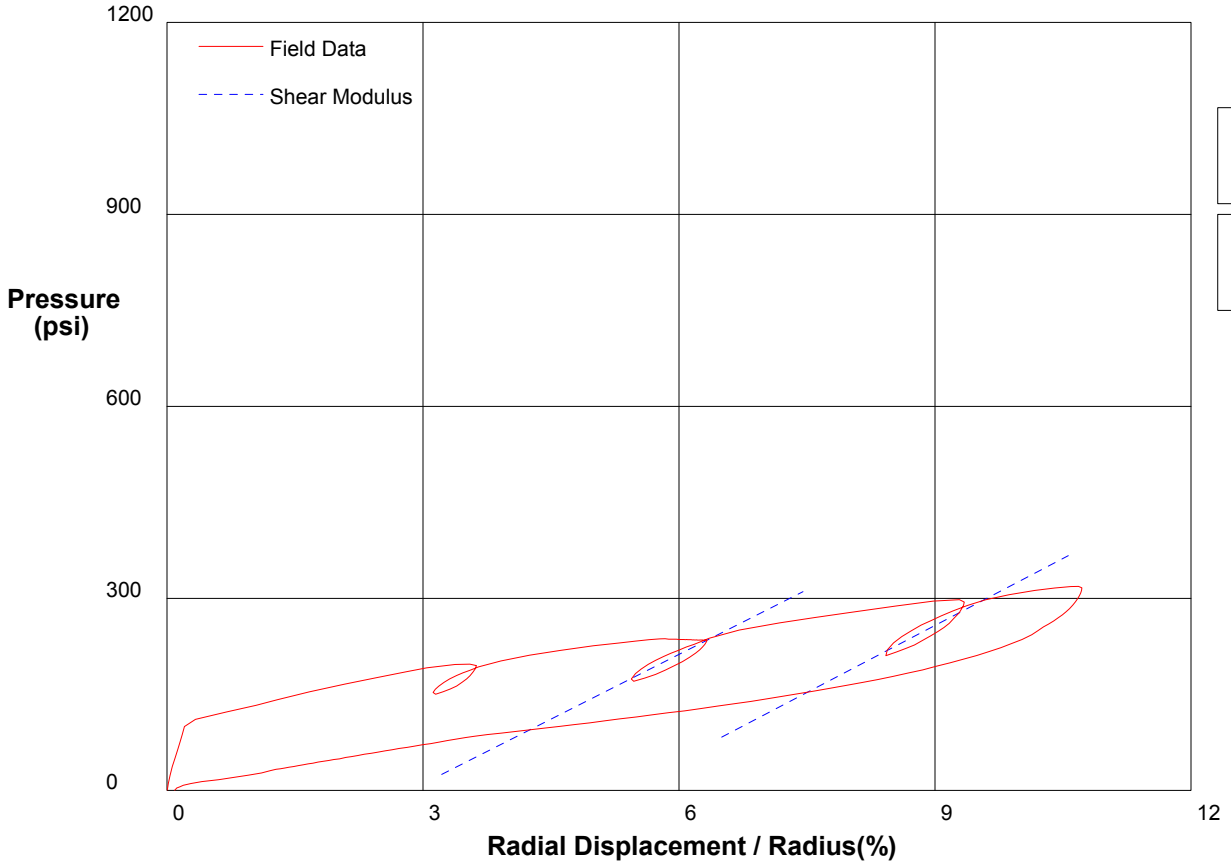
Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **1/29/2009**

Hole No. Z2-B2 **Depth 134.2ft** **File C:\DATA\ISE-812\SR710-24.P**



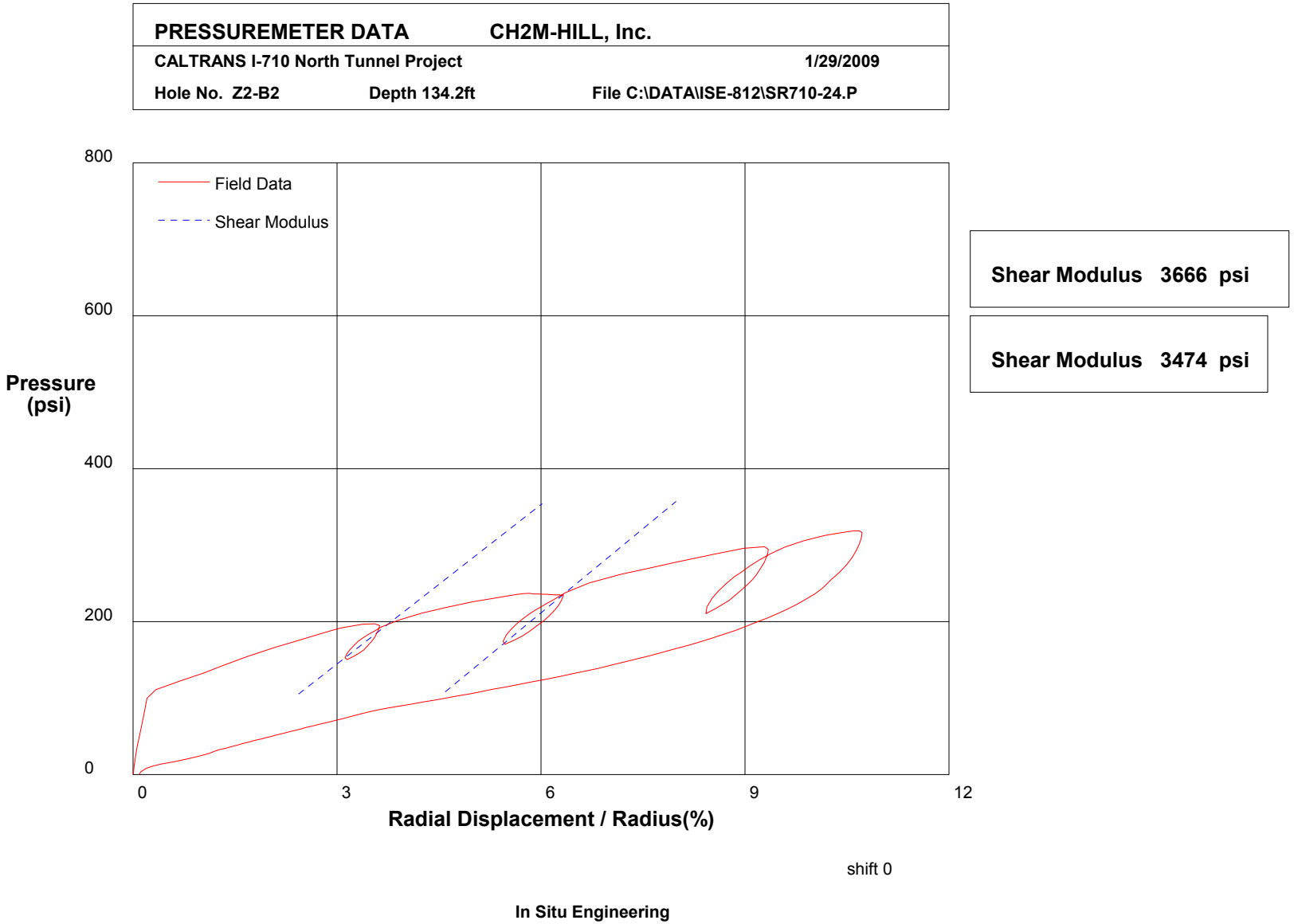
Shear Modulus 3487 psi

Shear Modulus 3370 psi

shift 0

In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

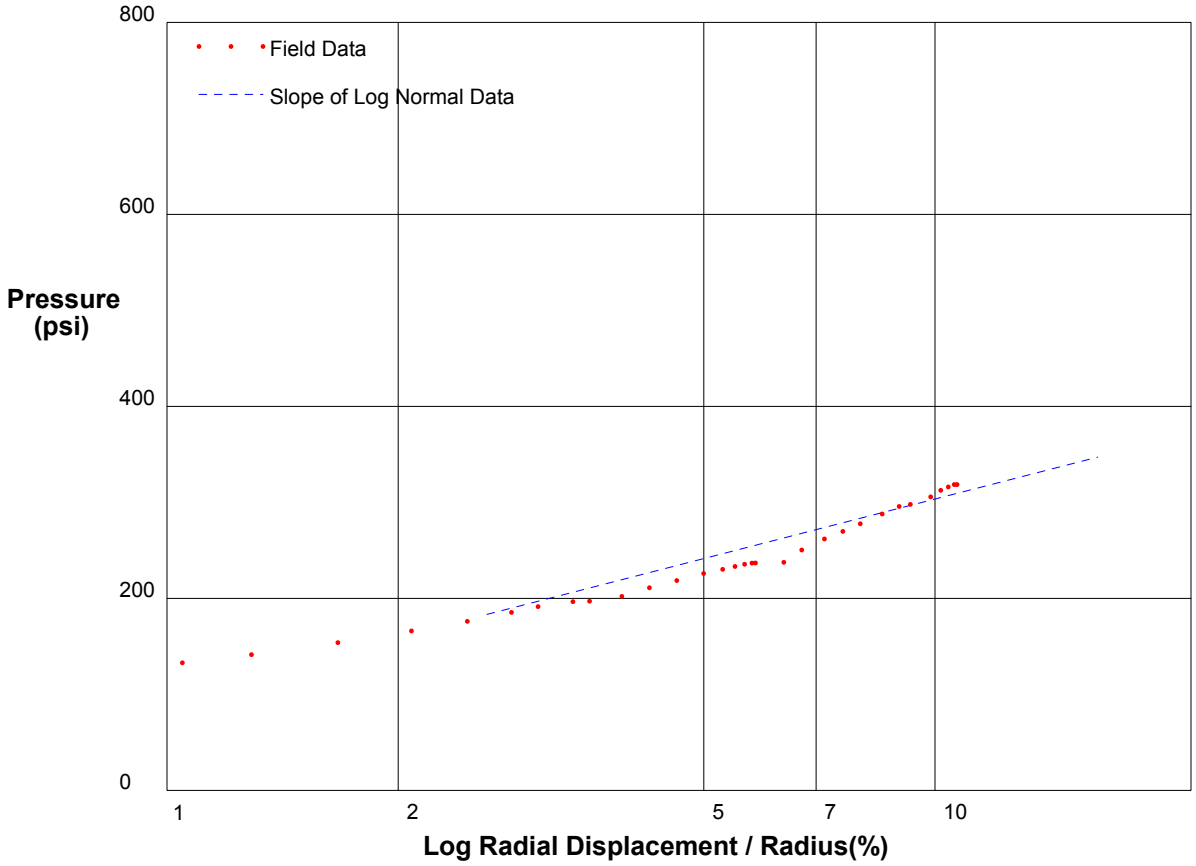


Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/29/2009**

Hole No. Z2-B2 **Depth 134.2ft** **File C:\DATA\ISE-812\SR710-24.P**



Shear Strength 89.5 psi
Limit Pressure 429 psi

shift 0

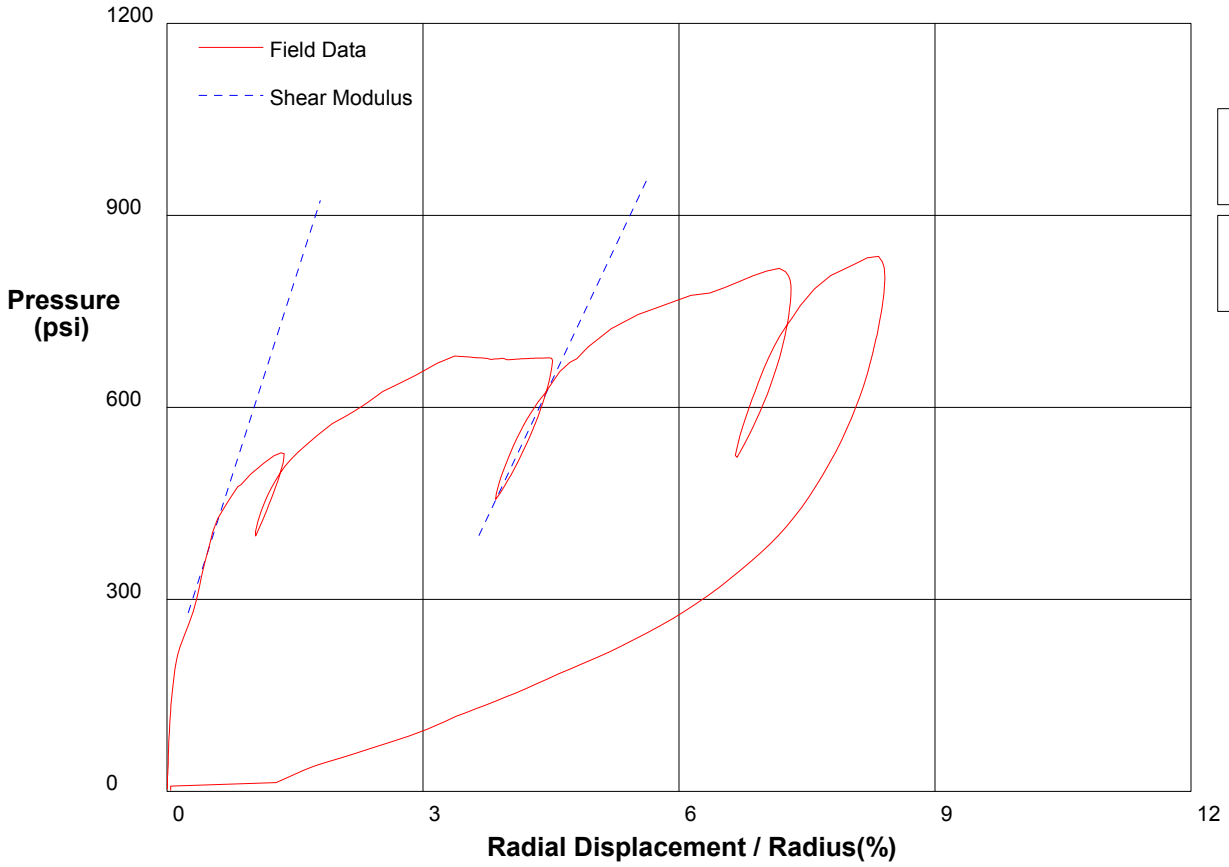
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/4/2009**

Hole No. Z2-B2 **Depth 251ft** **File C:\DATA\ISE-812\SR710-25.P**



Shear Modulus 14120 psi

Shear Modulus 20808 psi

shift 0

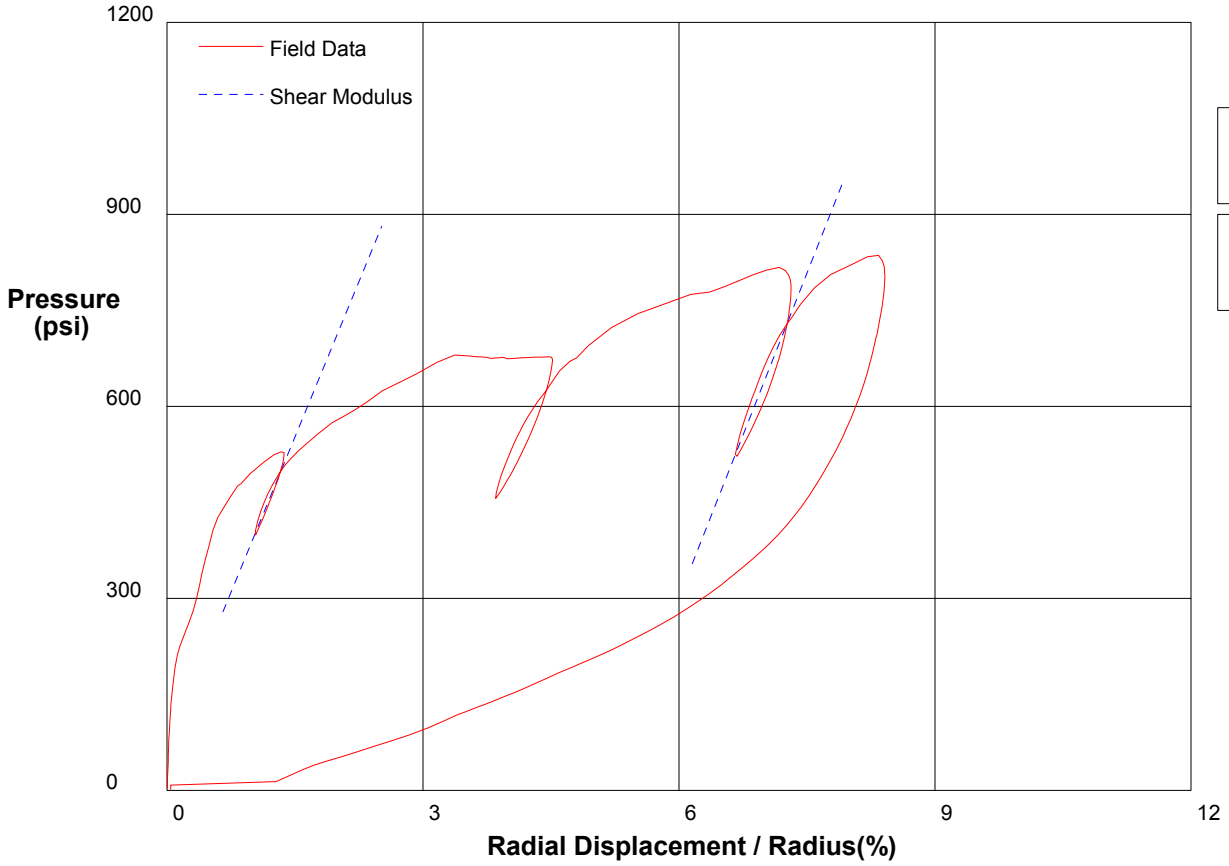
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **2/4/2009**

Hole No. Z2-B2 **Depth 251ft** **File C:\DATA\ISE-812\SR710-25.P**



Shear Modulus 16904 psi

Shear Modulus 16190 psi

shift 0

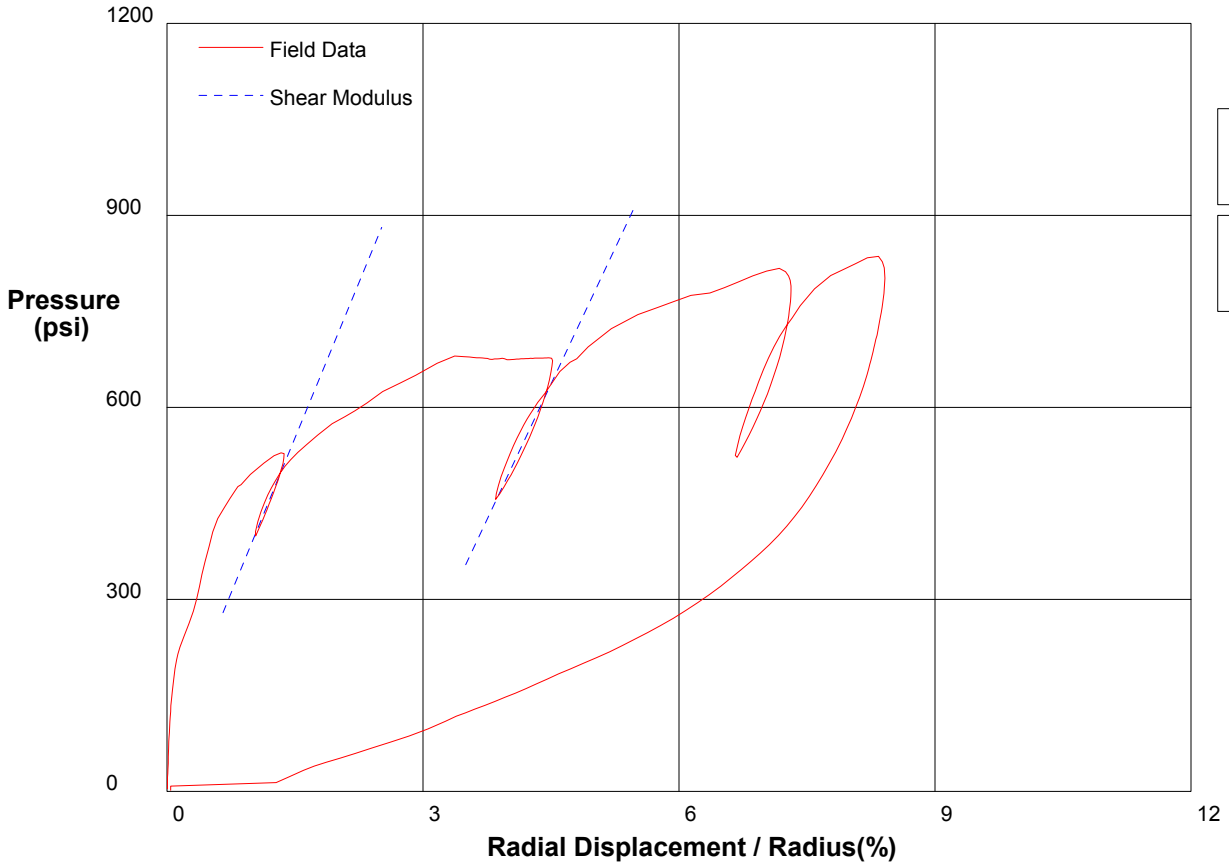
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **2/4/2009**

Hole No. Z2-B2 **Depth 251ft** **File C:\DATA\ISE-812\SR710-25.P**



Shear Modulus 14120 psi

Shear Modulus 16190 psi

shift 0

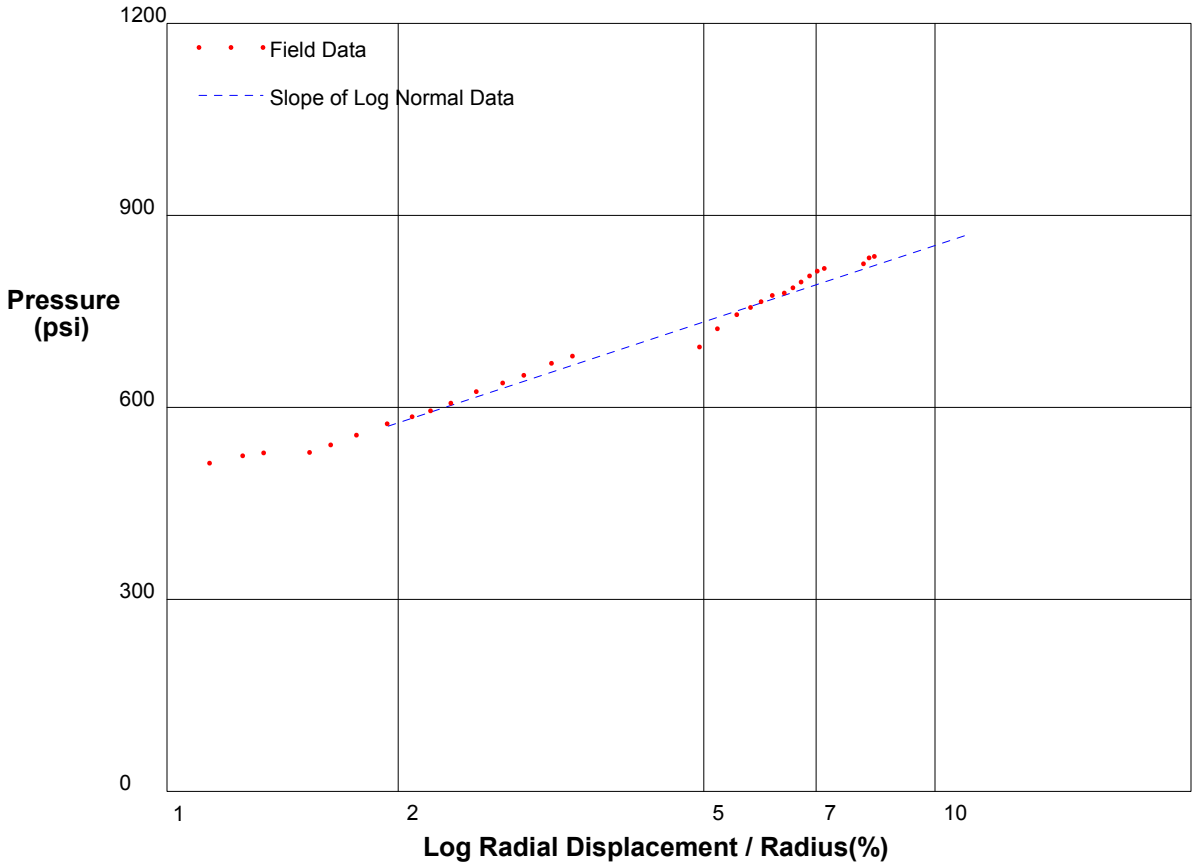
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/4/2009**

Hole No. Z2-B2 **Depth 251ft** **File C:\DATA\ISE-812\SR710-25.P**



Shear Strength 172.1 psi
Limit Pressure 1095 psi

shift 0

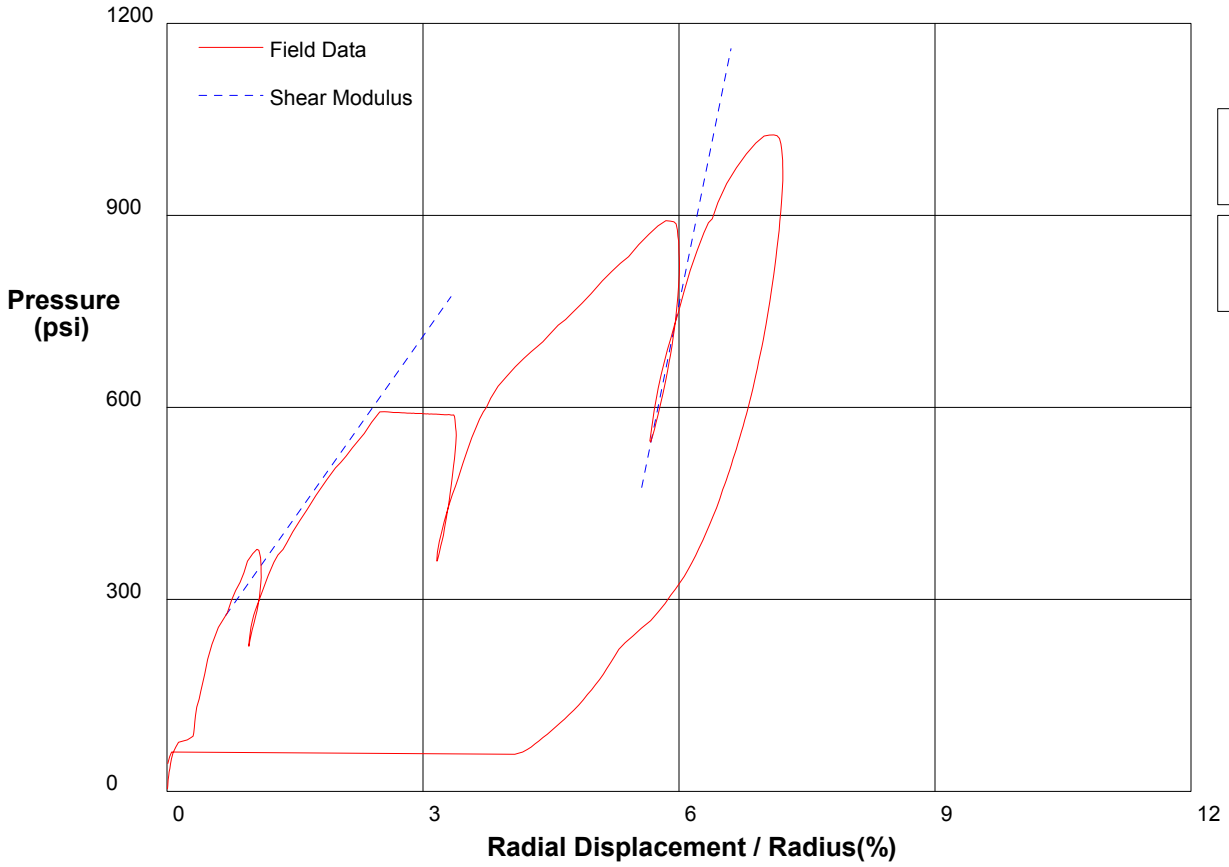
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/4/2009**

Hole No. Z2-B2 **Depth 249.5ft** **File C:\DATA\ISE-812\SR710-26.P**



Shear Modulus 32736 psi

Shear Modulus 9428 psi

shift 0

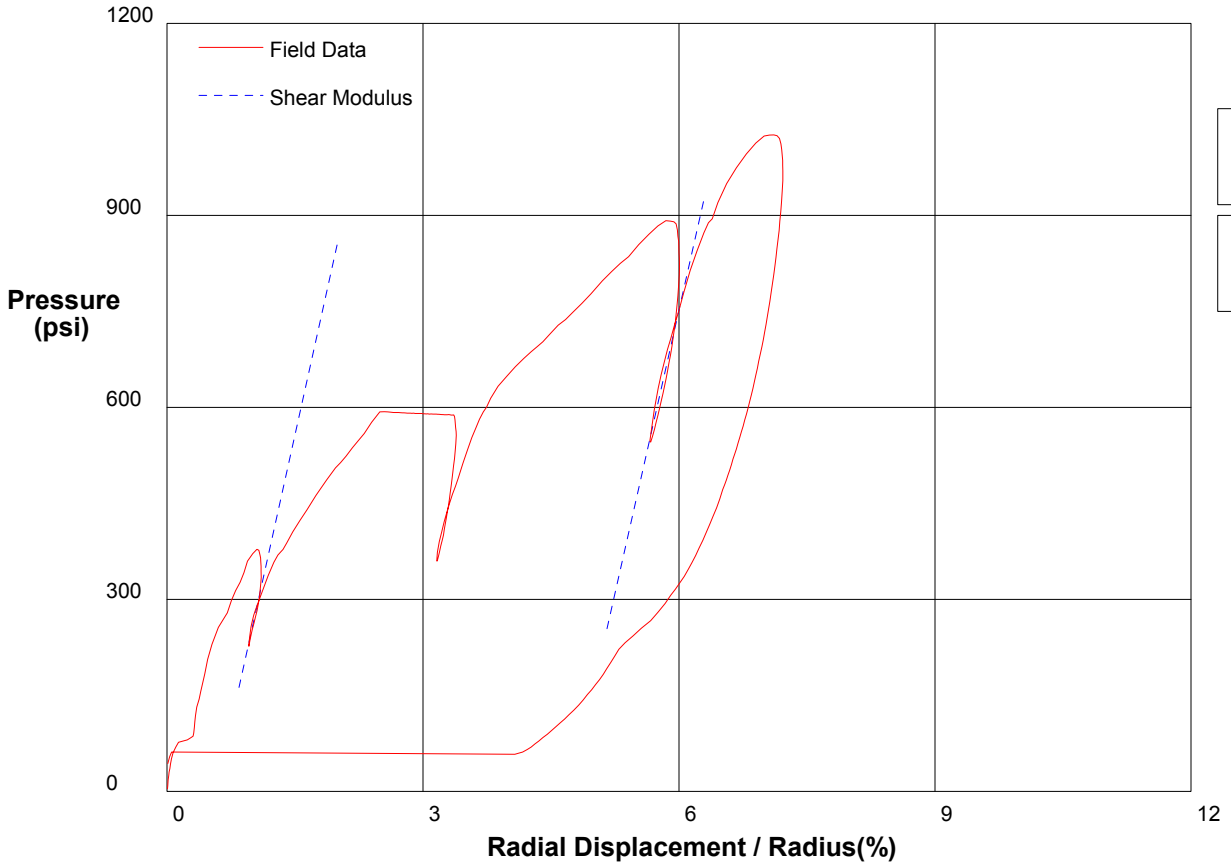
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **2/4/2009**

Hole No. Z2-B2 **Depth 249.5ft** **File C:\DATA\ISE-812\SR710-26.P**



Shear Modulus 29497 psi

Shear Modulus 30090 psi

shift 0

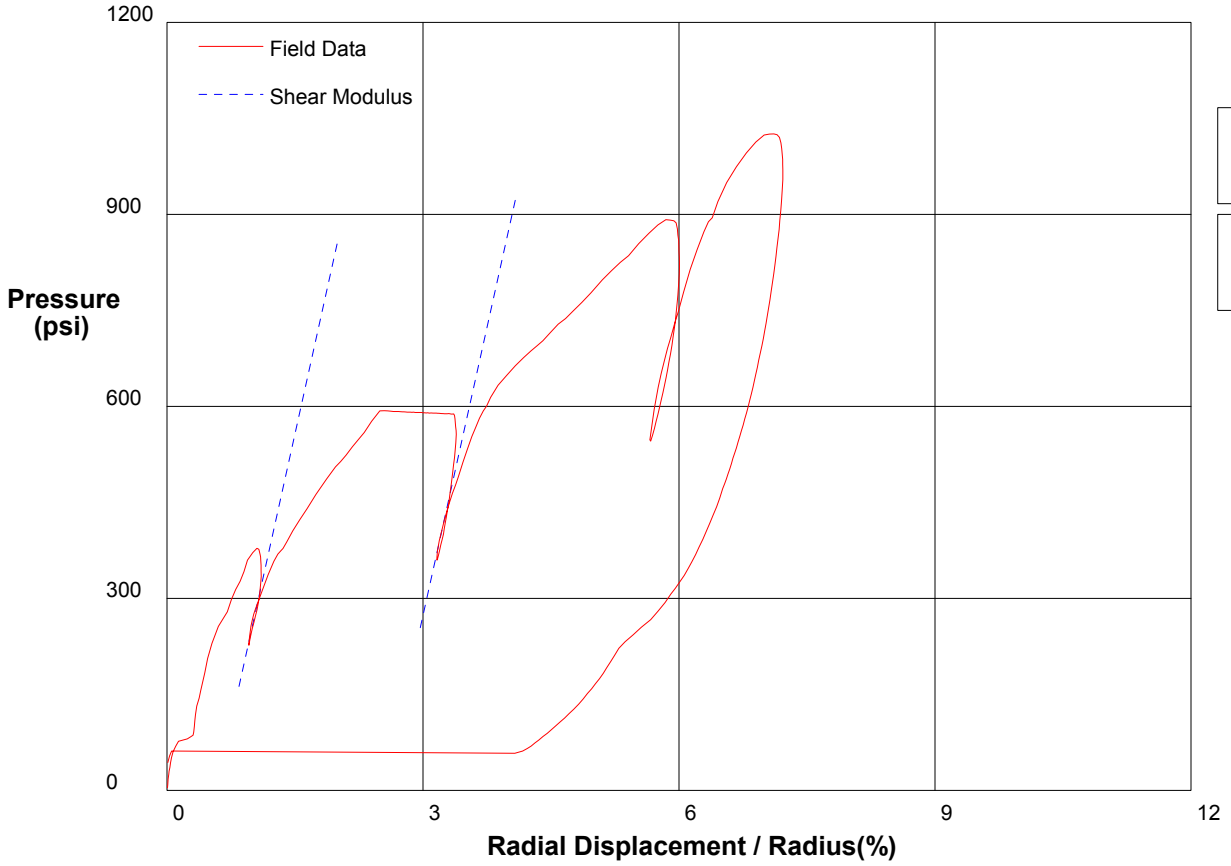
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **2/4/2009**

Hole No. Z2-B2 **Depth 249.5ft** **File C:\DATA\ISE-812\SR710-26.P**



Shear Modulus 30000 psi

Shear Modulus 30090 psi

shift 0

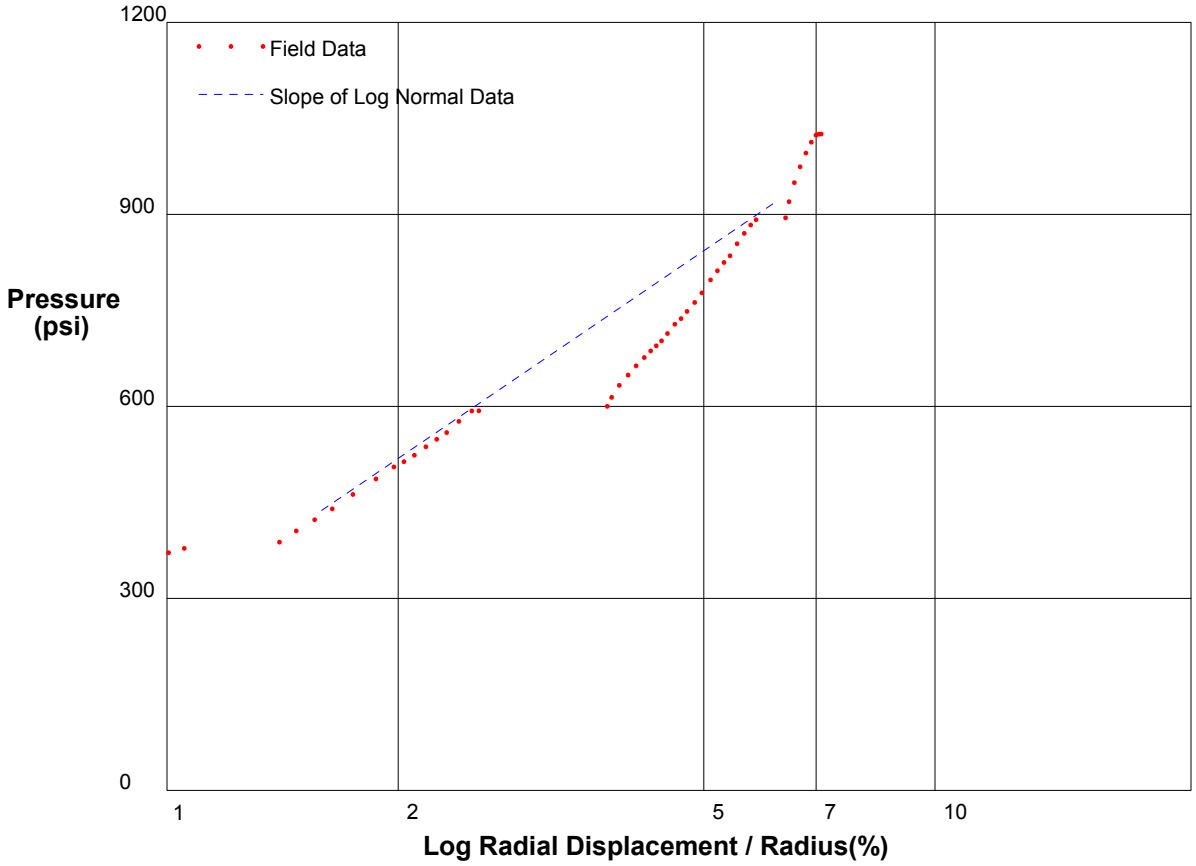
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/4/2009**

Hole No. Z2-B2 **Depth 249.5ft** **File C:\DATA\ISE-812\SR710-26.P**



Shear Strength 354 psi
Limit Pressure 1588 psi

shift 0

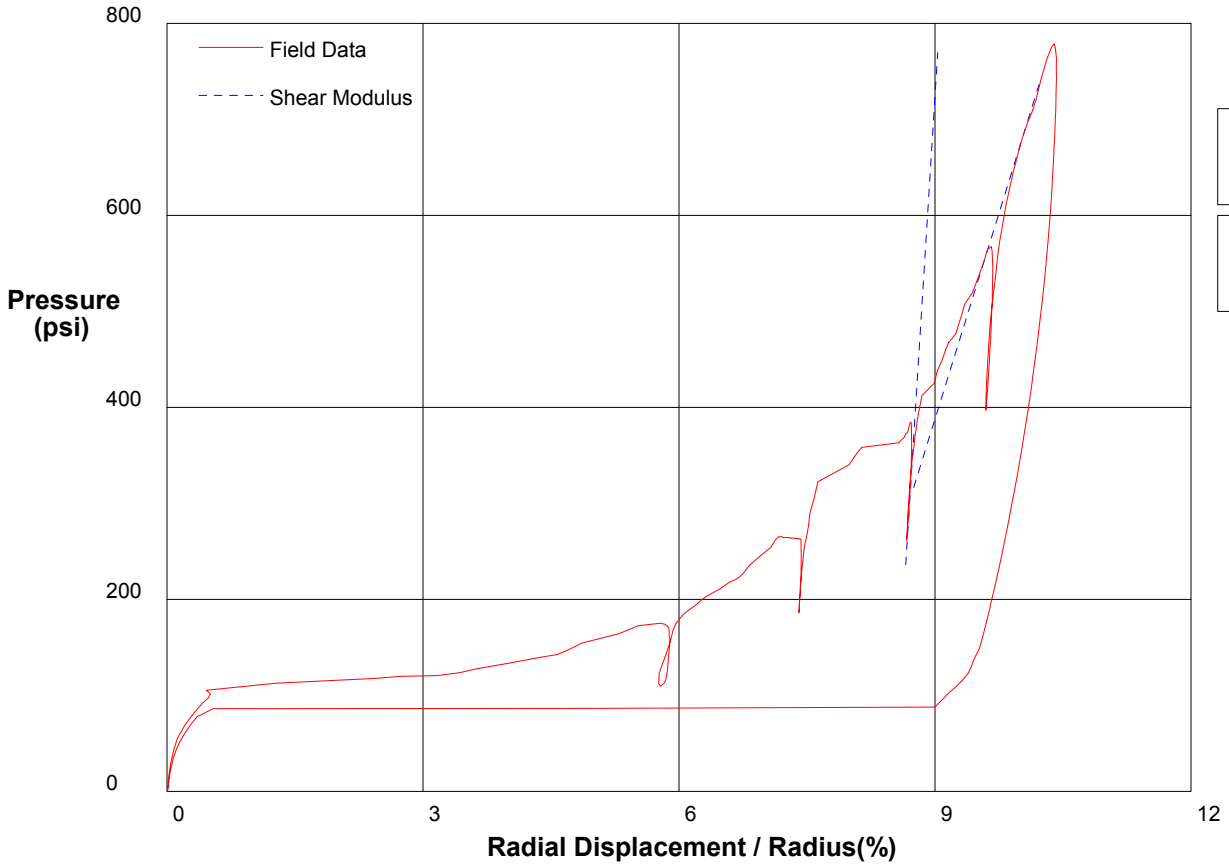
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **2/4/2009**

Hole No. Z1-B6 **Depth 203ft** **File C:\DATA\ISE-812\SR710-27.P**



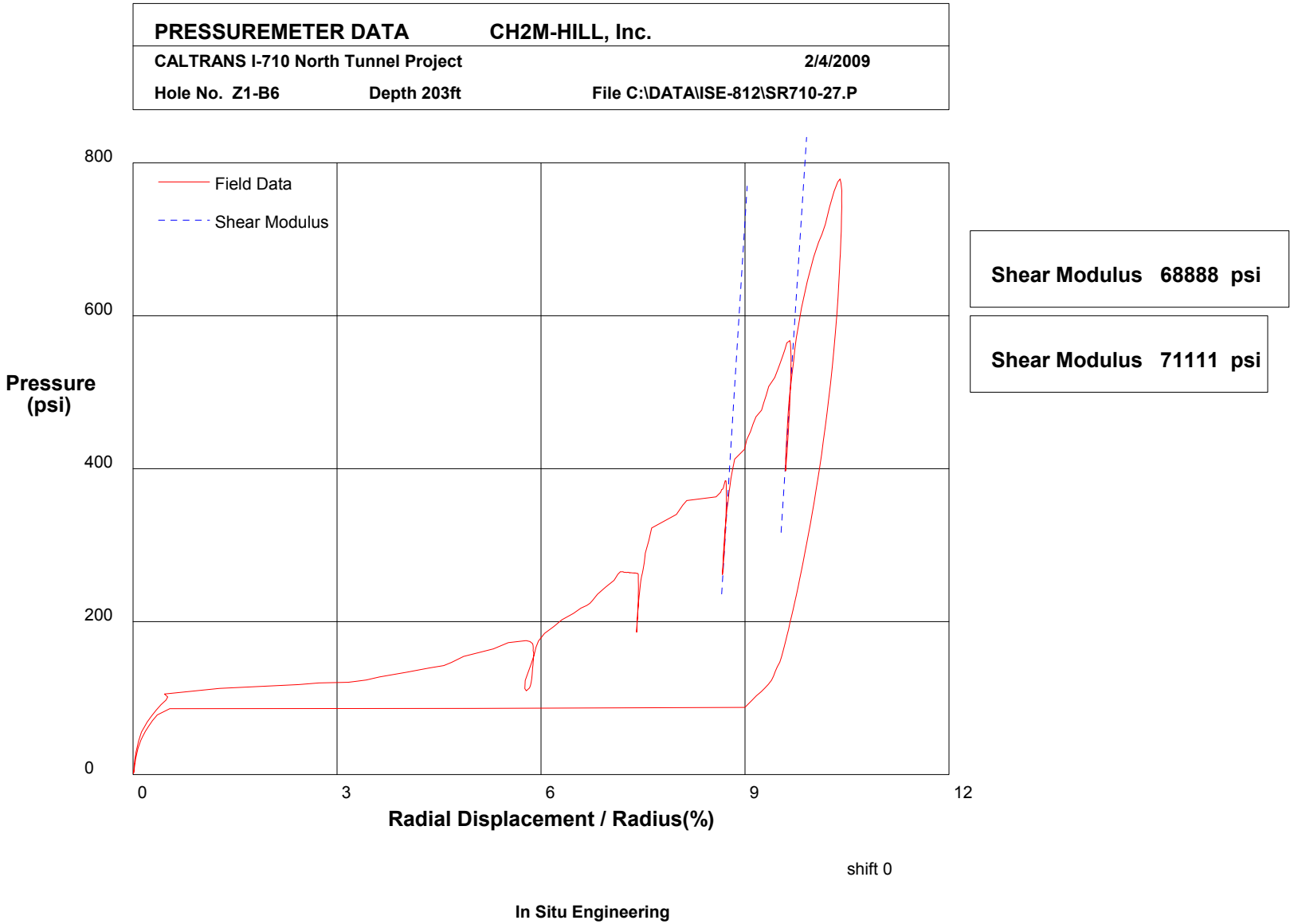
Shear Modulus 14278 psi

Shear Modulus 71111 psi

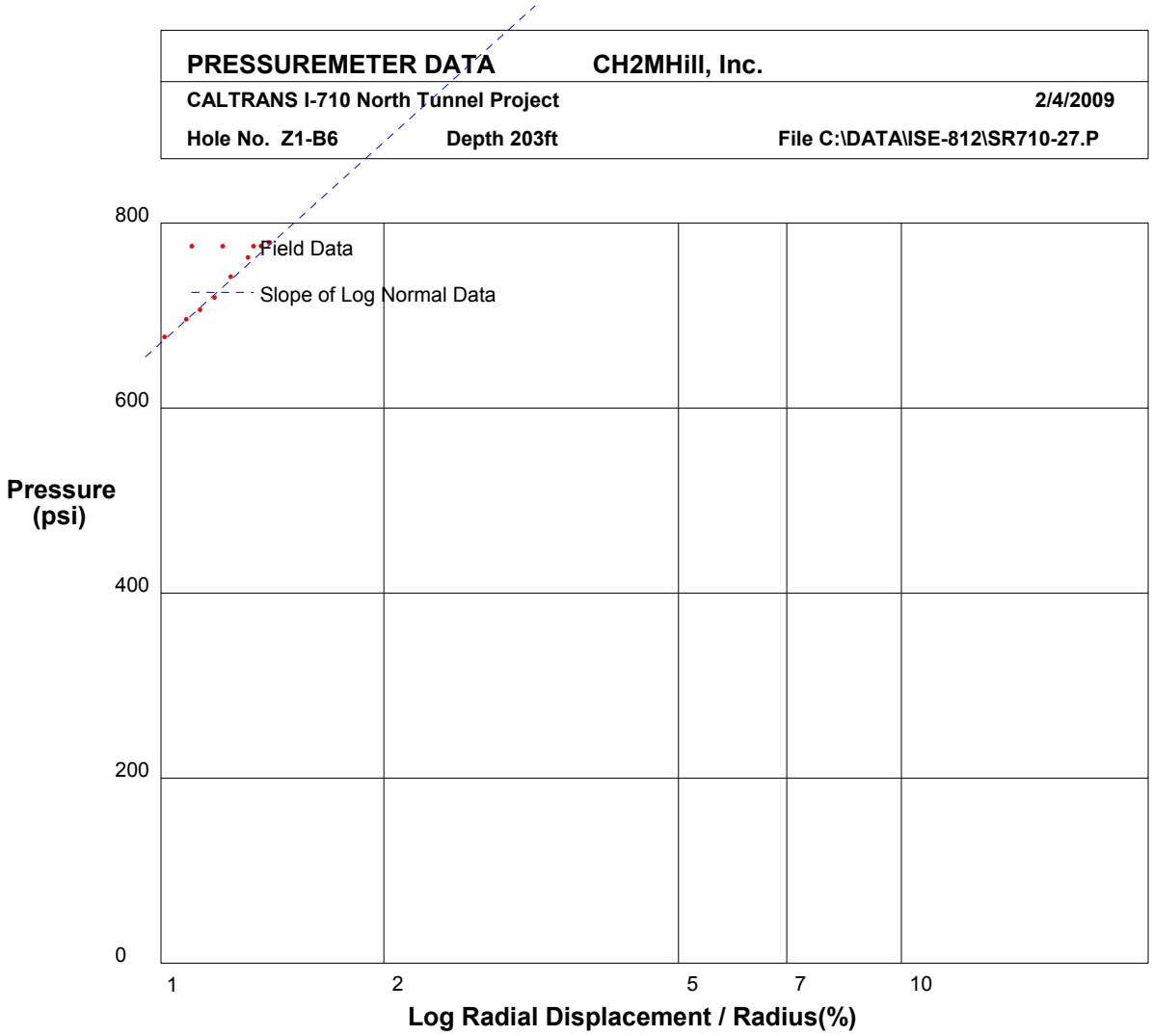
shift 0

In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation



Appendix I - Pressuremeter Data and Standard Interpretation



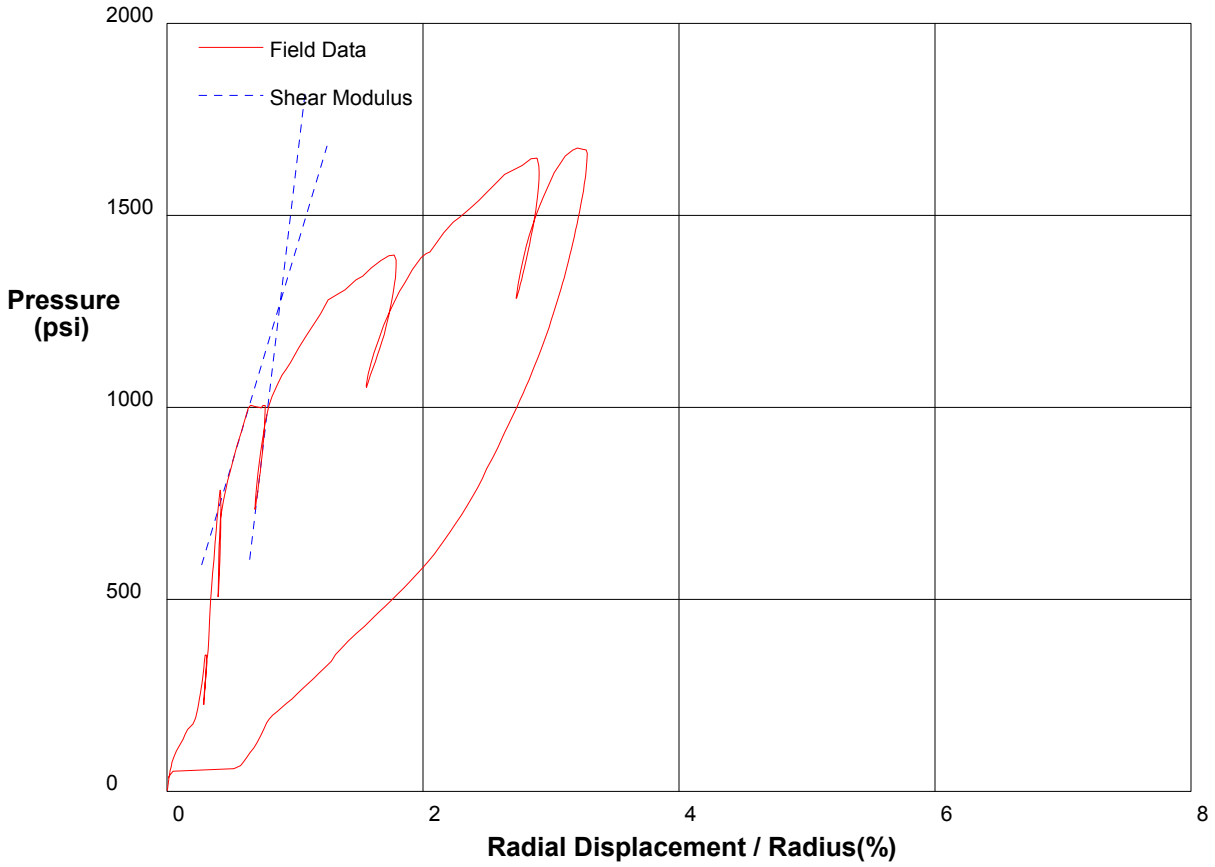
Shear Strength 313 psi
Limit Pressure 1833 psi

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/5/2009**

Hole No. Z1-B6 **Depth 245ft** **File C:\DATA\ISE-812\SR710-28.P**



Shear Modulus 140476 psi

Shear Modulus 55673 psi

shift 0

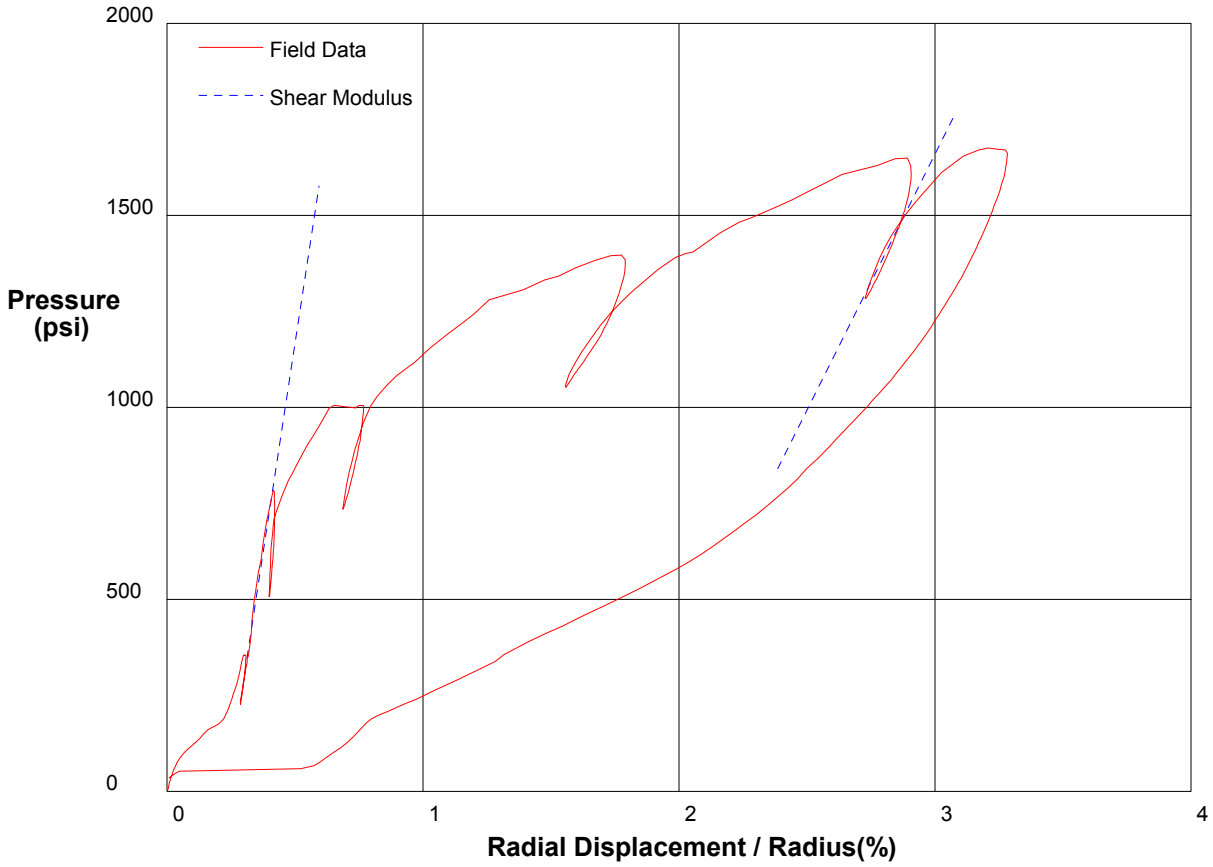
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **2/5/2009**

Hole No. Z1-B6 **Depth 245ft** **File C:\DATA\ISE-812\SR710-28.P**



Shear Modulus 66666 psi

Shear Modulus 218518 psi

shift 0

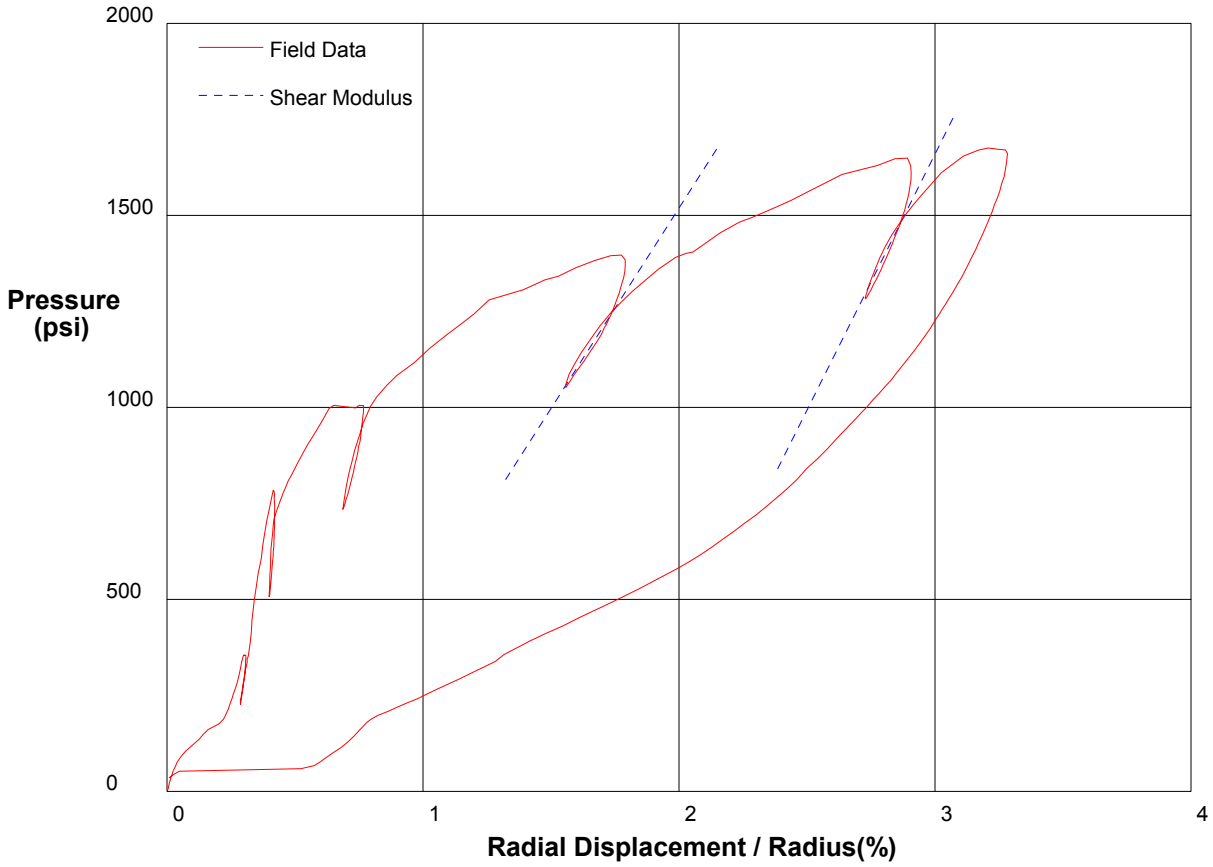
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **2/5/2009**

Hole No. Z1-B6 **Depth 245ft** **File C:\DATA\ISE-812\SR710-28.P**



Shear Modulus 66666 psi

Shear Modulus 52201 psi

shift 0

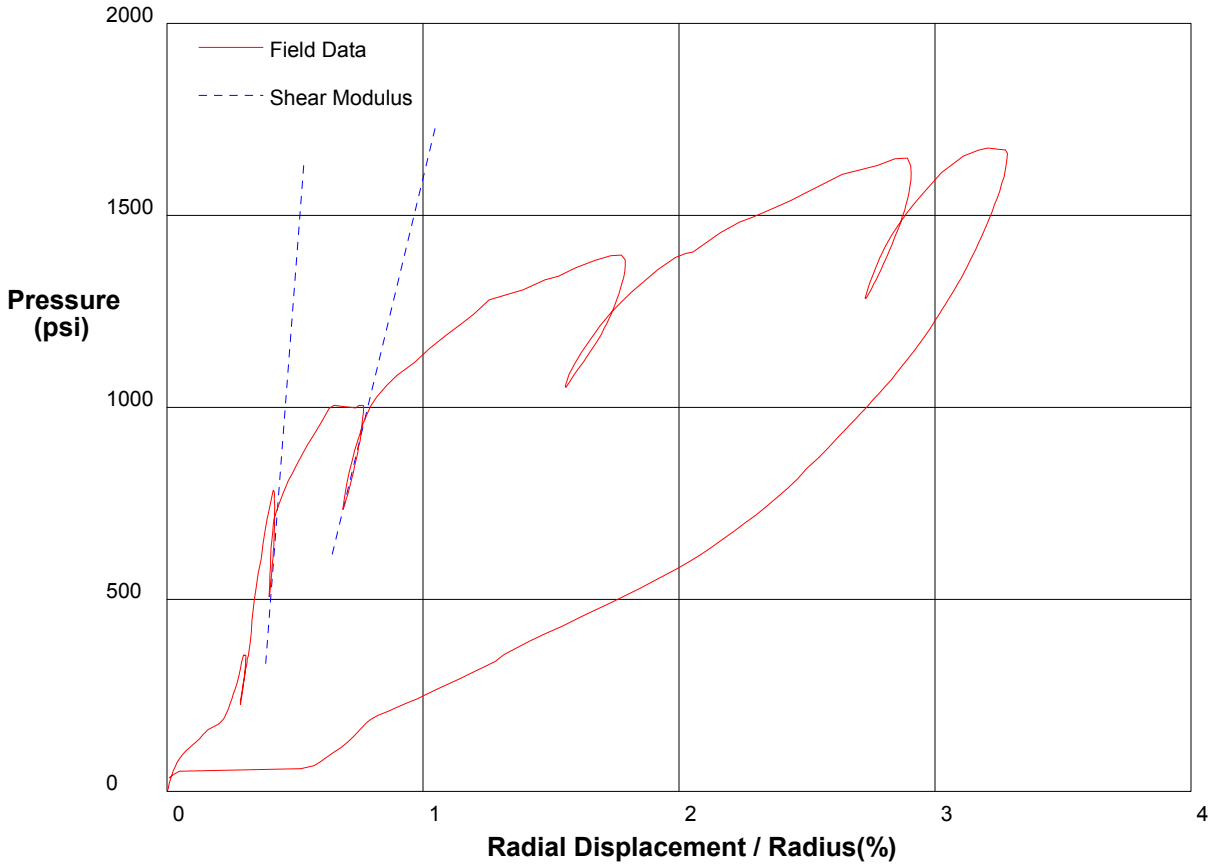
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **2/5/2009**

Hole No. Z1-B6 **Depth 245ft** **File C:\DATA\ISE-812\SR710-28.P**



Shear Modulus 138095 psi

Shear Modulus 435632 psi

shift 0

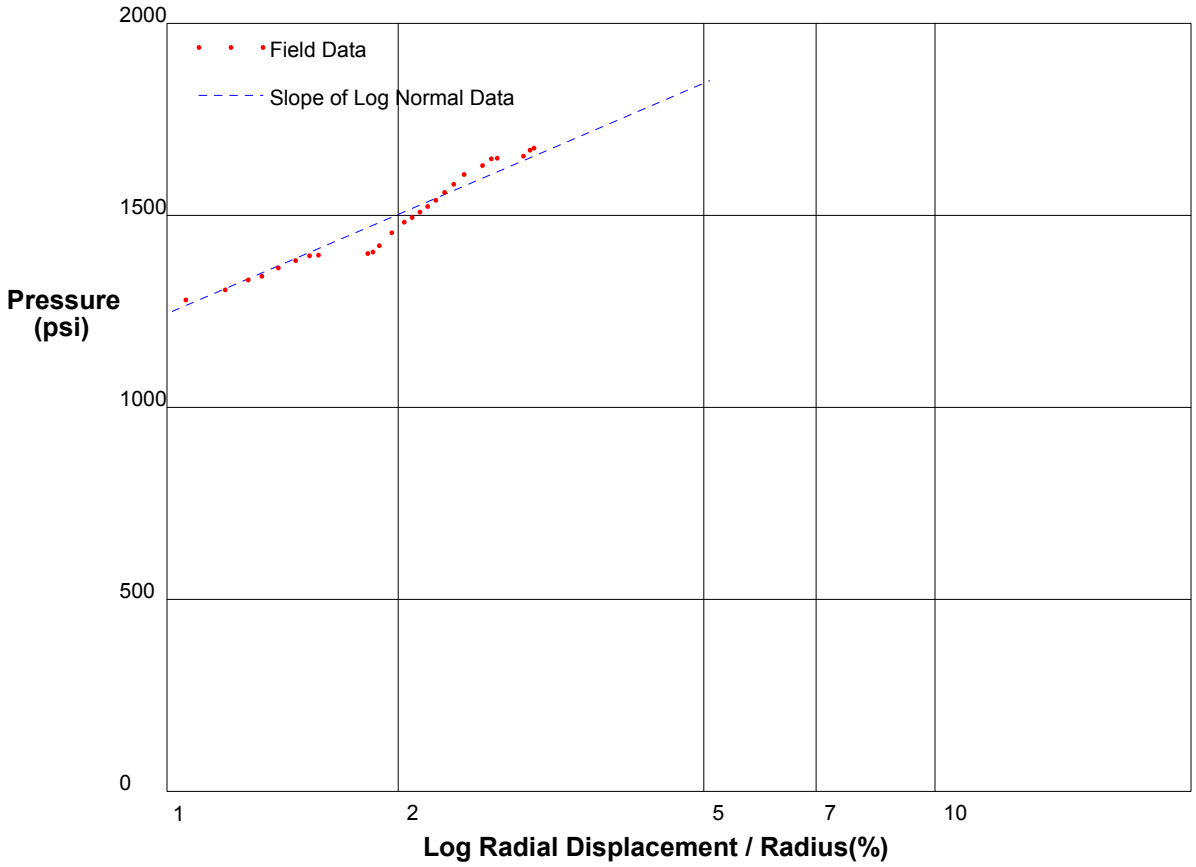
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/5/2009**

Hole No. Z1-B6 **Depth 245ft** **File C:\DATA\ISE-812\SR710-28.P**



Shear Strength 372.8 psi
Limit Pressure 2628 psi

shift .2

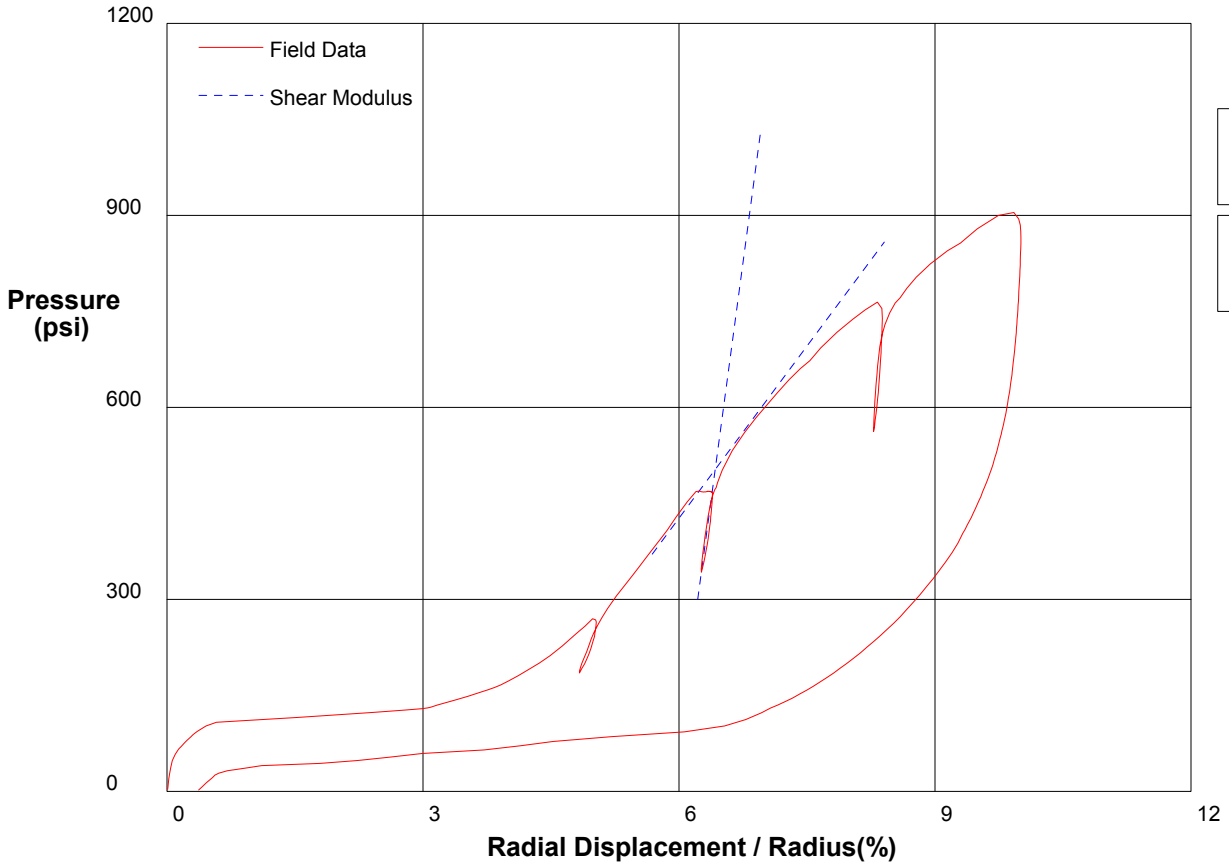
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/6/2009**

Hole No. Z3-B7 **Depth 225.8ft** **File C:\DATA\ISE-812\SR710-29.P**



Shear Modulus 49503 psi

Shear Modulus 8965 psi

shift 0

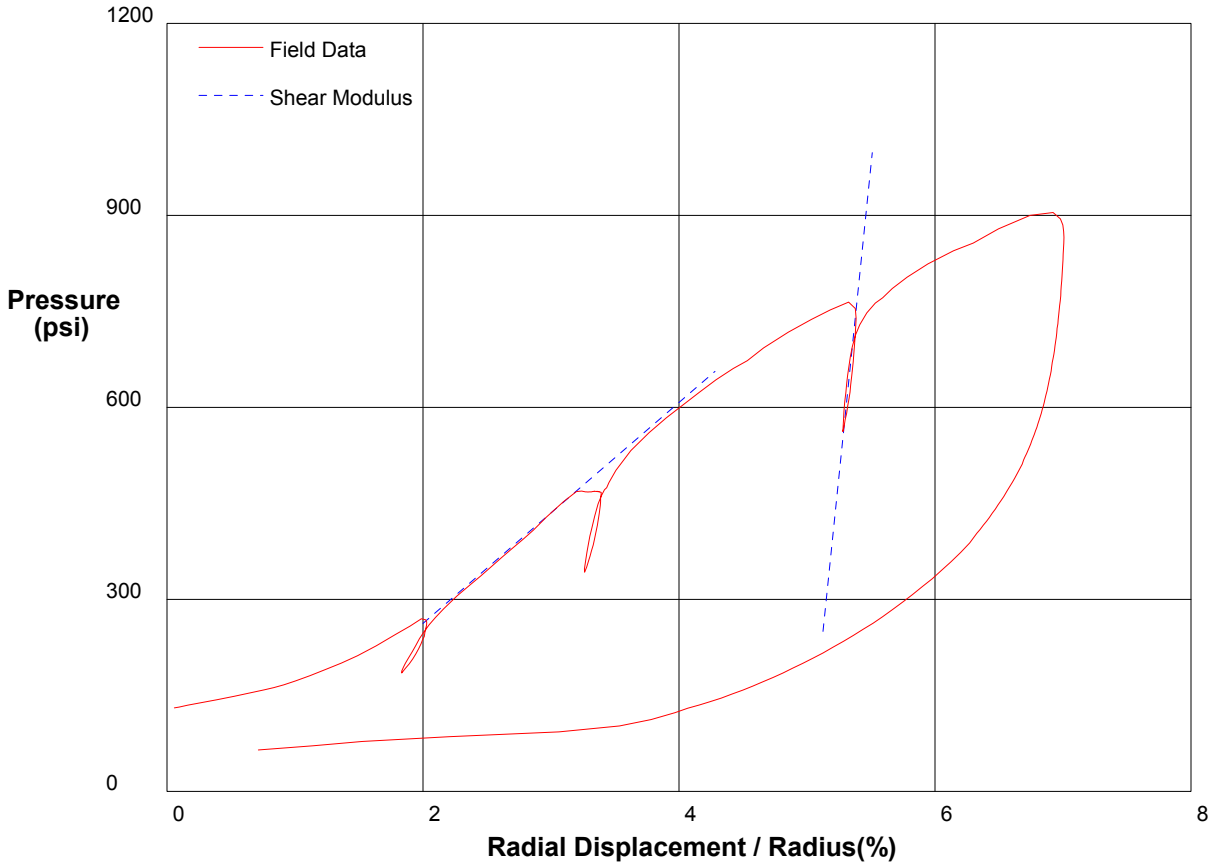
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/6/2009**

Hole No. Z3-B7 **Depth 225.8ft** **File C:\DATA\ISE-812\SR710-29.P**



Shear Modulus 97027 psi

Shear Modulus 8630 psi

shift 3

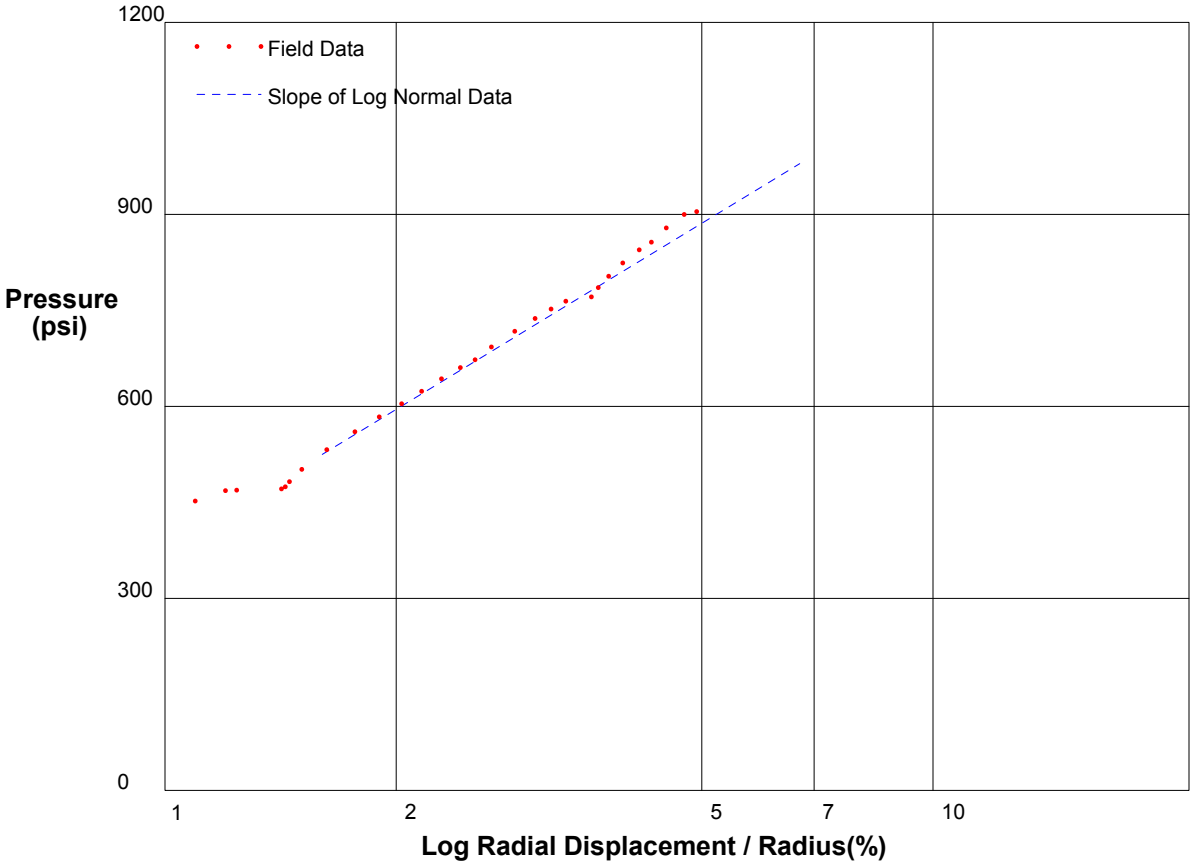
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/6/2009**

Hole No. Z3-B7 **Depth 225.8ft** **File C:\DATA\ISE-812\SR710-29.P**



Shear Strength 317.3 psi
Limit Pressure 1553 psi

shift 5

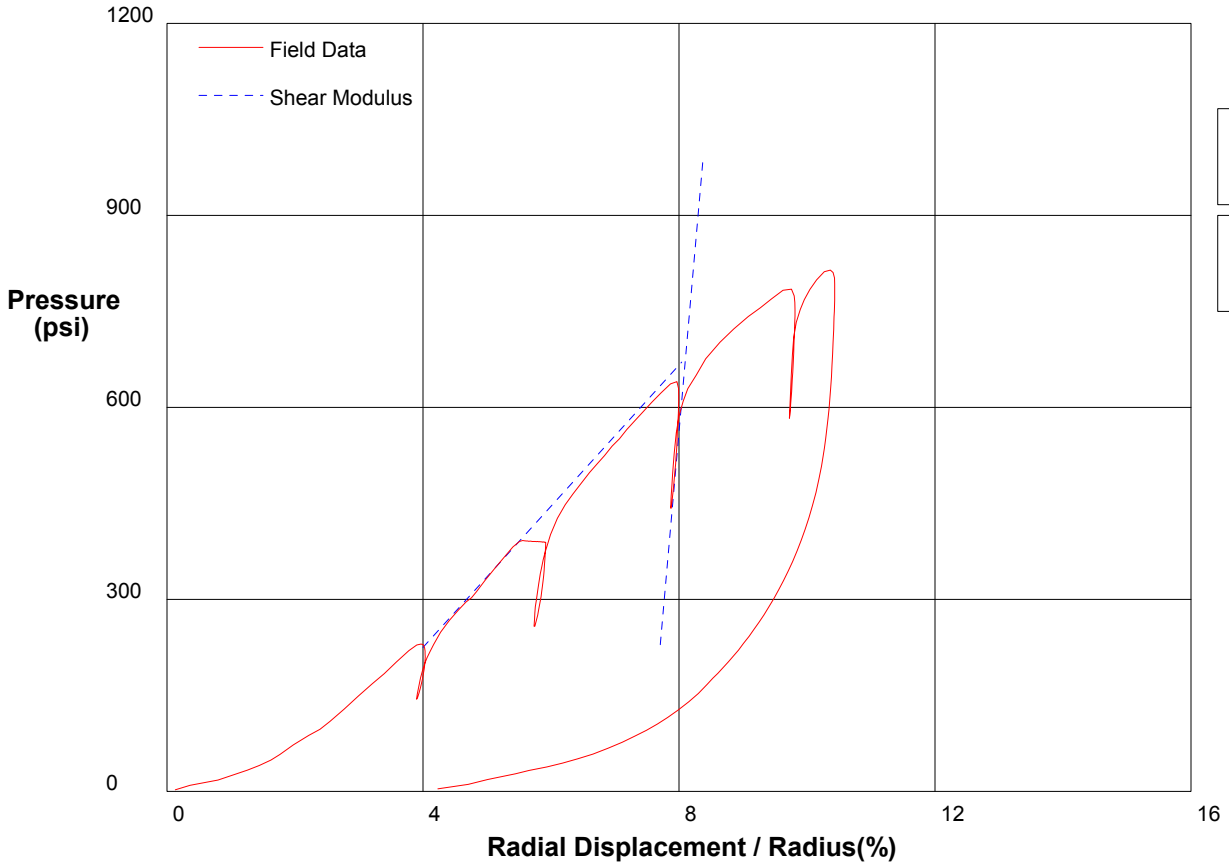
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/6/2009**

Hole No. Z3-B7 **Depth 224.3ft** **File C:\DATA\ISE-812\SR710-30.P**



Shear Modulus 56875 psi

Shear Modulus 5515 psi

shift 0

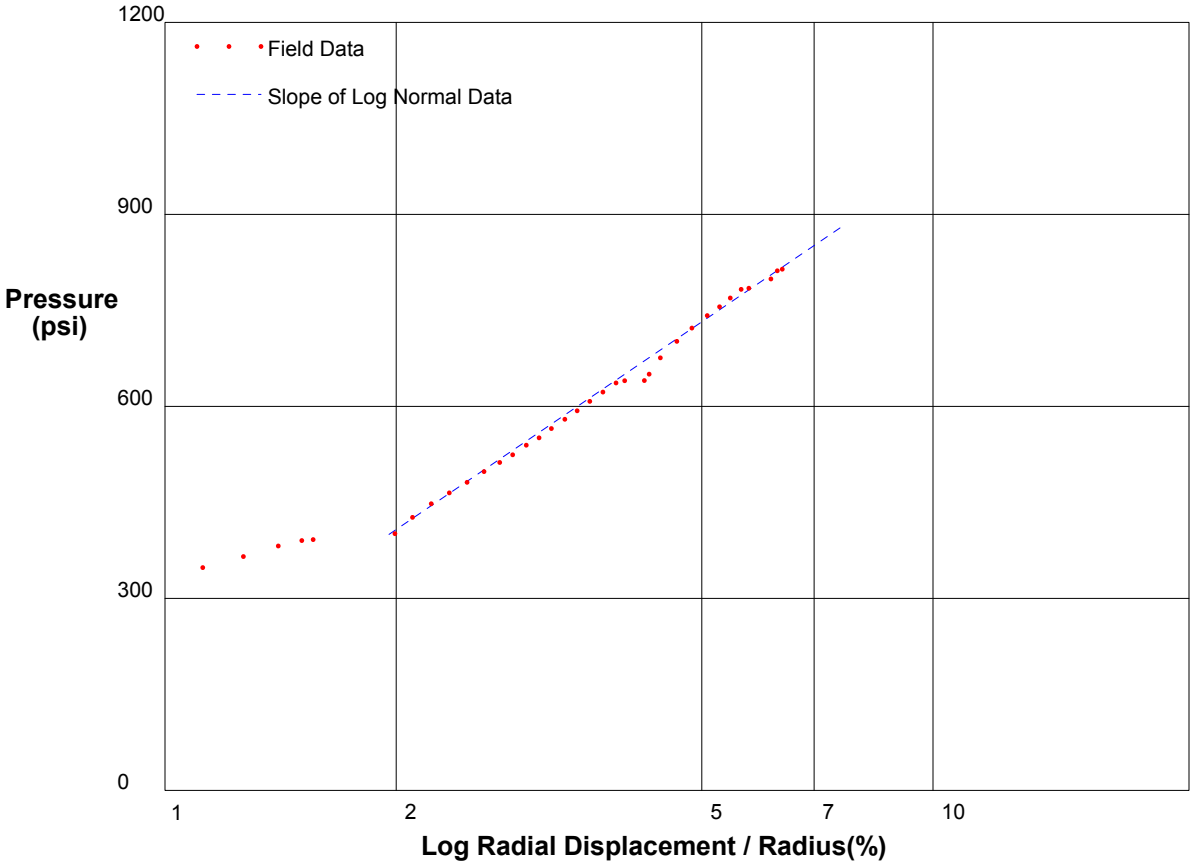
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/6/2009**

Hole No. Z3-B7 **Depth 224.3ft** **File C:\DATA\ISE-812\SR710-30.P**



Shear Strength 354 psi
Limit Pressure 1476 psi

shift 4

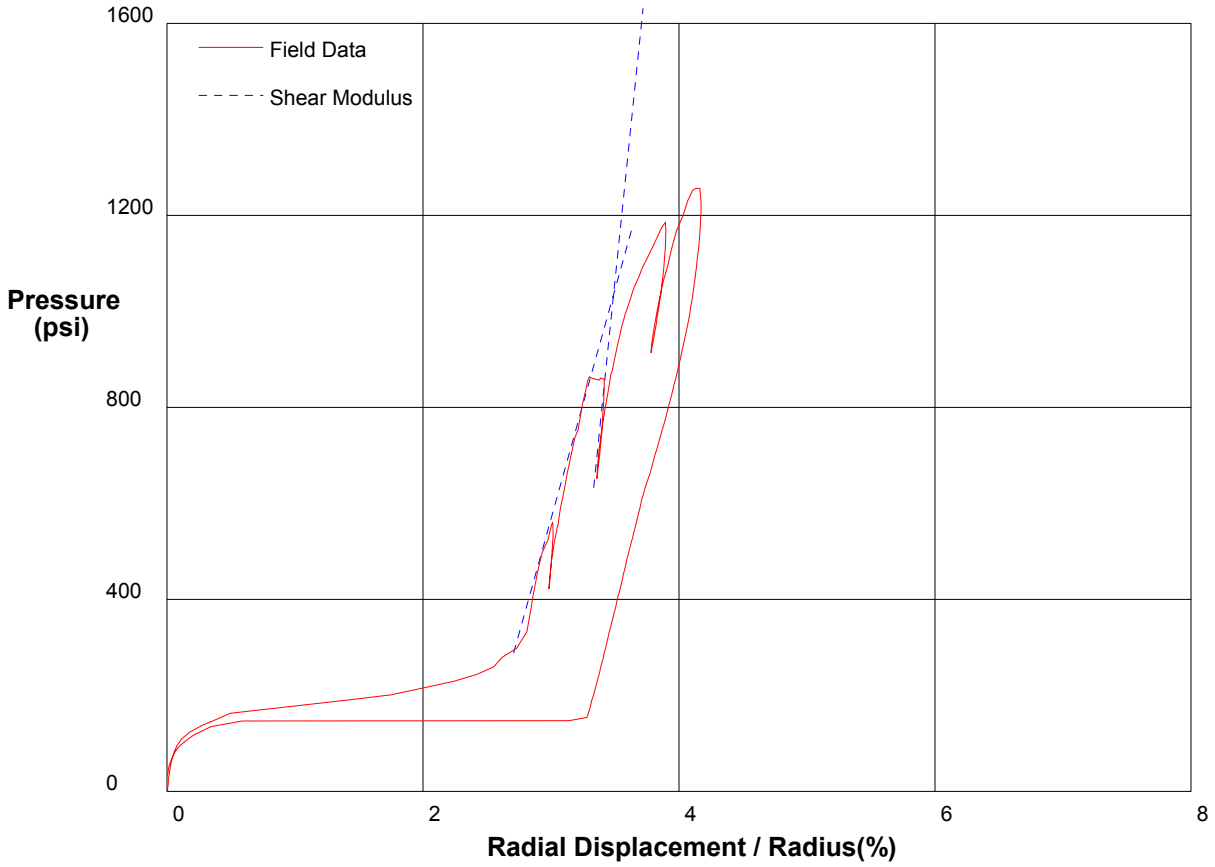
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/6/2009**

Hole No. Z1-B6 **Depth 332ft** **File C:\DATA\ISE-812\SR710-31.P**



Shear Modulus 129369 psi

Shear Modulus 47790 psi

shift 0

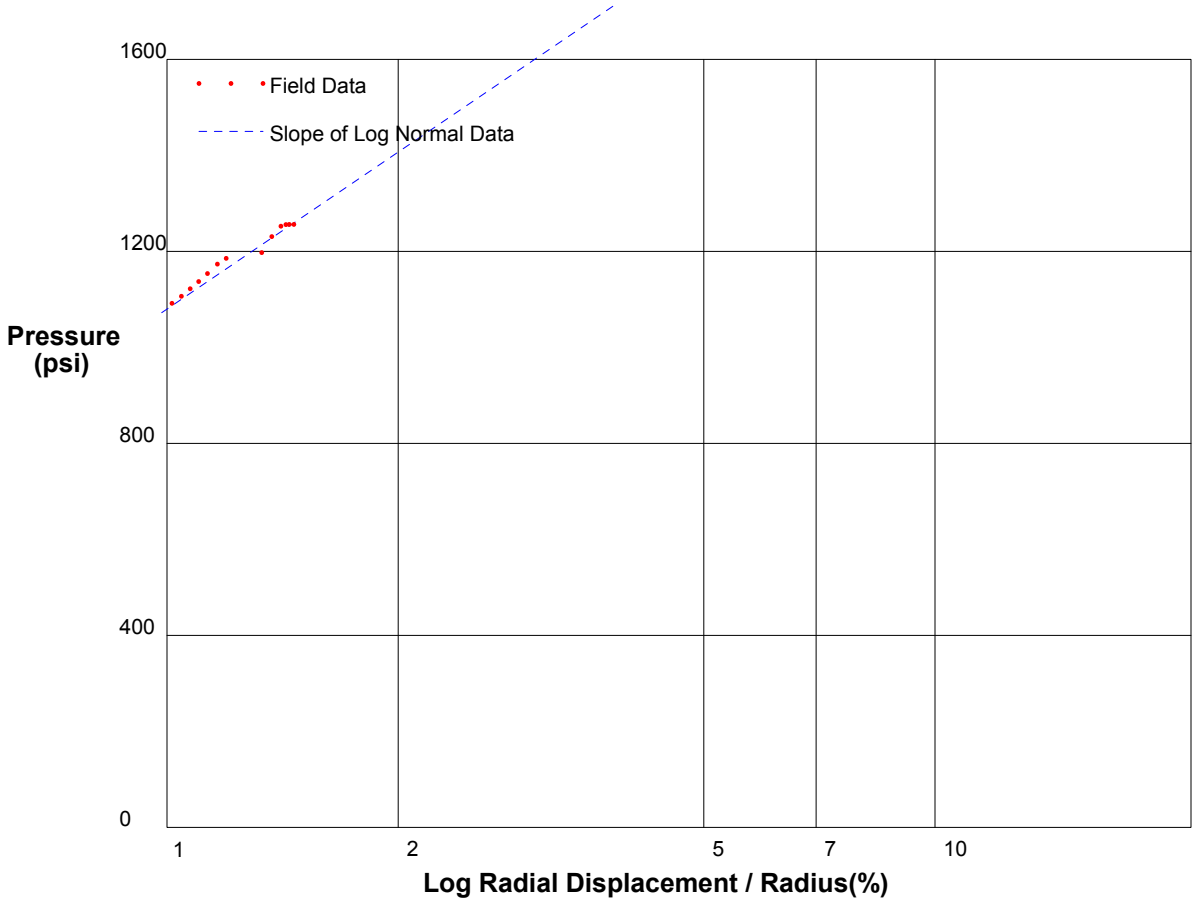
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/6/2009**

Hole No. Z1-B6 **Depth 332ft** **File C:\DATA\ISE-812\SR710-31.P**



Shear Strength 472 psi
Limit Pressure 2832 psi

shift 2.7

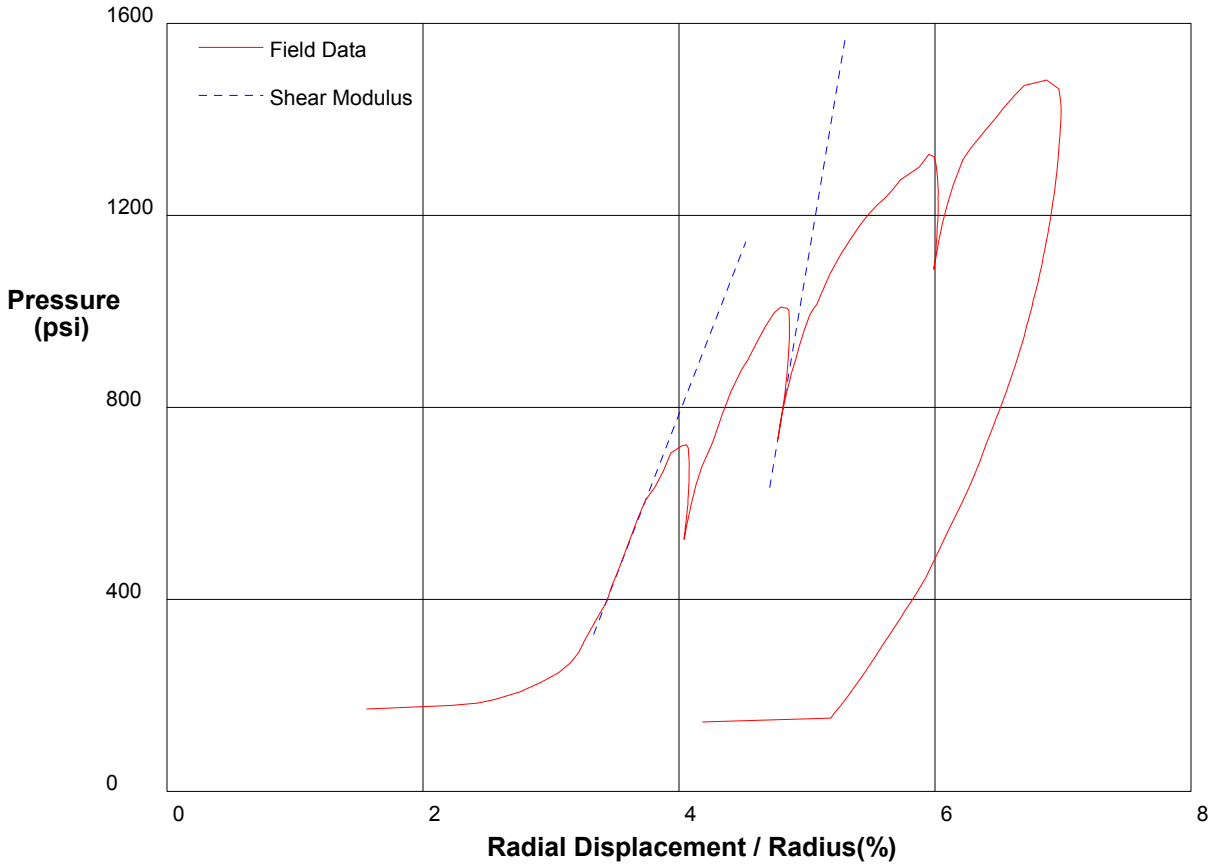
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/6/2009**

Hole No. Z1-B6 **Depth 330.5ft** **File C:\DATA\ISE-812\SR710-32.P**



Shear Modulus 79298 psi

Shear Modulus 34385 psi

shift 4.7

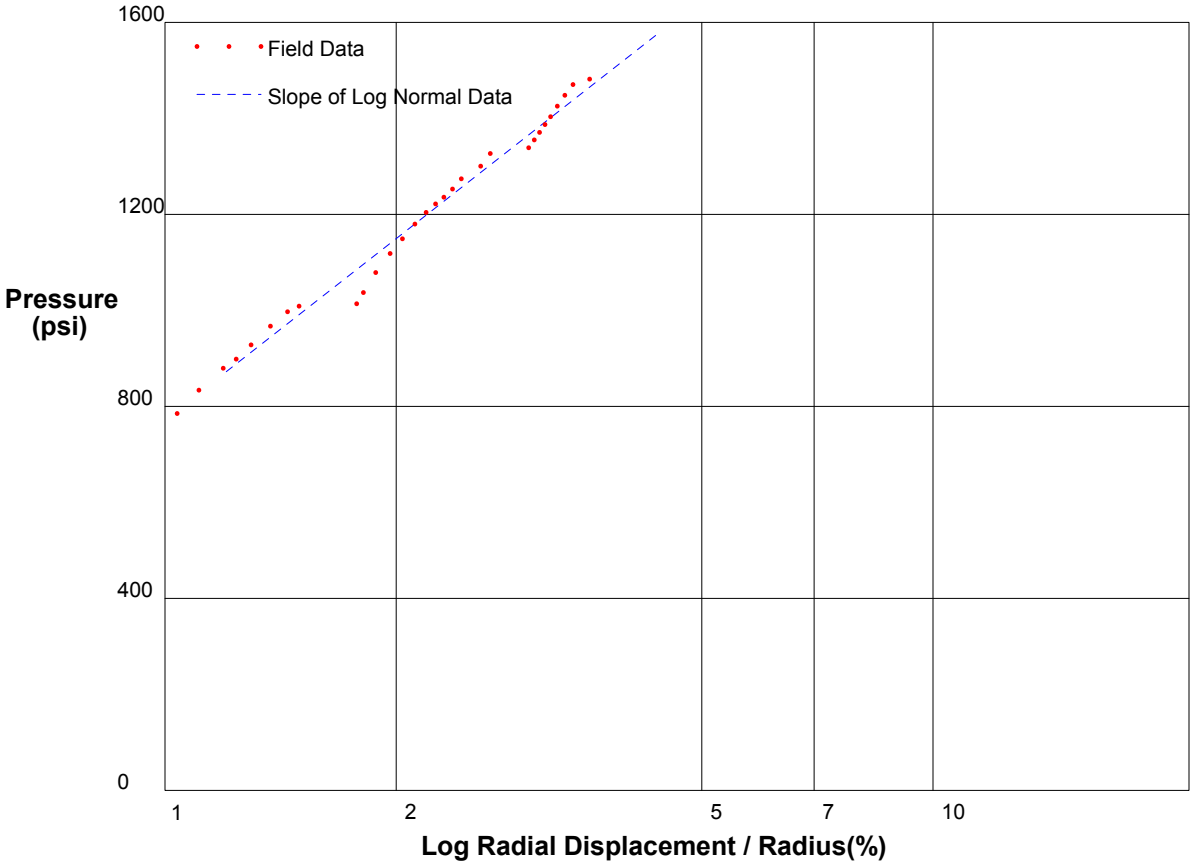
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/6/2009**

Hole No. Z1-B6 **Depth 330.5ft** **File C:\DATA\ISE-812\SR710-32.P**



Shear Strength 544.2 psi
Limit Pressure 2793 psi

shift 8

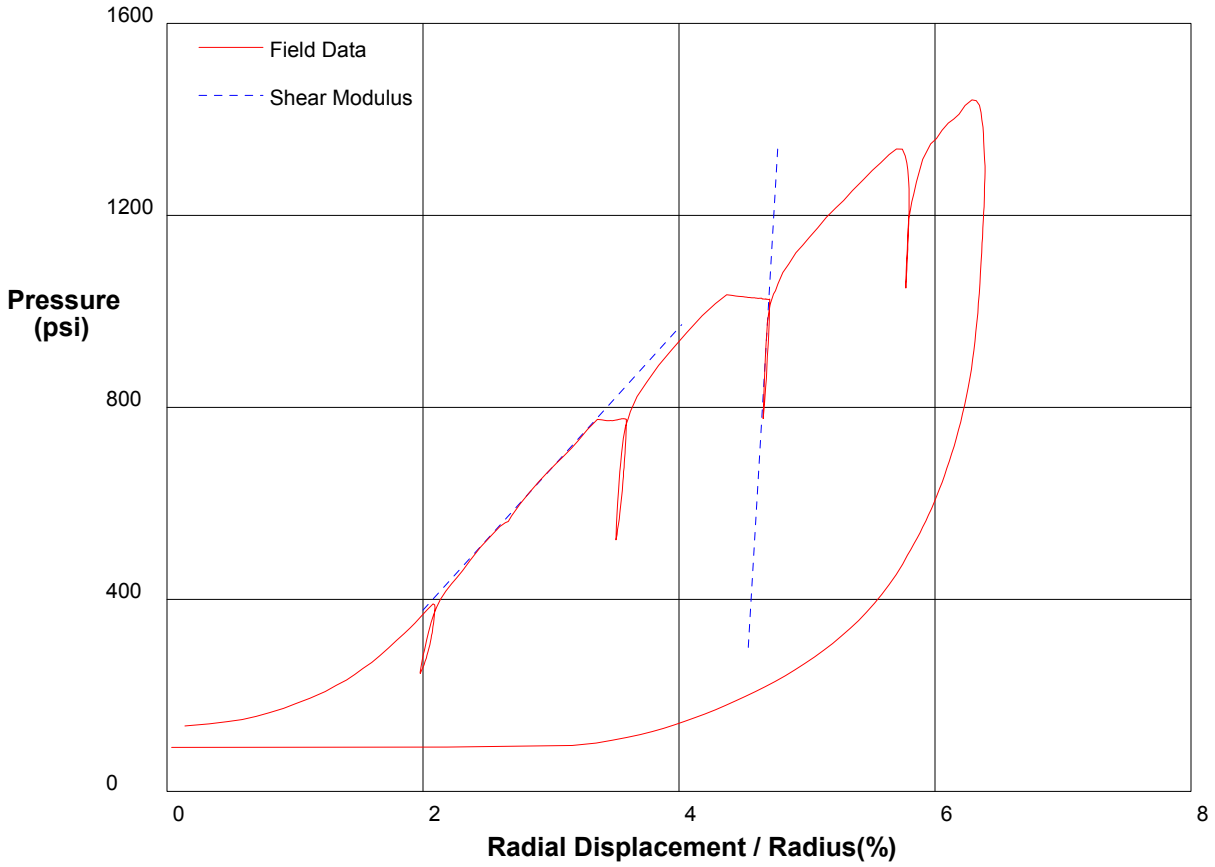
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/10/2009**

Hole No. Z3-B7 **Depth 252.5ft** **File C:\DATA\ISE-812\SR710-33.P**



Shear Modulus 226666 psi

Shear Modulus 14707 psi

shift 4

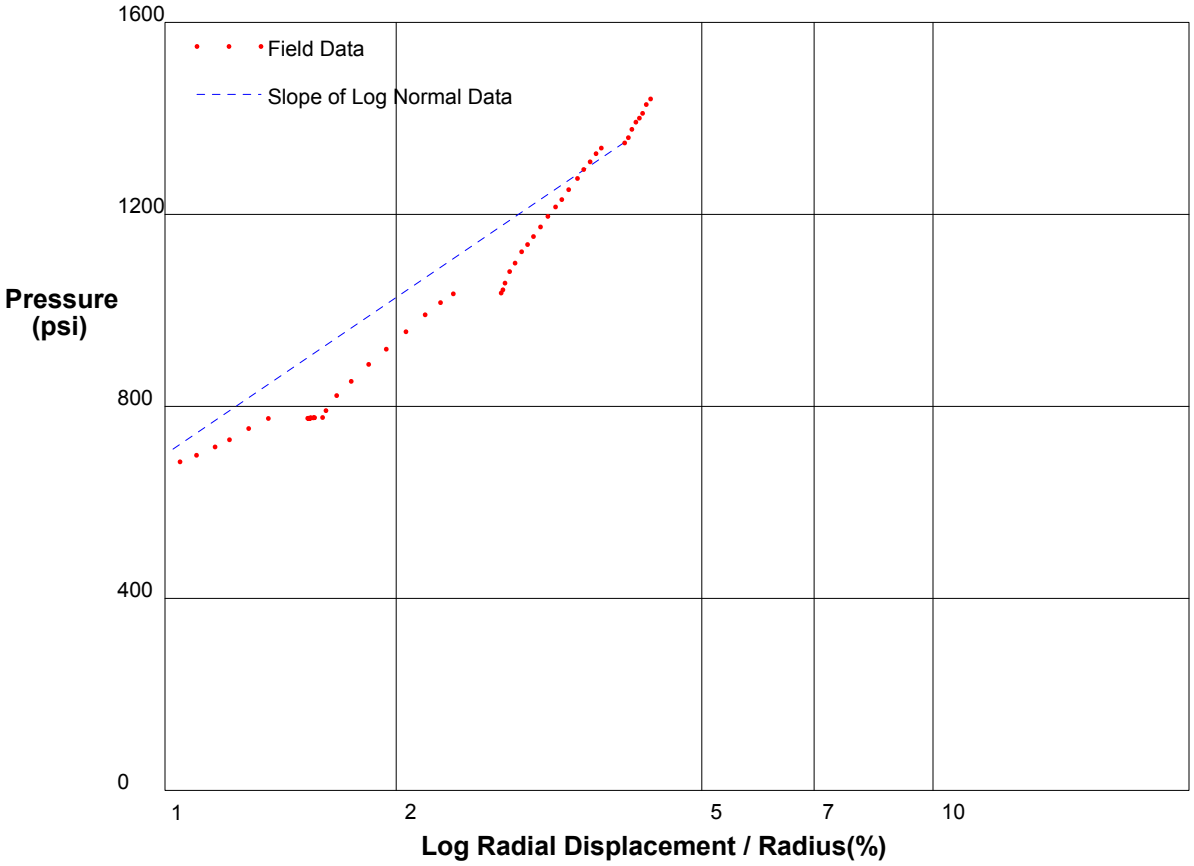
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/10/2009**

Hole No. Z3-B7 **Depth 252.5ft** **File C:\DATA\ISE-812\SR710-33.P**



Shear Strength 472 psi
Limit Pressure 2452 psi

shift 6

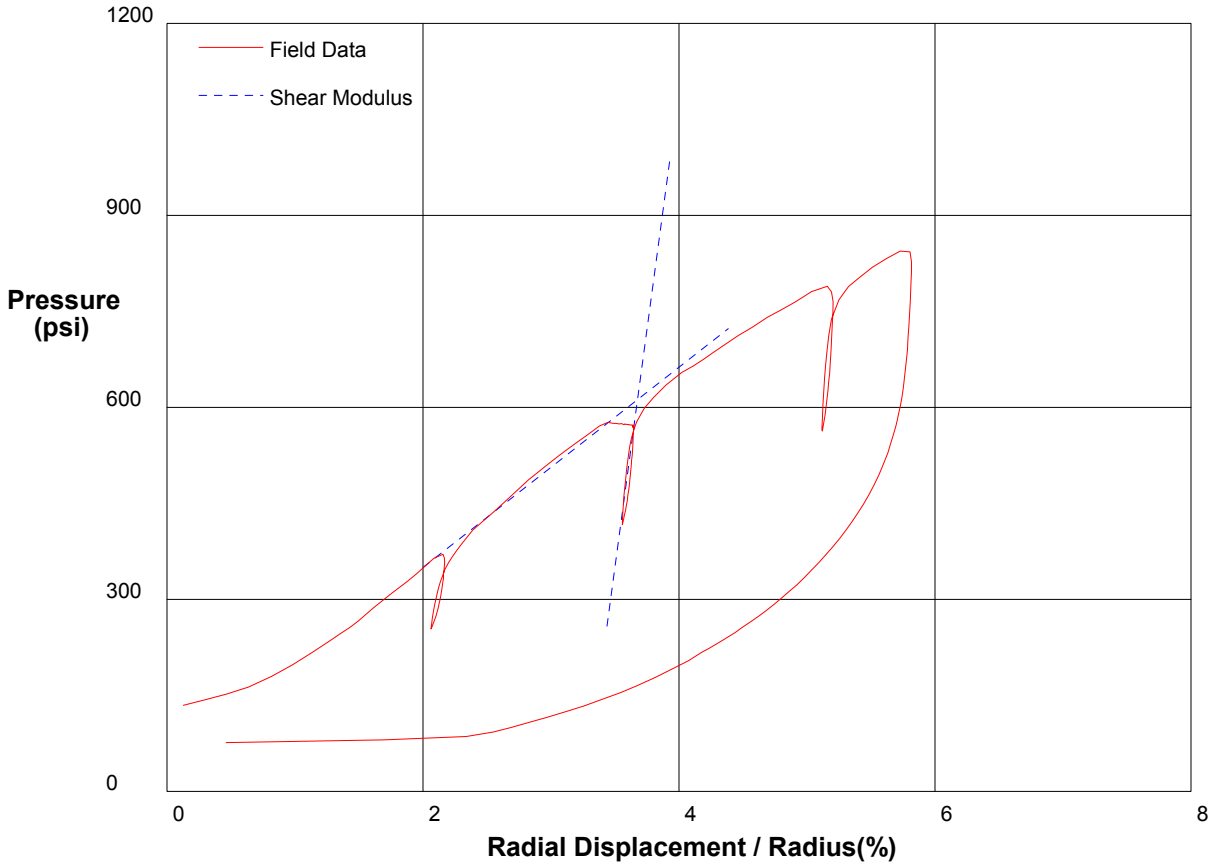
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/10/2009**

Hole No. Z3-B7 **Depth 251ft** **File C:\DATA\ISE-812\SR710-34.P**



Shear Modulus 74255 psi

Shear Modulus 7816 psi

shift 5.2

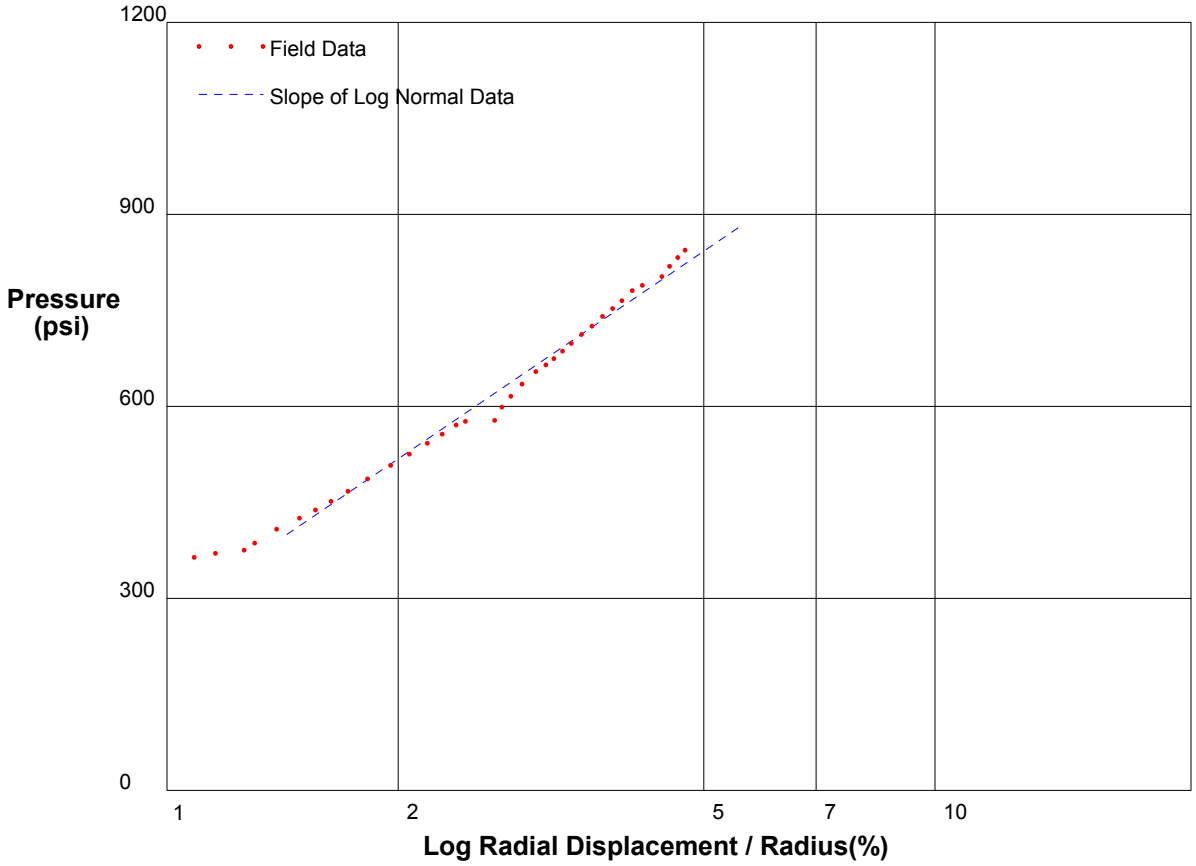
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/10/2009**

Hole No. Z3-B7 **Depth 251ft** **File C:\DATA\ISE-812\SR710-34.P**



Shear Strength 354 psi
Limit Pressure 1587 psi

shift 6.2

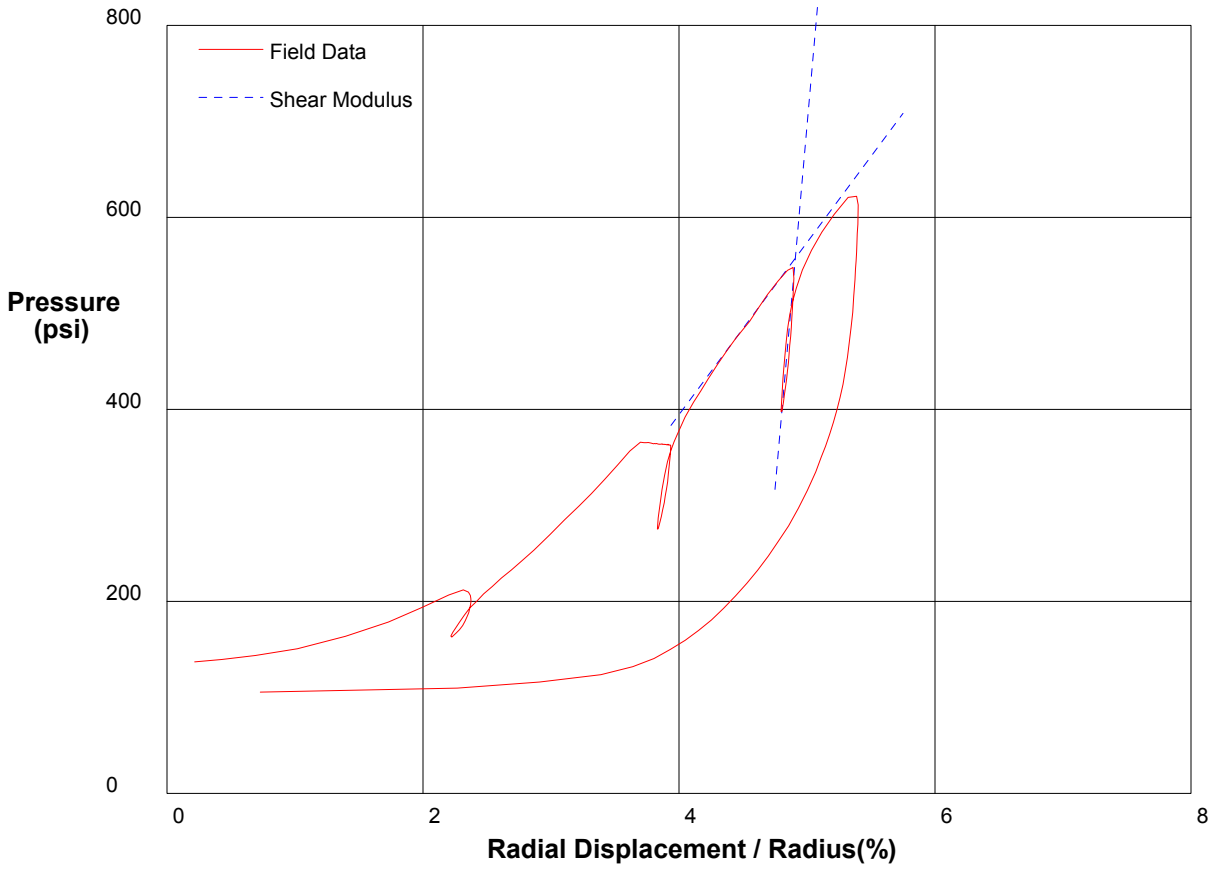
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/10/2009**

Hole No. Z3-B7 **Depth 271.6ft** **File C:\DATA\ISE-812\SR710-35.P**



Shear Modulus 75833 psi

Shear Modulus 8965 psi

shift 7.2

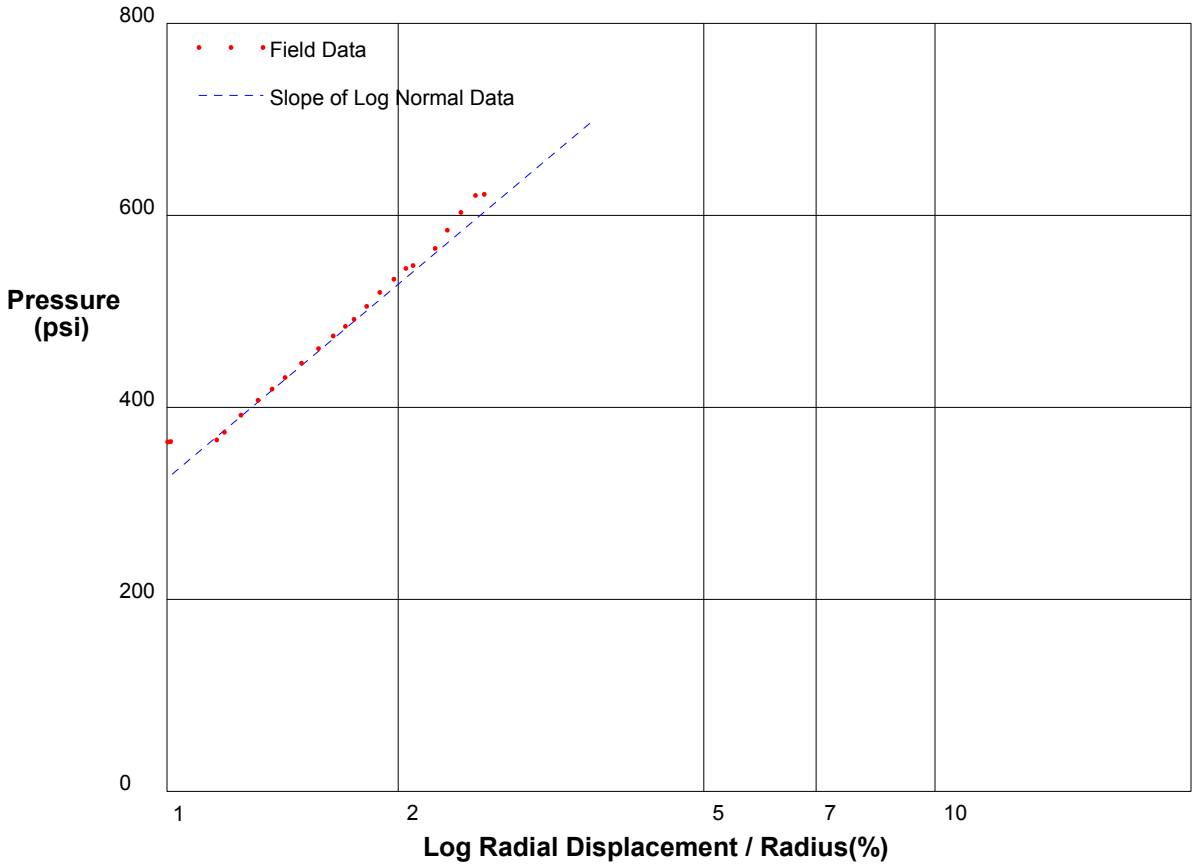
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/10/2009**

Hole No. Z3-B7 **Depth 271.6ft** **File C:\DATA\ISE-812\SR710-35.P**



Shear Strength 291.9 psi
Limit Pressure 1410 psi

shift 10

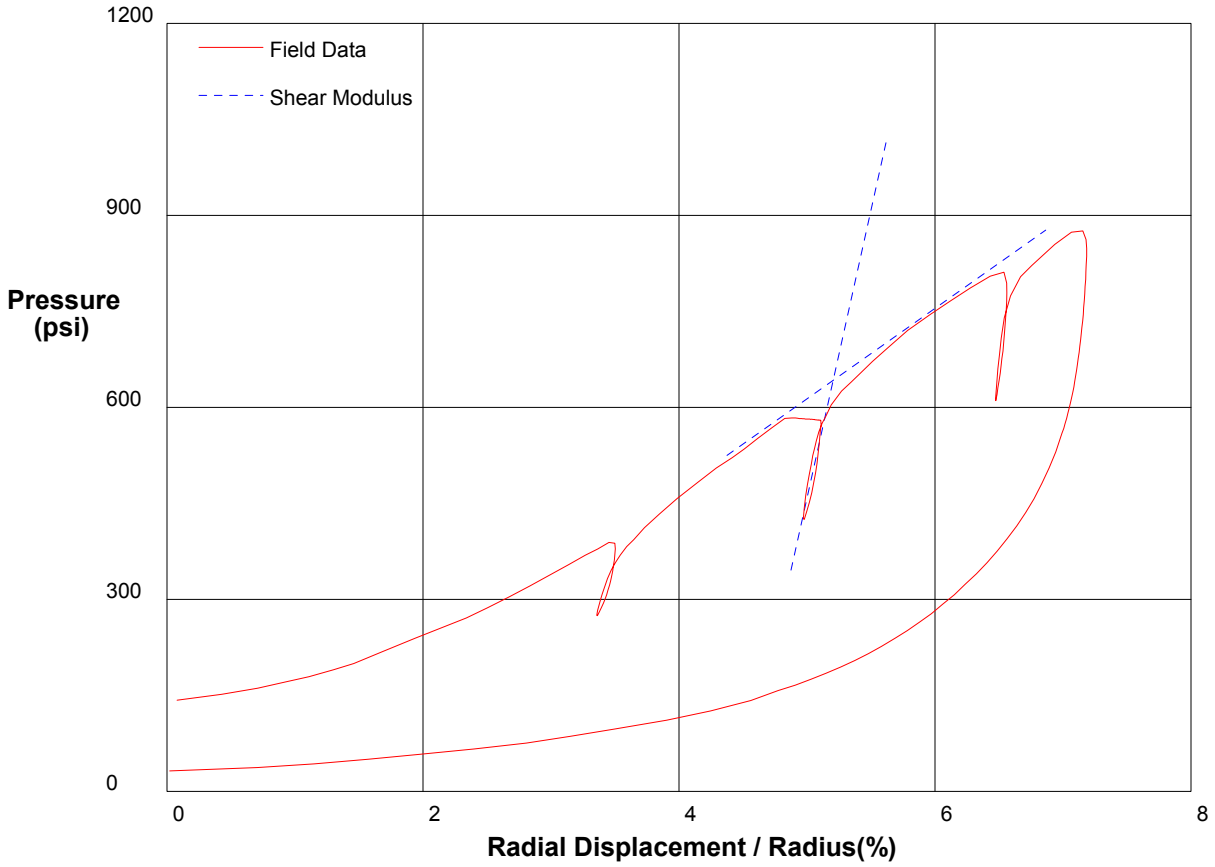
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/10/2009**

Hole No. Z3-B7 **Depth 270.1ft** **File C:\DATA\ISE-812\SR710-36.P**



Shear Modulus 45000 psi

Shear Modulus 7071 psi

shift 4

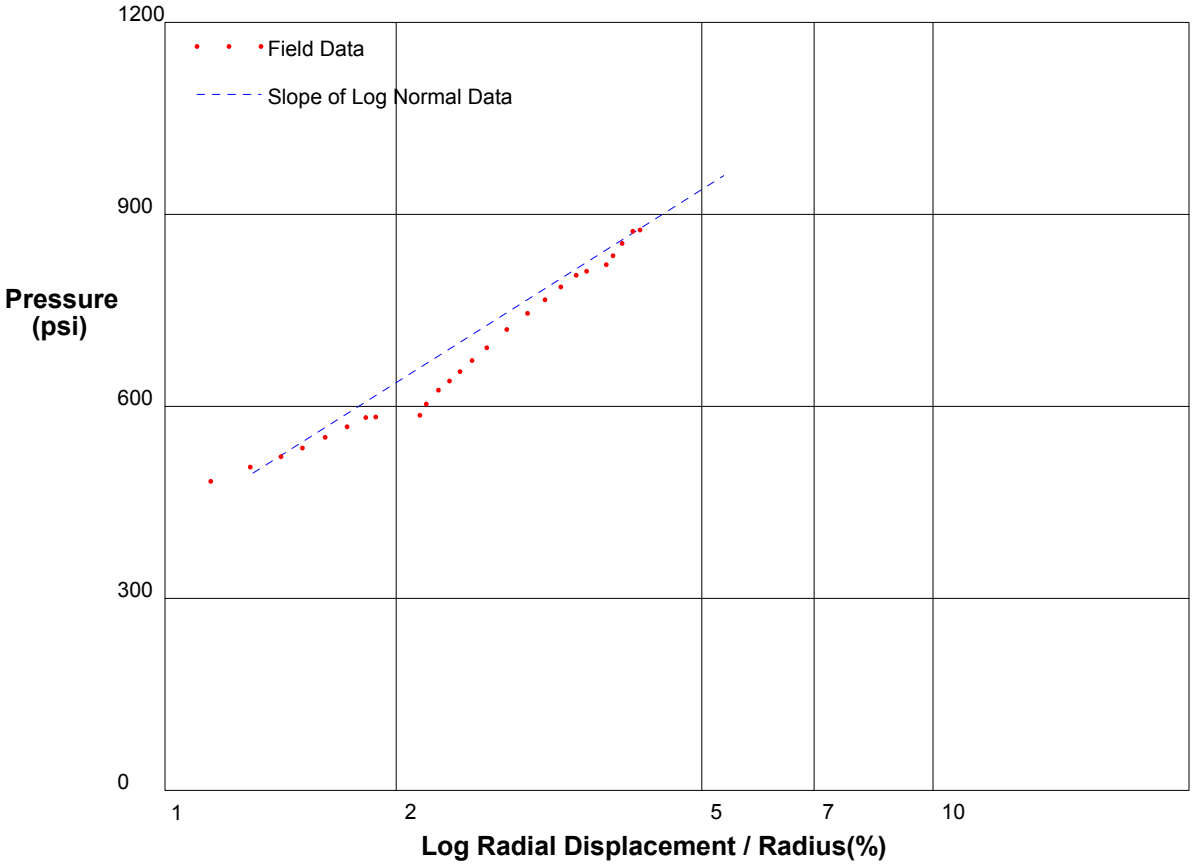
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/10/2009**

Hole No. Z3-B7 **Depth 270.1ft** **File C:\DATA\ISE-812\SR710-36.P**



Shear Strength 329.2 psi
Limit Pressure 1631 psi

shift 7

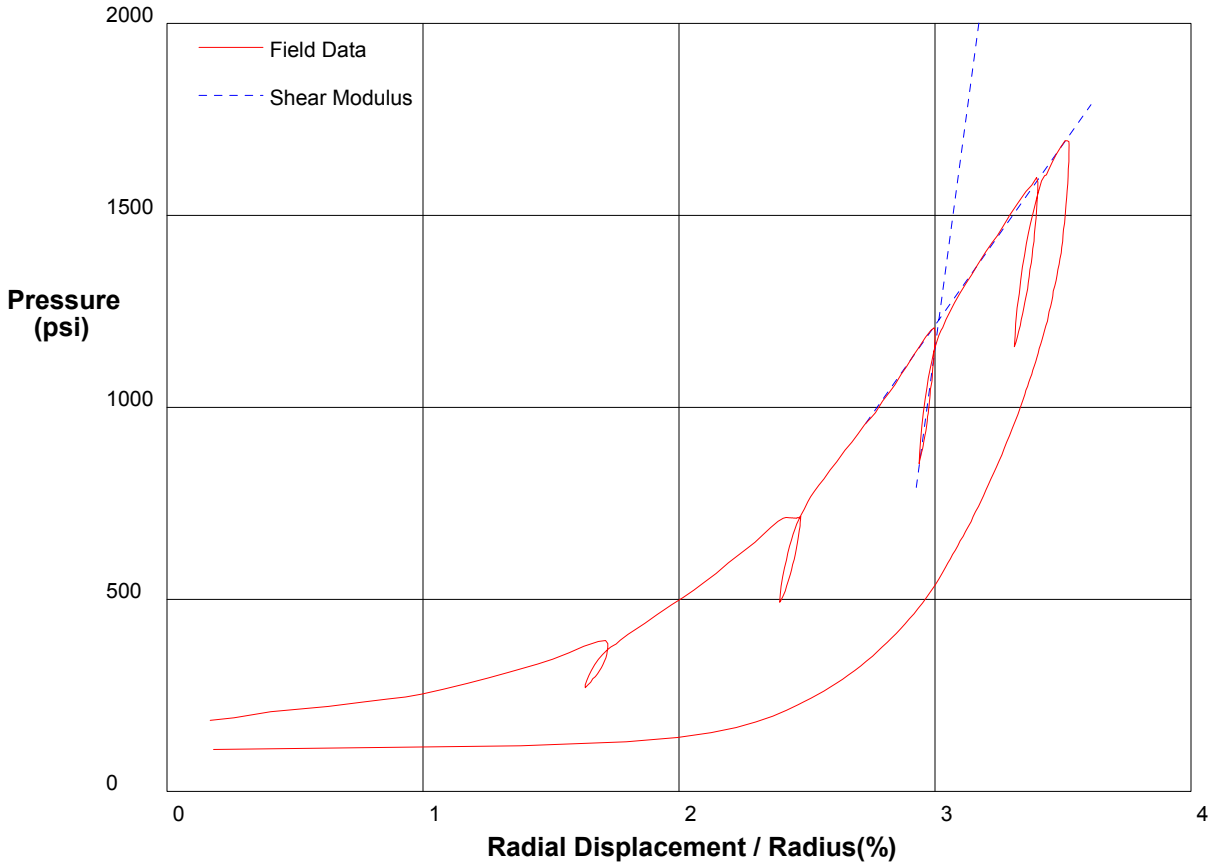
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/19/2009**

Hole No. Z1-B5 **Depth 278ft** **File C:\DATA\ISE-812\SR710-37.P**



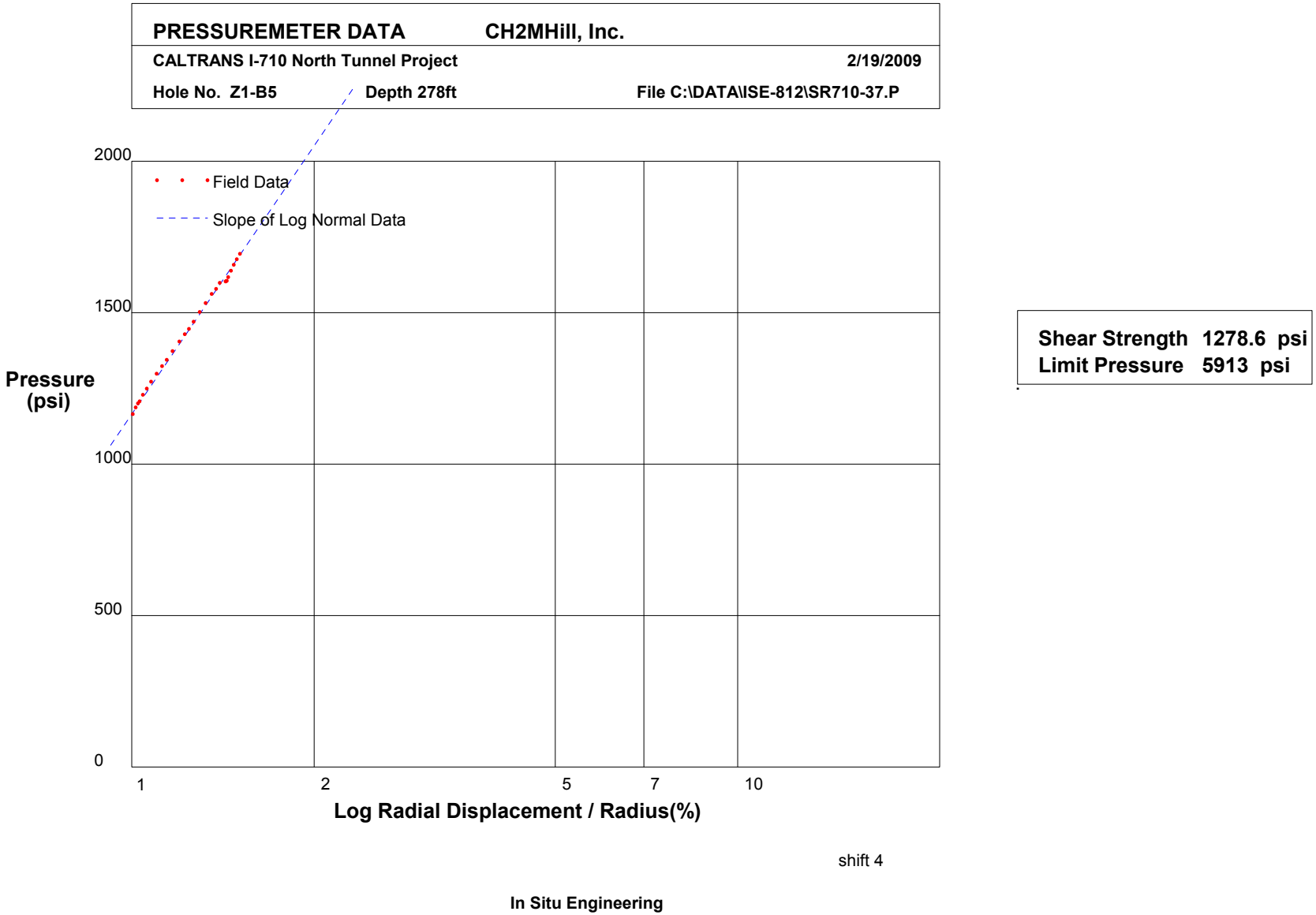
Shear Modulus 247517 psi

Shear Modulus 47140 psi

shift 2

In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

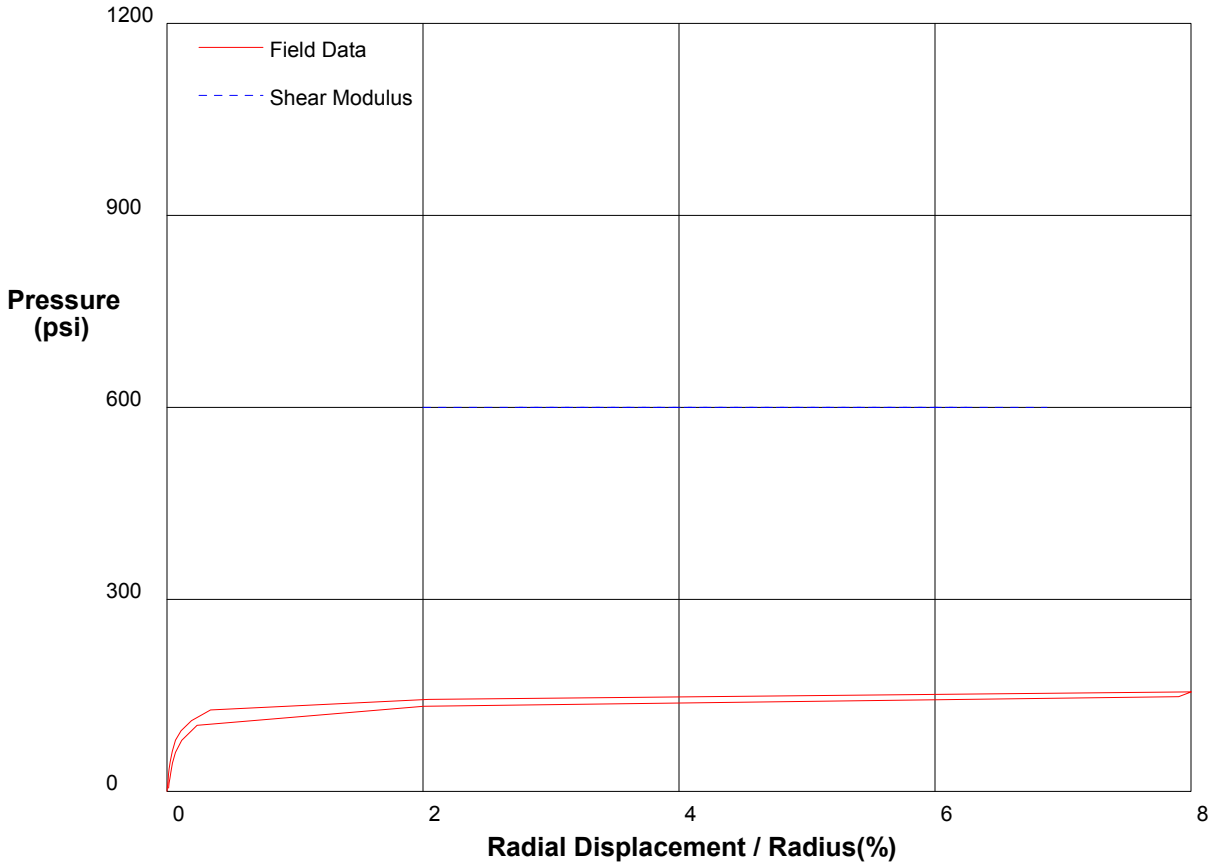


Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/19/2009**

Hole No. Z1-B5 **Depth 276.5ft** **File C:\DATA\ISE-812\SR710-38.P**



Shear Modulus 0 psi

Shear Modulus 0 psi

shift 0

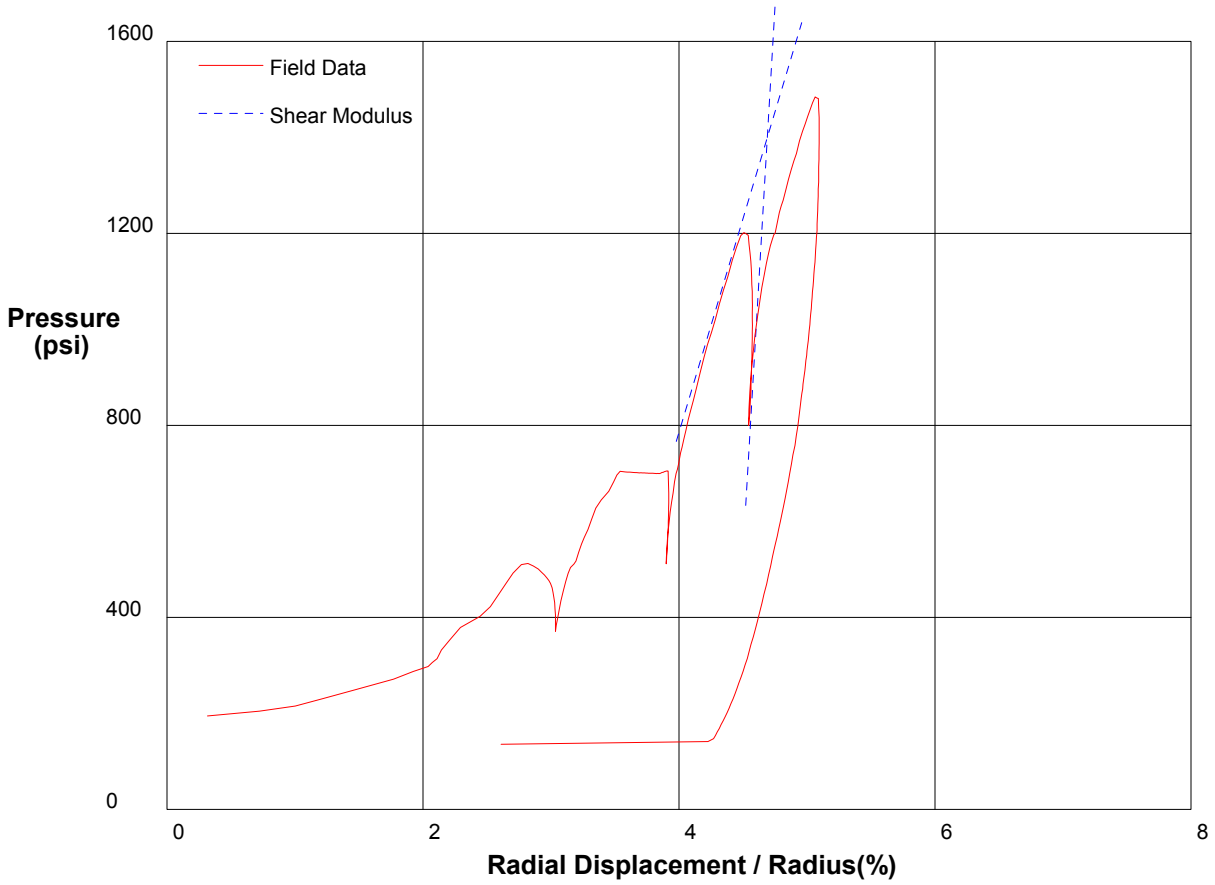
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/19/2009**

Hole No. Z1-B4 **Depth 332ft** **File C:\DATA\ISE-812\SR710-39.P**



Shear Modulus 226666 psi

Shear Modulus 44539 psi

shift 2

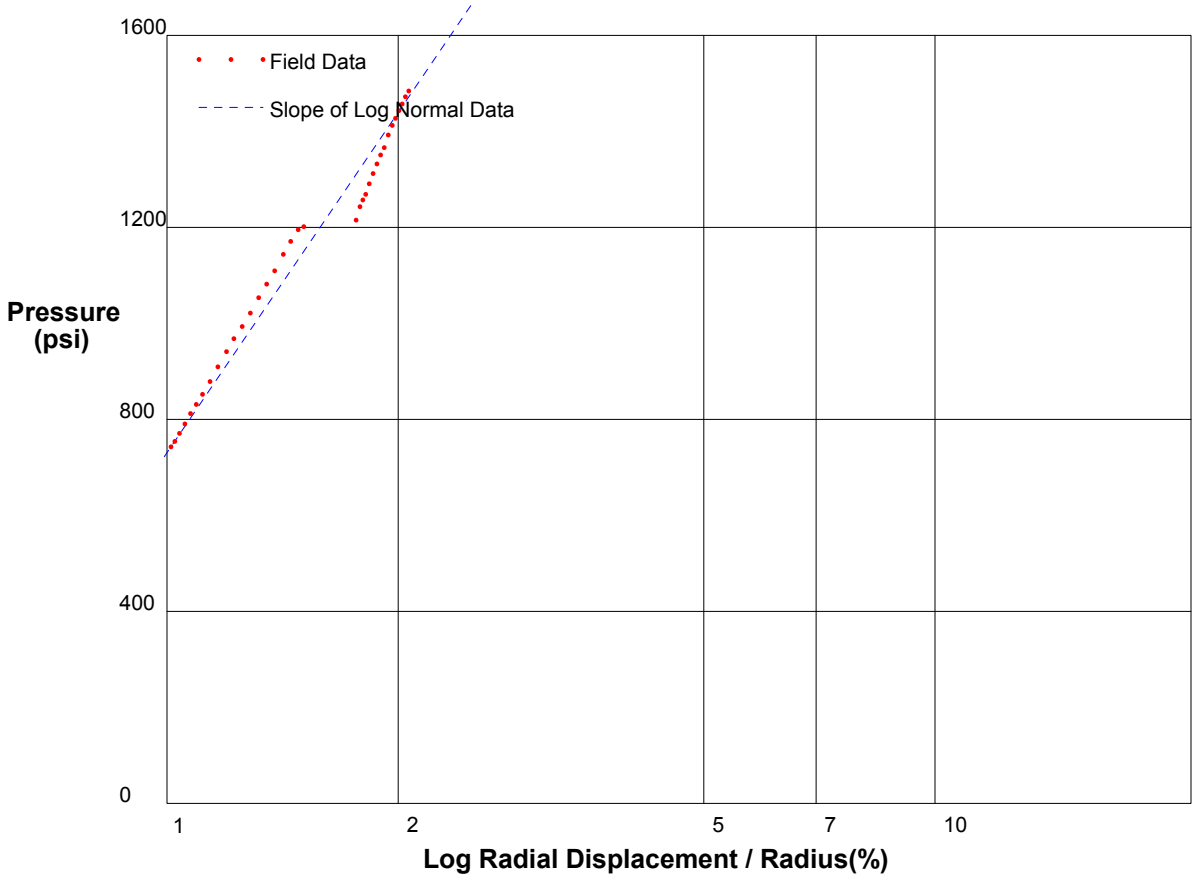
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/19/2009**

Hole No. Z1-B4 **Depth 332ft** **File C:\DATA\ISE-812\SR710-39.P**



Shear Strength 1022.9 psi
Limit Pressure 4529 psi

shift 5

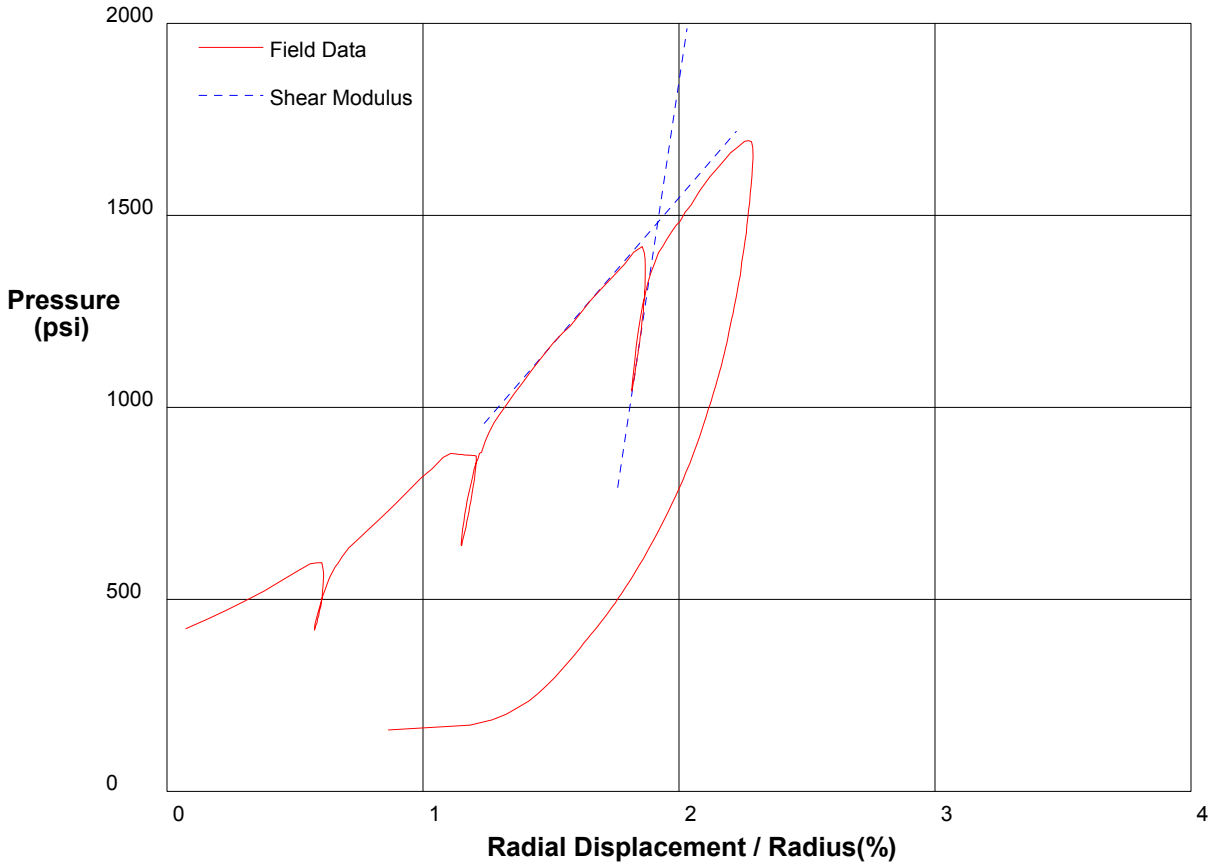
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/19/2009**

Hole No. Z1-B4 **Depth 330.5ft** **File C:\DATA\ISE-812\SR710-40.P**



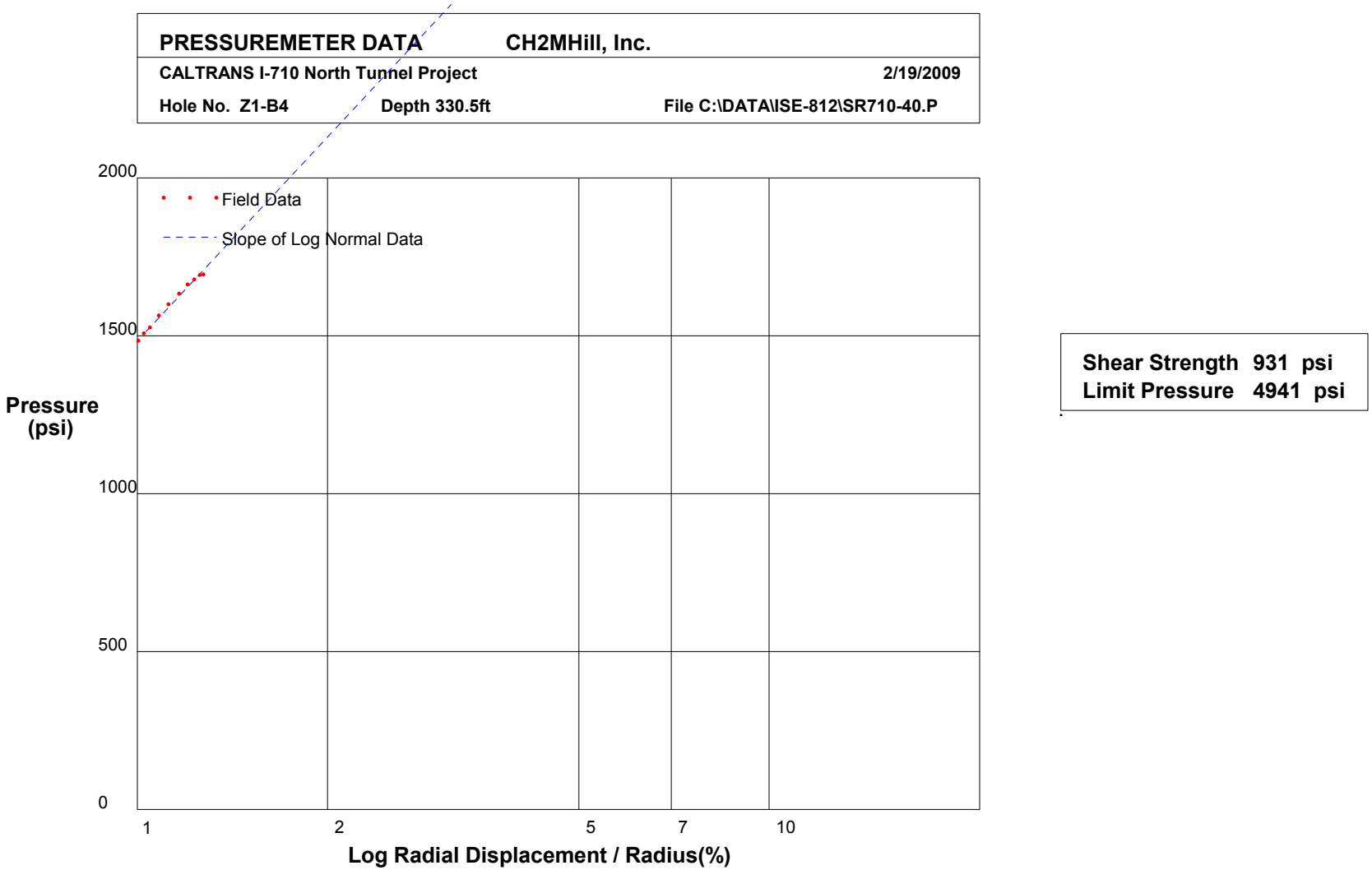
Shear Modulus 220512 psi

Shear Modulus 38624 psi

shift 4

In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

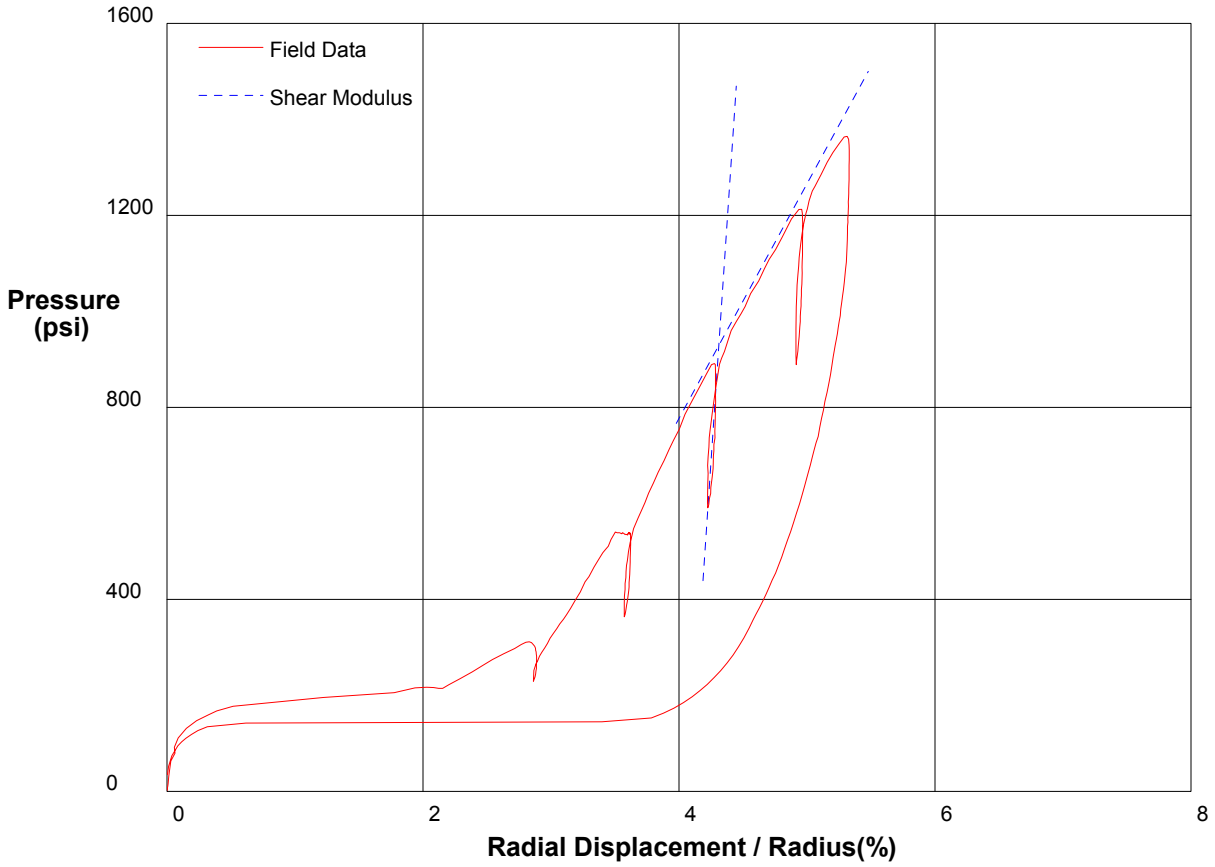


Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/20/2009**

Hole No. Z1-B5 **Depth 347ft** **File C:\DATA\ISE-812\SR710-41.P**



Shear Modulus 197866 psi

Shear Modulus 24444 psi

shift 0

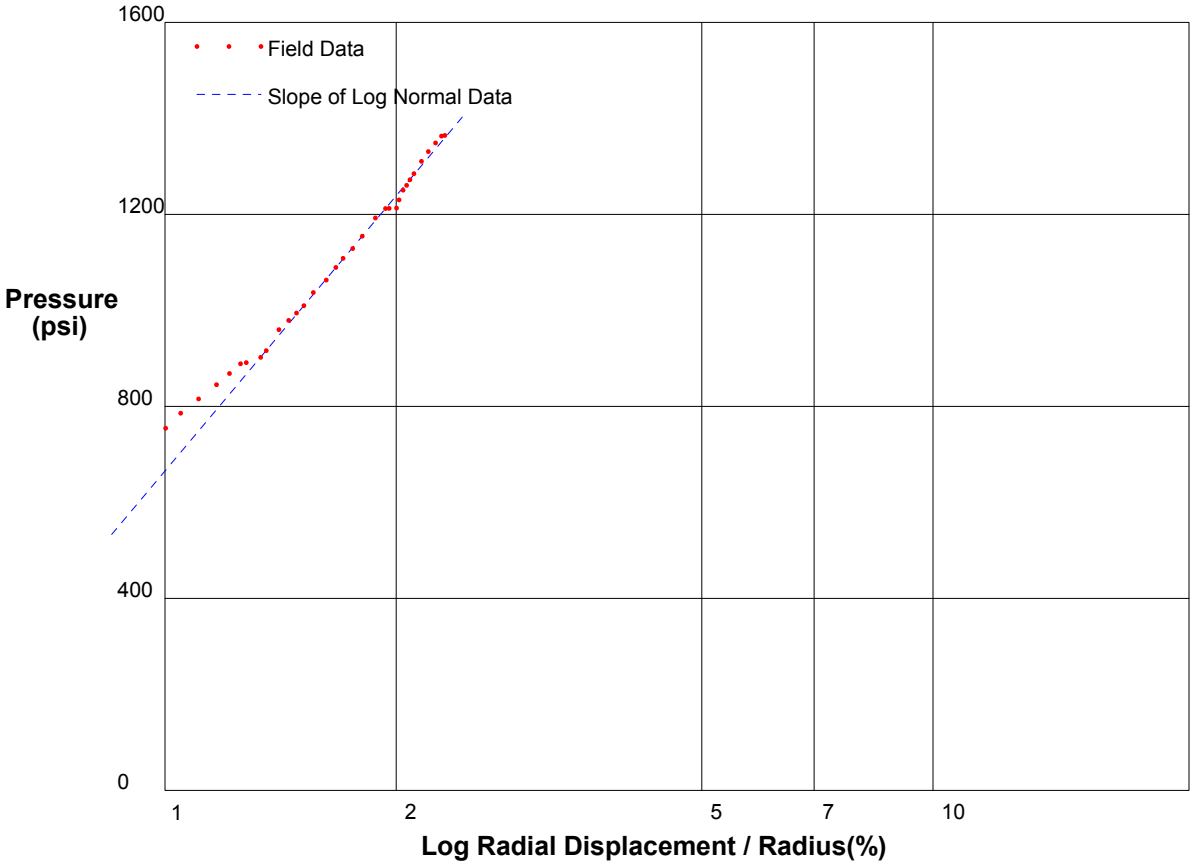
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/20/2009**

Hole No. Z1-B5 **Depth 347ft** **File C:\DATA\ISE-812\SR710-41.P**



Shear Strength 826.9 psi
Limit Pressure 3736 psi

shift 3

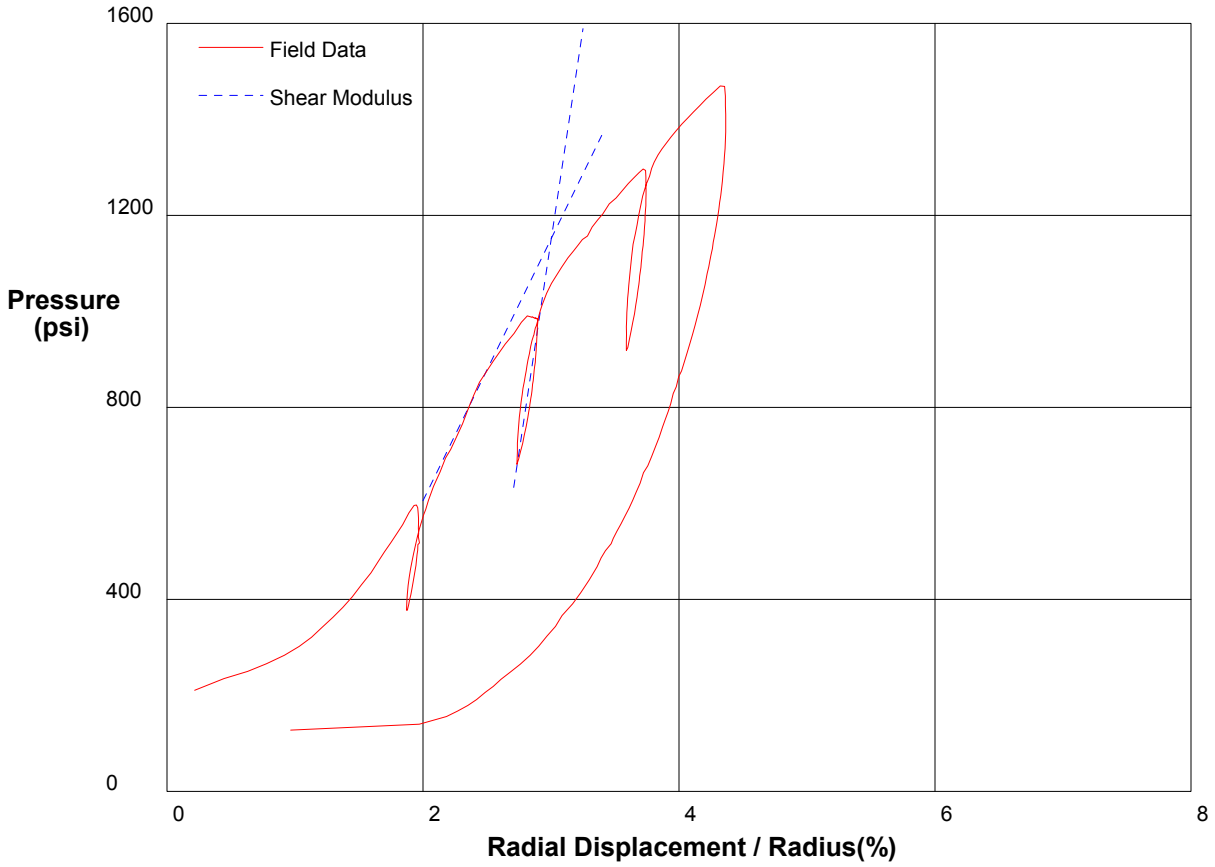
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/20/2009**

Hole No. Z1-B5 **Depth 345.5ft** **File C:\DATA\ISE-812\SR710-42.P**



Shear Modulus 88205 psi

Shear Modulus 27263 psi

shift 2.8

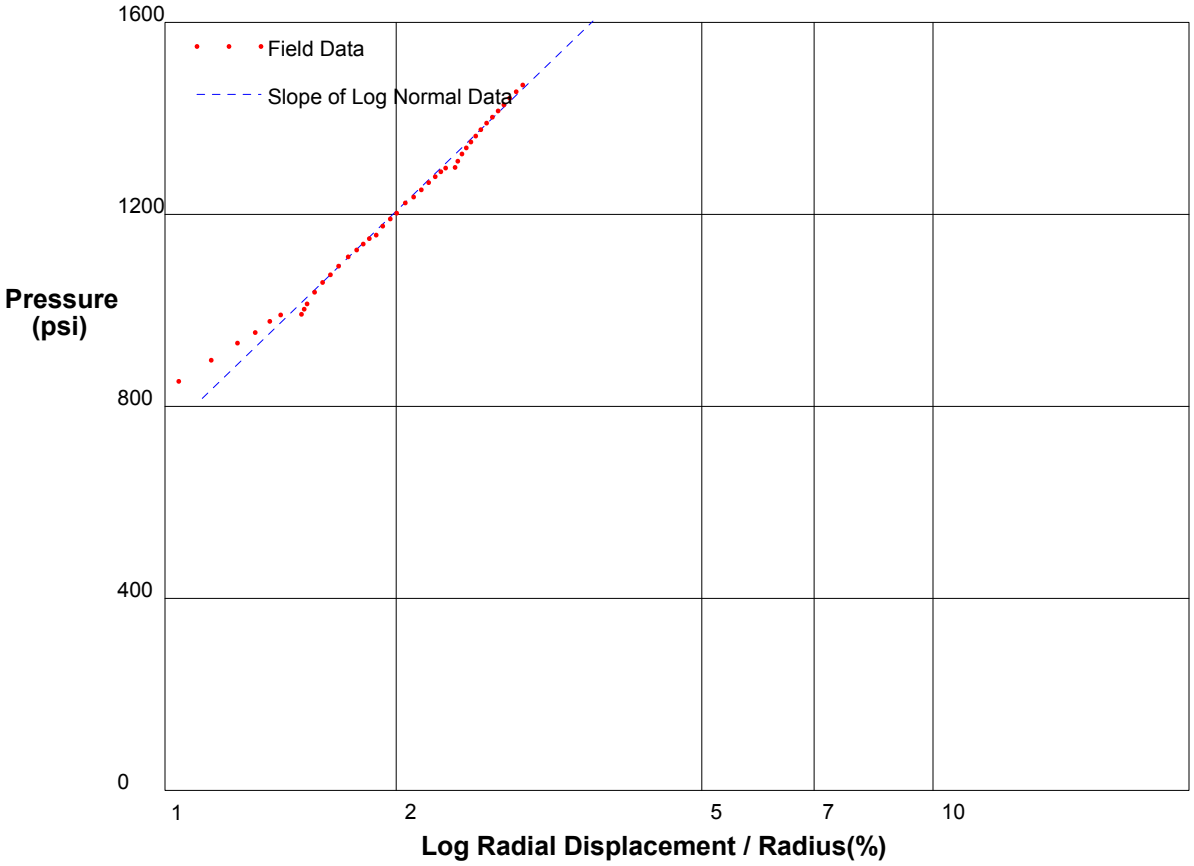
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/20/2009**

Hole No. Z1-B5 **Depth 345.5ft** **File C:\DATA\ISE-812\SR710-42.P**



Shear Strength 671.1 psi
Limit Pressure 3233 psi

shift 4.2

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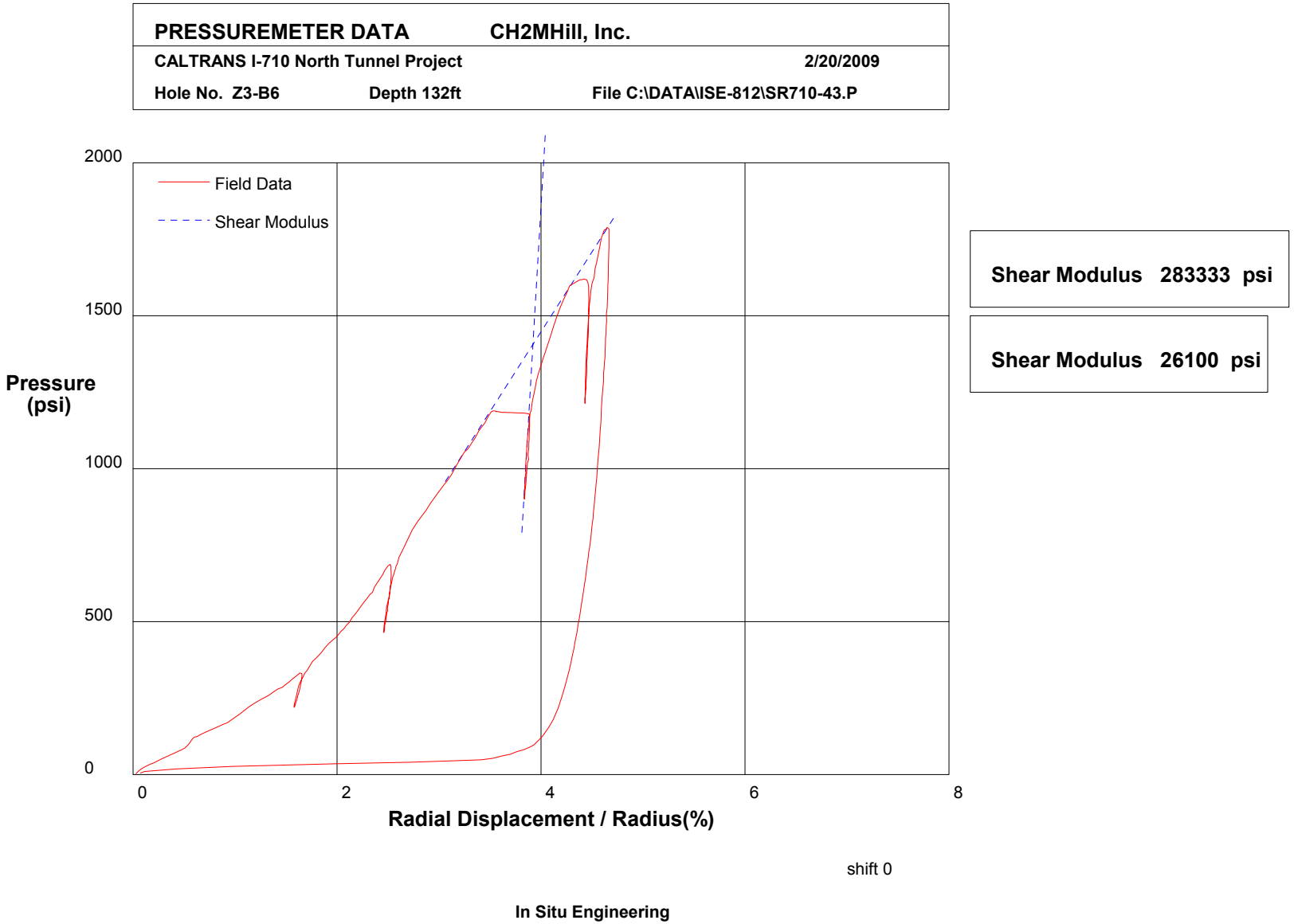
Appendix I - Pressuremeter Data and Standard Interpretation

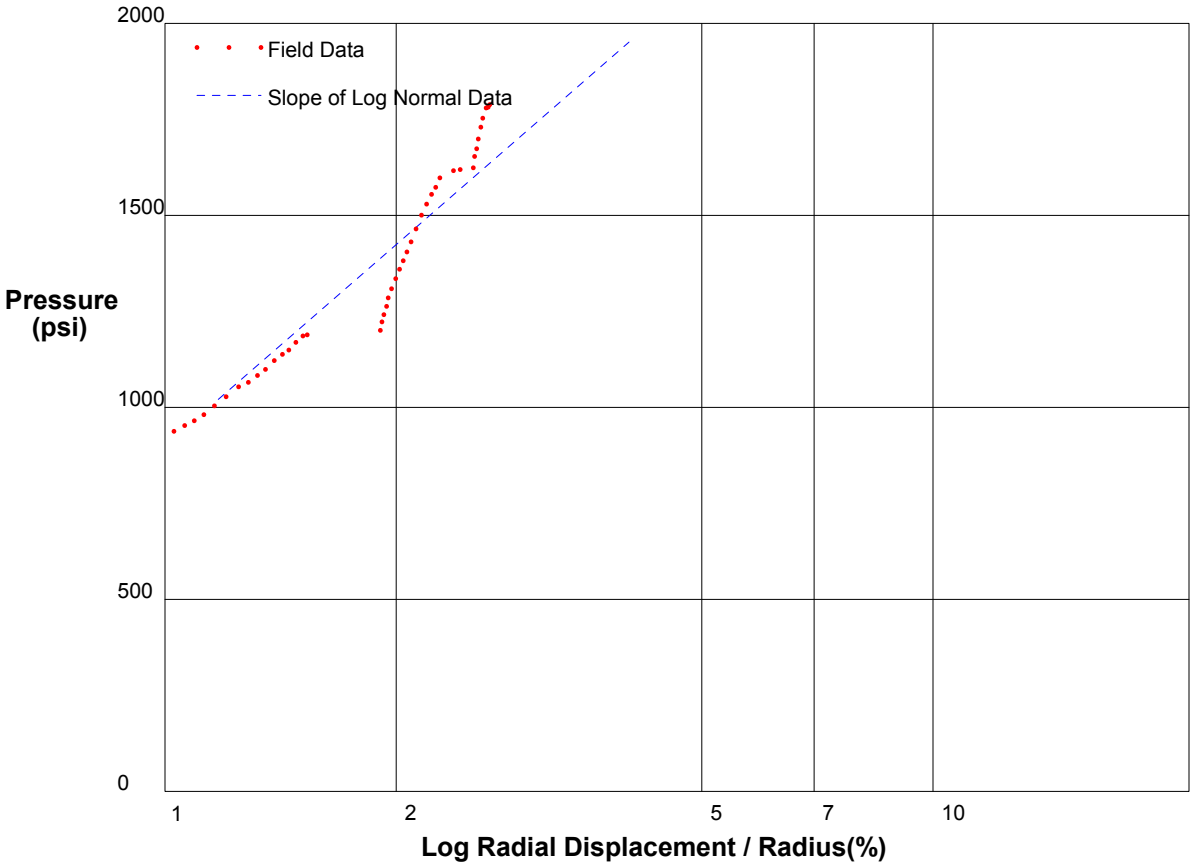


Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/20/2009**

Hole No. Z3-B6 **Depth 132ft** **File C:\DATA\ISE-812\SR710-43.P**



Shear Strength 755.7 psi
Limit Pressure 3706 psi

shift 2

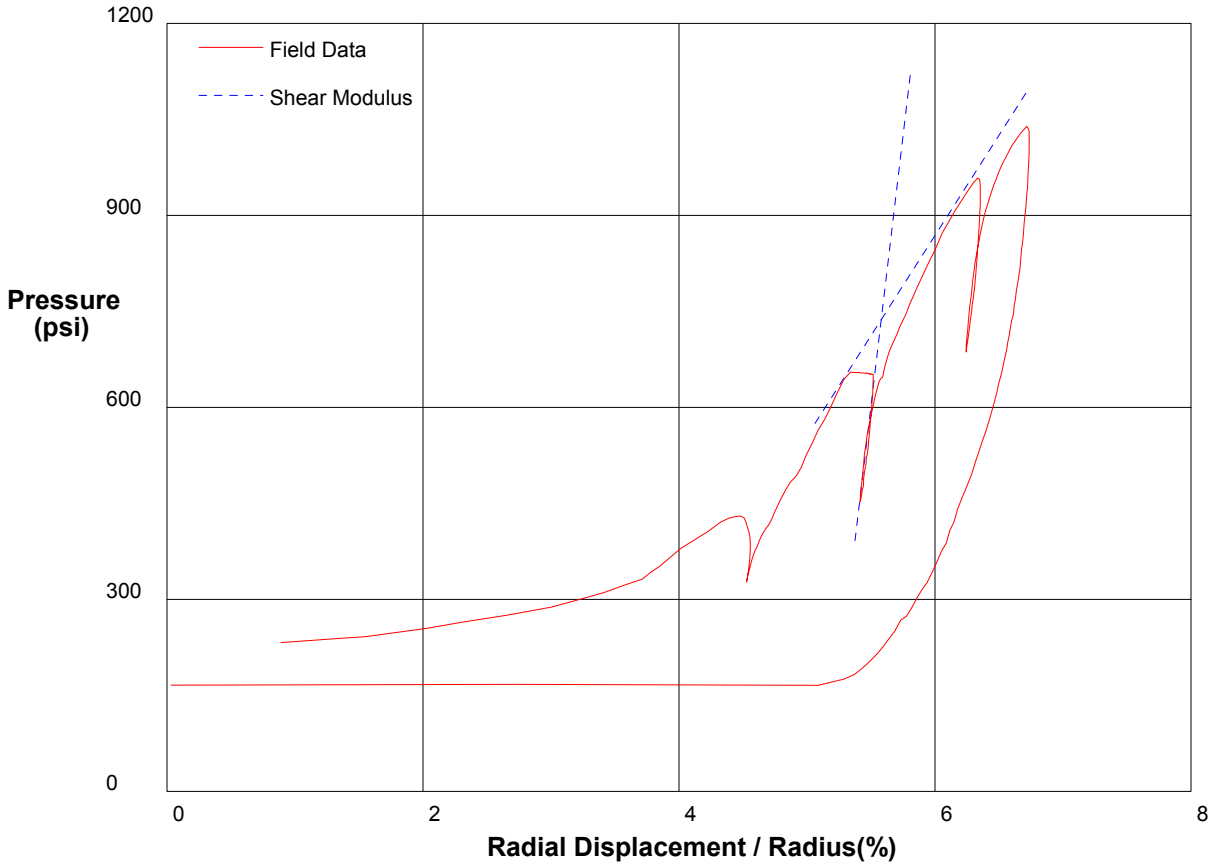
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/23/2009**

Hole No. Z1-B5 **Depth 398ft** **File C:\DATA\ISE-812\SR710-44.P**



Shear Modulus 84285 psi

Shear Modulus 15660 psi

shift 1.5

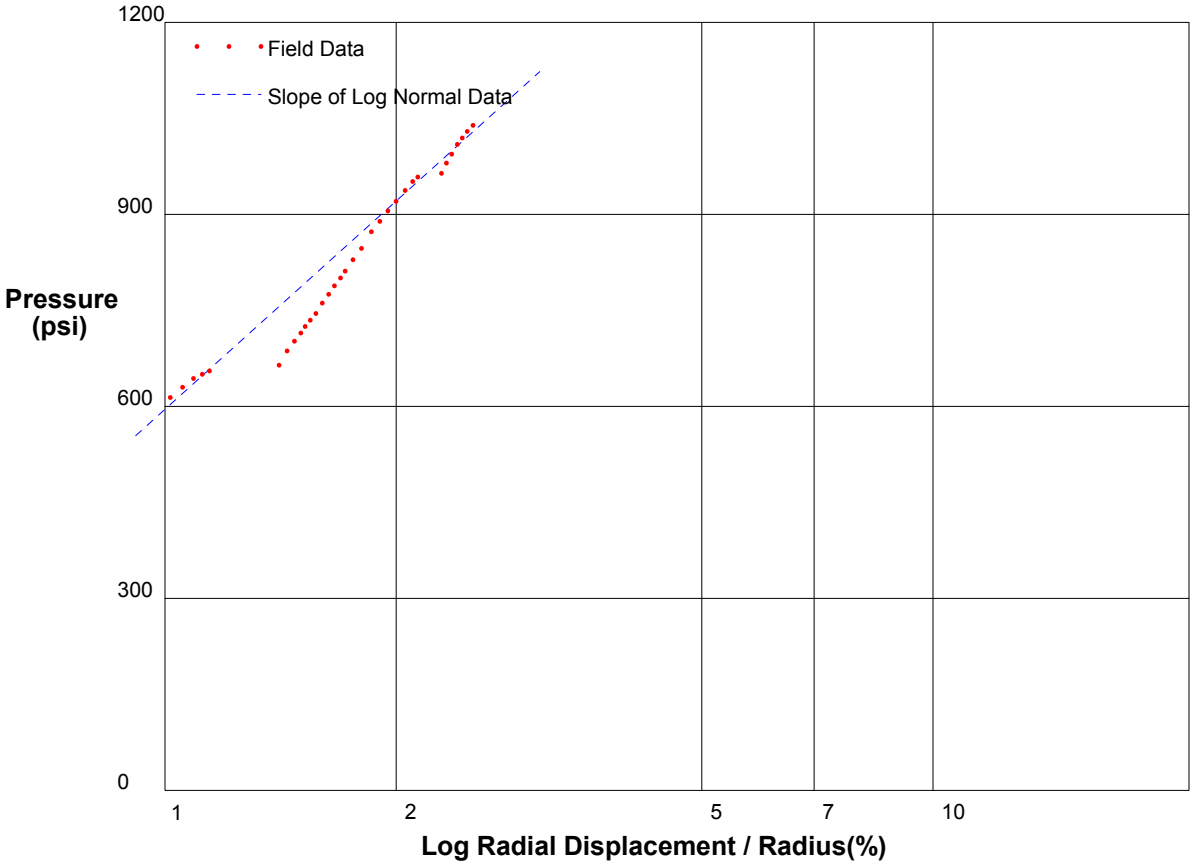
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/23/2009**

Hole No. Z1-B5 **Depth 398ft** **File C:\DATA\ISE-812\SR710-44.P**



Shear Strength 469.5 psi
Limit Pressure 2339 psi

shift 5.7

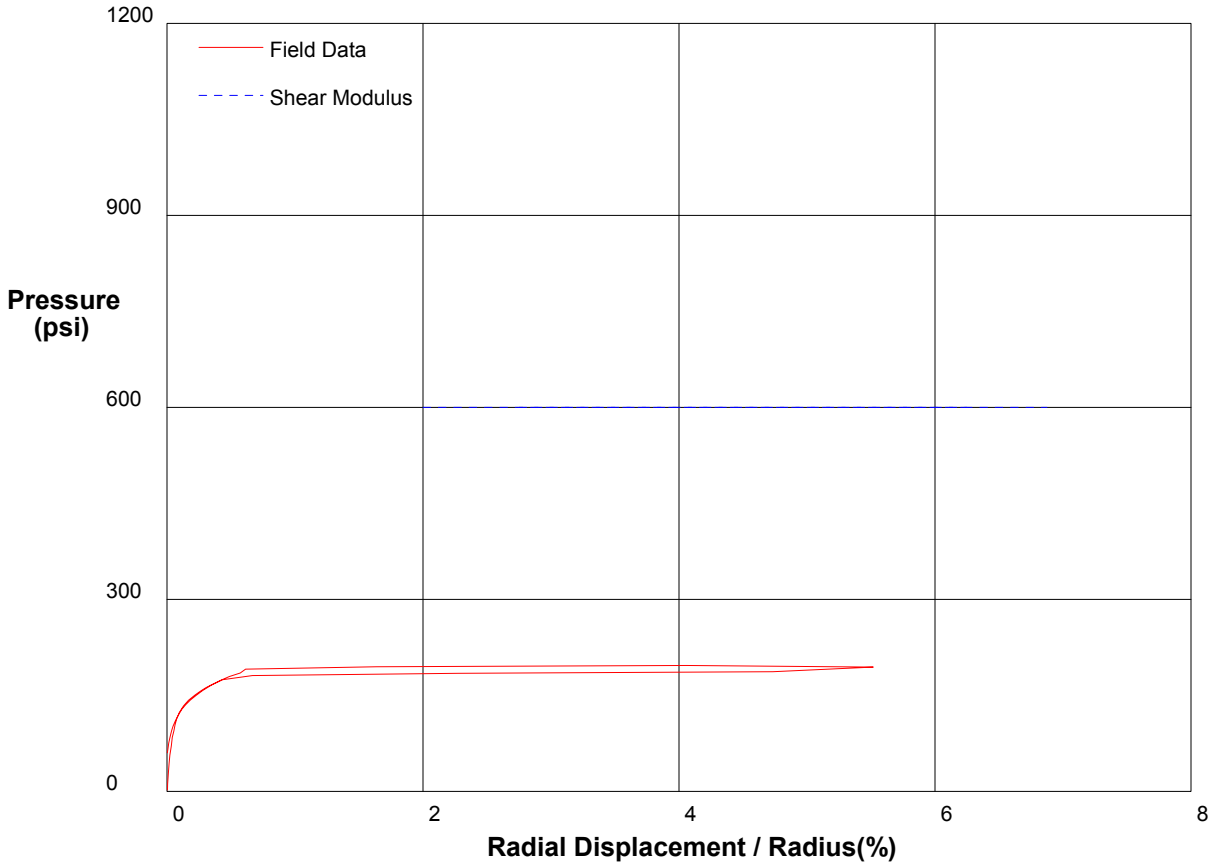
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/23/2009**

Hole No. Z1-B5 **Depth 396.5ft** **File C:\DATA\ISE-812\SR710-45.P**



Shear Modulus 0 psi

Shear Modulus 0 psi

shift 0

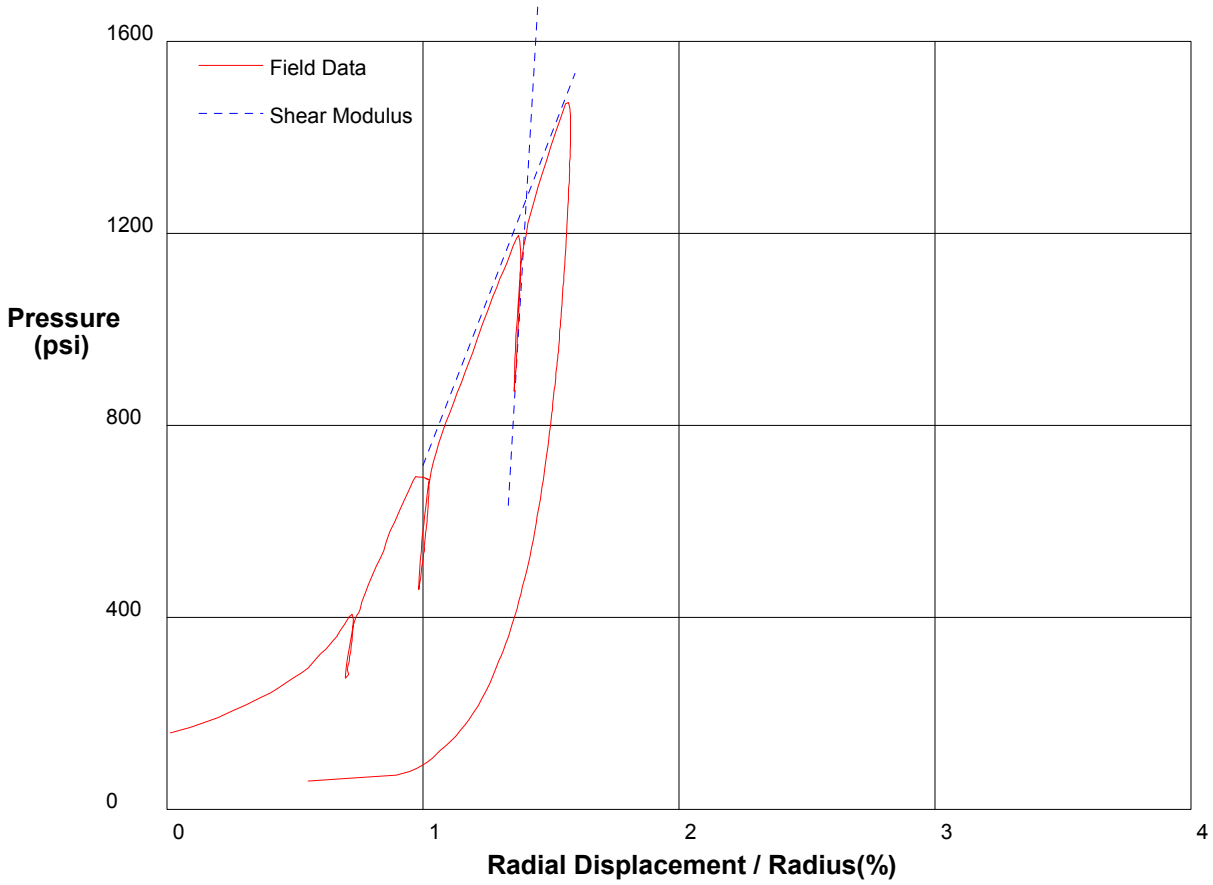
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/23/2009**

Hole No. Z3-B6 **Depth 168ft** **File C:\DATA\ISE-812\SR710-46.P**



Shear Modulus 453333 psi

Shear Modulus 68771 psi

shift 2

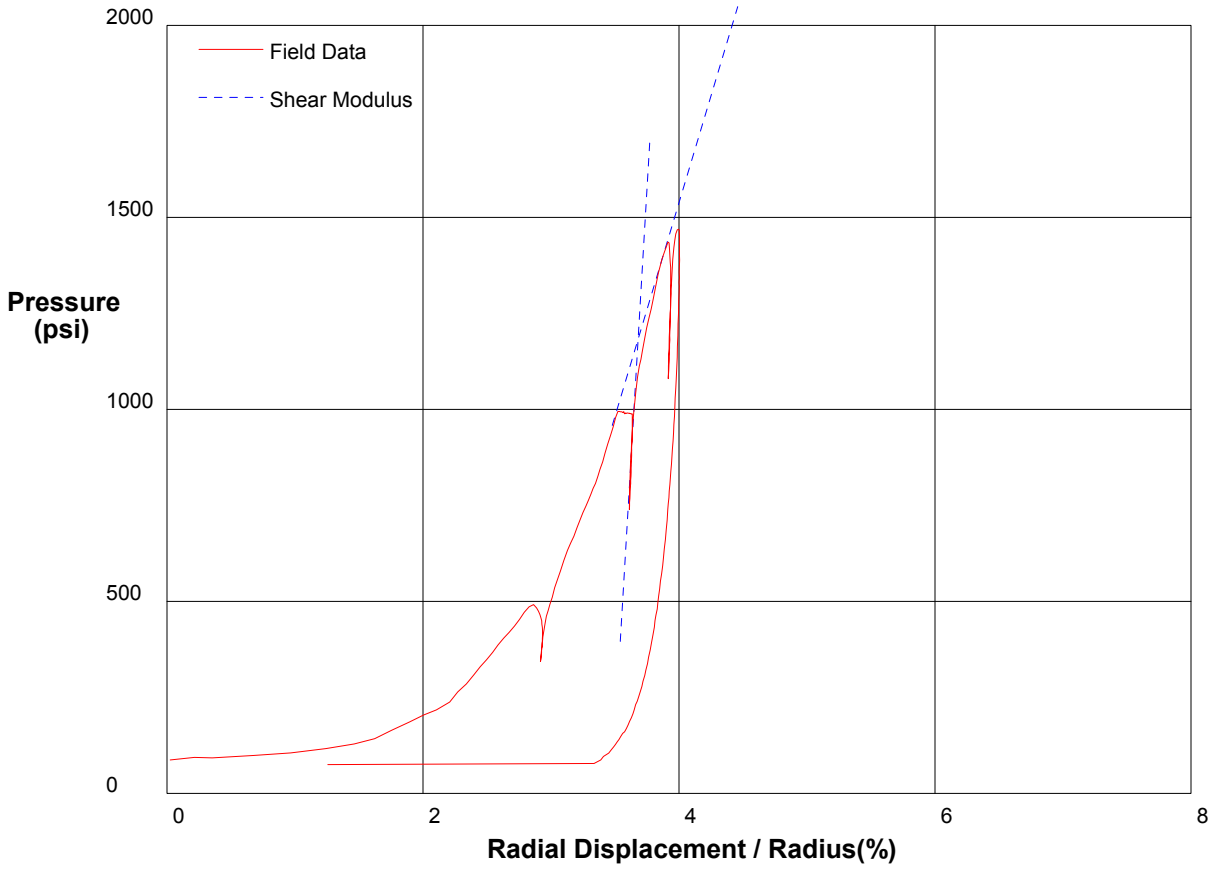
In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/23/2009**

Hole No. Z3-B6 **Depth 166.5ft** **File C:\DATA\ISE-812\SR710-47.P**



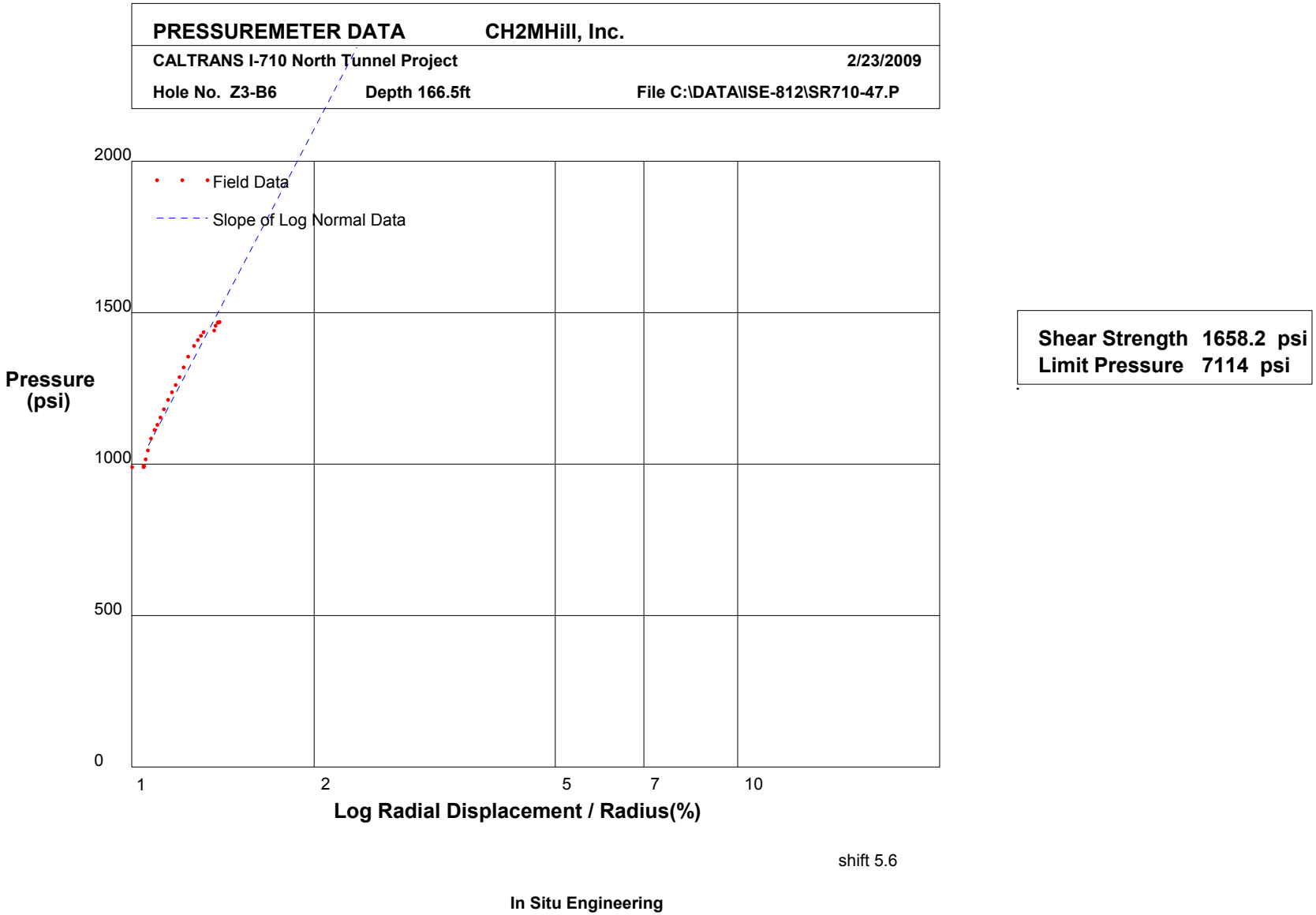
Shear Modulus 283333 psi

Shear Modulus 55673 psi

shift 3

In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

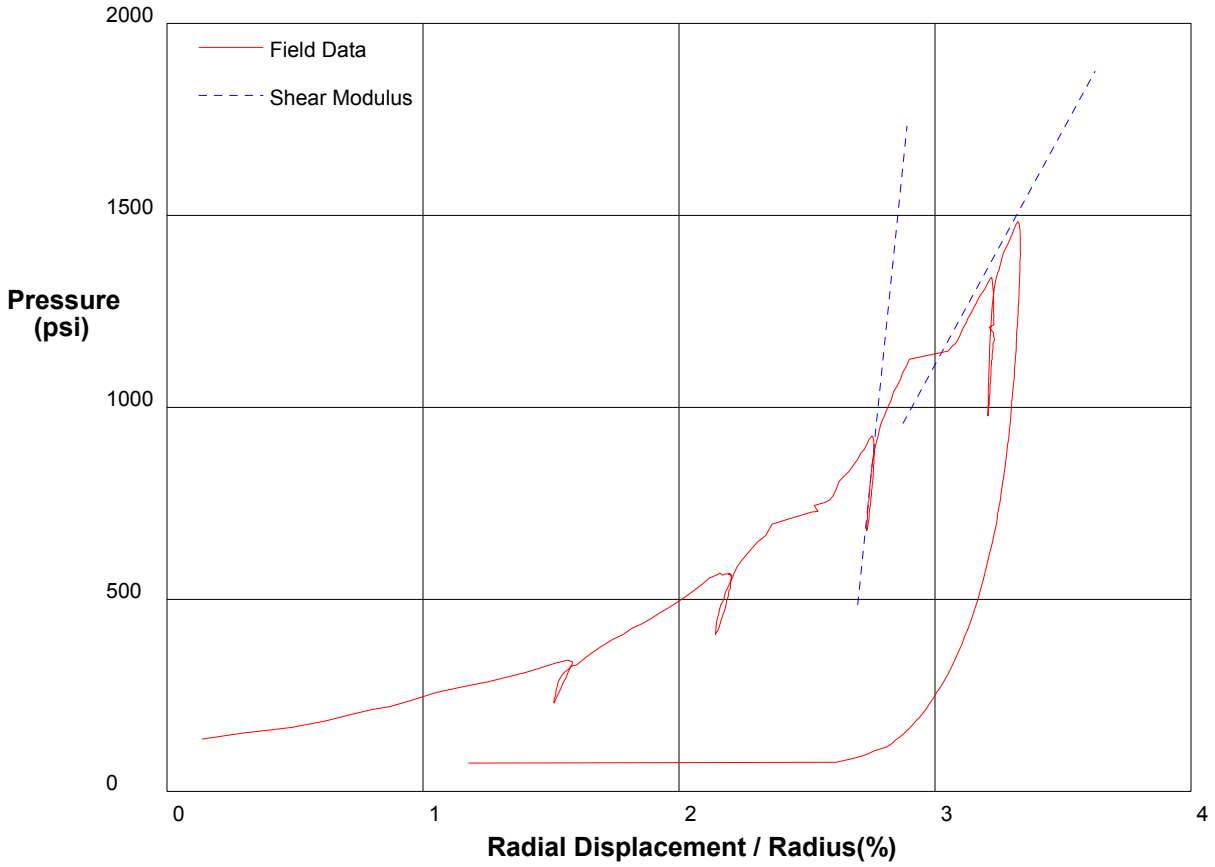


Appendix I - Pressuremeter Data and Standard Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/24/2009**

Hole No. Z3-B6 **Depth 188.2ft** **File C:\DATA\ISE-812\SR710-48.P**



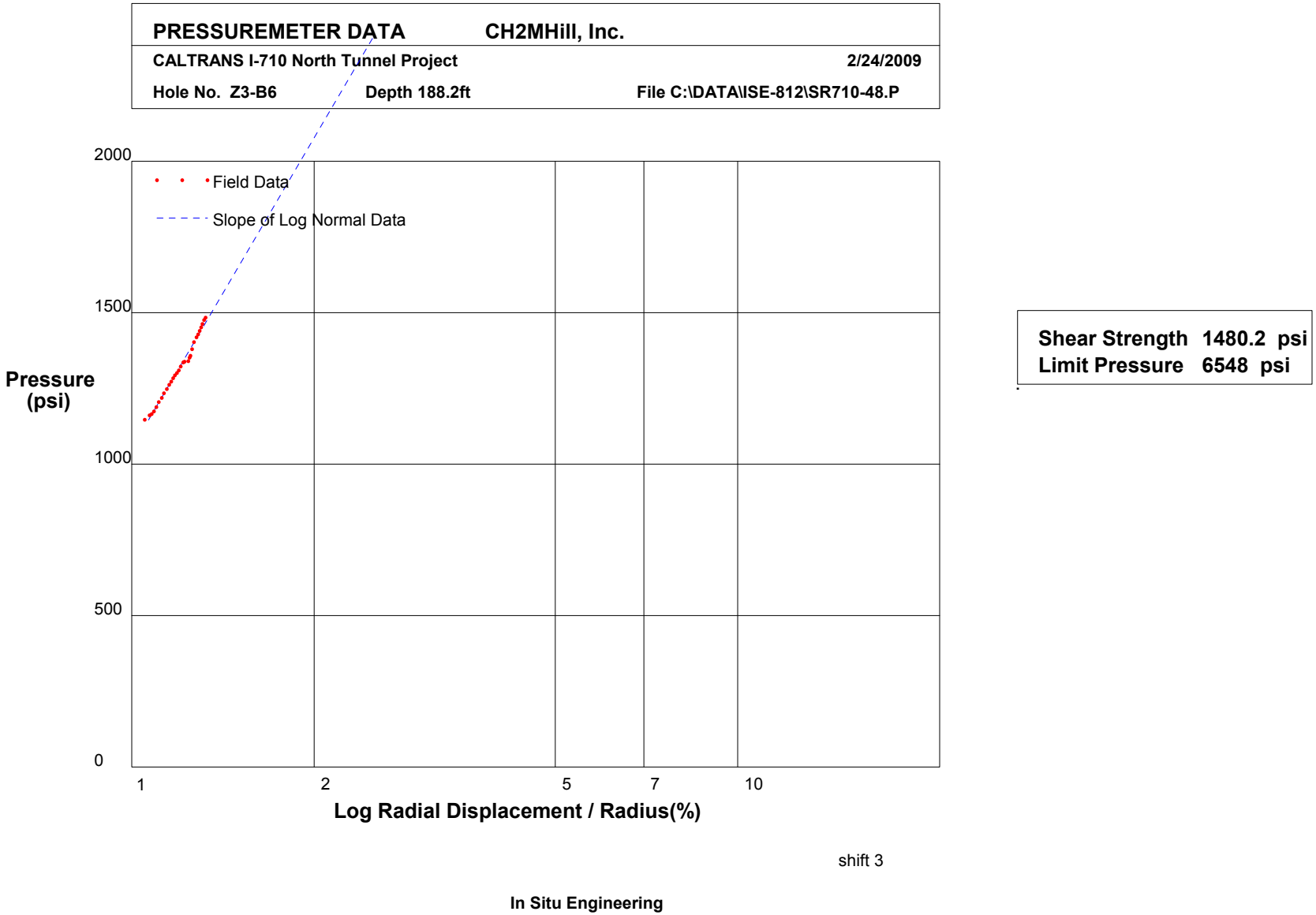
Shear Modulus 323423 psi

Shear Modulus 61111 psi

shift 1

In Situ Engineering

Appendix I - Pressuremeter Data and Standard Interpretation

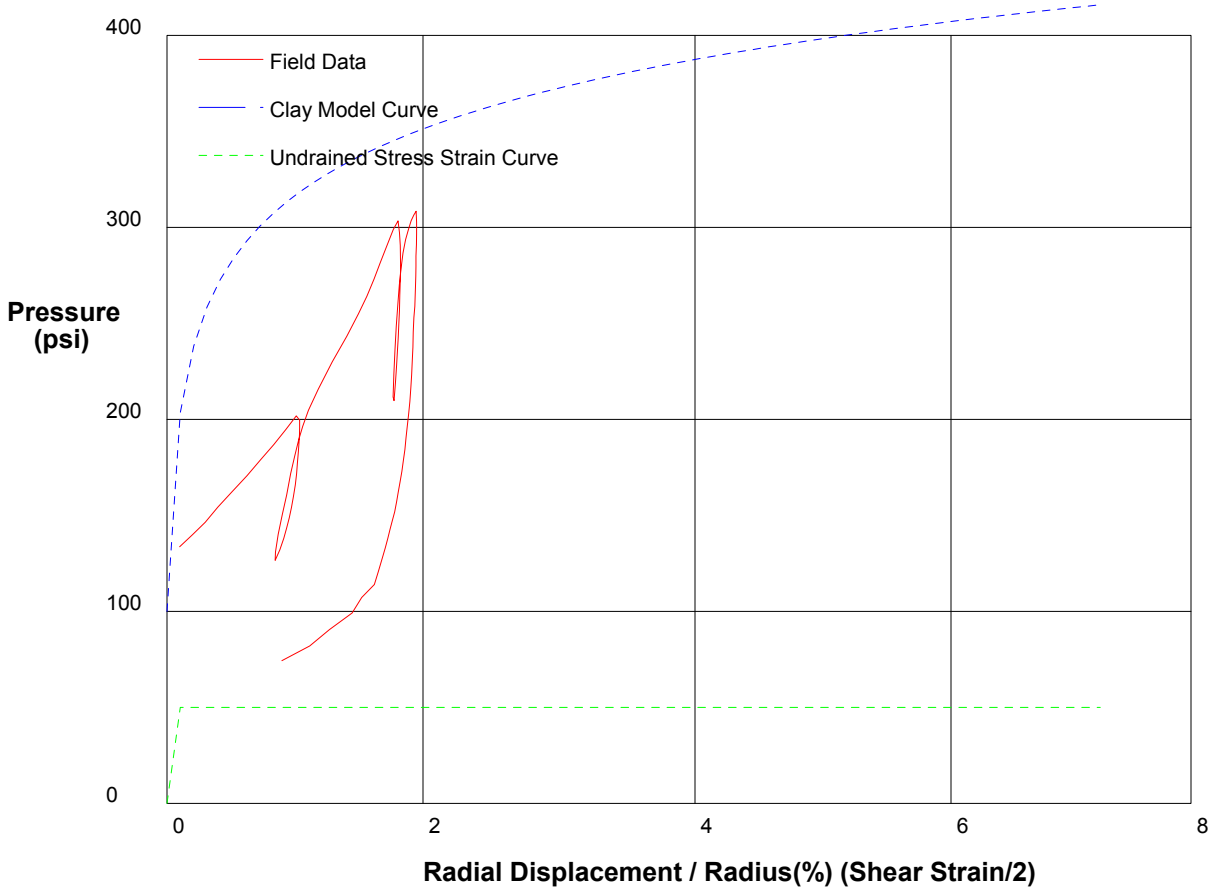


Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/16/2009**

Hole No. Z3-B2 **Depth 200.9ft** **File C:\DATA\ISE-812\SR710-01.P**



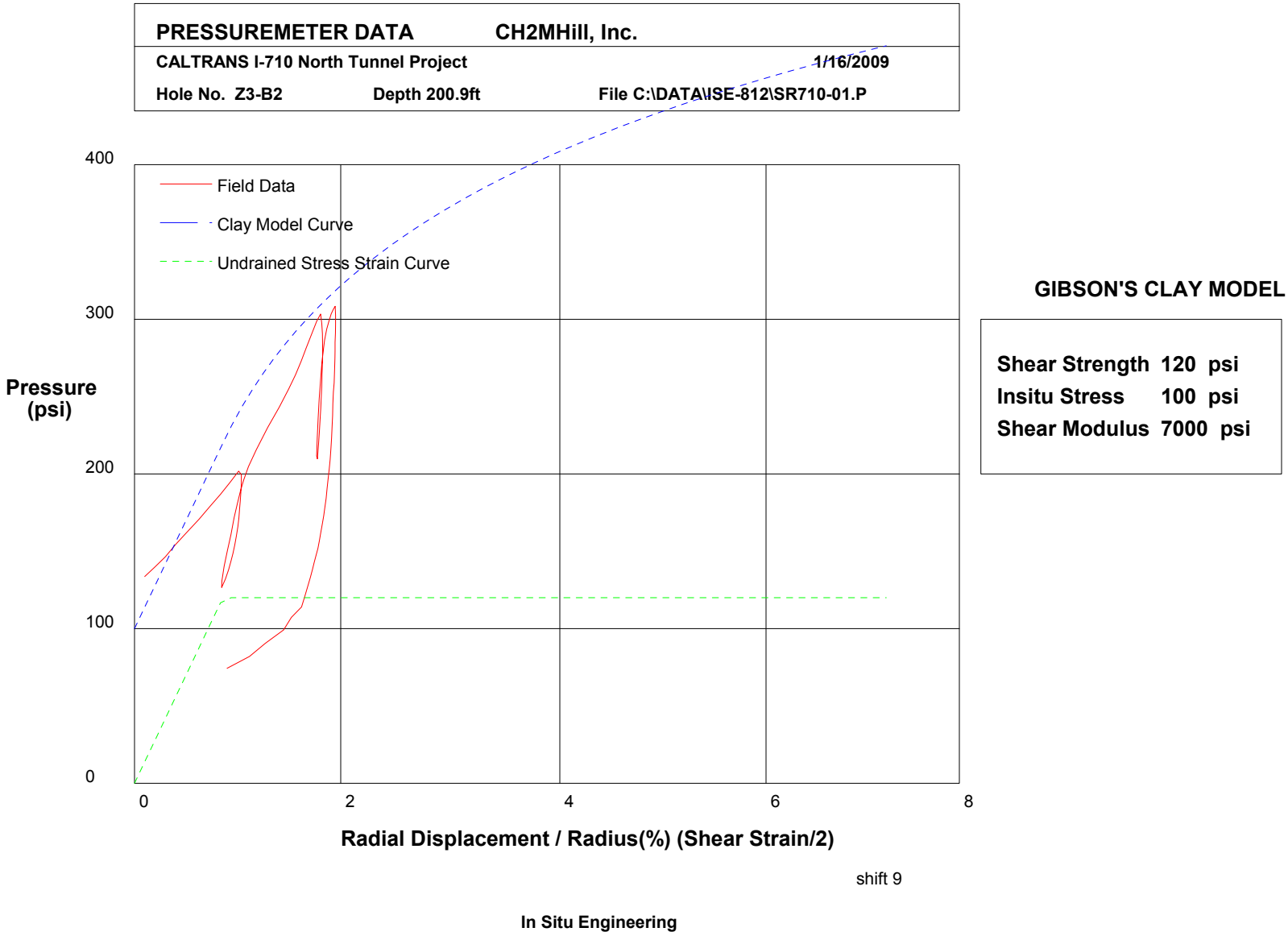
GIBSON'S CLAY MODEL

Shear Strength 50 psi
Insitu Stress 100 psi
Shear Modulus 70000 psi

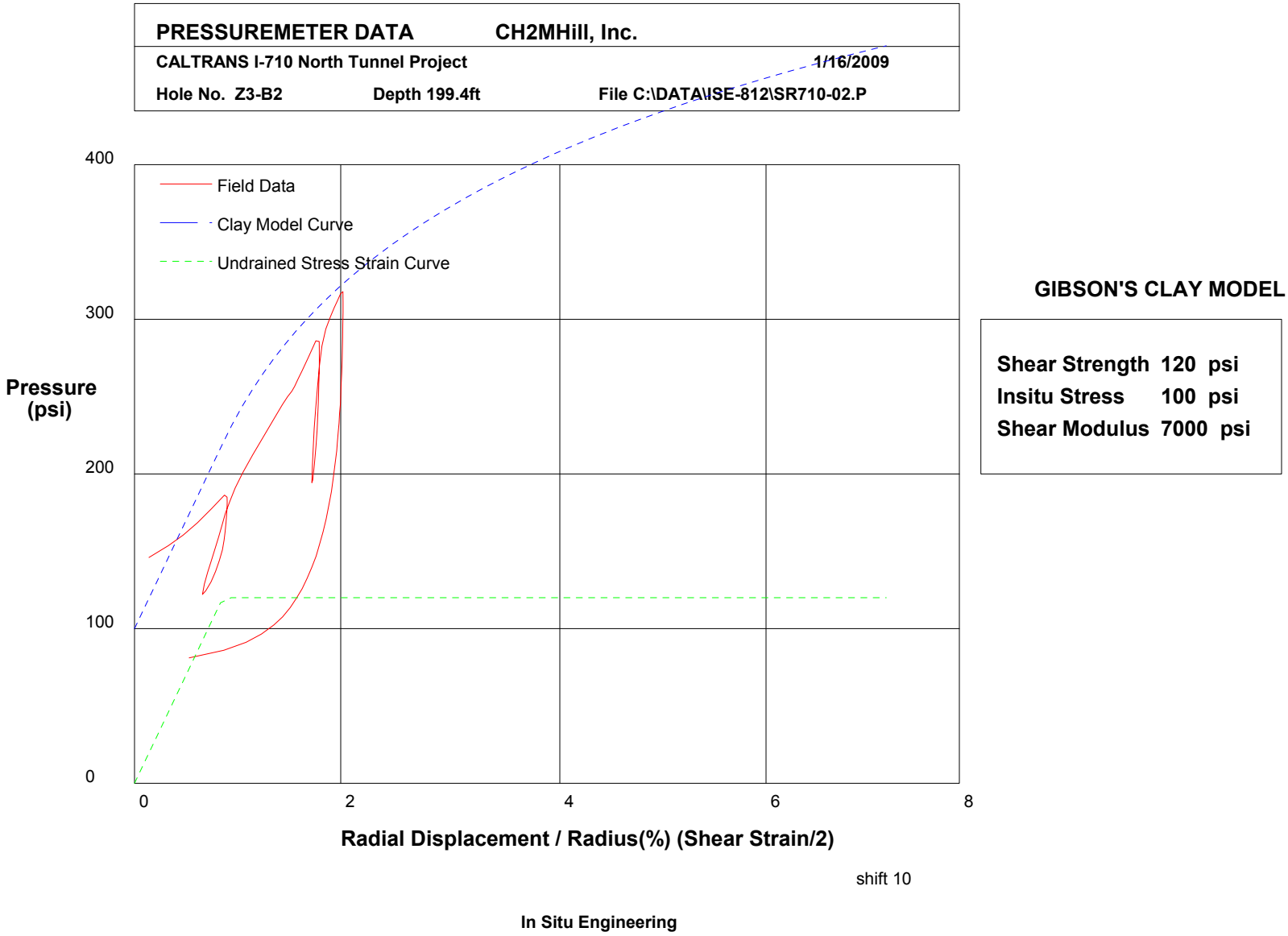
shift 9

In Situ Engineering

Appendix II - Pressuremeter Model Interpretation



Appendix II - Pressuremeter Model Interpretation

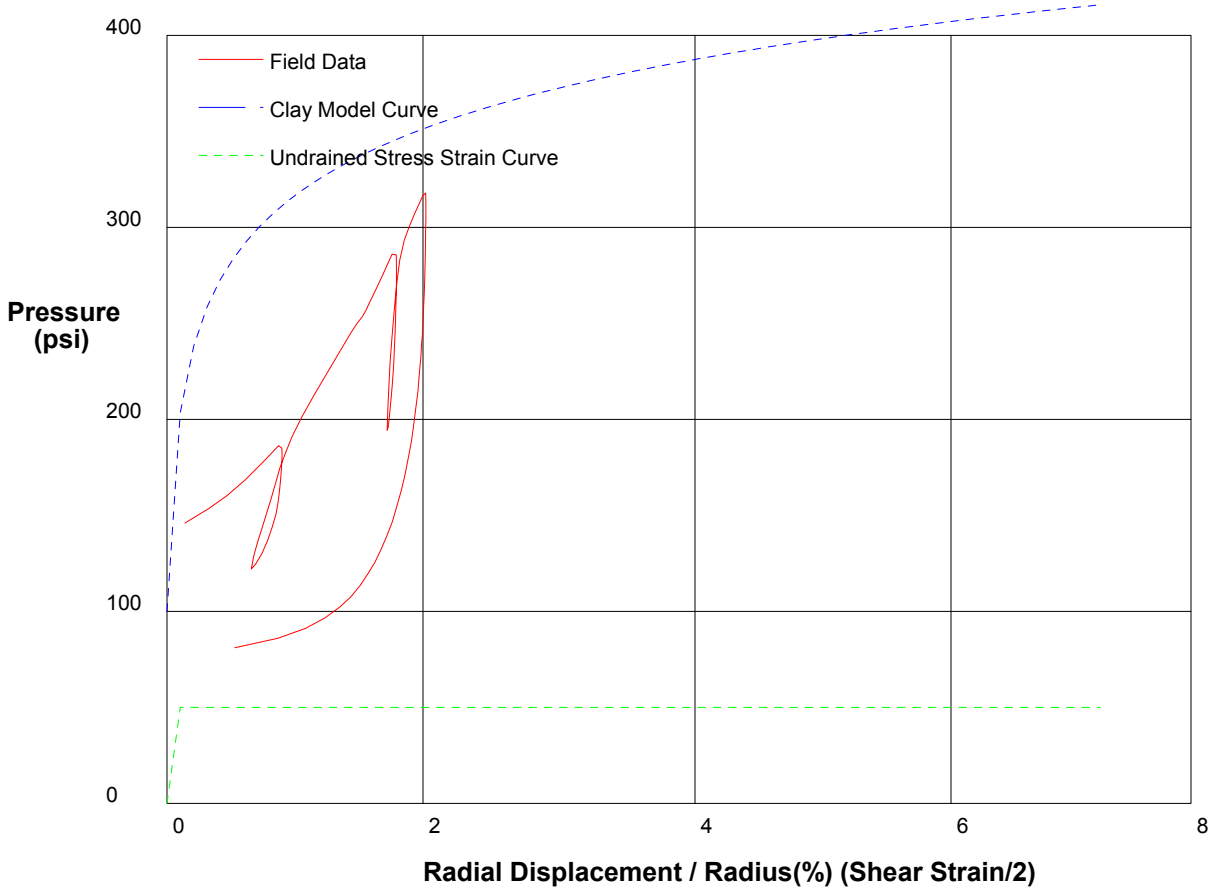


Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/16/2009**

Hole No. Z3-B2 **Depth 199.4ft** **File C:\DATA\ISE-812\SR710-02.P**



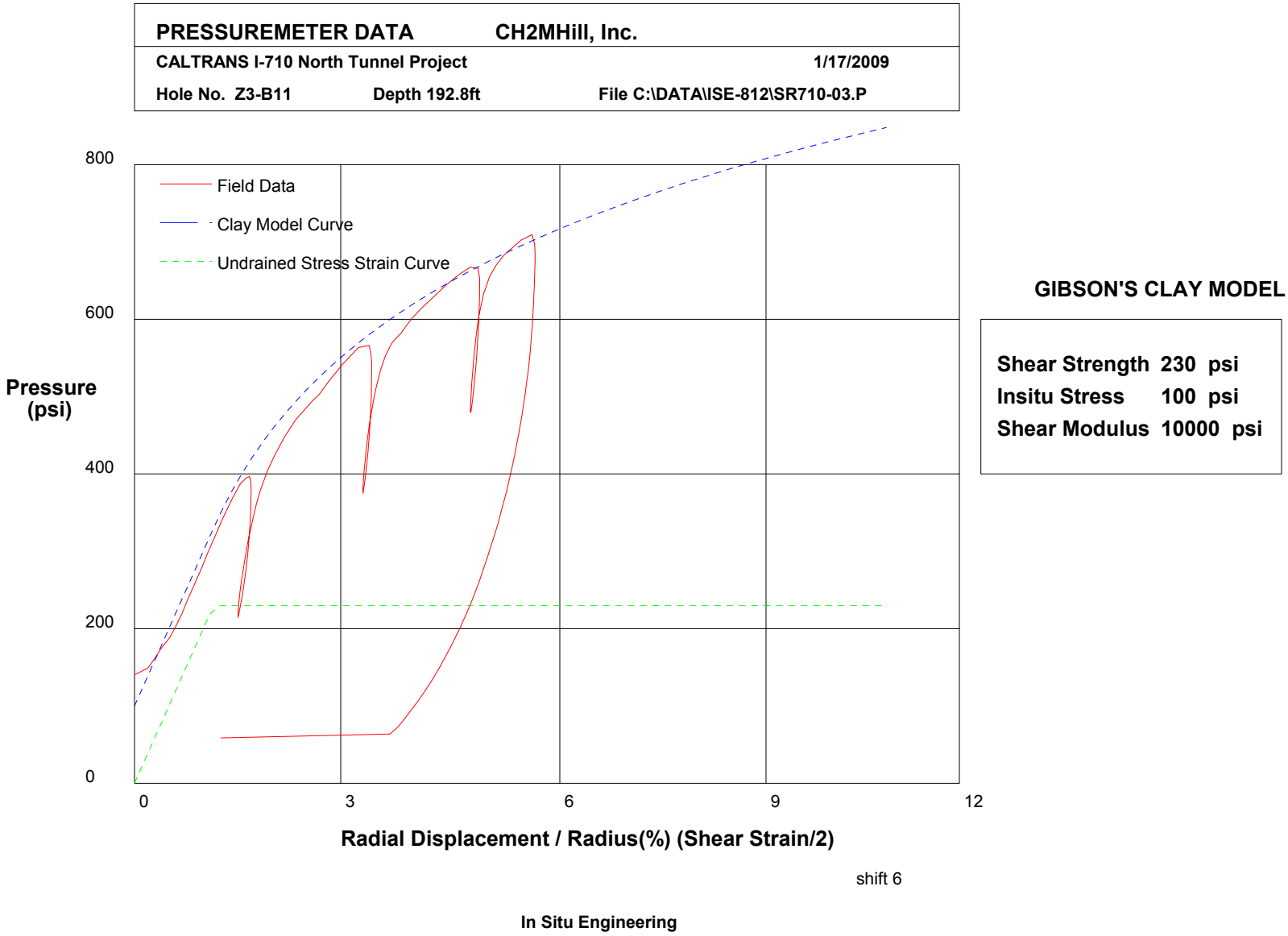
GIBSON'S CLAY MODEL

Shear Strength 50 psi
Insitu Stress 100 psi
Shear Modulus 70000 psi

shift 10

In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

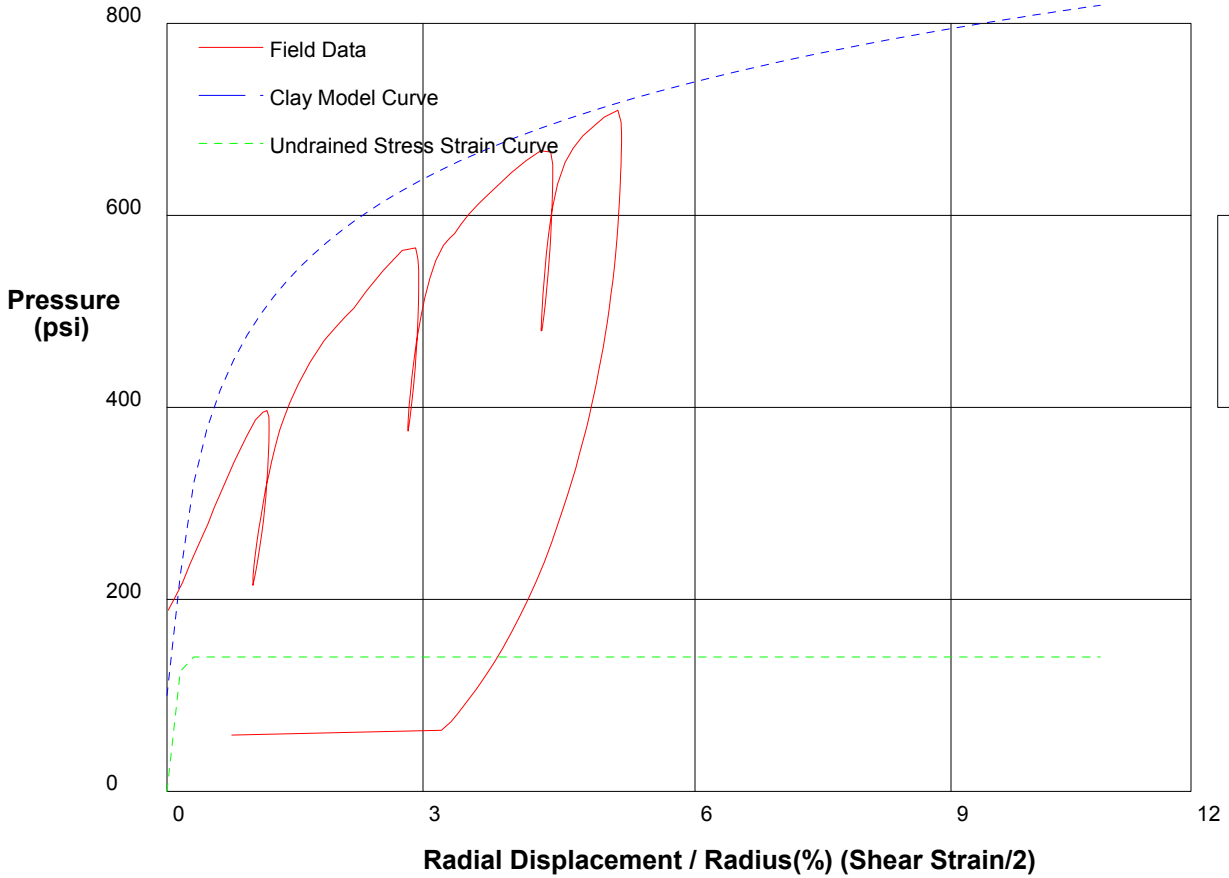


Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/17/2009**

Hole No. Z3-B11 **Depth 192.8ft** **File C:\DATA\ISE-812\SR710-03.P**



GIBSON'S CLAY MODEL

Shear Strength	**140 psi**
Insitu Stress	**100 psi**
Shear Modulus	**40000 psi**

shift 6.5

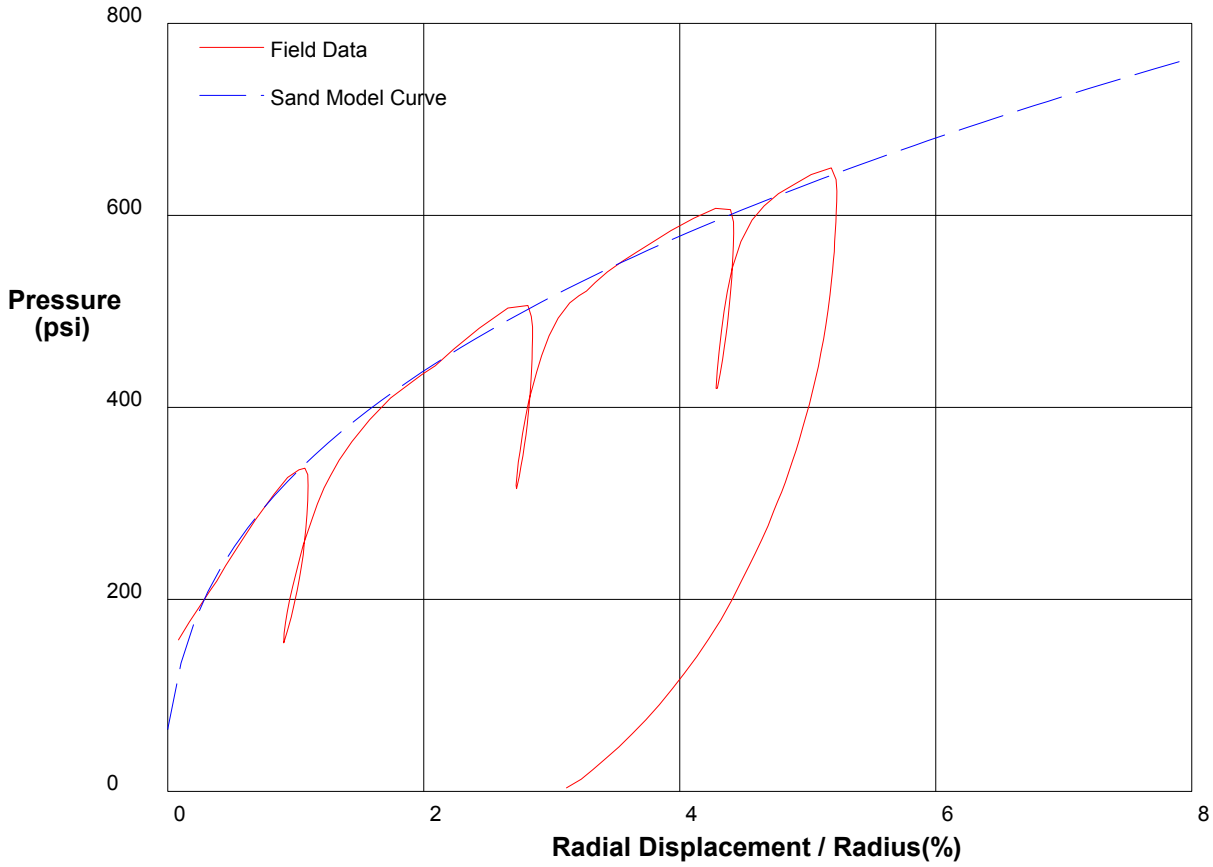
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-170 North Tunnel Project **1/17/2009**

Hole No. Z3-B11 **Depth 192.8ft** **File C:\DATA\ISE-812\SR710-03.P**



THE In Situ Engineering SAND MODEL

Water Pressure	**60 psi**
Friction Angle	**36 deg**
Critical Friction Angle	**32 deg**
Lateral Stress	**65 psi**
Shear Modulus	**35000 psi**

shift 6.6

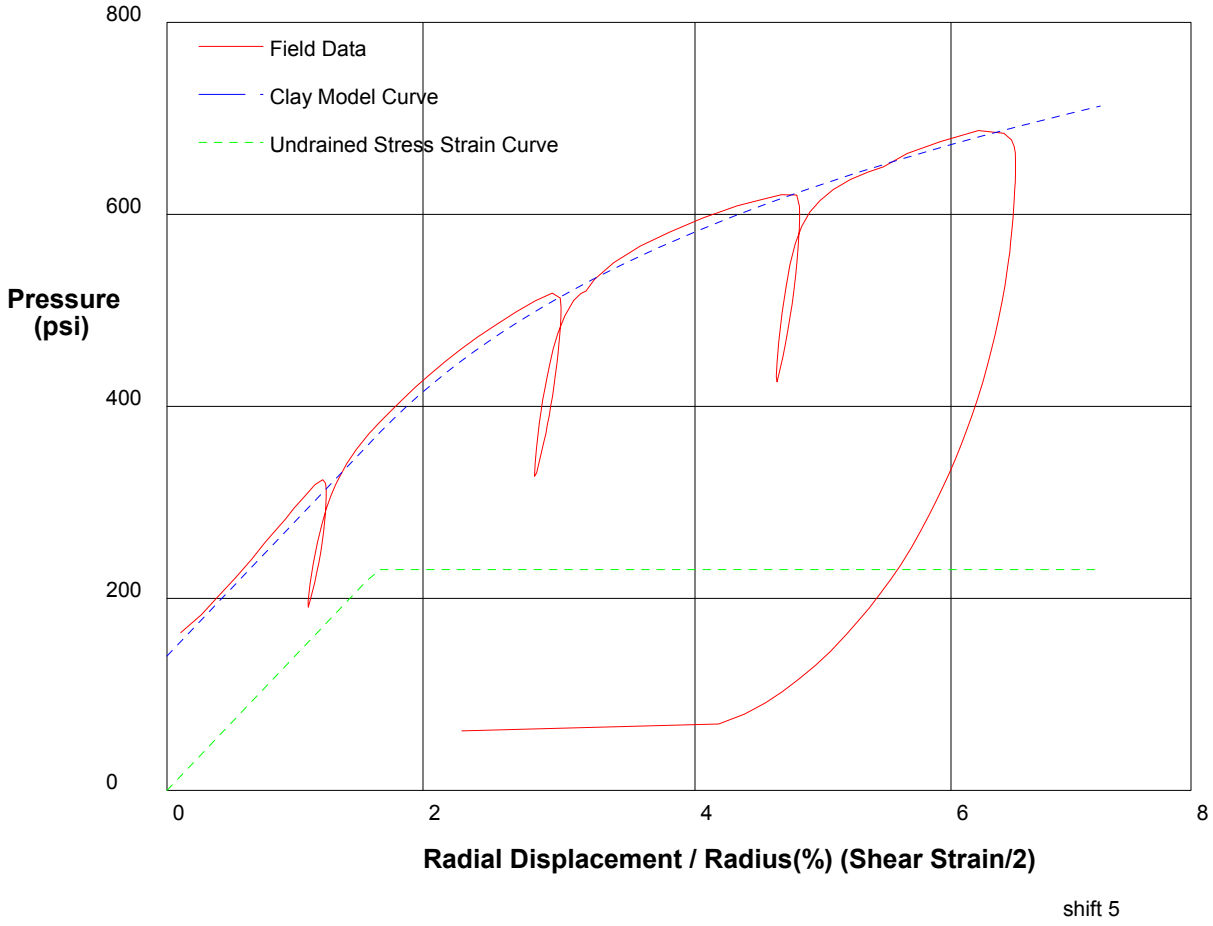
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/17/2009**

Hole No. Z3-B11 **Depth 191.3ft** **File C:\DATA\ISE-812\SR710-04.P**



GIBSON'S CLAY MODEL

Shear Strength	**230 psi**
Insitu Stress	**140 psi**
Shear Modulus	**7000 psi**

shift 5

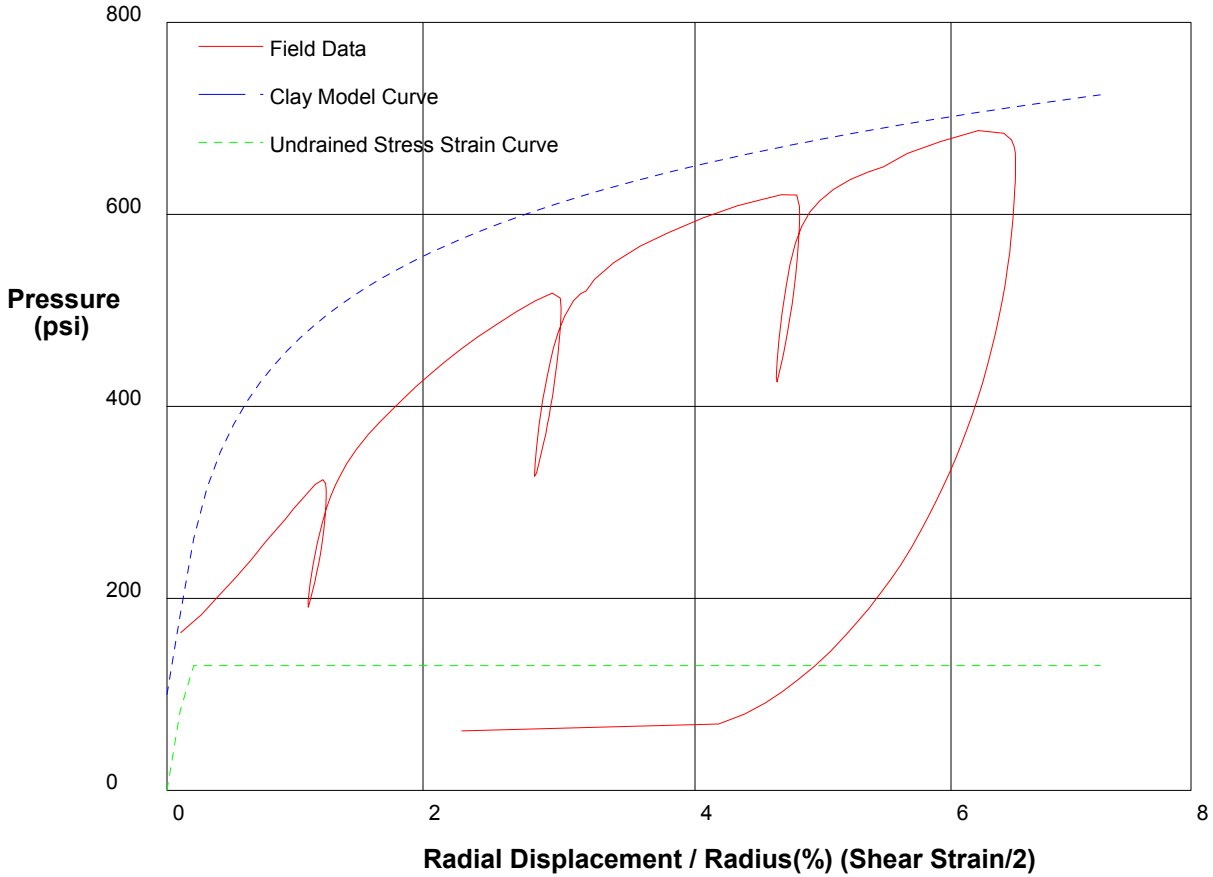
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/17/2009**

Hole No. Z3-B11 **Depth 191.3ft** **File C:\DATA\ISE-812\SR710-04.P**



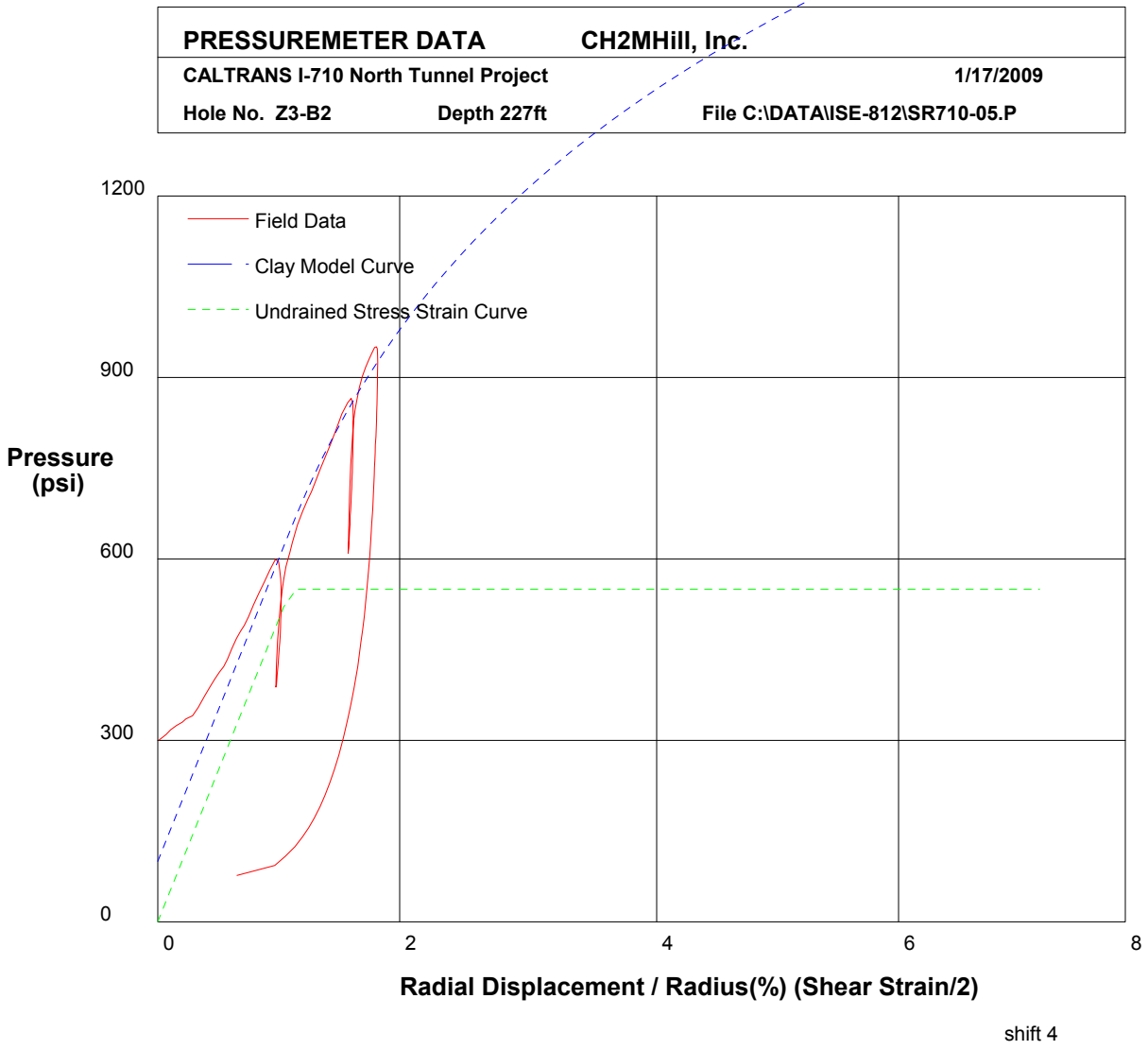
GIBSON'S CLAY MODEL

Shear Strength	**130 psi**
Insitu Stress	**100 psi**
Shear Modulus	**40000 psi**

shift 5

In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

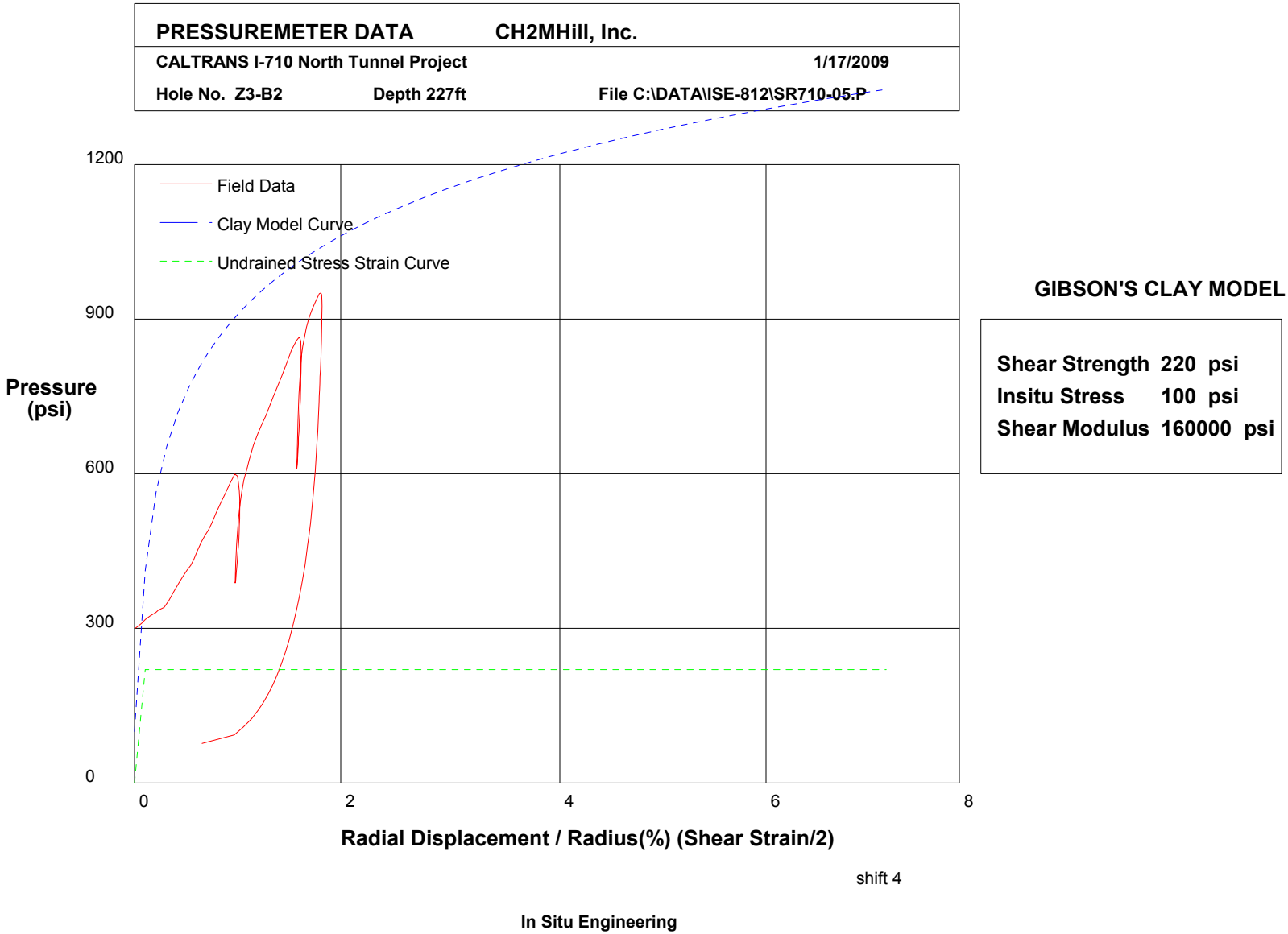


GIBSON'S CLAY MODEL

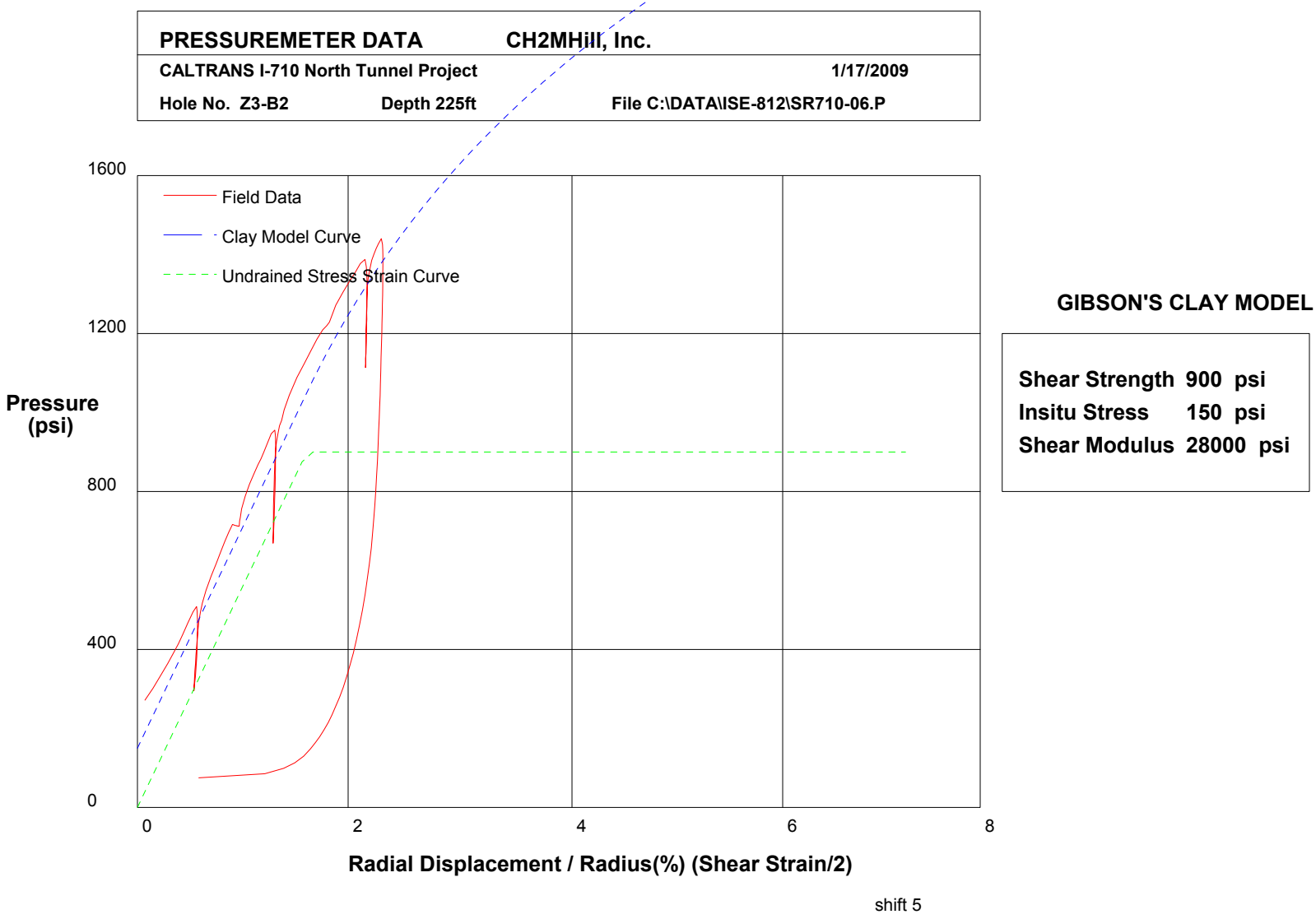
Shear Strength	**550 psi**
Insitu Stress	**100 psi**
Shear Modulus	**25000 psi**

In Situ Engineering

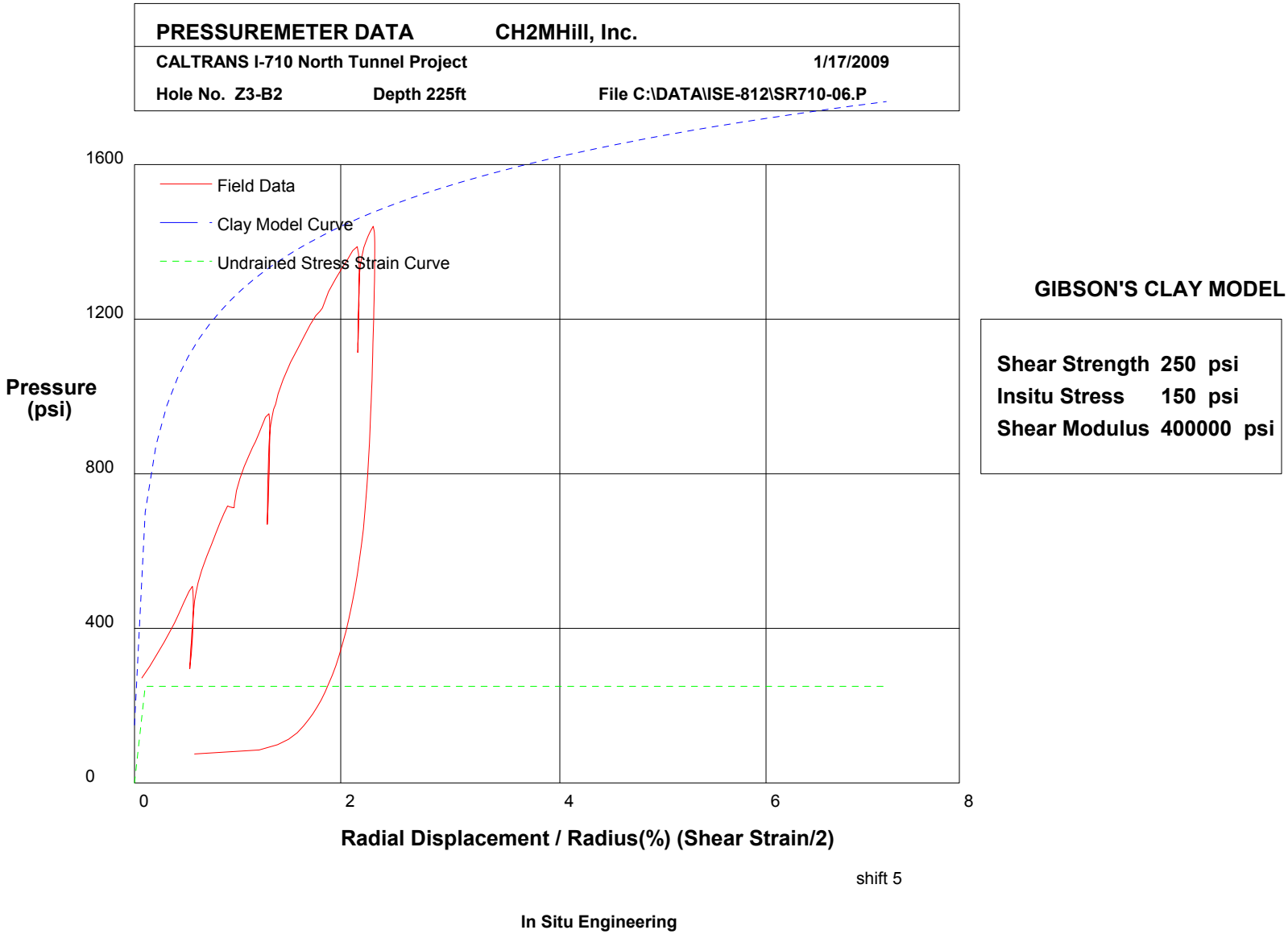
Appendix II - Pressuremeter Model Interpretation



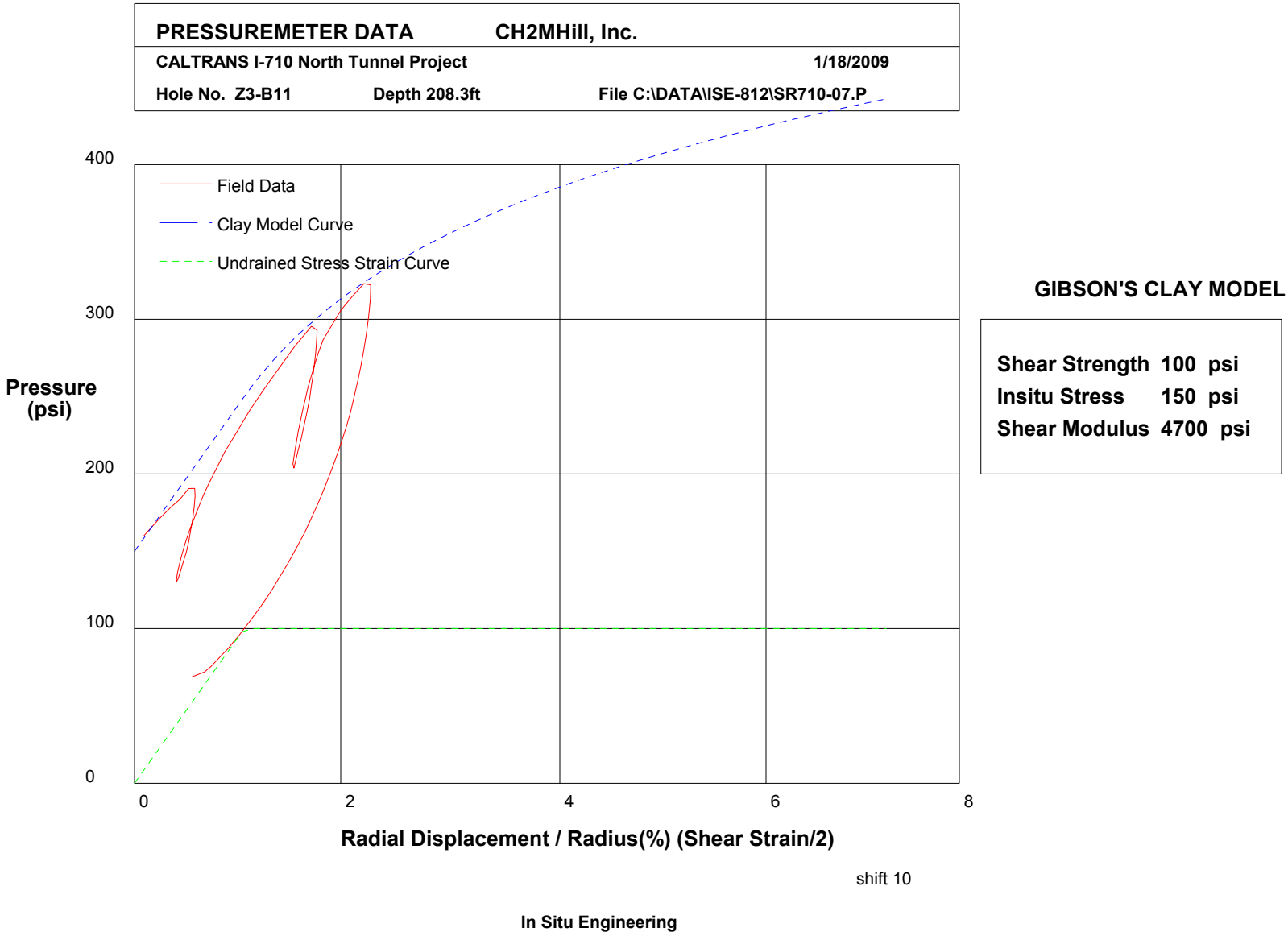
Appendix II - Pressuremeter Model Interpretation



Appendix II - Pressuremeter Model Interpretation



Appendix II - Pressuremeter Model Interpretation

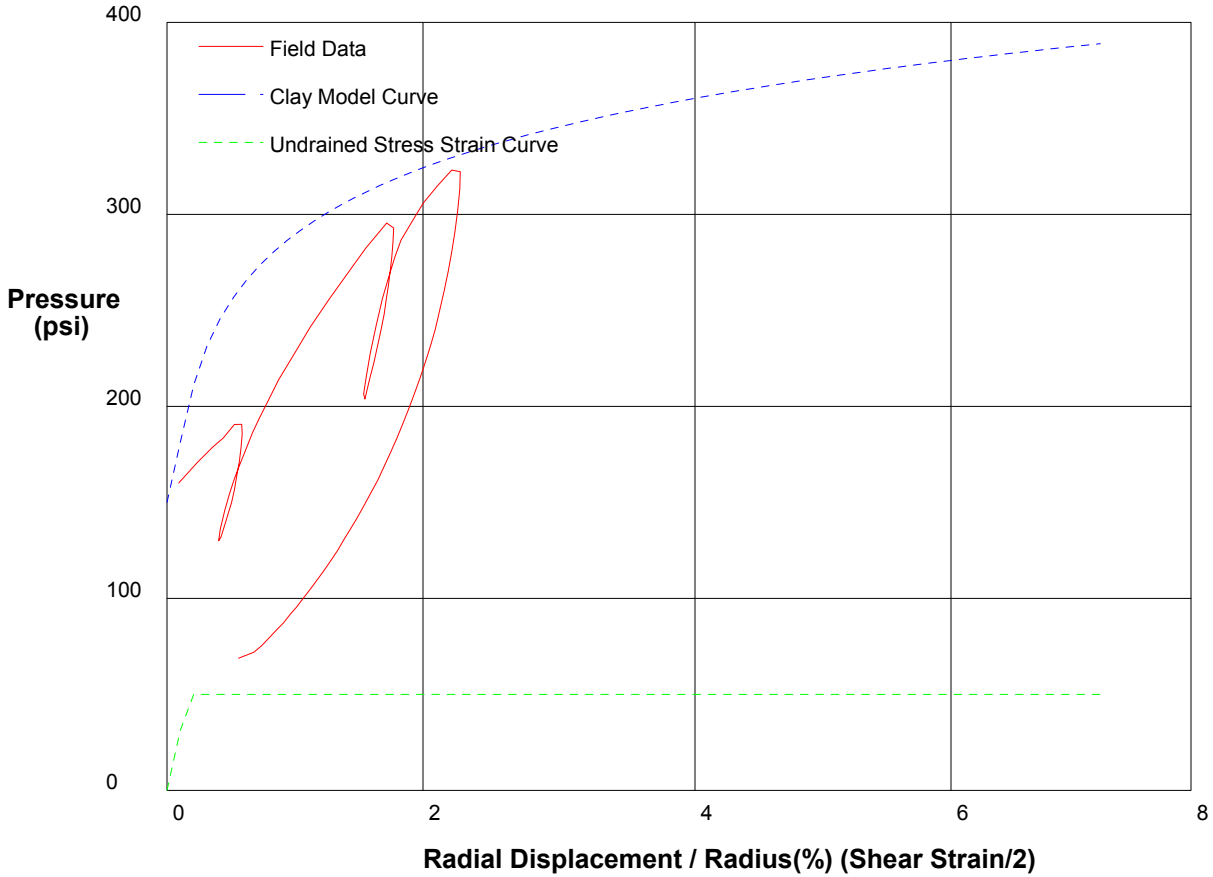


Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/18/2009**

Hole No. Z3-B11 **Depth 208.3ft** **File C:\DATA\ISE-812\SR710-07.P**



GIBSON'S CLAY MODEL

Shear Strength	**50 psi**
Insitu Stress	**150 psi**
Shear Modulus	**15000 psi**

shift 10

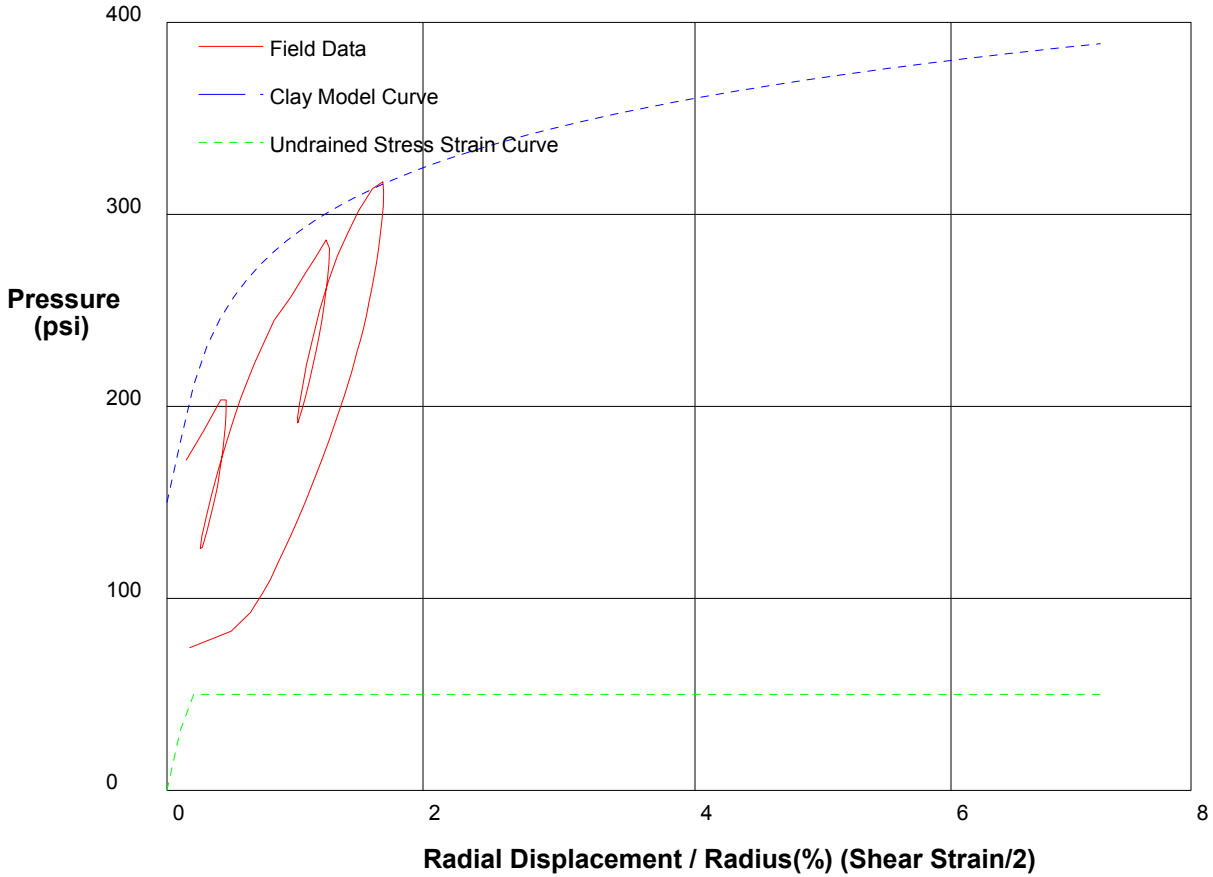
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/18/2009**

Hole No. Z3-B11 **Depth 206.9ft** **File C:\DATA\ISE-812\SR710-08.P**



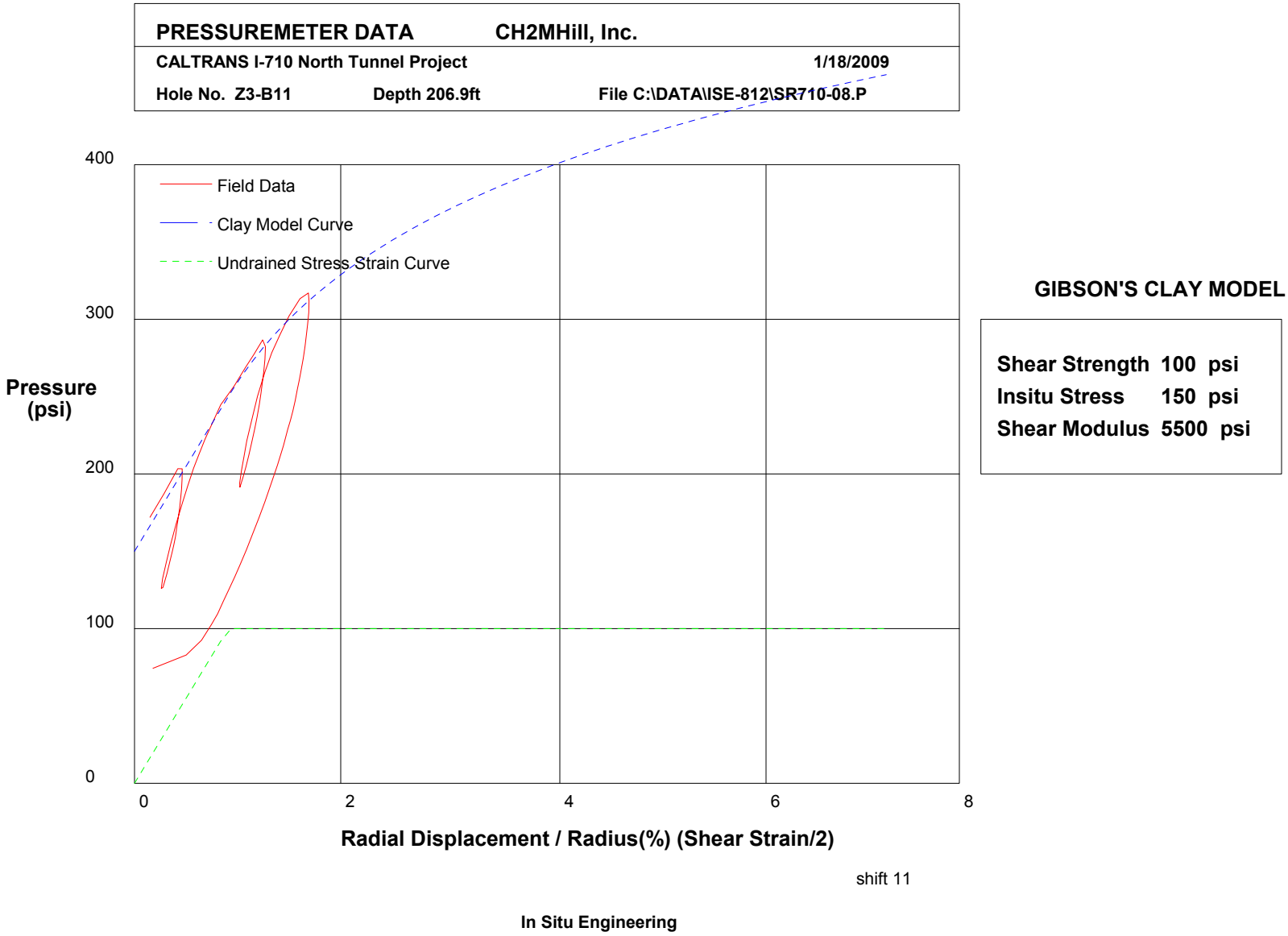
GIBSON'S CLAY MODEL

Shear Strength 50 psi
Insitu Stress 150 psi
Shear Modulus 15000 psi

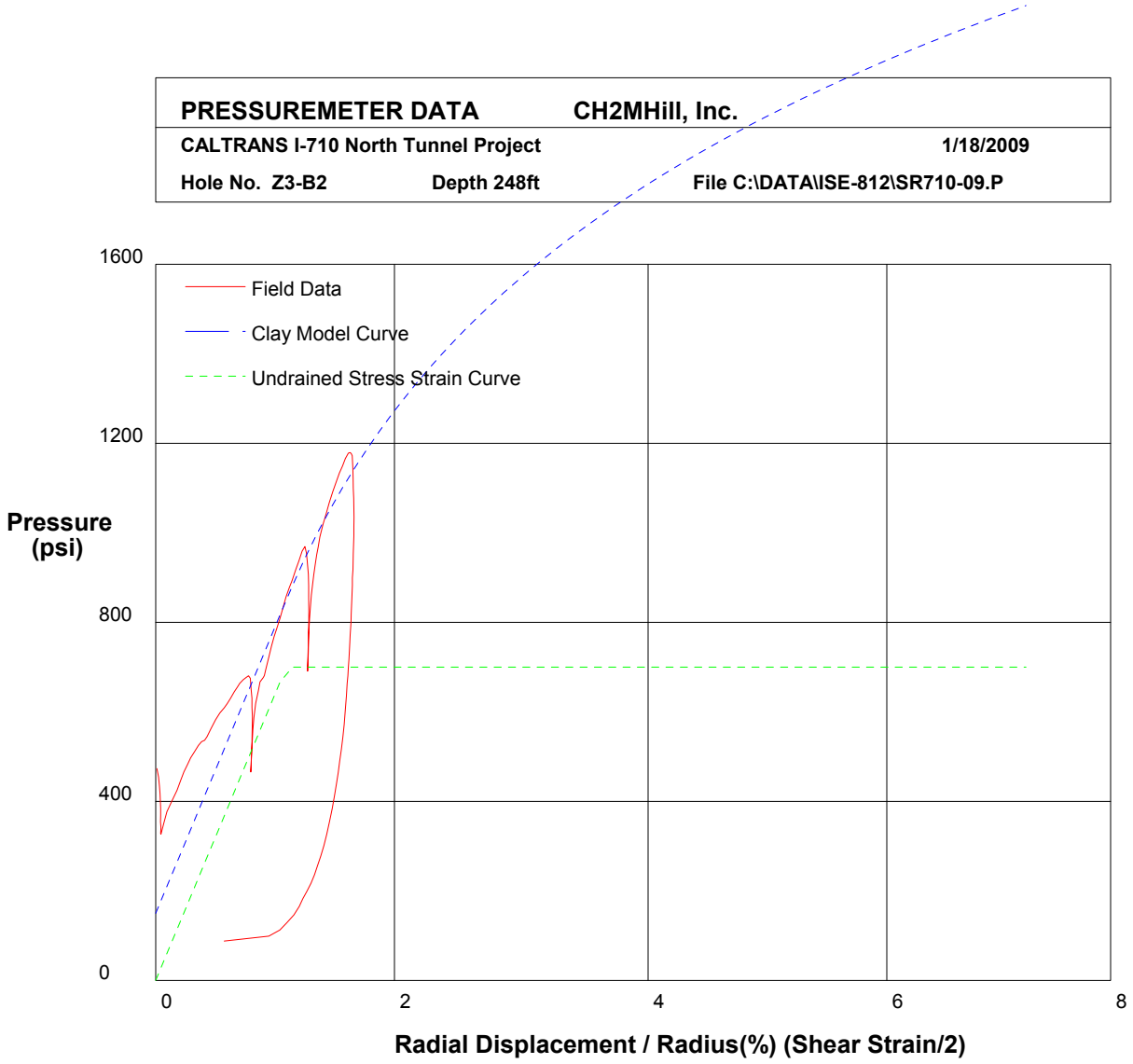
shift 11

In Situ Engineering

Appendix II - Pressuremeter Model Interpretation



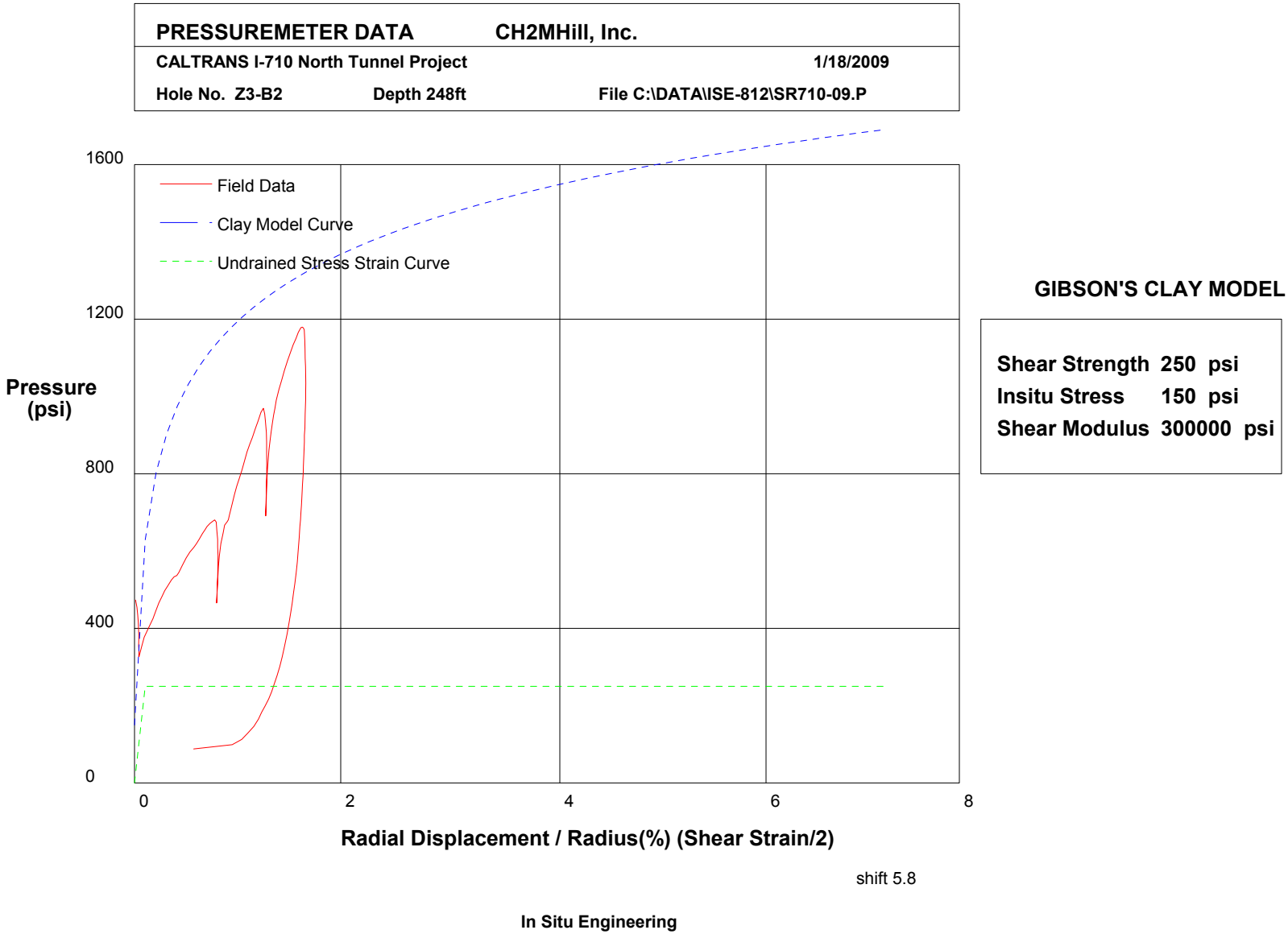
Appendix II - Pressuremeter Model Interpretation



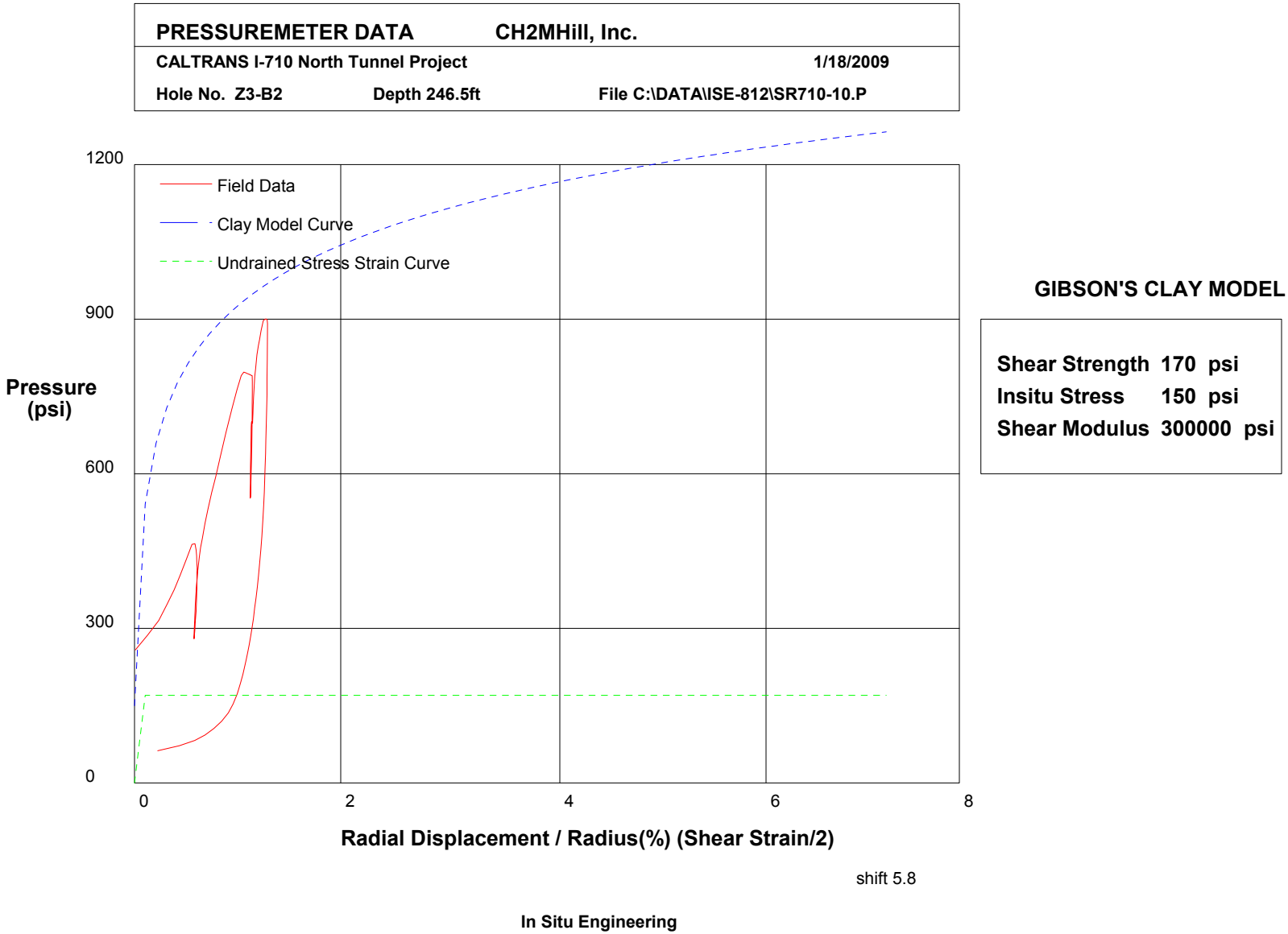
GIBSON'S CLAY MODEL

Shear Strength	**700 psi**
Insitu Stress	**150 psi**
Shear Modulus	**32000 psi**

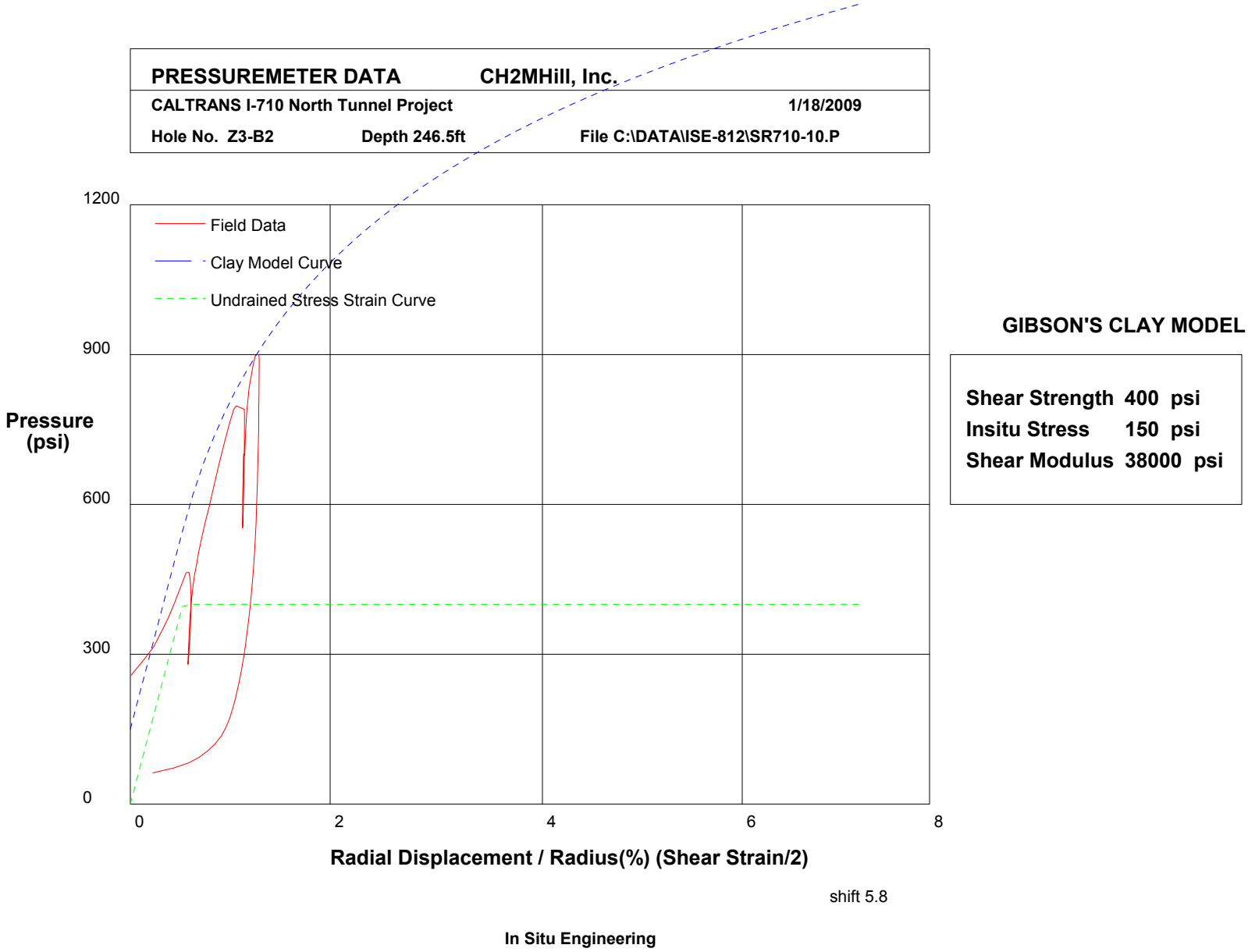
Appendix II - Pressuremeter Model Interpretation



Appendix II - Pressuremeter Model Interpretation



Appendix II - Pressuremeter Model Interpretation

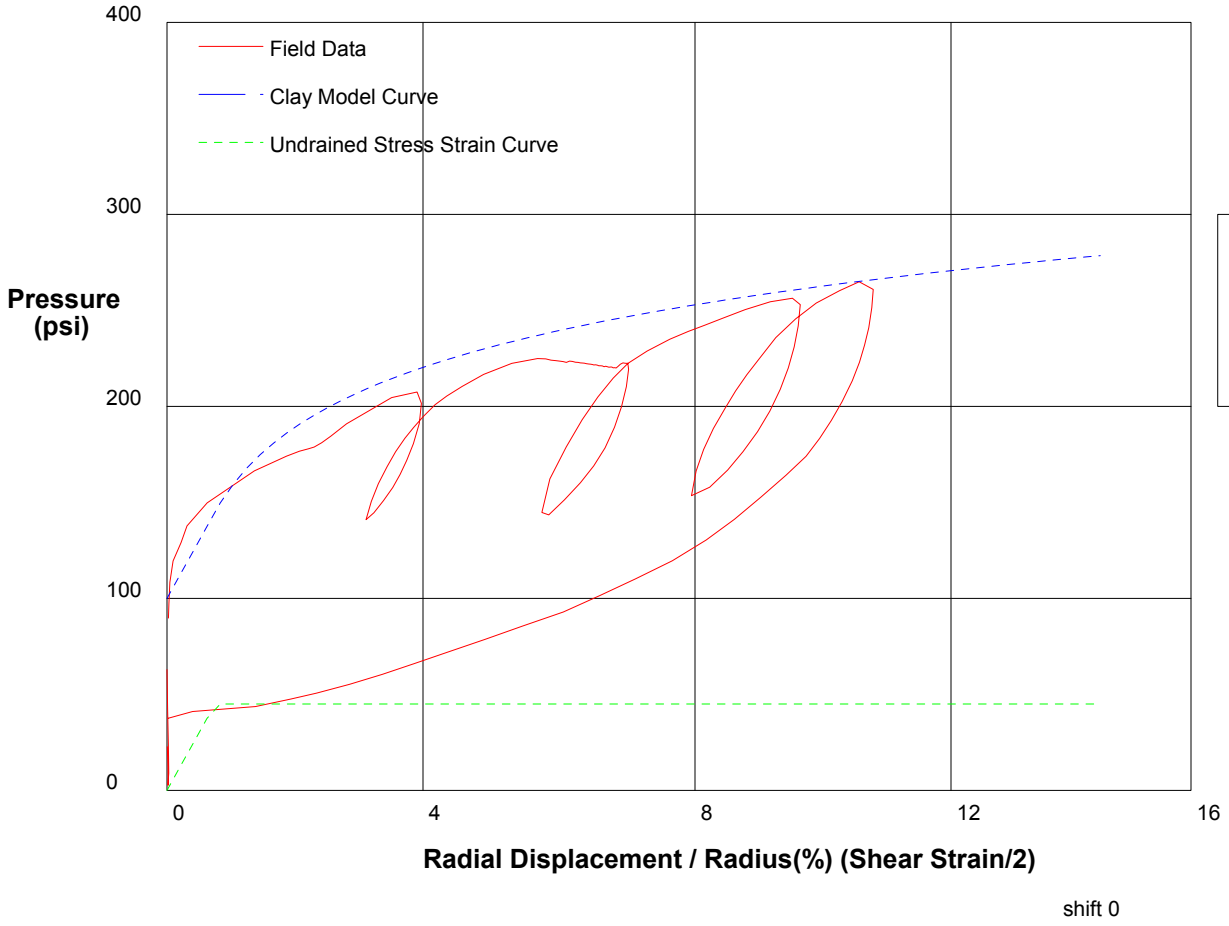


Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/19/2009**

Hole No. Z2-B1 **Depth 129ft** **File C:\DATA\ISE-812\SR710-11.P**



GIBSON'S CLAY MODEL

Shear Strength	**45 psi**
Insitu Stress	**100 psi**
Shear Modulus	**3000 psi**

shift 0

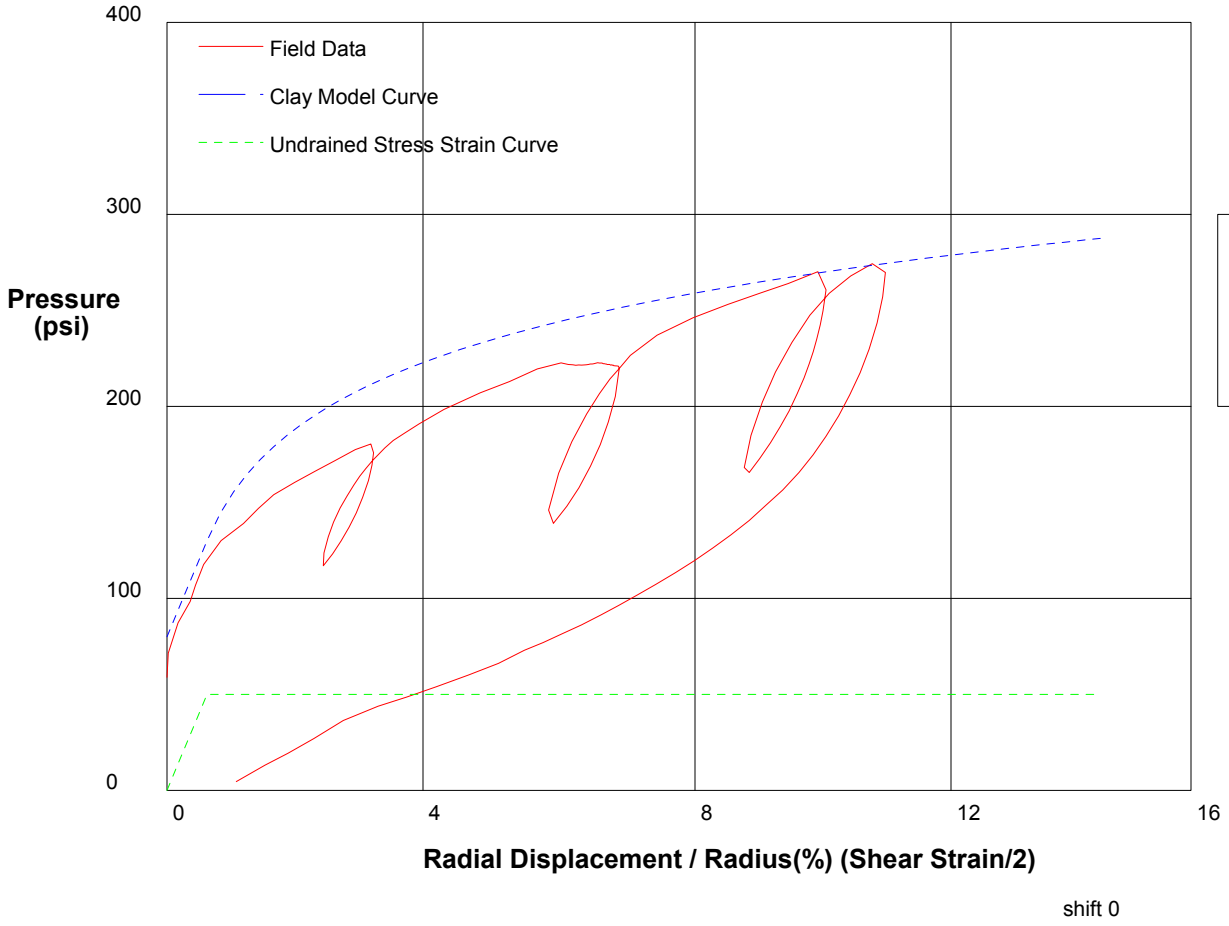
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/19/2009**

Hole No. Z2-B1 **Depth 127.5ft** **File C:\DATA\ISE-812\SR710-12.P**



GIBSON'S CLAY MODEL

Shear Strength 50 psi
Insitu Stress 80 psi
Shear Modulus 4000 psi

shift 0

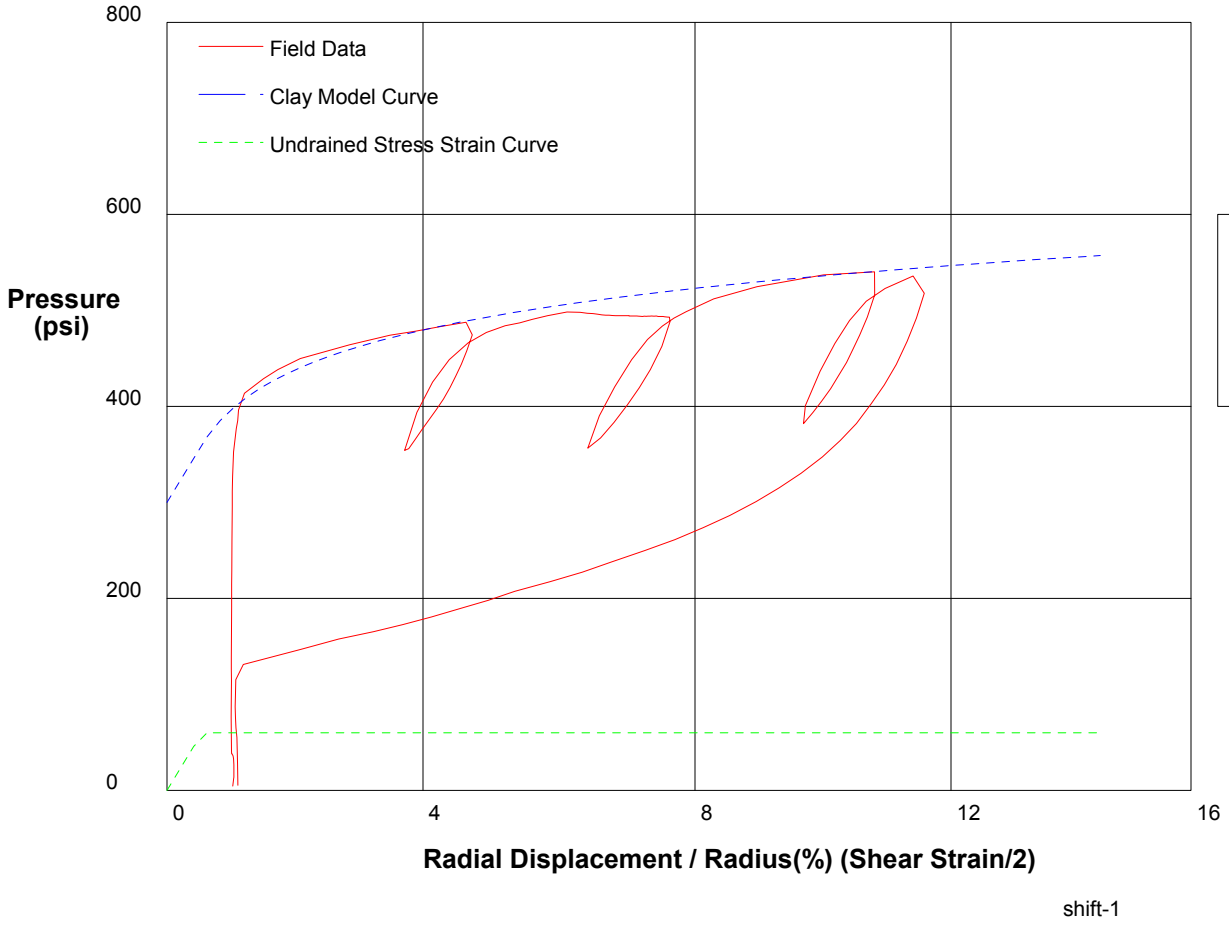
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/20/2009**

Hole No. Z2-B1 **Depth 140ft** **File C:\DATA\ISE-812\SR710-13.P**



GIBSON'S CLAY MODEL

Shear Strength 60 psi
Insitu Stress 300 psi
Shear Modulus 5500 psi

shift-1

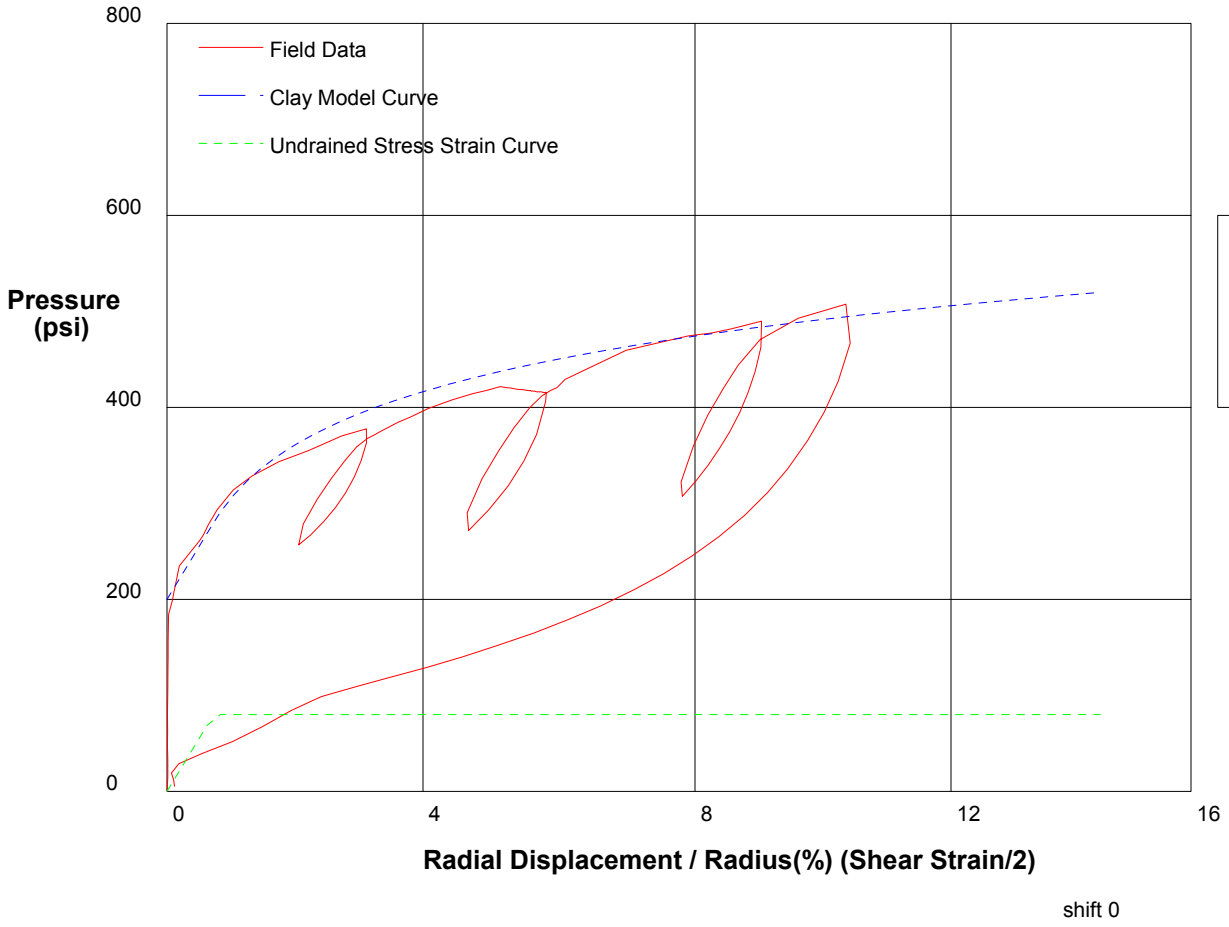
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/20/2009**

Hole No. Z2-B1 **Depth 138.5ft** **File C:\DATA\ISE-812\SR710-14.P**



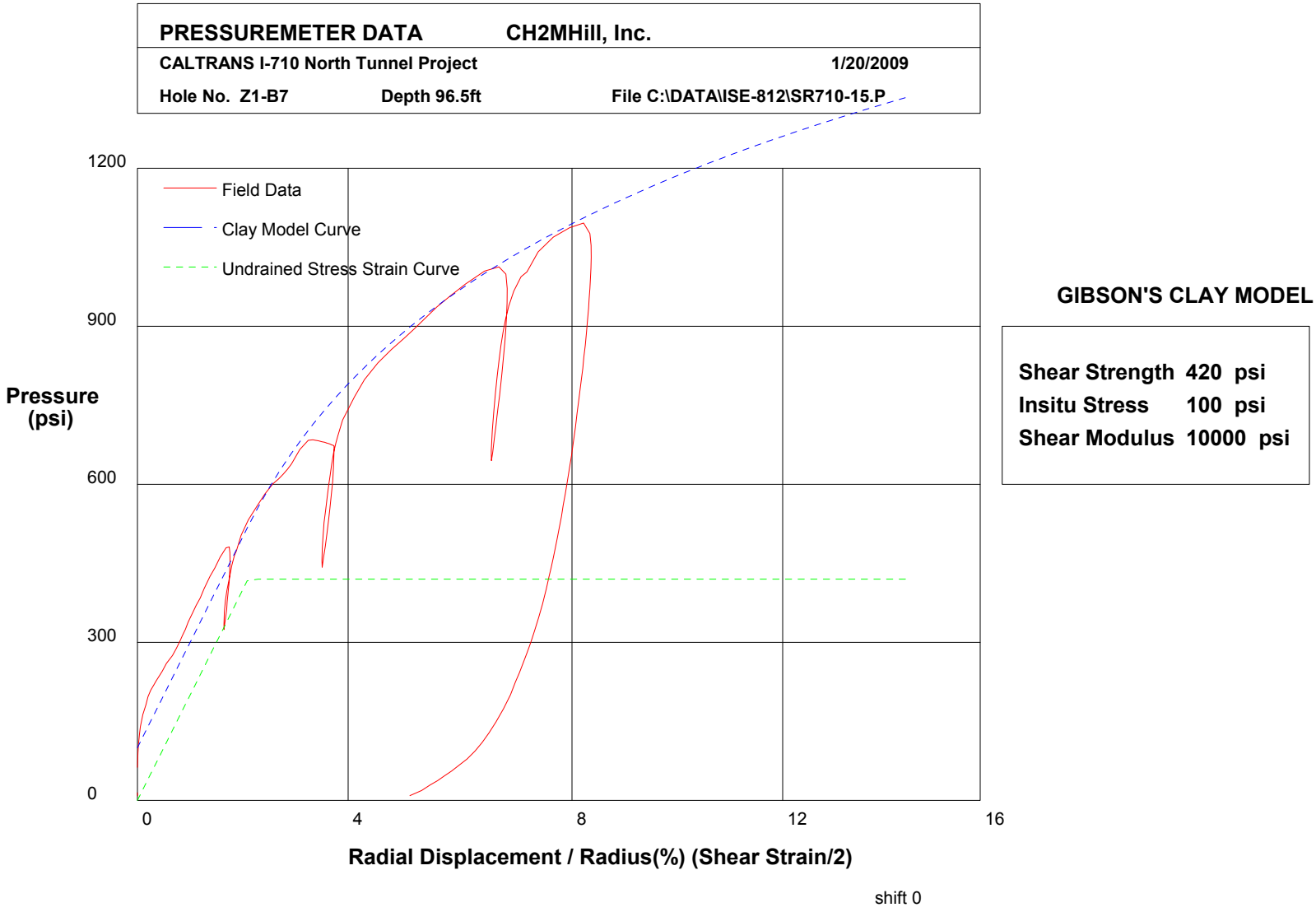
GIBSON'S CLAY MODEL

Shear Strength 80 psi
Insitu Stress 200 psi
Shear Modulus 5500 psi

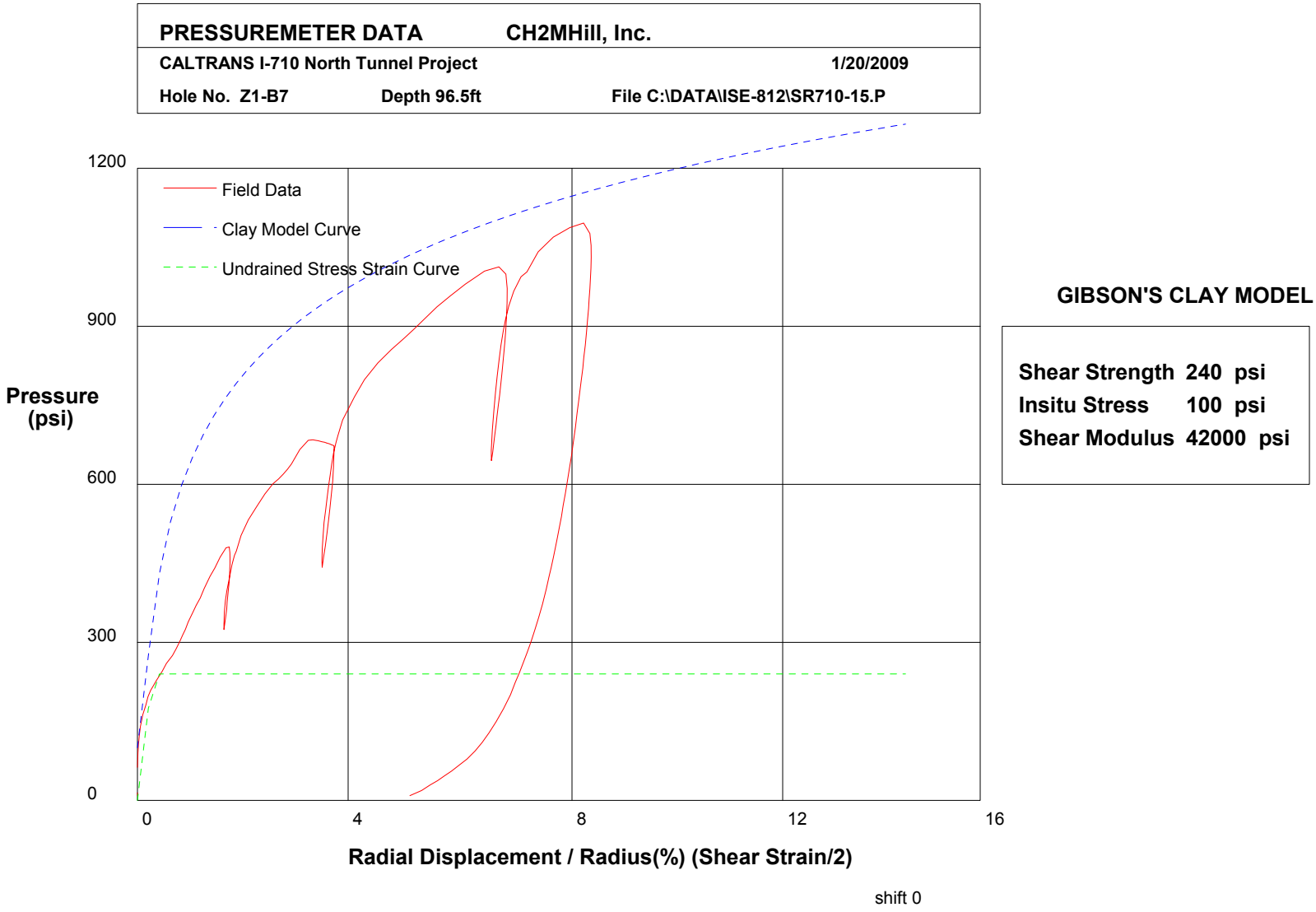
shift 0

In Situ Engineering

Appendix II - Pressuremeter Model Interpretation



Appendix II - Pressuremeter Model Interpretation

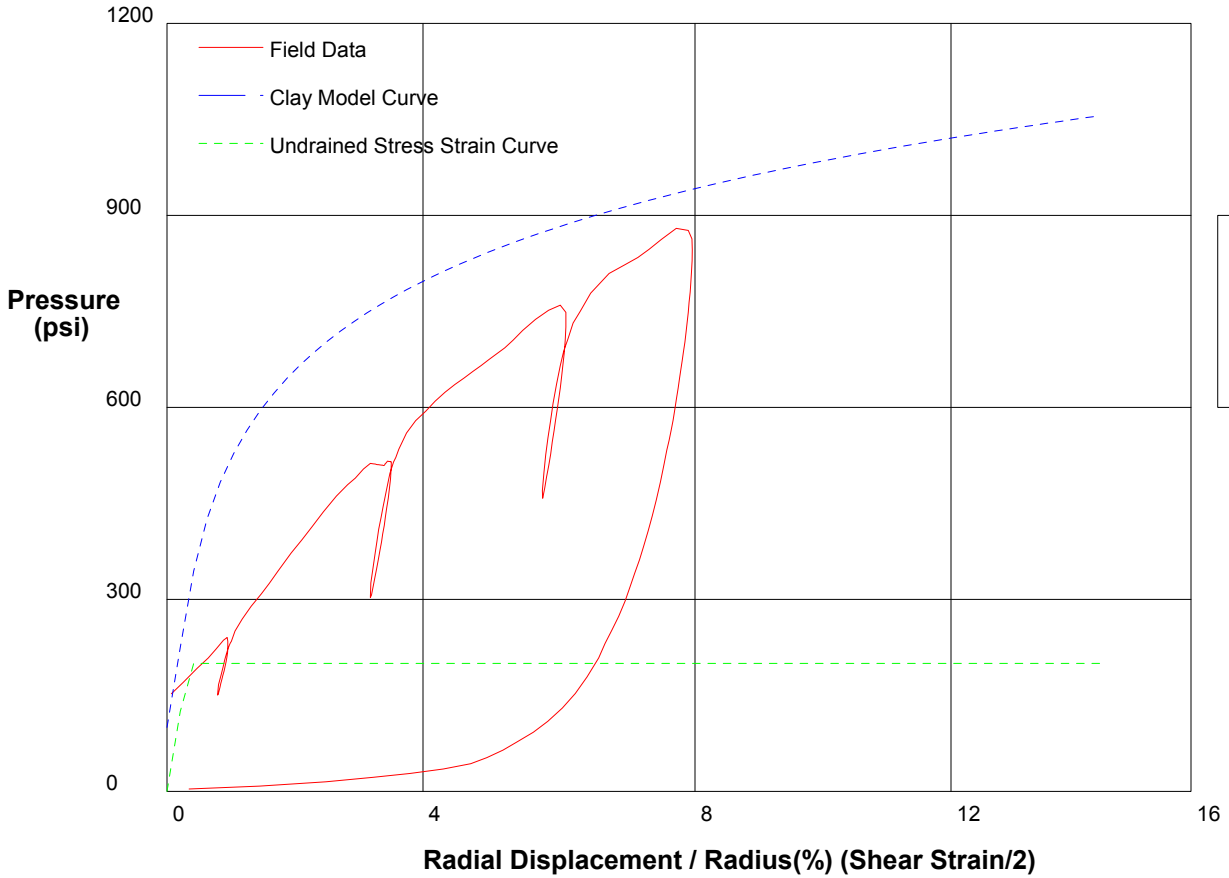


Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/20/2009**

Hole No. Z1-B7 **Depth 95ft** **File C:\DATA\ISE-812\SR710-16.P**



GIBSON'S CLAY MODEL

Shear Strength 200 psi
Insitu Stress 100 psi
Shear Modulus 30000 psi

shift 2

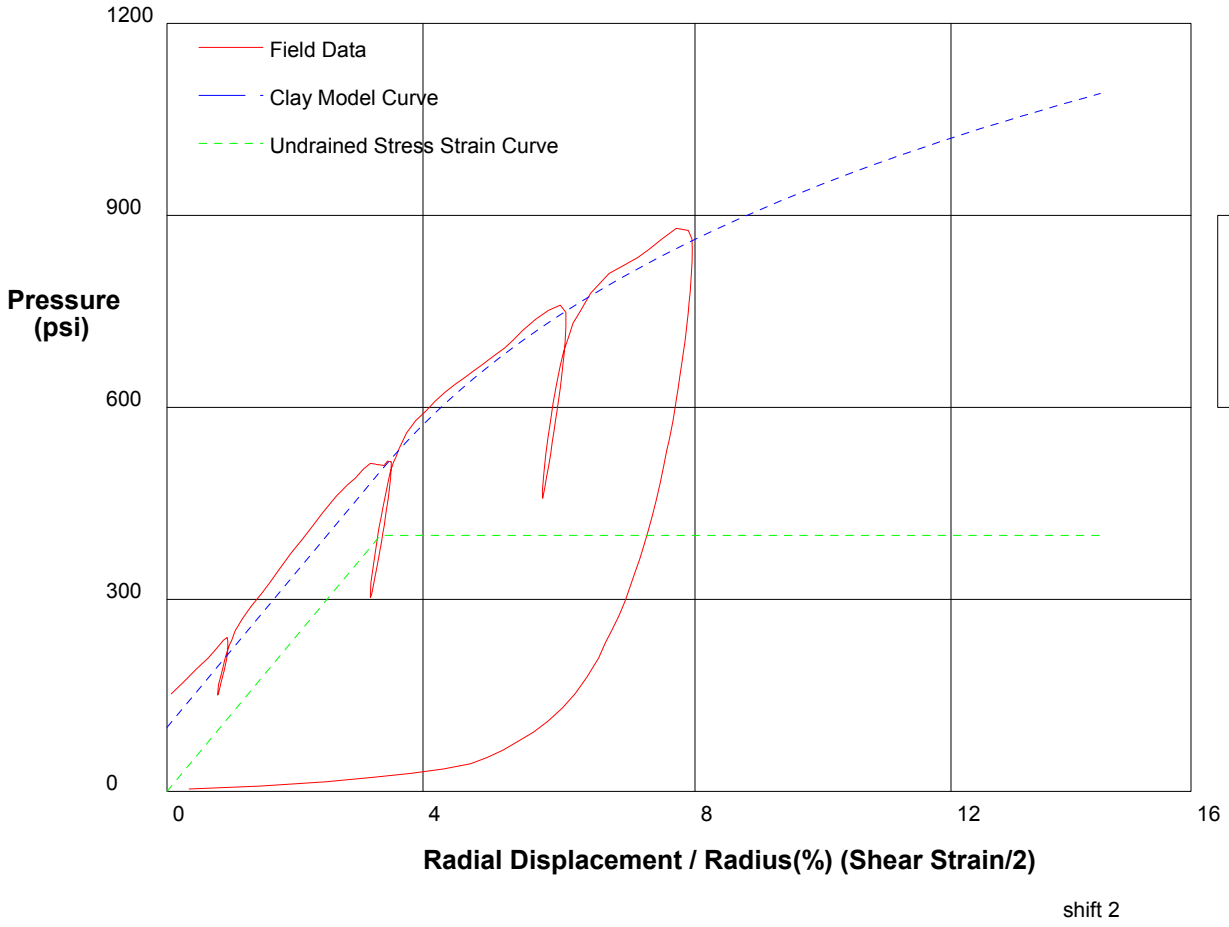
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/20/2009**

Hole No. Z1-B7 **Depth 95ft** **File C:\DATA\ISE-812\SR710-16.P**



GIBSON'S CLAY MODEL

Shear Strength	**400 psi**
Insitu Stress	**100 psi**
Shear Modulus	**6000 psi**

shift 2

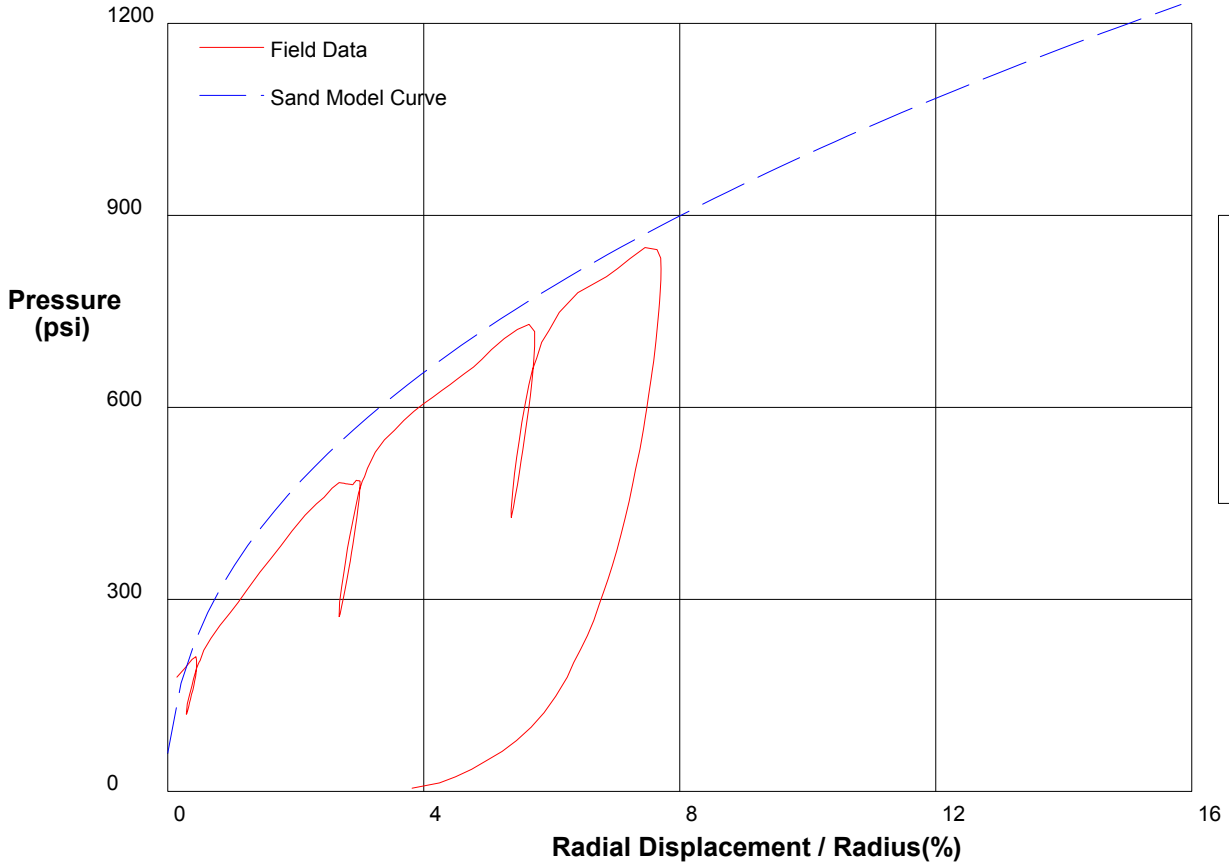
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/20/2009**

Hole No. Z1-B7 **Depth 95ft** **File C:\DATA\ISE-812\SR710-16.P**



THE In Situ Engineering SAND MODEL

Water Pressure	**30 psi**
Friction Angle	**40 deg**
Critical Friction Angle	**32 deg**
Lateral Stress	**60 psi**
Shear Modulus	**30000 psi**

shift 2.5

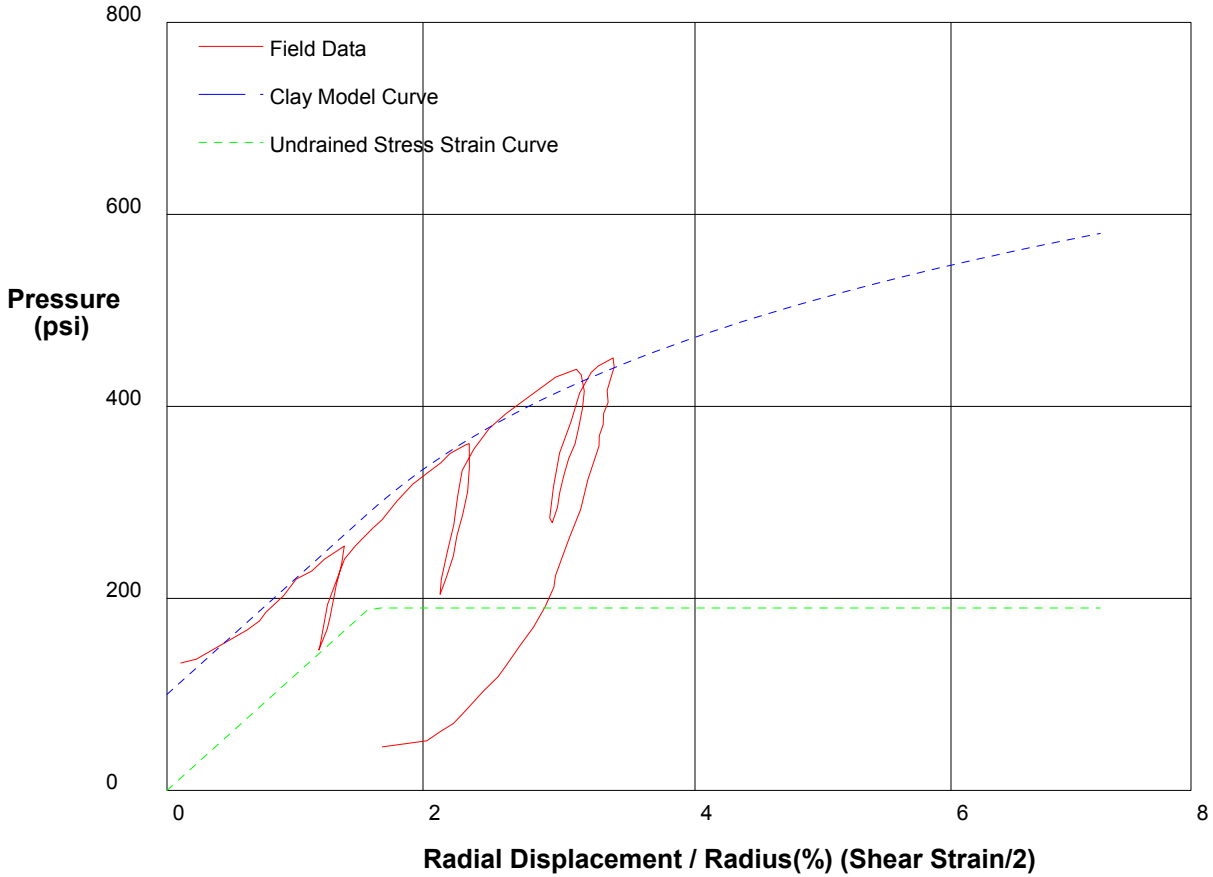
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/21/2009**

Hole No. Z1-B7 **Depth 111.5ft** **File C:\DATA\ISE-812\SR710-17.P**



GIBSON'S CLAY MODEL

Shear Strength 190 psi
Insitu Stress 100 psi
Shear Modulus 6000 psi

shift 9.1

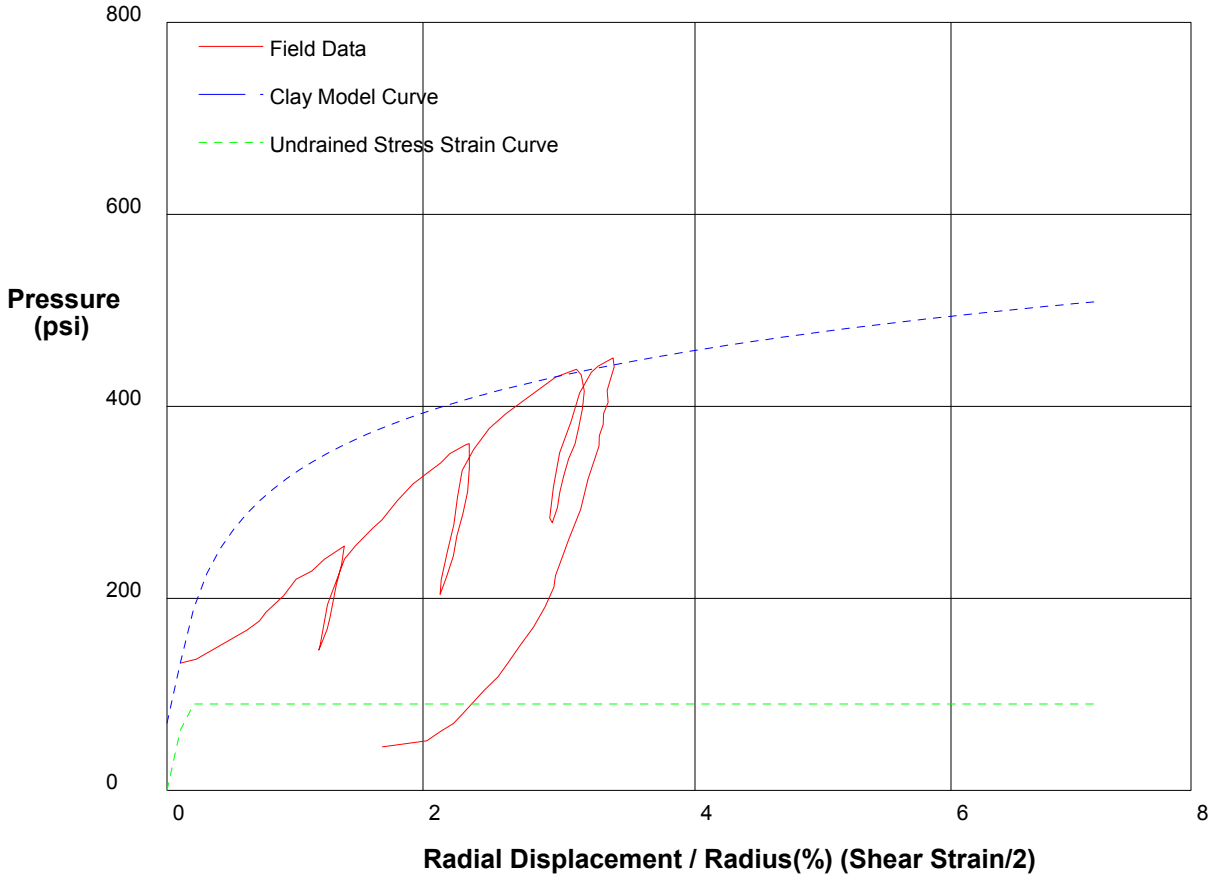
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/21/2009**

Hole No. Z1-B7 **Depth 111.5ft** **File C:\DATA\ISE-812\SR710-17.P**



GIBSON'S CLAY MODEL

Shear Strength 90 psi
Insitu Stress 70 psi
Shear Modulus 30000 psi

shift 9.1

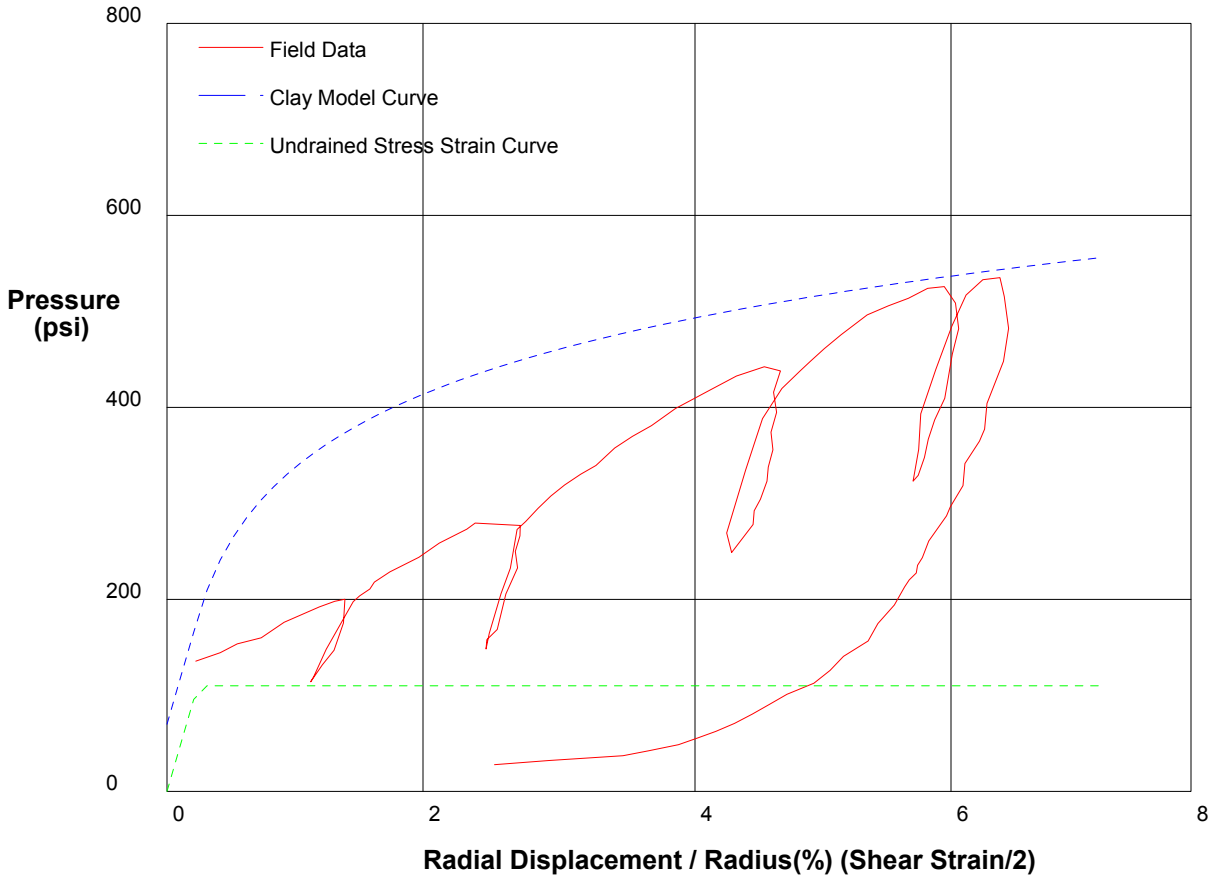
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/21/2009**

Hole No. Z1-B7 **Depth 110ft** **File C:\DATA\ISE-812\SR710-18.P**



GIBSON'S CLAY MODEL

Shear Strength 110 psi
Insitu Stress 70 psi
Shear Modulus 23000 psi

shift 4.5

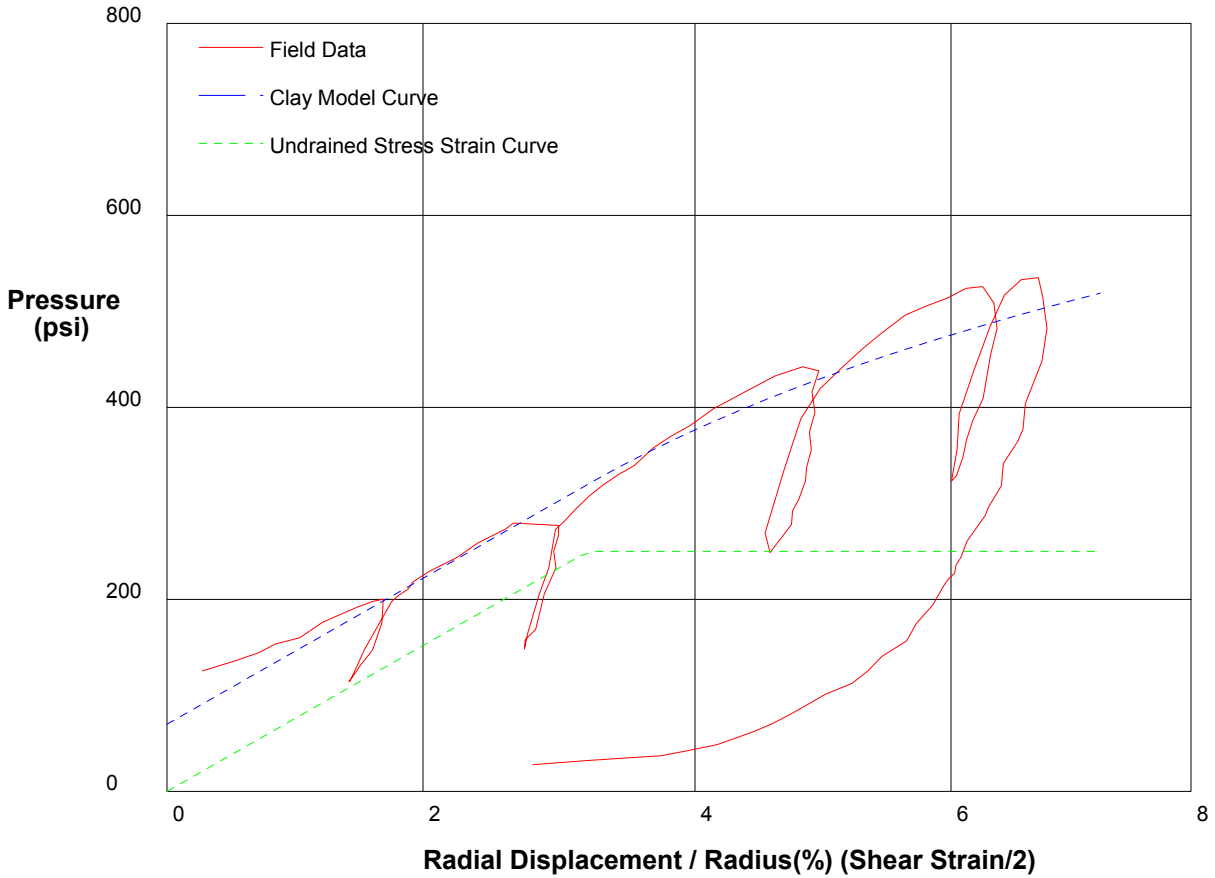
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/21/2009**

Hole No. Z1-B7 **Depth 110ft** **File C:\DATA\ISE-812\SR710-18.P**



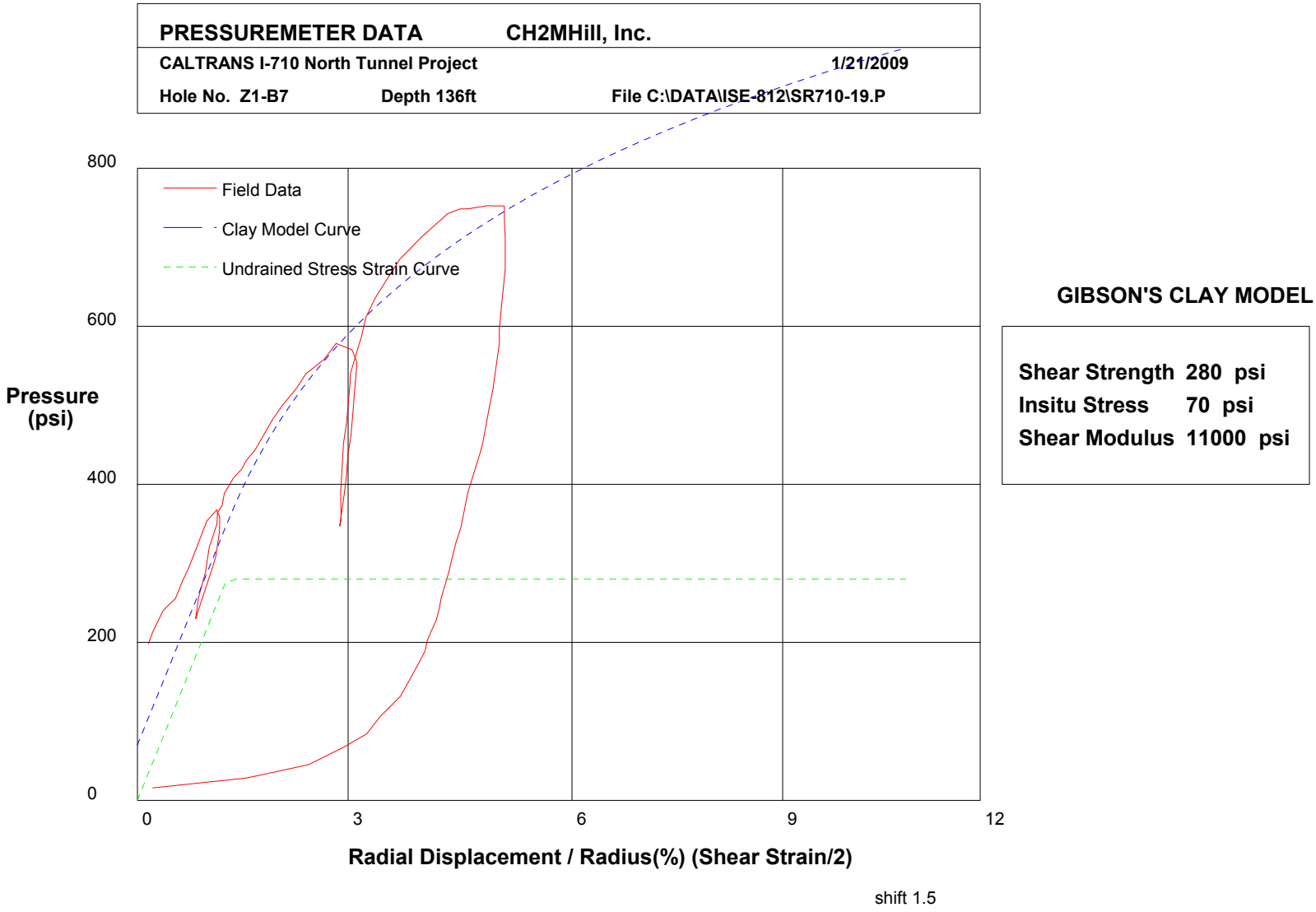
GIBSON'S CLAY MODEL

Shear Strength 250 psi
Insitu Stress 70 psi
Shear Modulus 3800 psi

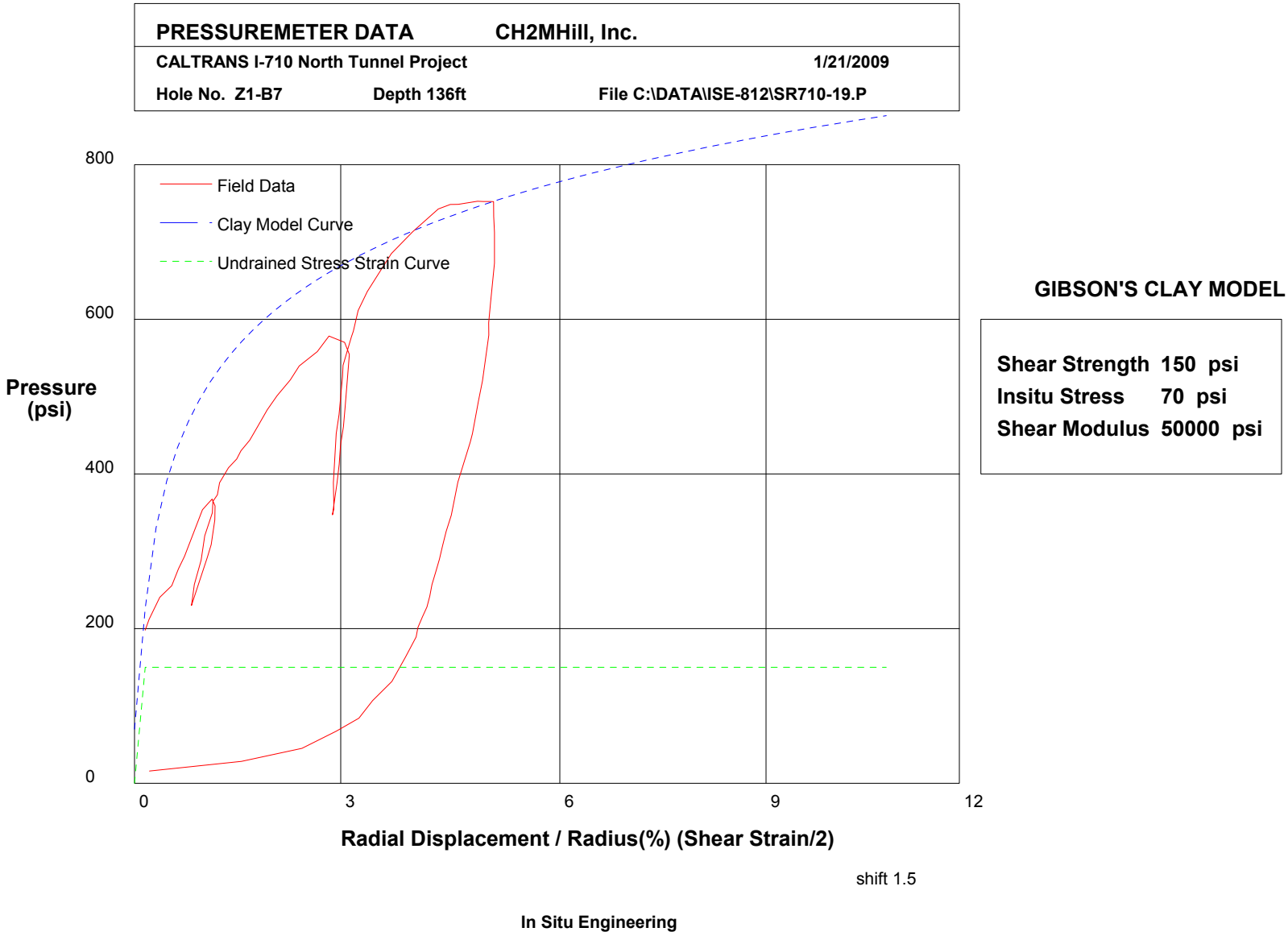
shift 4.2

In Situ Engineering

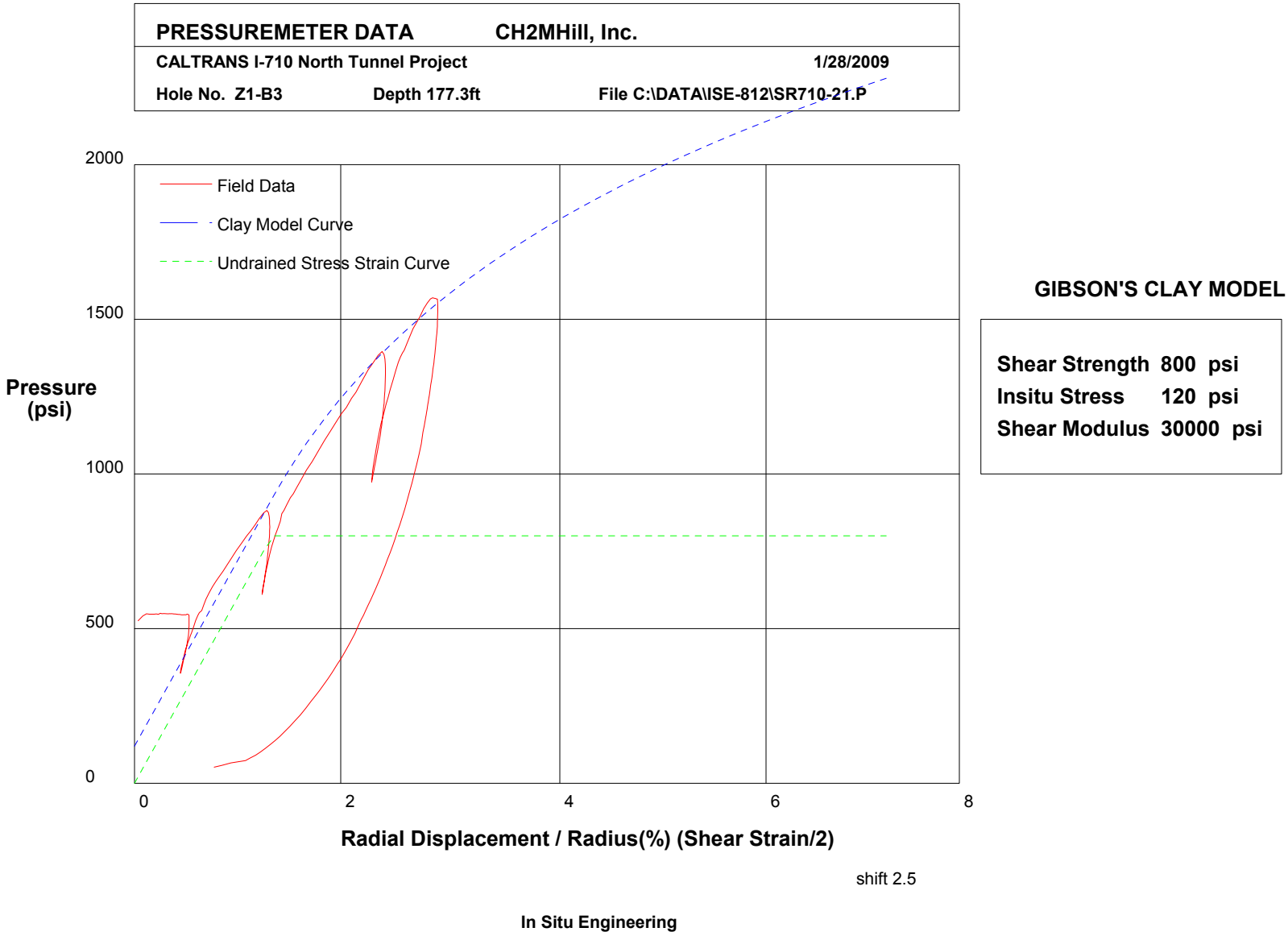
Appendix II - Pressuremeter Model Interpretation



Appendix II - Pressuremeter Model Interpretation



Appendix II - Pressuremeter Model Interpretation

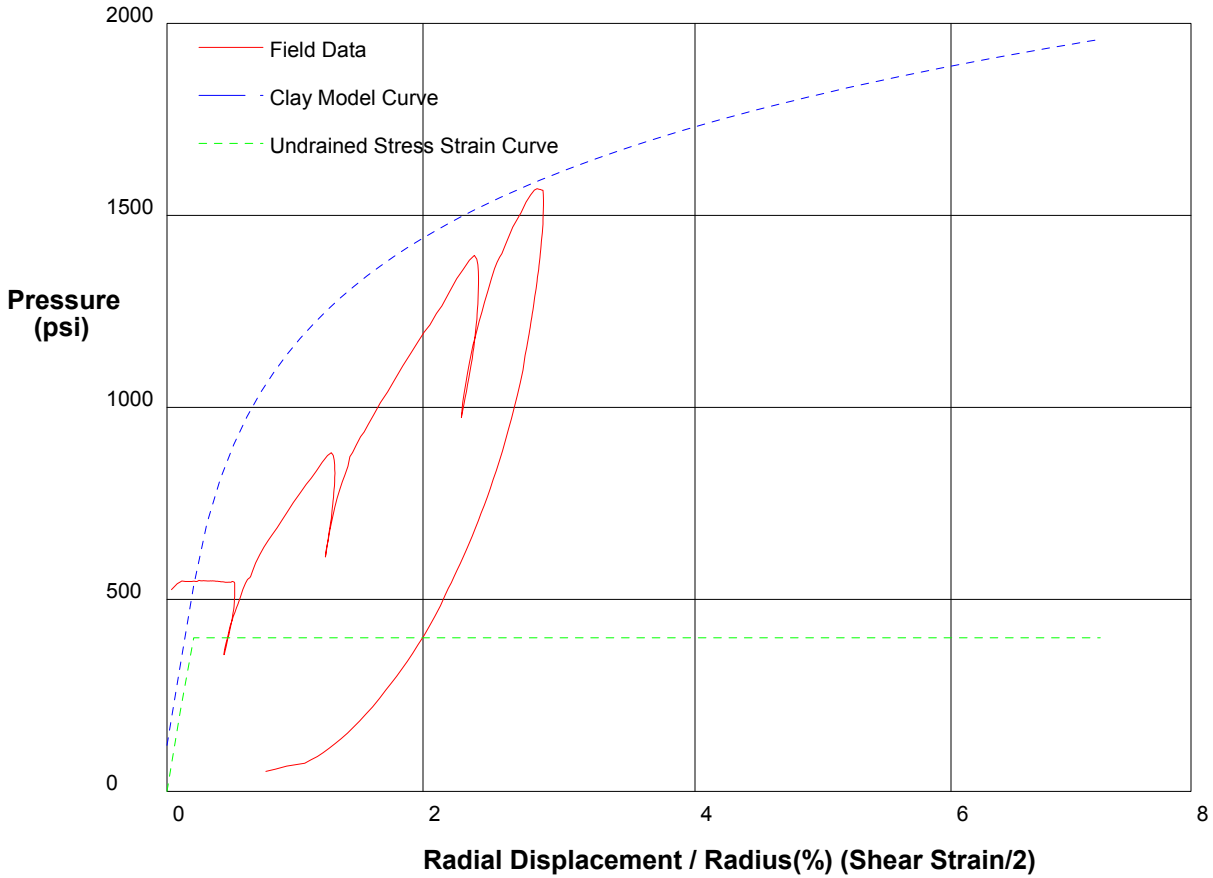


Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/28/2009**

Hole No. Z1-B3 **Depth 177.3ft** **File C:\DATA\ISE-812\SR710-21.P**



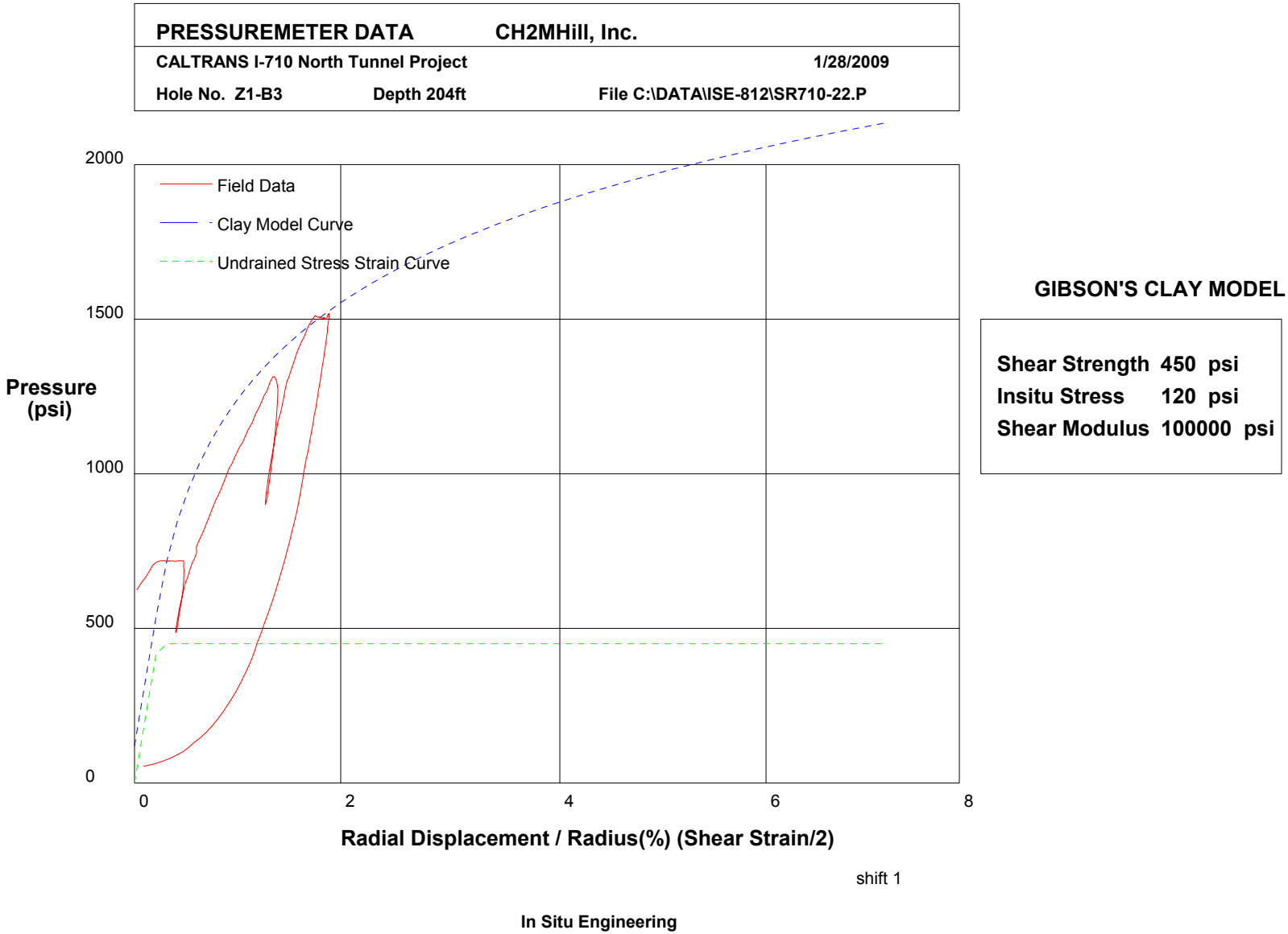
GIBSON'S CLAY MODEL

Shear Strength	**400 psi**
Insitu Stress	**120 psi**
Shear Modulus	**100000 psi**

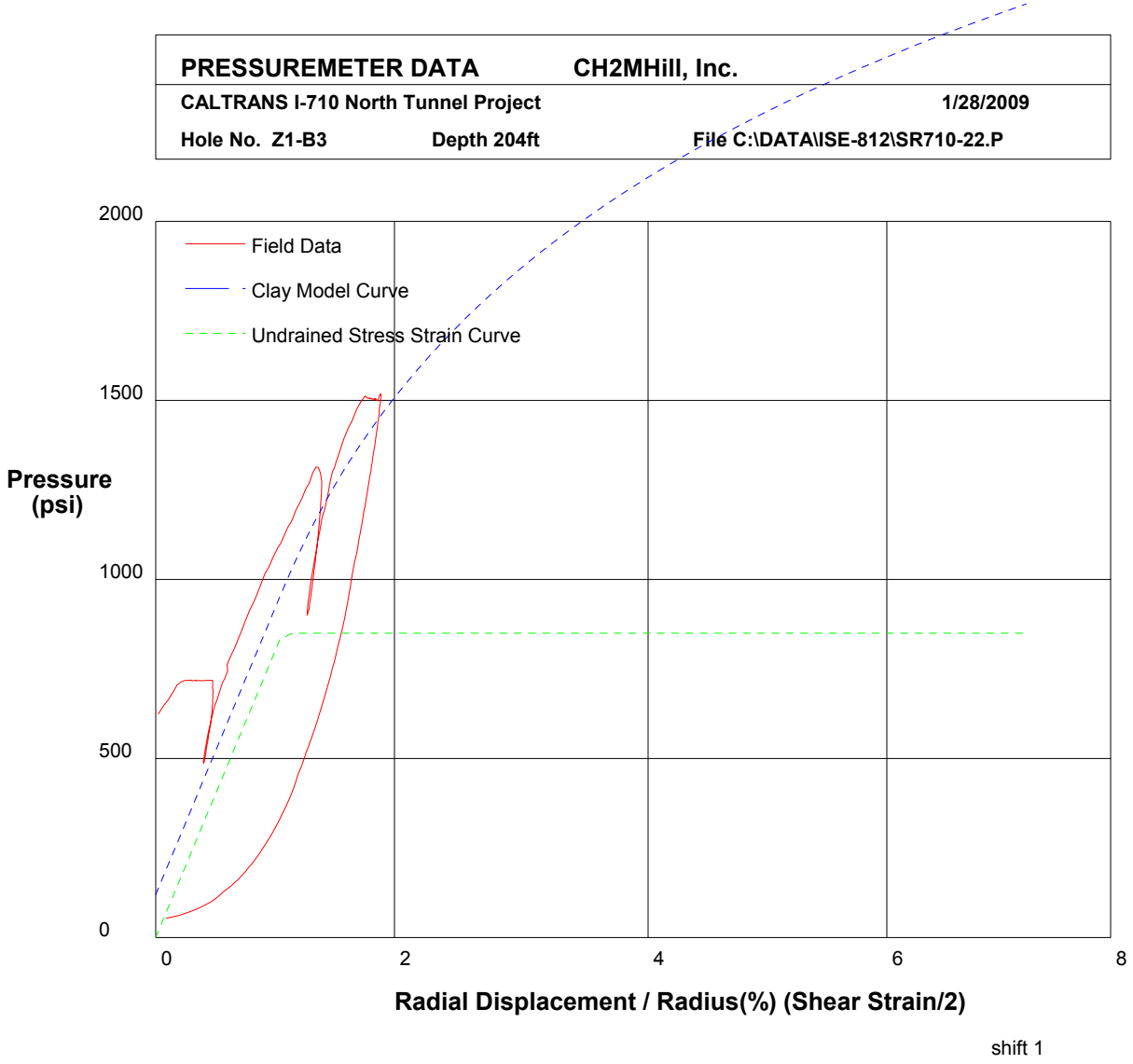
shift 2.5

In Situ Engineering

Appendix II - Pressuremeter Model Interpretation



Appendix II - Pressuremeter Model Interpretation



GIBSON'S CLAY MODEL

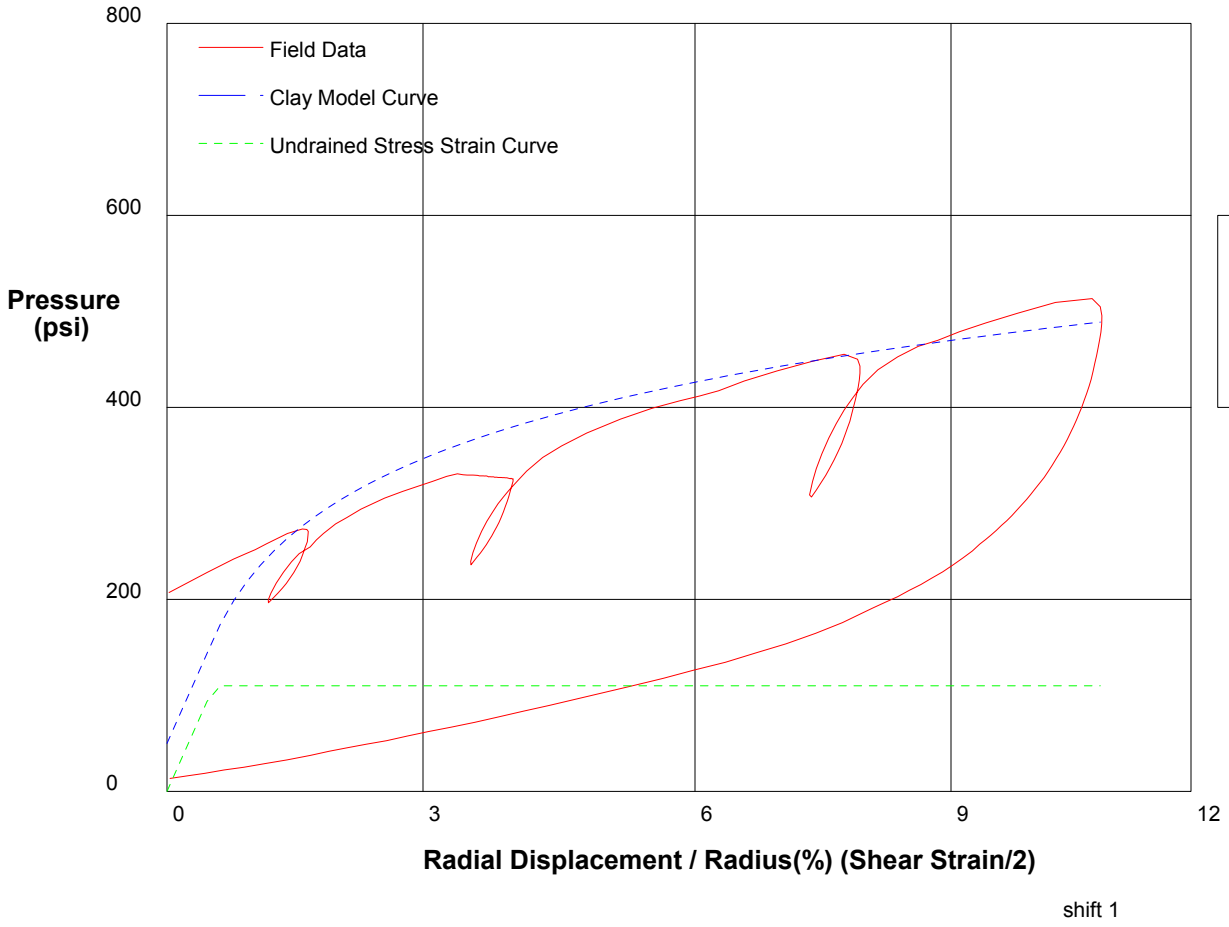
Shear Strength	**850 psi**
Insitu Stress	**120 psi**
Shear Modulus	**40000 psi**

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/29/2009**

Hole No. Z2-B2 **Depth 135.7ft** **File C:\DATA\ISE-812\SR710-23.P**



GIBSON'S CLAY MODEL

Shear Strength 110 psi
Insitu Stress 50 psi
Shear Modulus 10000 psi

shift 1

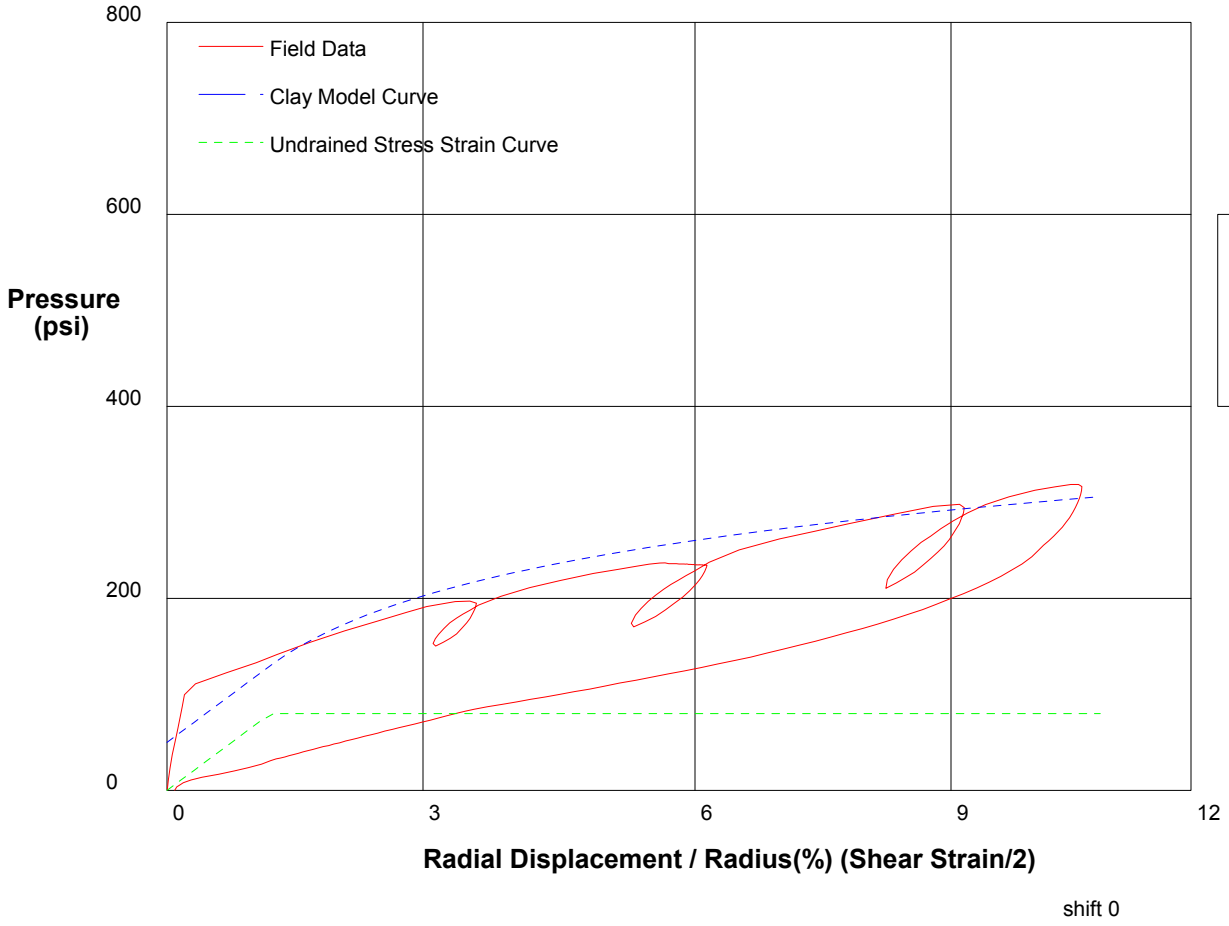
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **1/29/2009**

Hole No. Z2-B2 **Depth 134.2ft** **File C:\DATA\ISE-812\SR710-24.P**



GIBSON'S CLAY MODEL

Shear Strength 80 psi
Insitu Stress 50 psi
Shear Modulus 3300 psi

shift 0

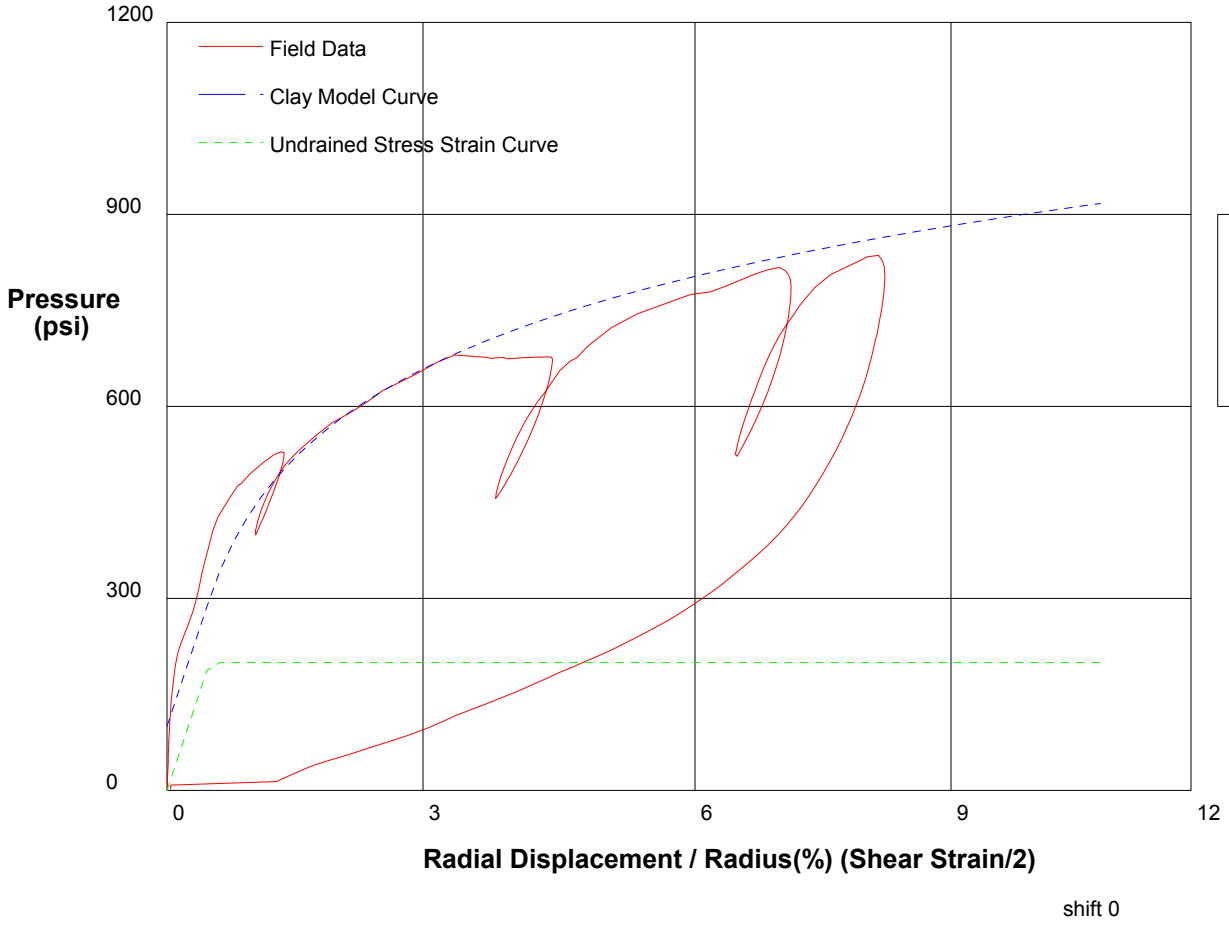
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/4/2009**

Hole No. Z2-B2 **Depth 251ft** **File C:\DATA\ISE-812\SR710-25.P**



GIBSON'S CLAY MODEL

Shear Strength 200 psi
Insitu Stress 100 psi
Shear Modulus 20000 psi

shift 0

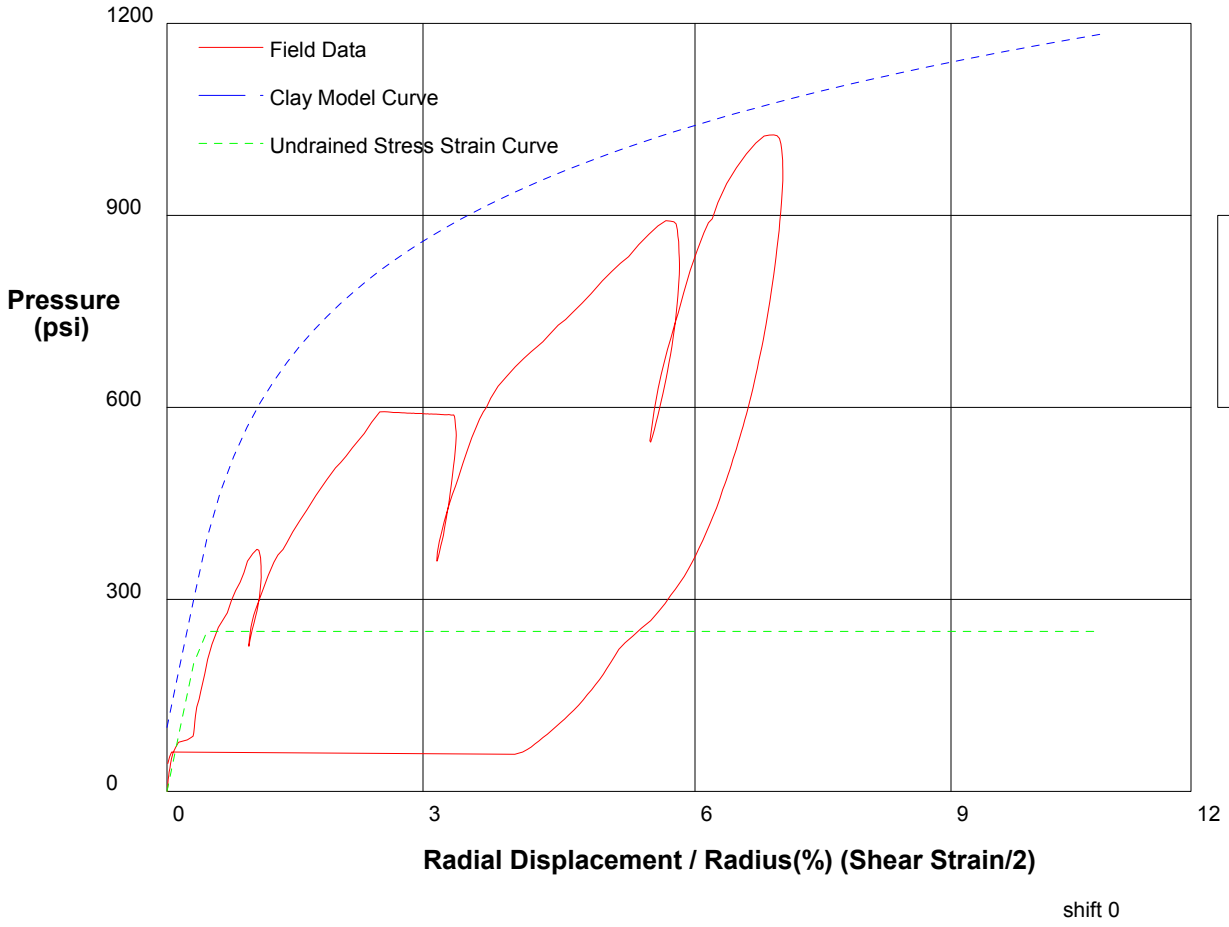
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/4/2009**

Hole No. Z2-B2 **Depth 249.5ft** **File C:\DATA\ISE-812\SR710-26.P**



GIBSON'S CLAY MODEL

Shear Strength	**250 psi**
Insitu Stress	**100 psi**
Shear Modulus	**32000 psi**

shift 0

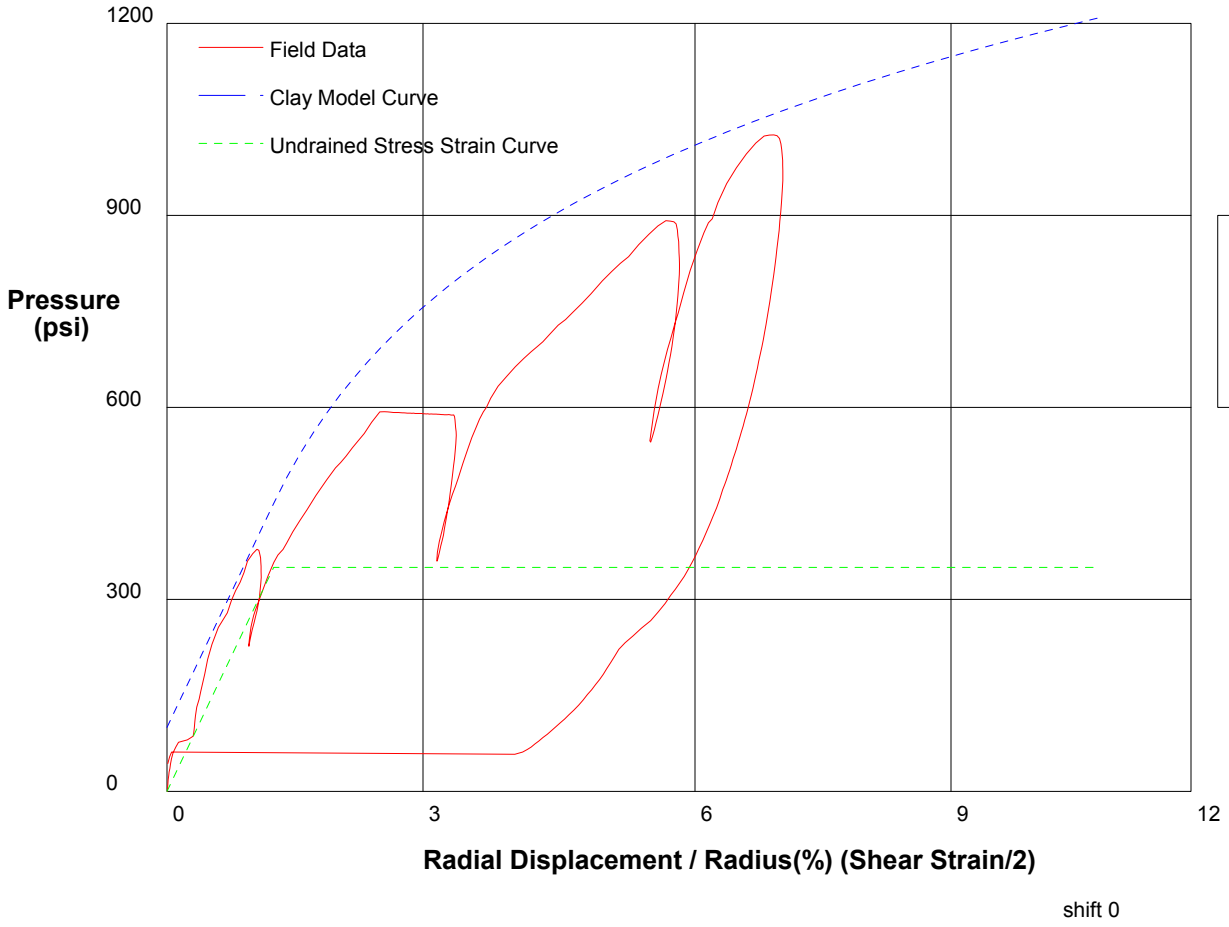
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/4/2009**

Hole No. Z2-B2 **Depth 249.5ft** **File C:\DATA\ISE-812\SR710-26.P**



GIBSON'S CLAY MODEL

Shear Strength	**350 psi**
Insitu Stress	**100 psi**
Shear Modulus	**14000 psi**

shift 0

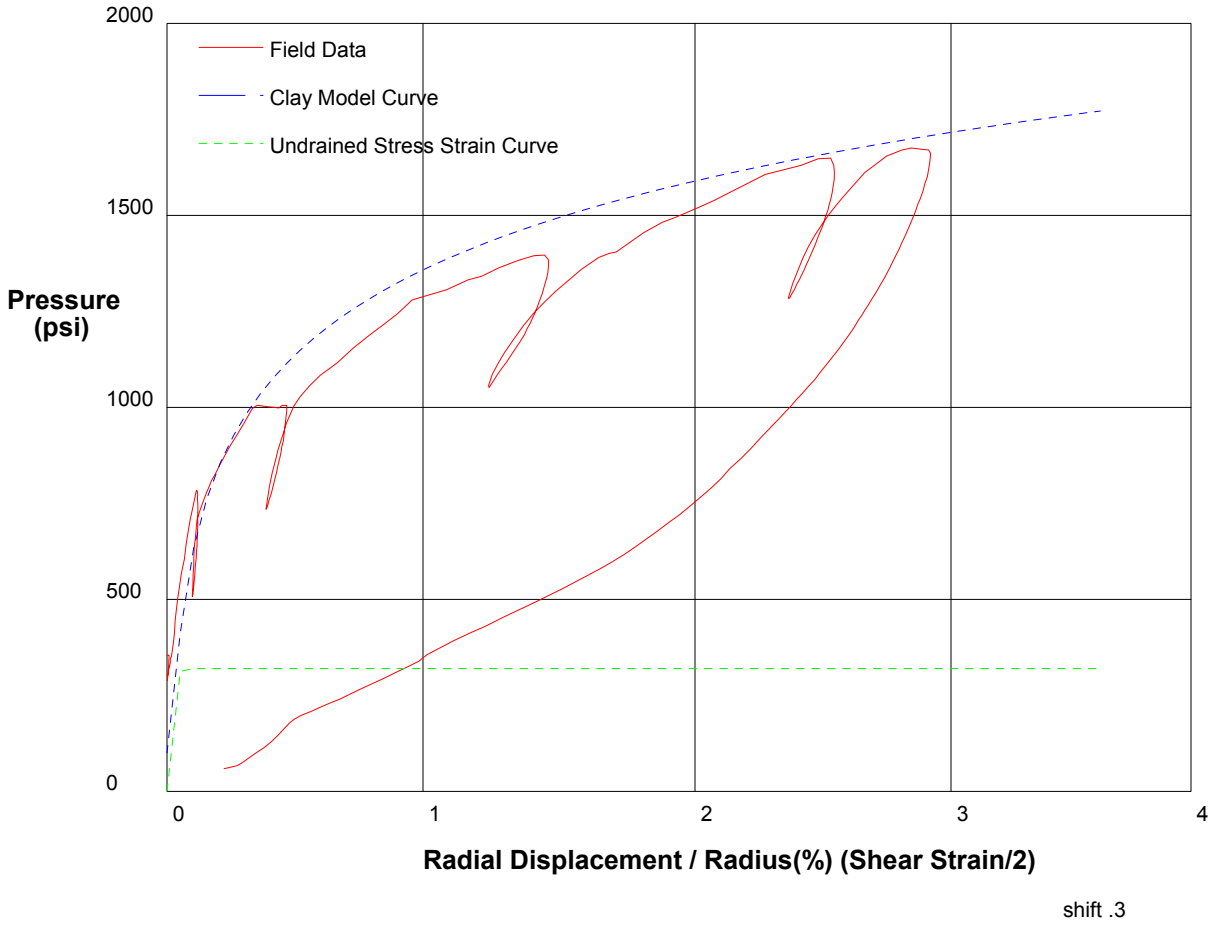
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2M-HILL, Inc.**

CALTRANS I-710 North Tunnel Project **2/5/2009**

Hole No. Z1-B6 **Depth 245ft** **File C:\DATA\ISE-812\SR710-28.P**



GIBSON'S CLAY MODEL

Shear Strength	**320 psi**
Insitu Stress	**100 psi**
Shear Modulus	**300000 psi**

shift .3

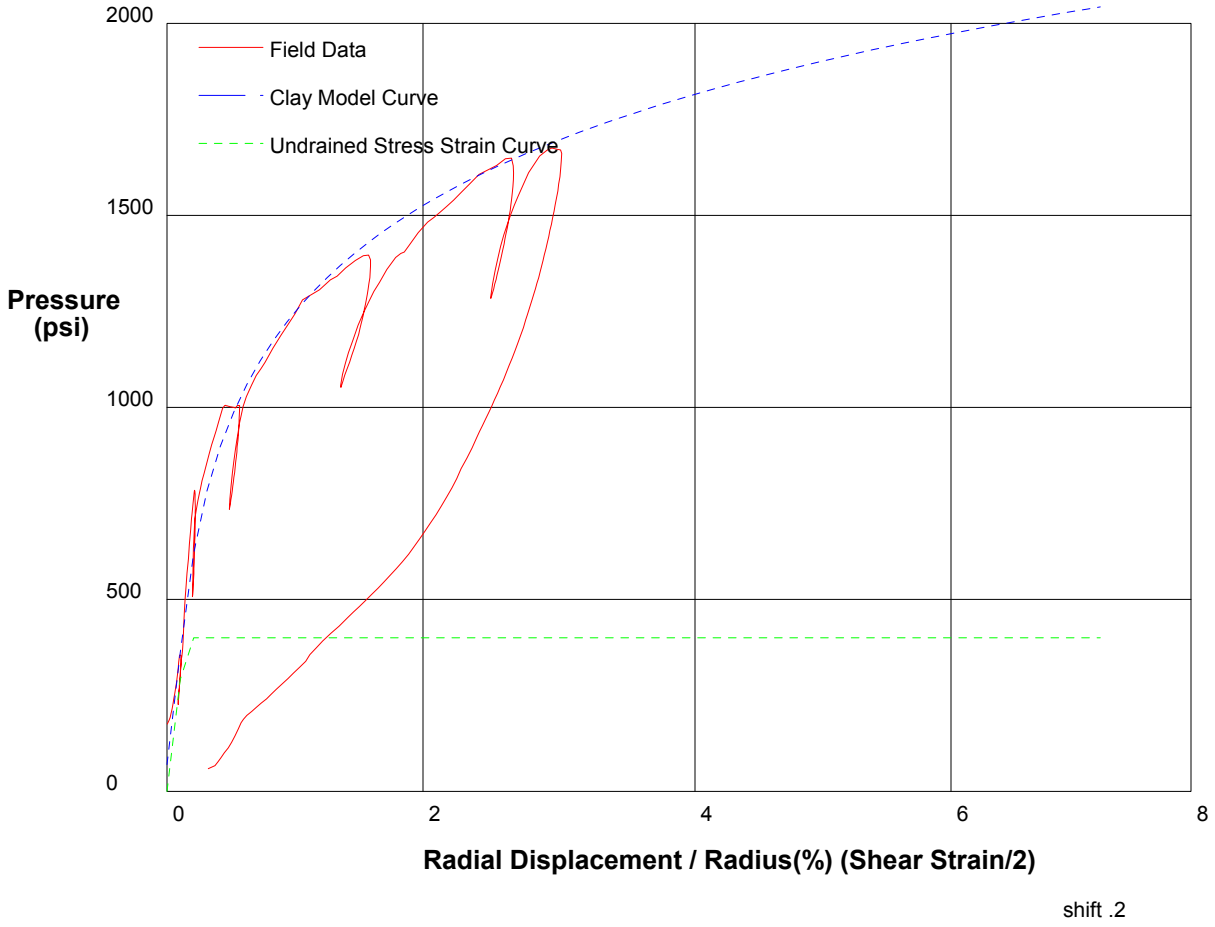
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/5/2009**

Hole No. Z1-B6 **Depth 245ft** **File C:\DATA\ISE-812\SR710-28.P**



GIBSON'S CLAY MODEL

Shear Strength 400 psi
Insitu Stress 70 psi
Shear Modulus 140000 psi

shift .2

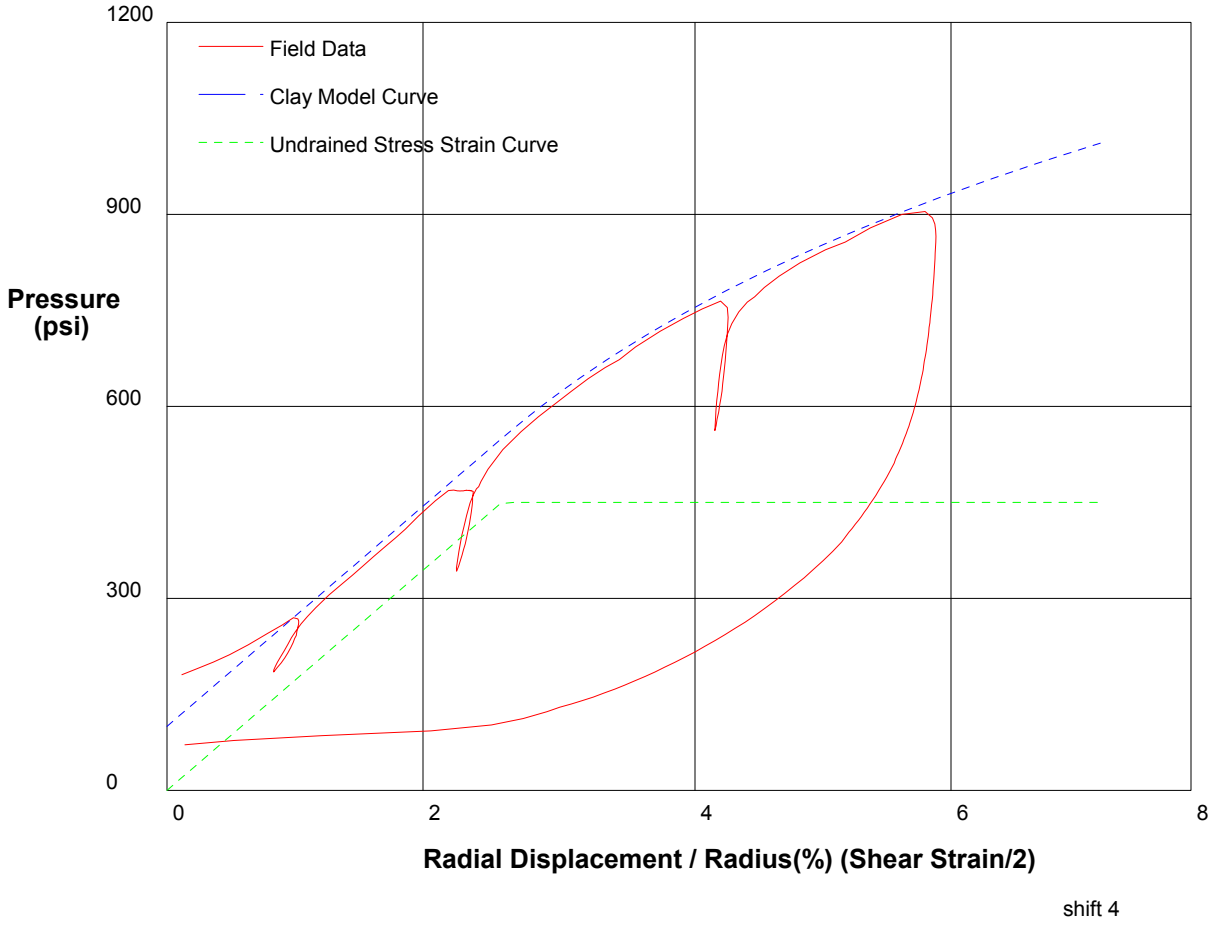
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/6/2009**

Hole No. Z3-B7 **Depth 225.8ft** **File C:\DATA\ISE-812\SR710-29.P**



GIBSON'S CLAY MODEL

Shear Strength	**450 psi**
Insitu Stress	**100 psi**
Shear Modulus	**8600 psi**

shift 4

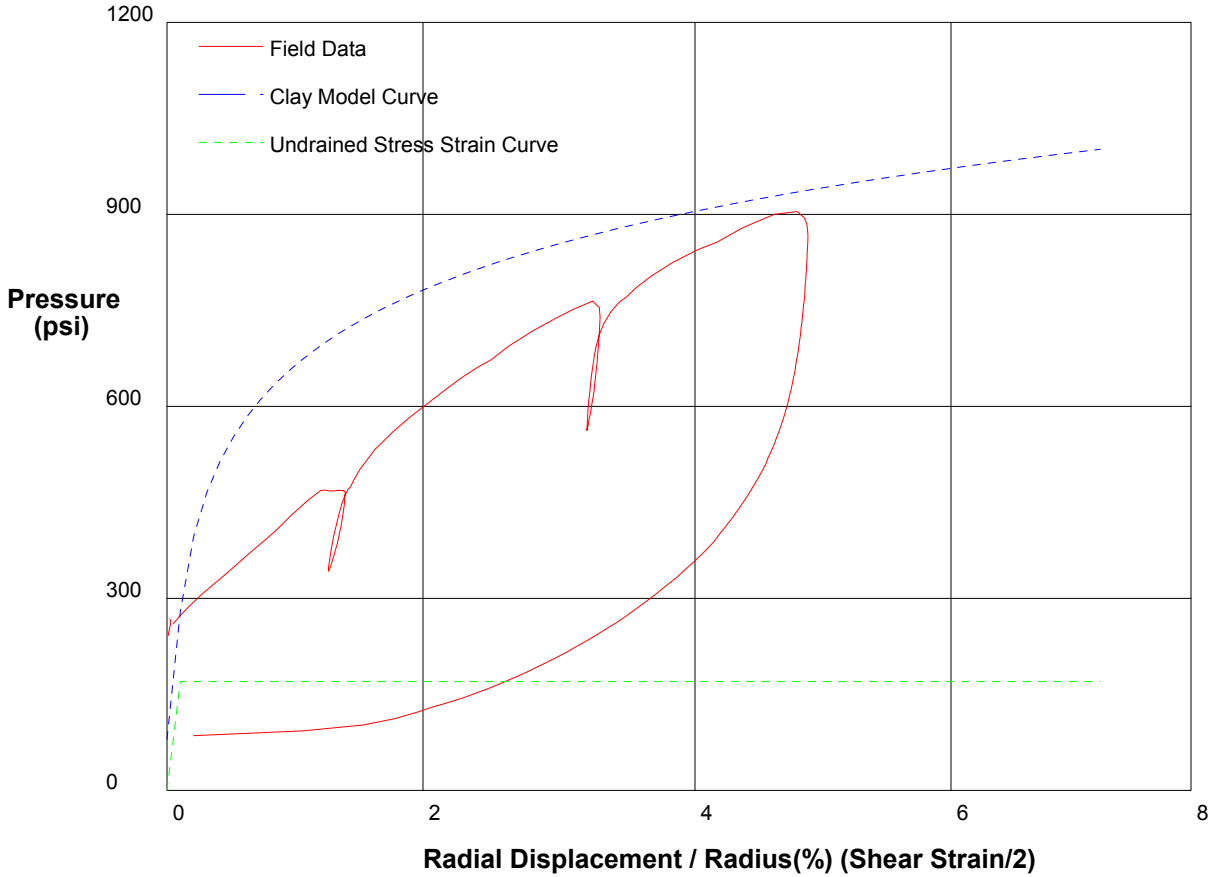
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/6/2009**

Hole No. Z3-B7 **Depth 225.8ft** **File C:\DATA\ISE-812\SR710-29.P**



GIBSON'S CLAY MODEL

Shear Strength 170 psi
Insitu Stress 80 psi
Shear Modulus 97000 psi

shift 5

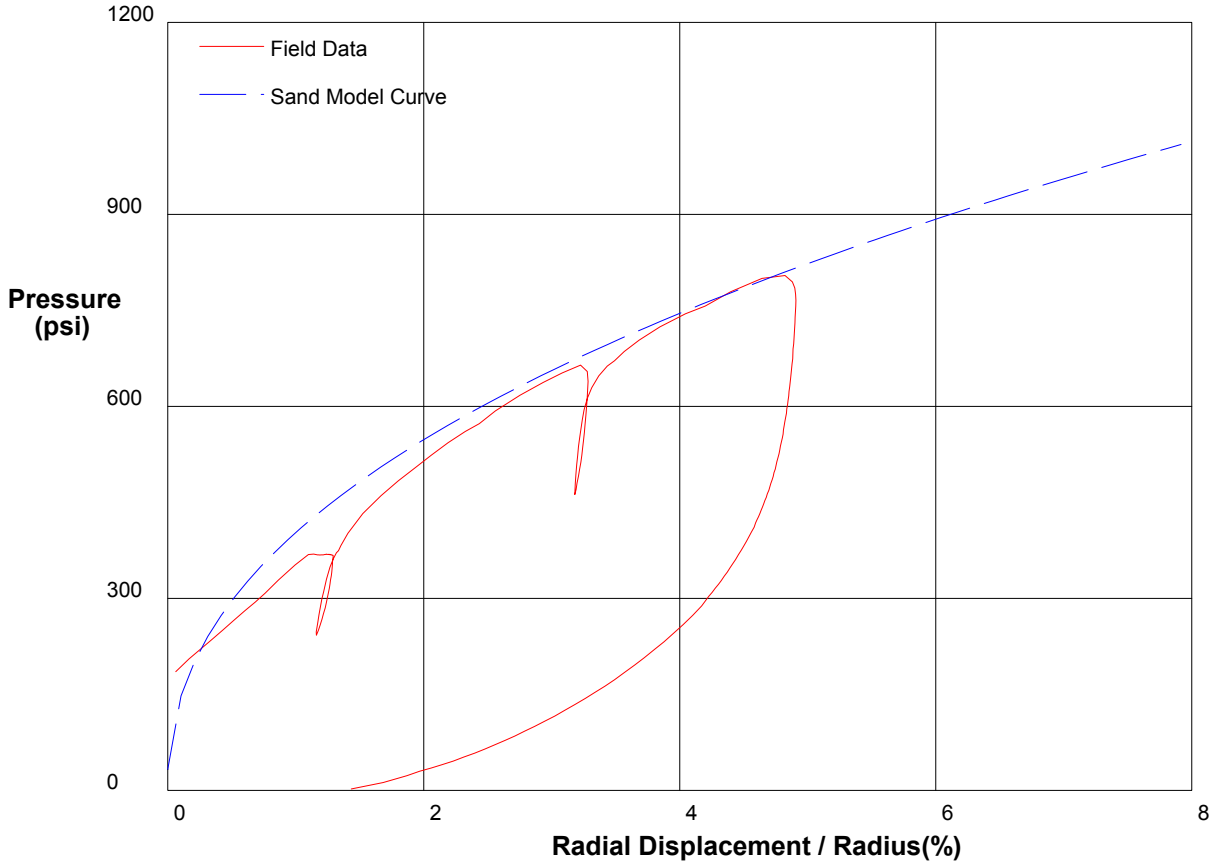
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/6/2009**

Hole No. Z3-B7 **Depth 225.8ft** **File C:\DATA\ISE-812\SR710-29.P**



THE In Situ Engineering SAND MODEL

Water Pressure	**100 psi**
Friction Angle	**39 deg**
Critical Friction Angle	**32 deg**
Lateral Stress	**33 psi**
Shear Modulus	**97000 psi**

shift 5.1

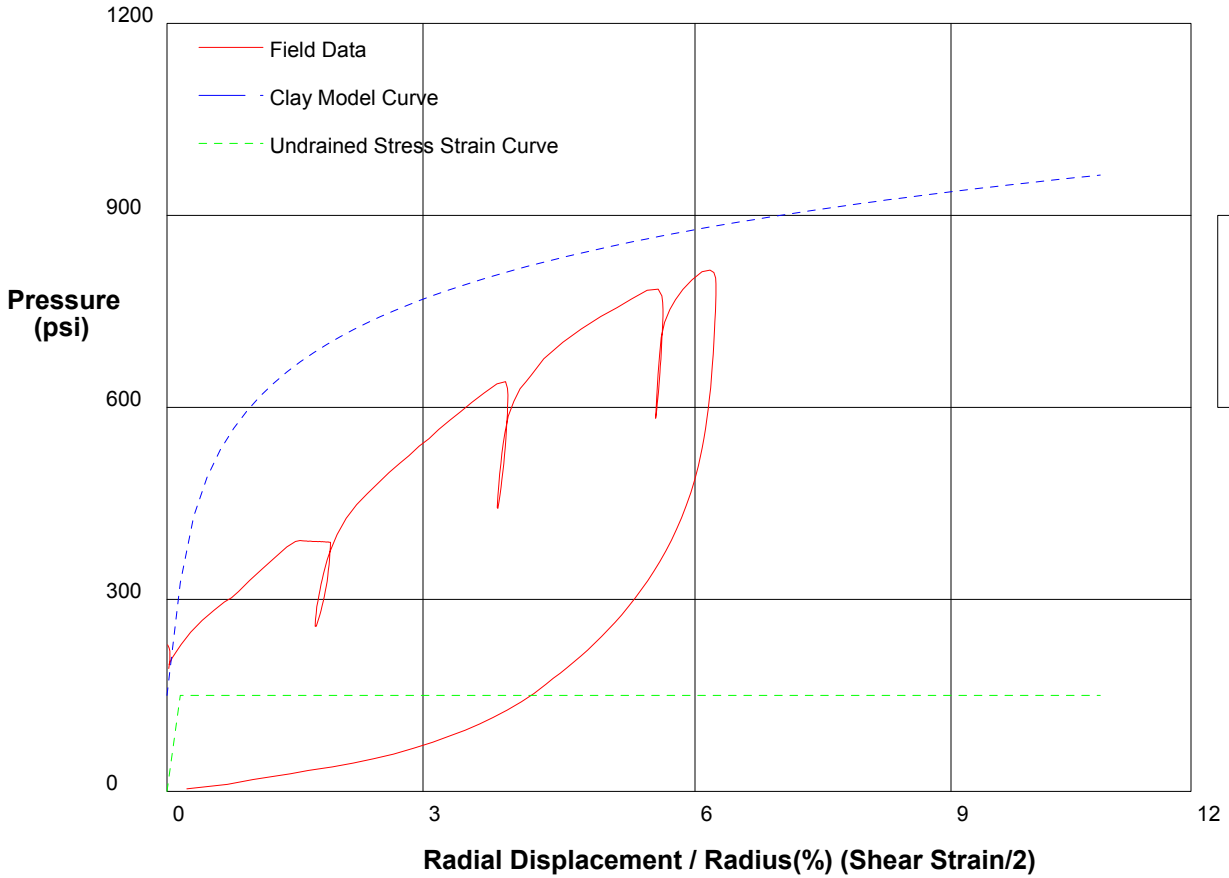
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/6/2009**

Hole No. Z3-B7 **Depth 224.3ft** **File C:\DATA\ISE-812\SR710-30.P**



GIBSON'S CLAY MODEL

Shear Strength	**150 psi**
Insitu Stress	**150 psi**
Shear Modulus	**57000 psi**

shift 4

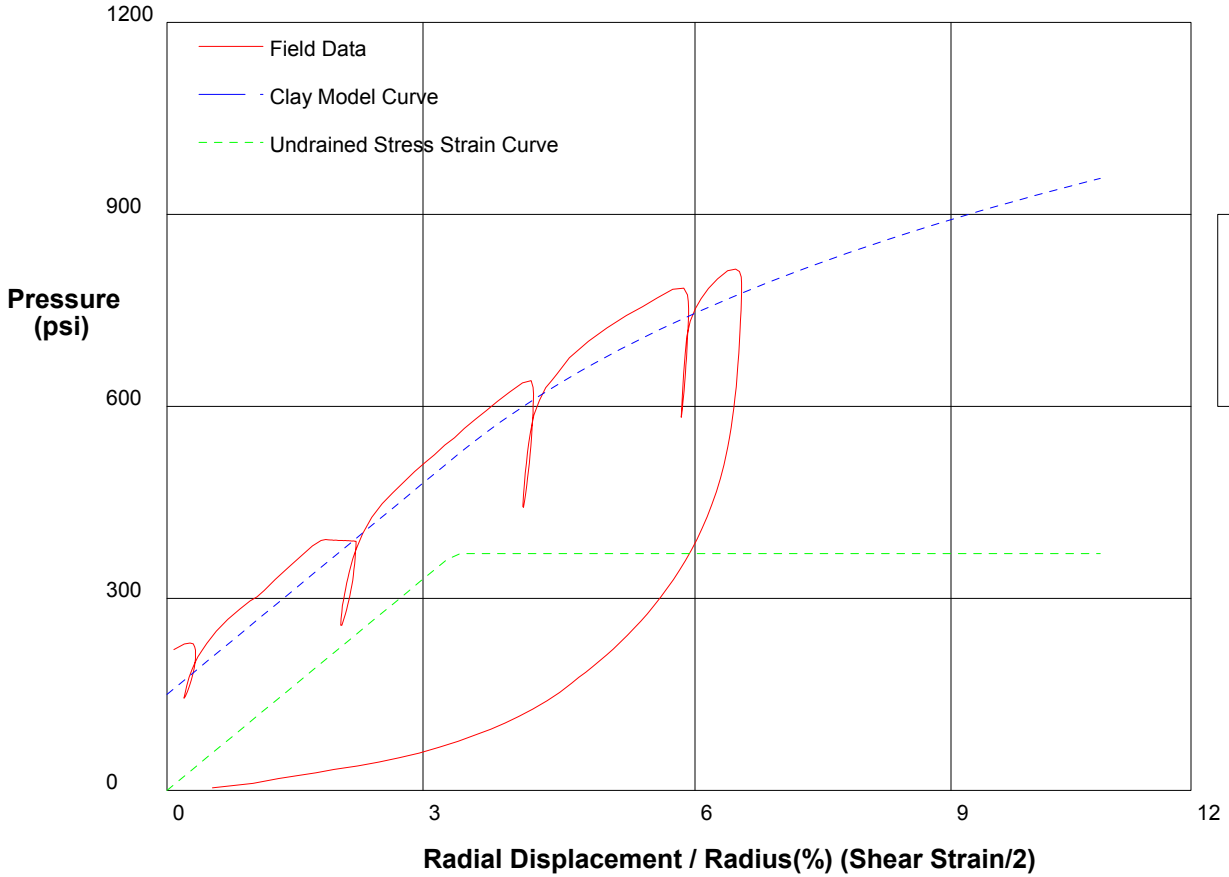
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/6/2009**

Hole No. Z3-B7 **Depth 224.3ft** **File C:\DATA\ISE-812\SR710-30.P**



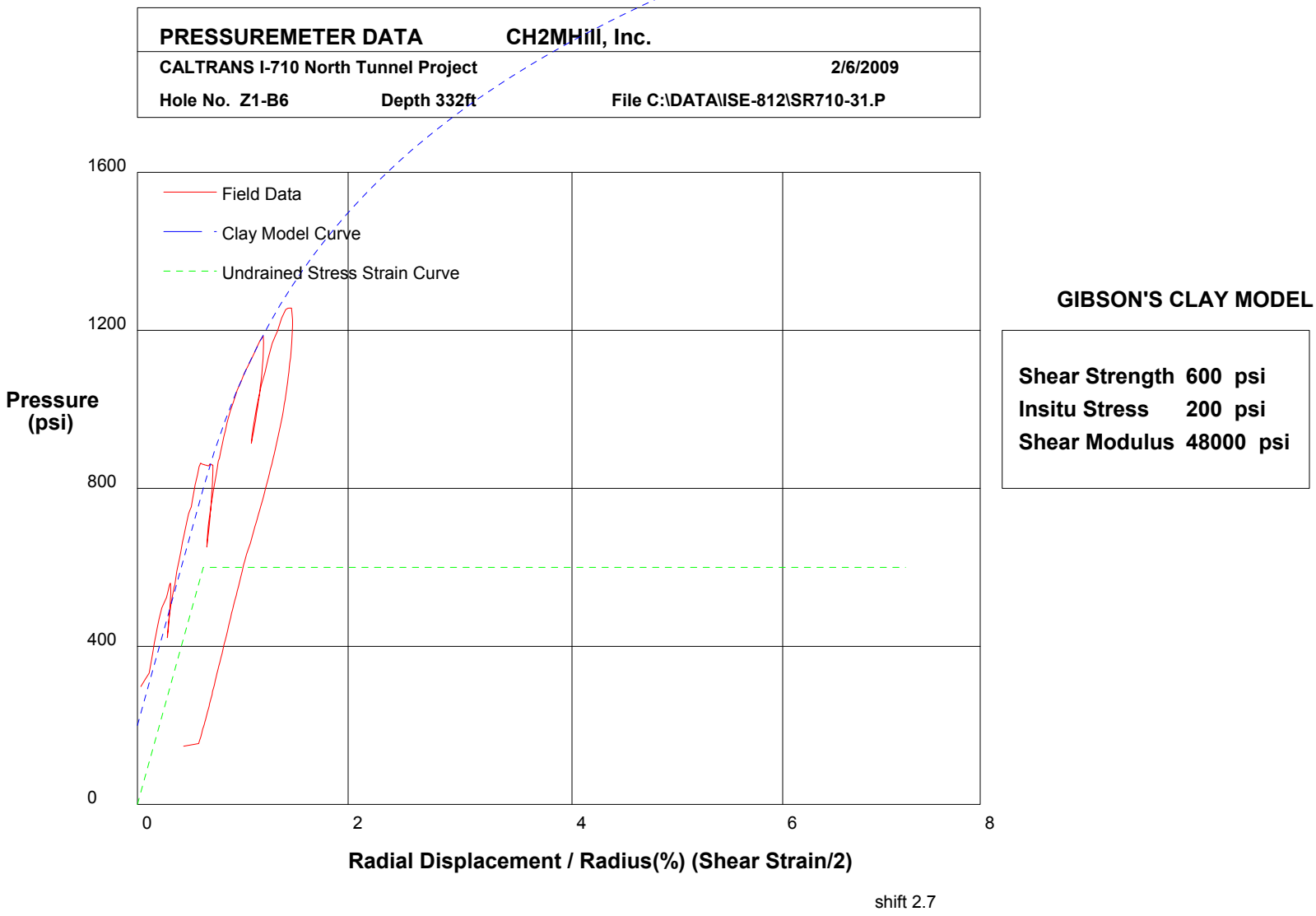
GIBSON'S CLAY MODEL

Shear Strength 370 psi
Insitu Stress 150 psi
Shear Modulus 5500 psi

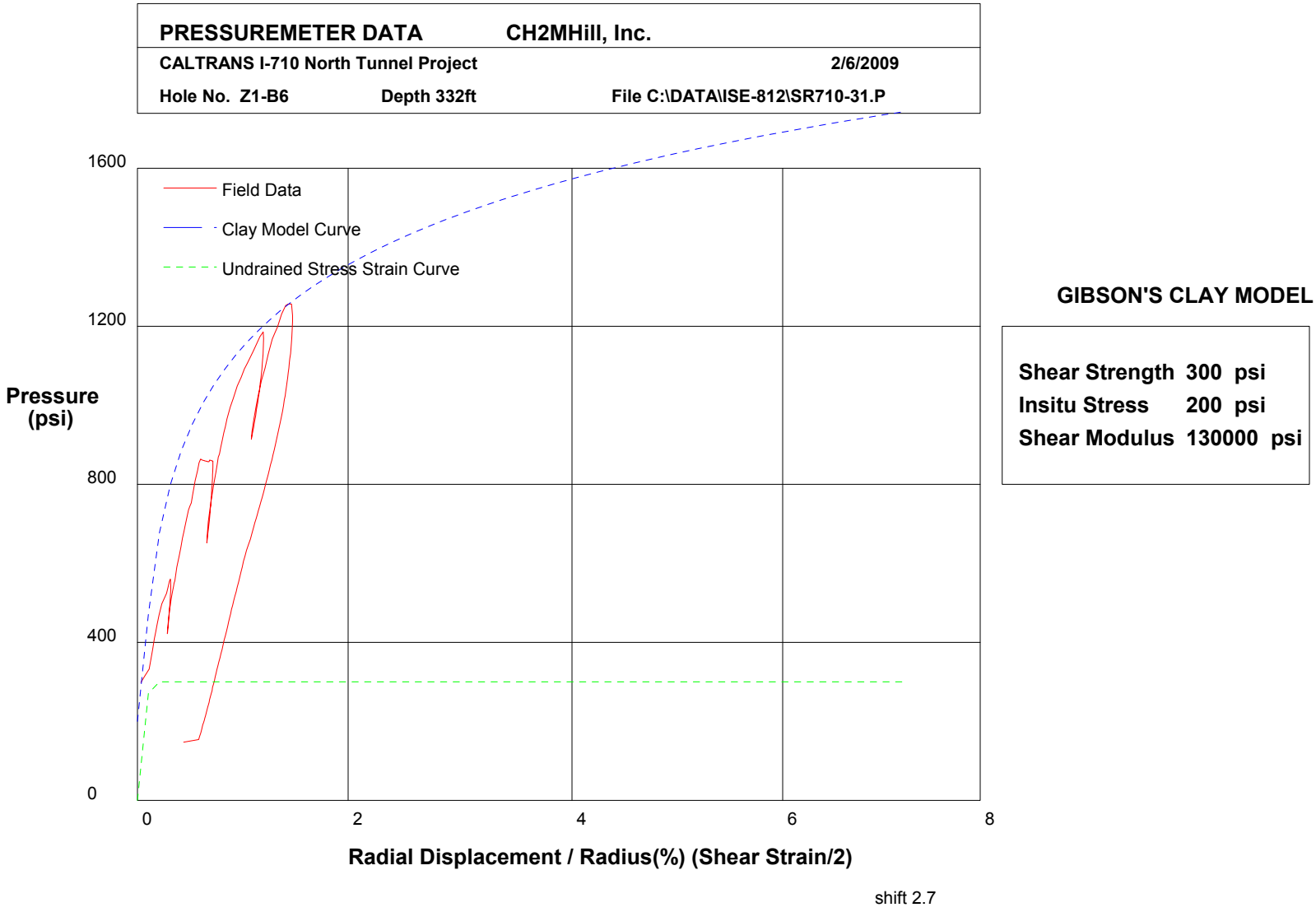
shift 3.7

In Situ Engineering

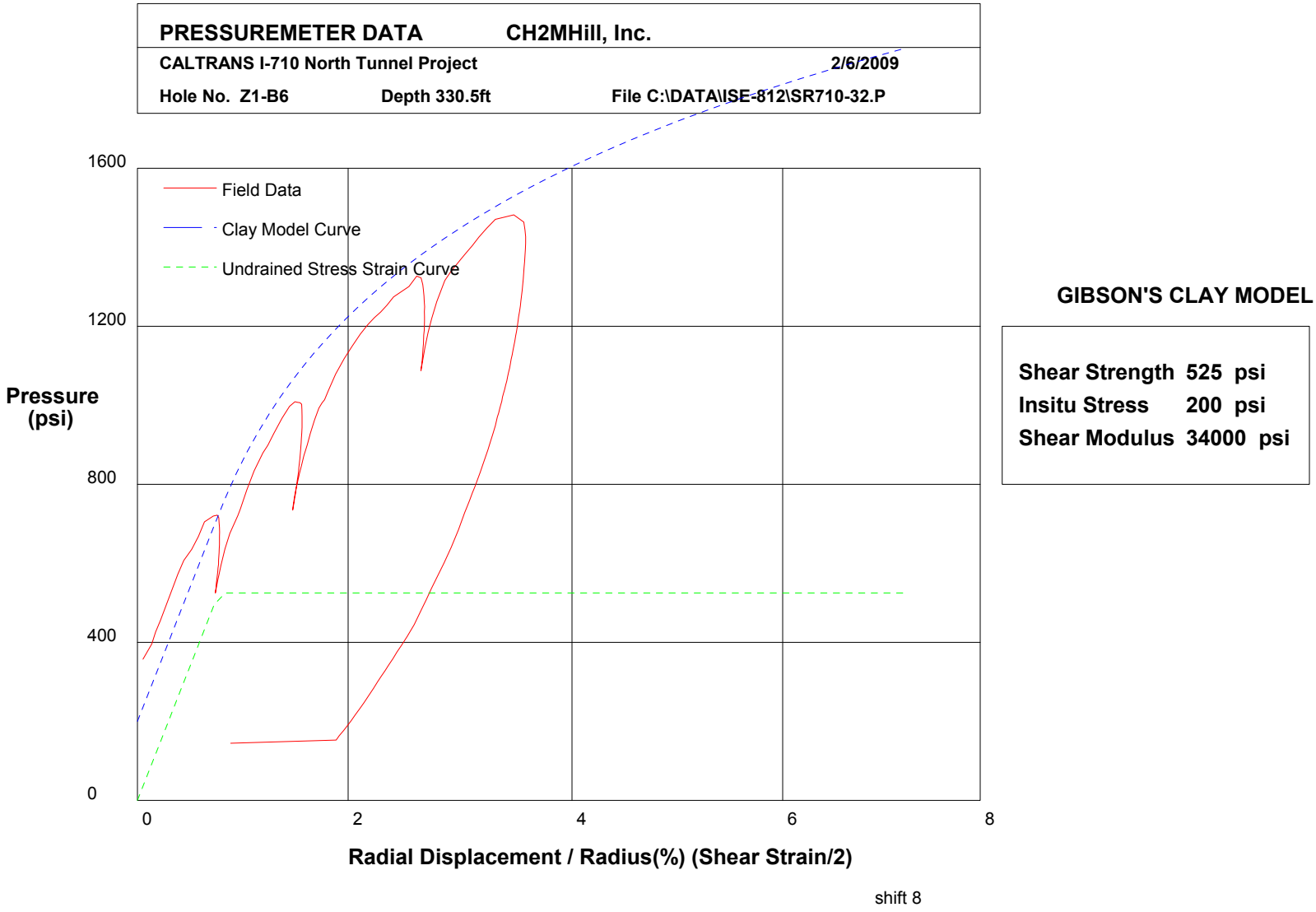
Appendix II - Pressuremeter Model Interpretation



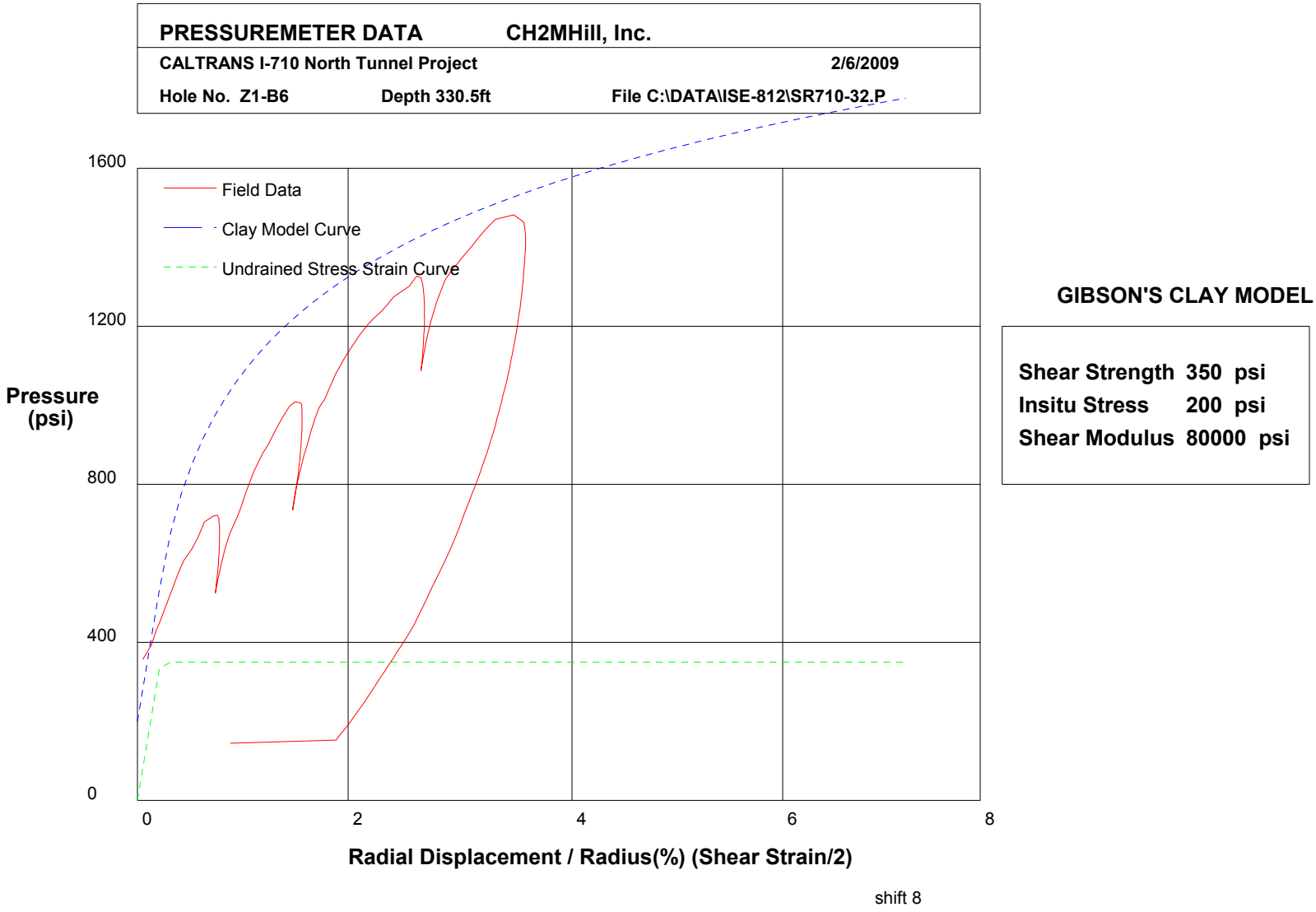
Appendix II - Pressuremeter Model Interpretation



Appendix II - Pressuremeter Model Interpretation



Appendix II - Pressuremeter Model Interpretation

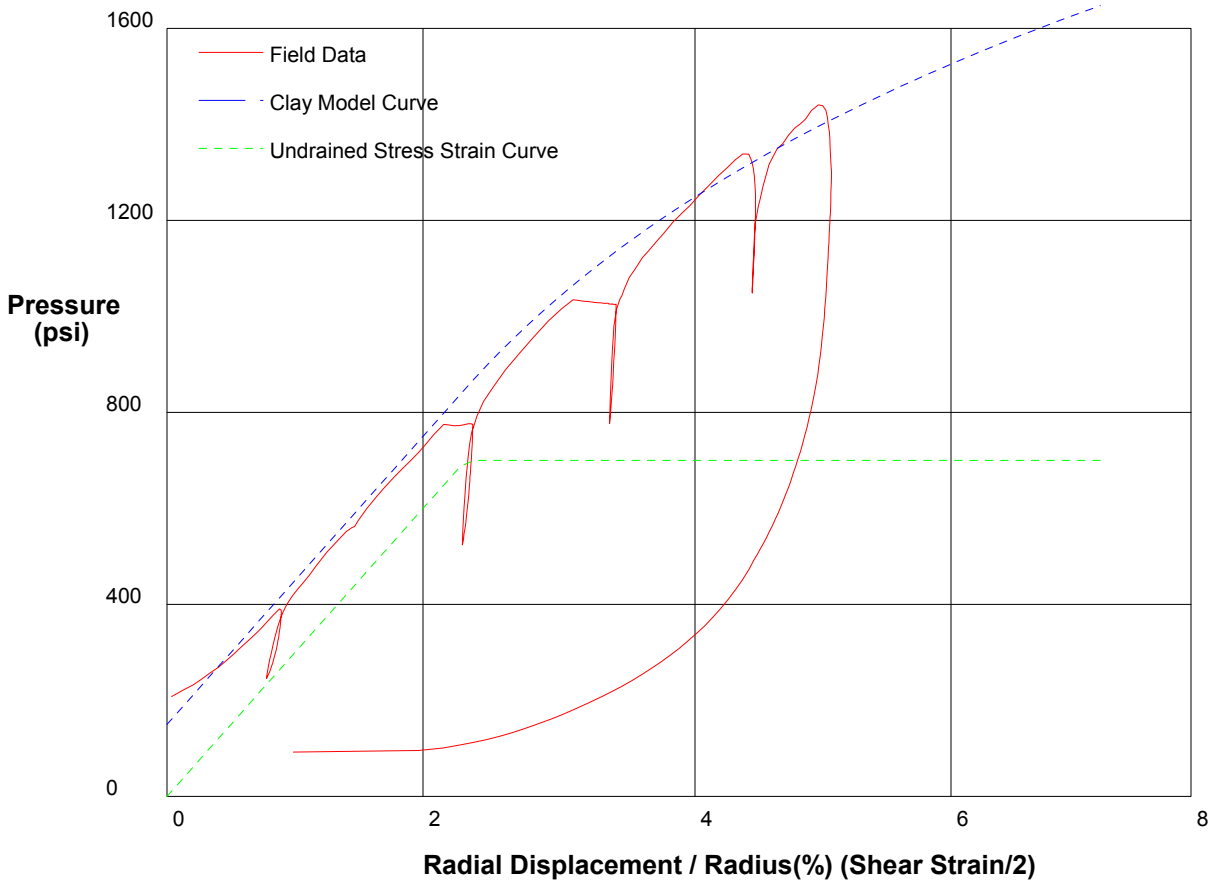


Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/10/2009**

Hole No. Z3-B7 **Depth 252.5ft** **File C:\DATA\ISE-812\SR710-33.P**



GIBSON'S CLAY MODEL

Shear Strength	**700 psi**
Insitu Stress	**150 psi**
Shear Modulus	**15000 psi**

shift 5.2

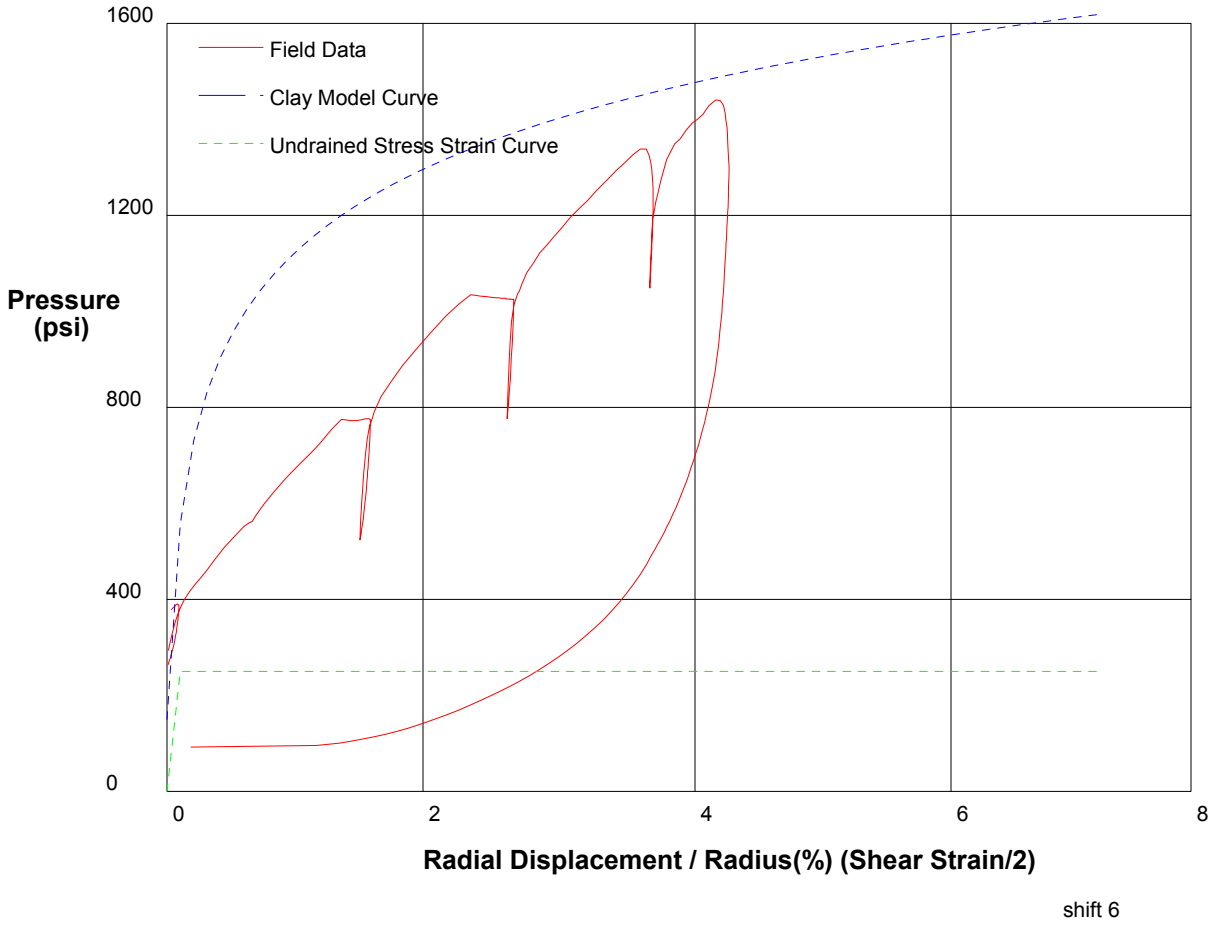
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/10/2009**

Hole No. Z3-B7 **Depth 252.5ft** **File C:\DATA\ISE-812\SR710-33.P**



GIBSON'S CLAY MODEL

Shear Strength	**250 psi**
Insitu Stress	**150 psi**
Shear Modulus	**225000 psi**

shift 6

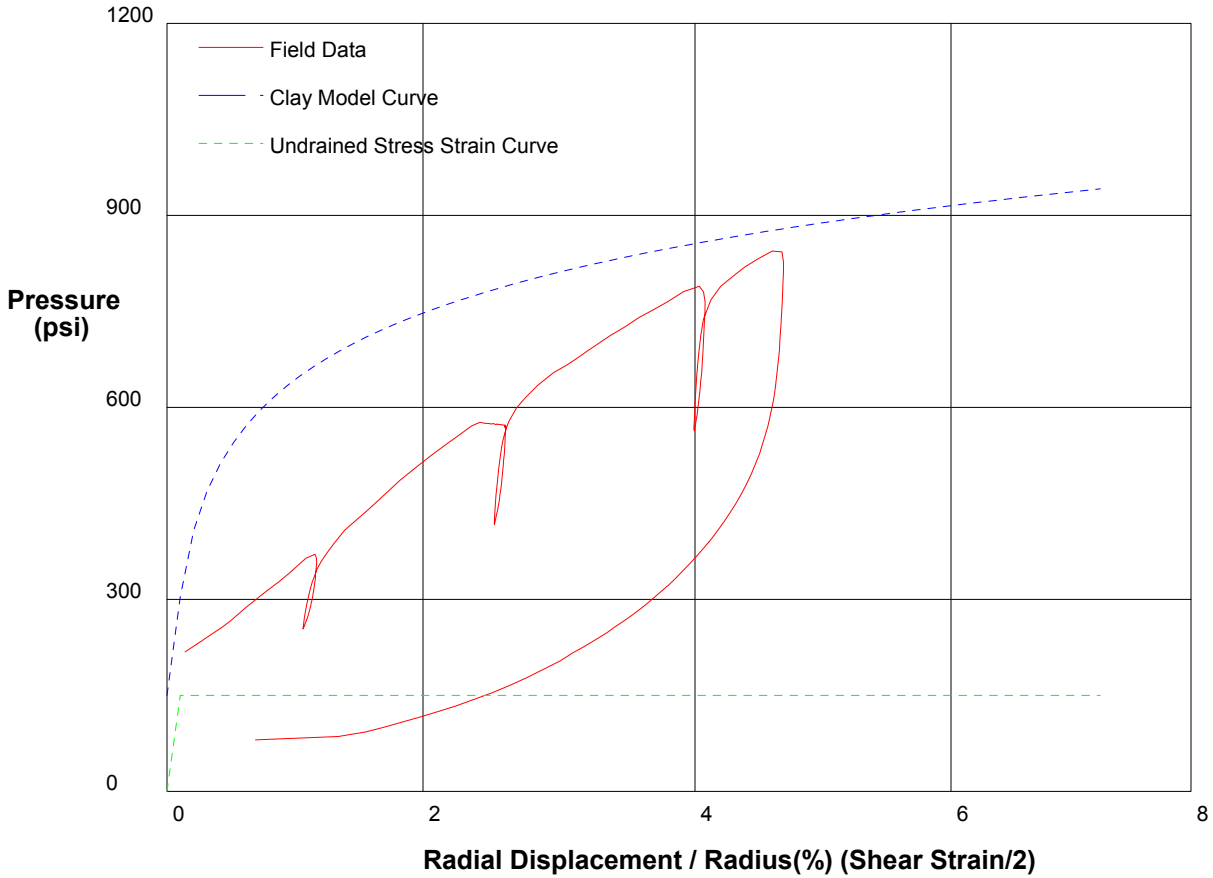
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/10/2009**

Hole No. Z3-B7 **Depth 251ft** **File C:\DATA\ISE-812\SR710-34.P**



GIBSON'S CLAY MODEL

Shear Strength	**150 psi**
Insitu Stress	**150 psi**
Shear Modulus	**74000 psi**

shift 6.2

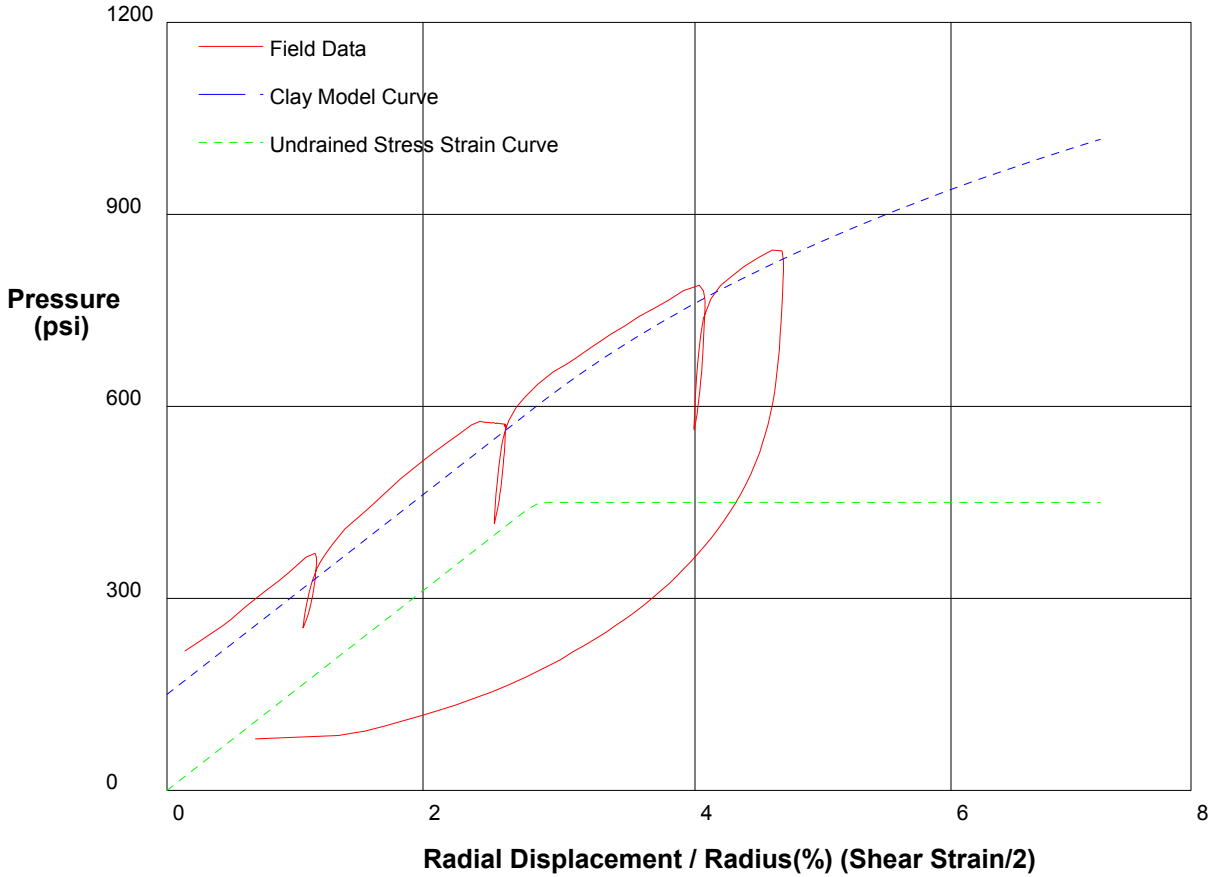
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/10/2009**

Hole No. Z3-B7 **Depth 251ft** **File C:\DATA\ISE-812\SR710-34.P**



GIBSON'S CLAY MODEL

Shear Strength	**450 psi**
Insitu Stress	**150 psi**
Shear Modulus	**7800 psi**

shift 6.2

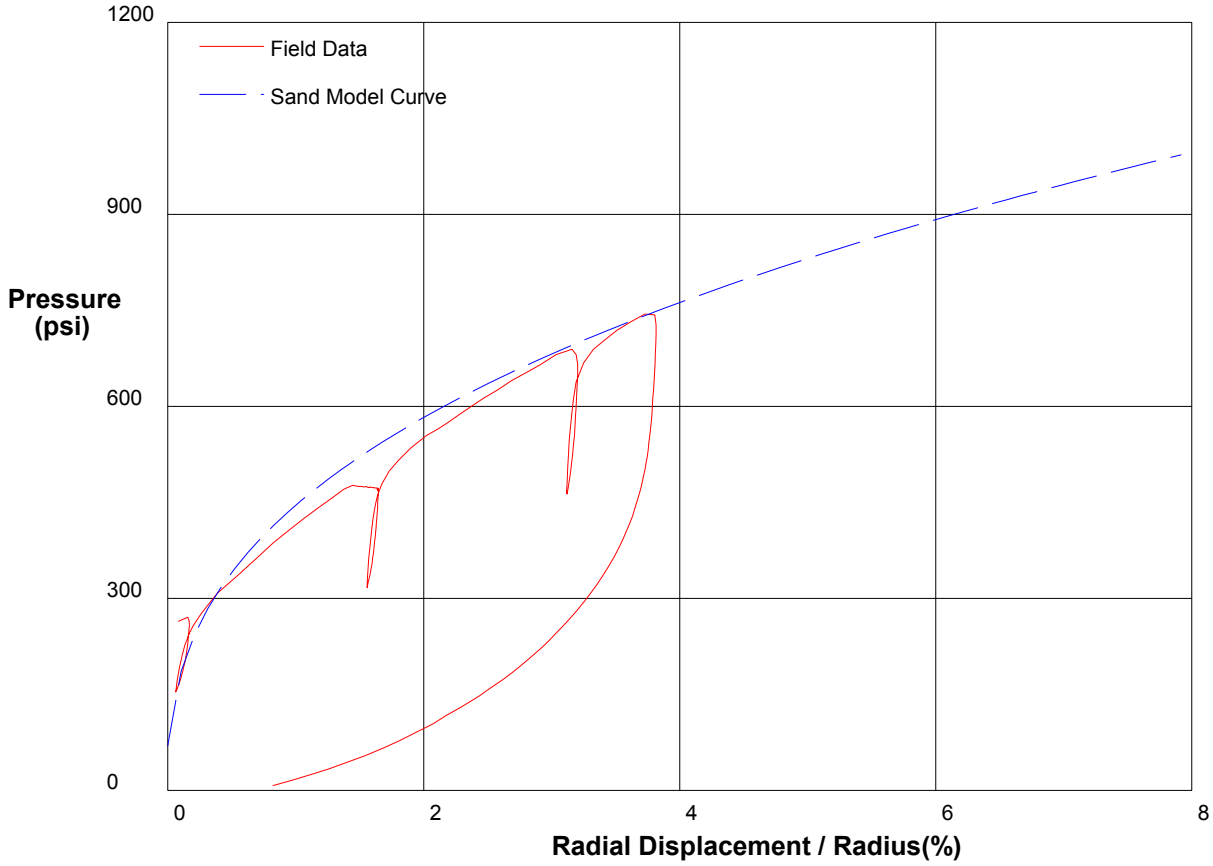
In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/10/2009**

Hole No. Z3-B7 **Depth 251ft** **File C:\DATA\ISE-812\SR710-34.P**



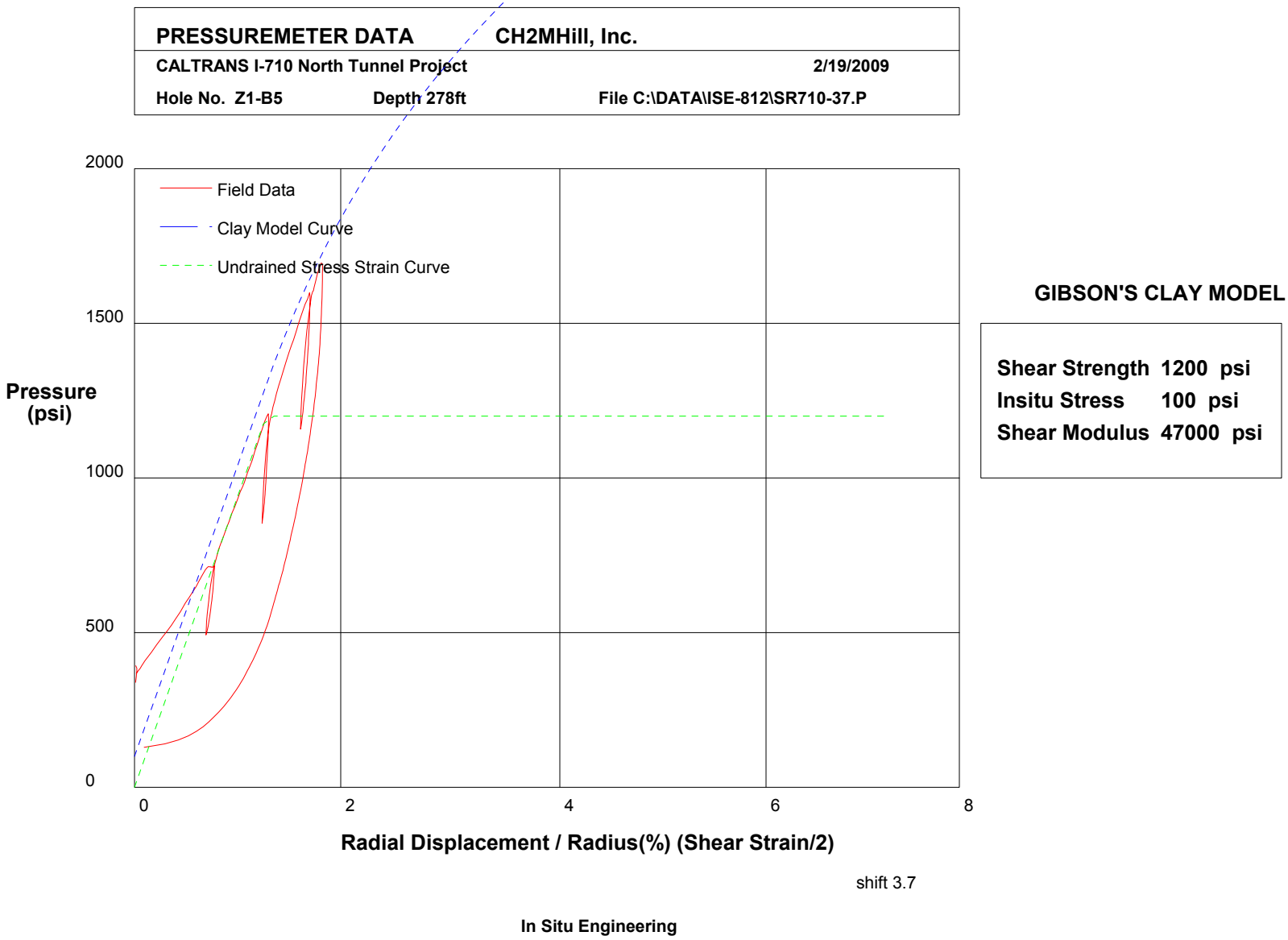
THE In Situ Engineering SAND MODEL

Water Pressure	**100 psi**
Friction Angle	**35 deg**
Critical Friction Angle	**32 deg**
Lateral Stress	**70 psi**
Shear Modulus	**74000 psi**

shift 7.2

In Situ Engineering

Appendix II - Pressuremeter Model Interpretation

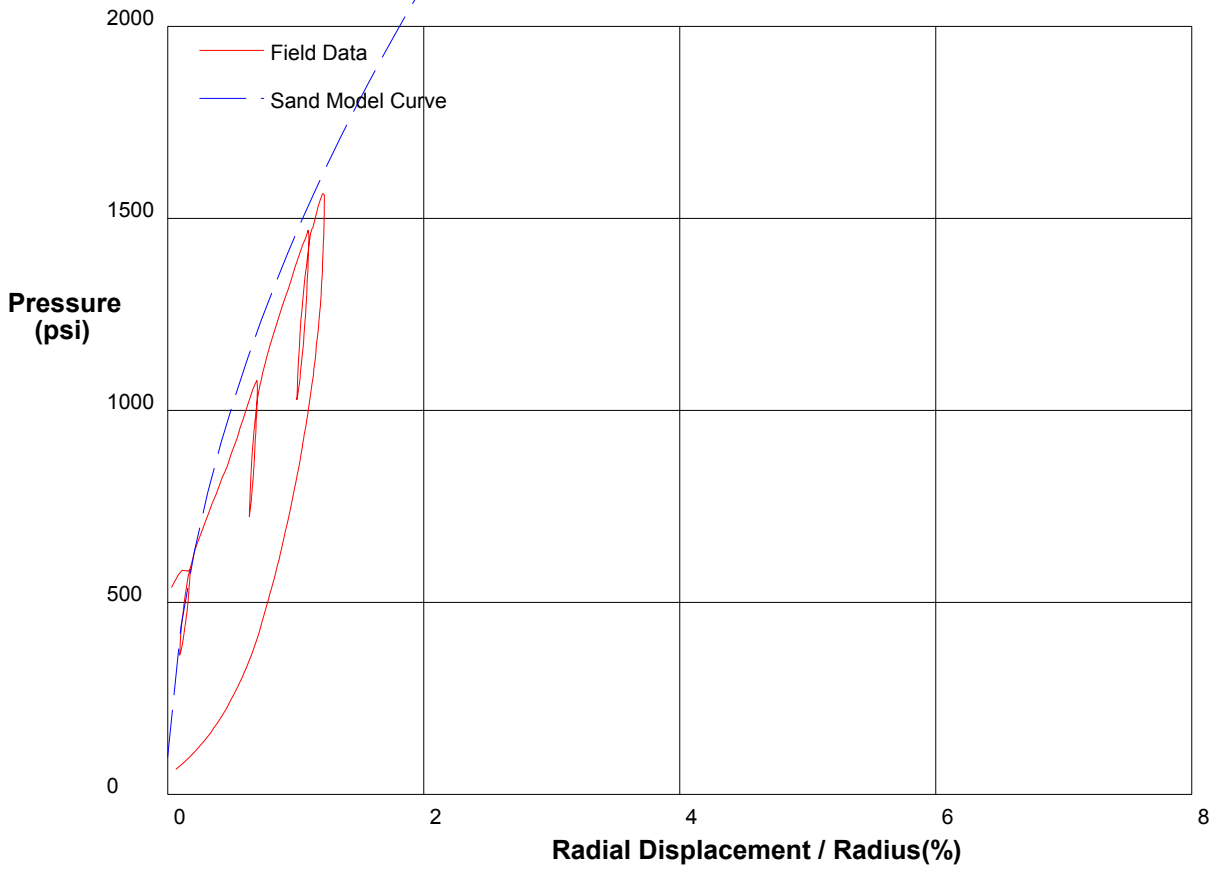


Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/19/2009**

Hole No. Z1-B5 **Depth 278ft** **File C:\DATA\ISE-812\SR710-37.P**



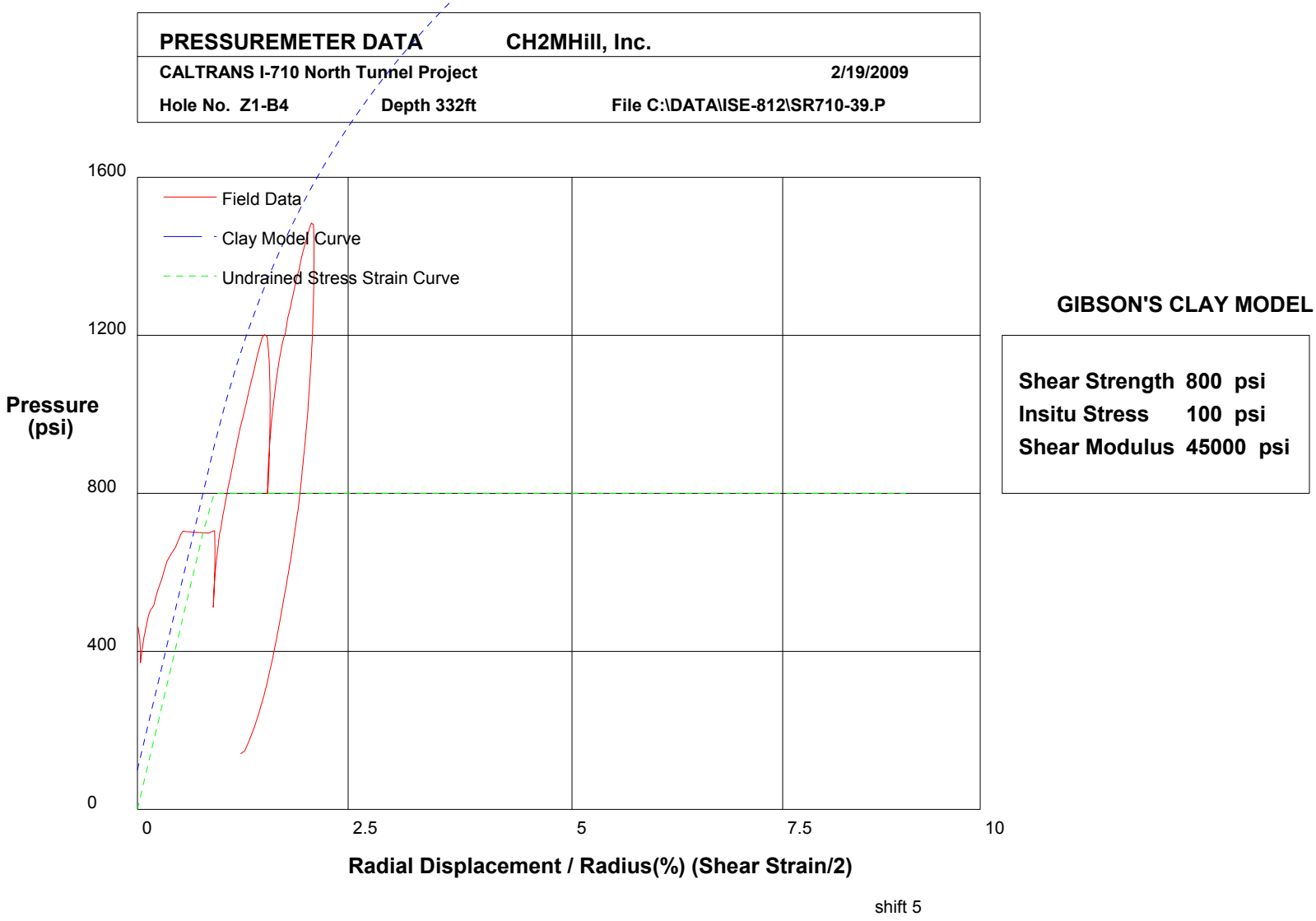
THE In Situ Engineering SAND MODEL

Water Pressure	**130 psi**
Friction Angle	**45 deg**
Critical Friction Angle	**32 deg**
Lateral Stress	**100 psi**
Shear Modulus	**200000 psi**

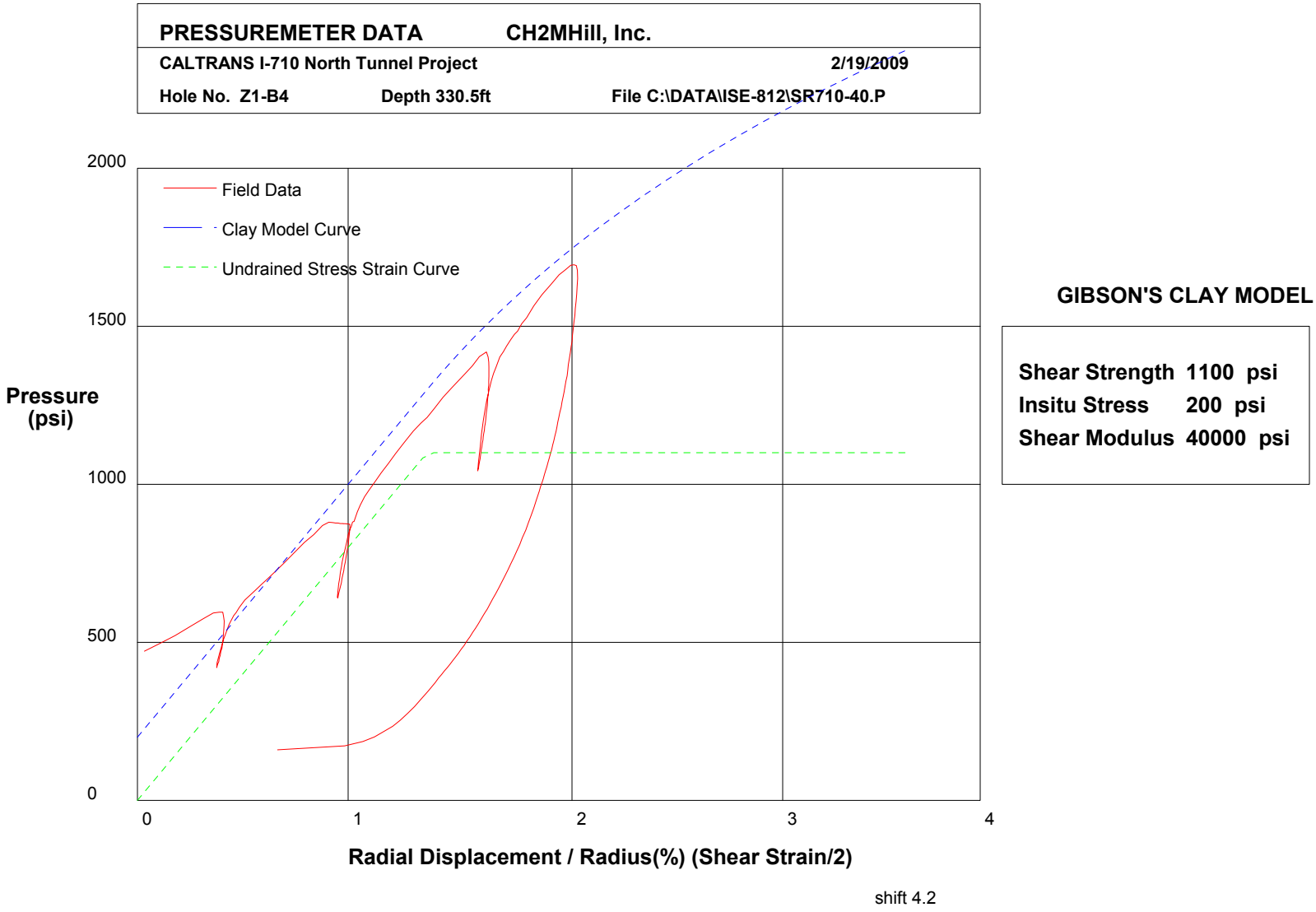
shift 4.3

In Situ Engineering

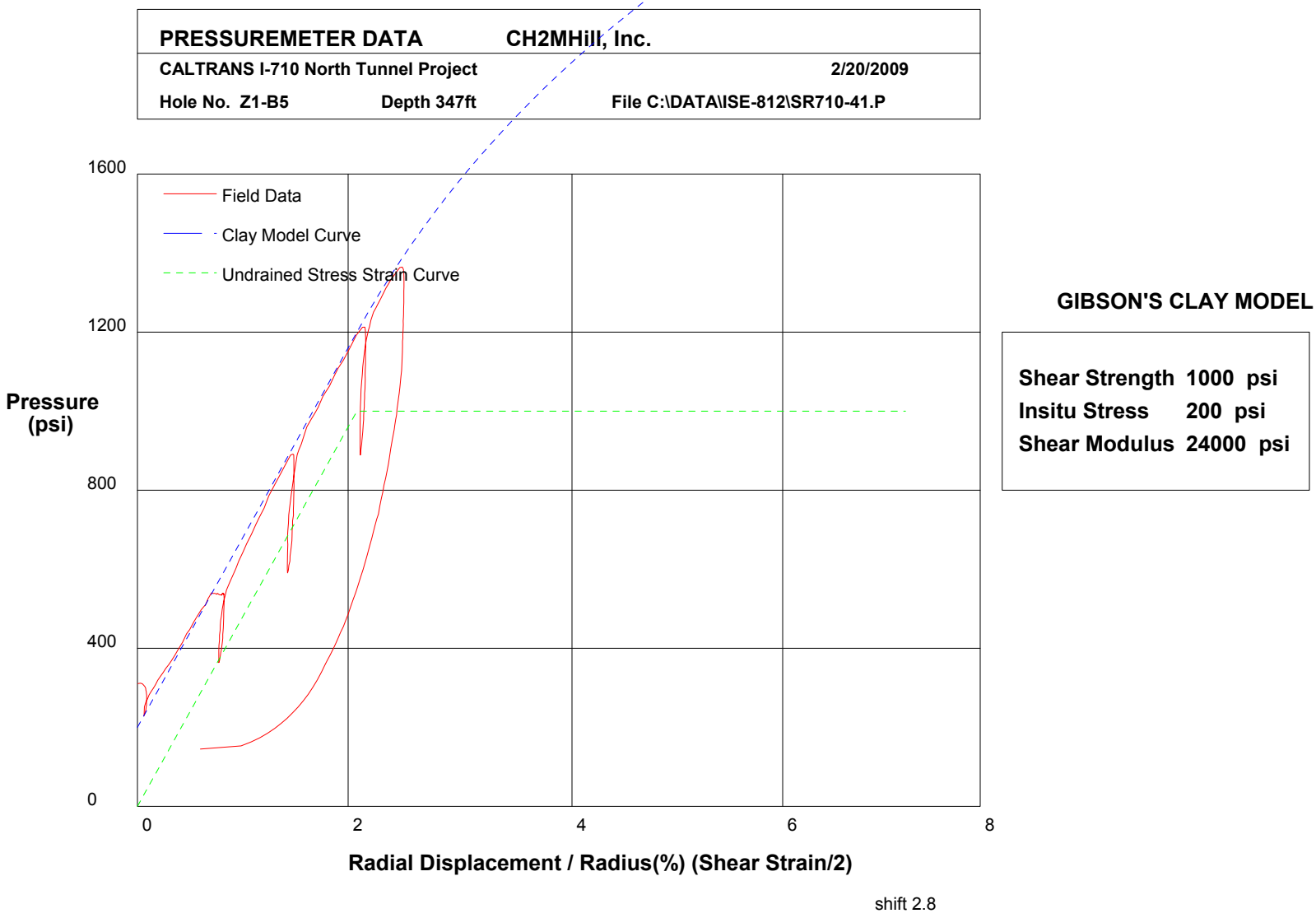
Appendix II - Pressuremeter Model Interpretation



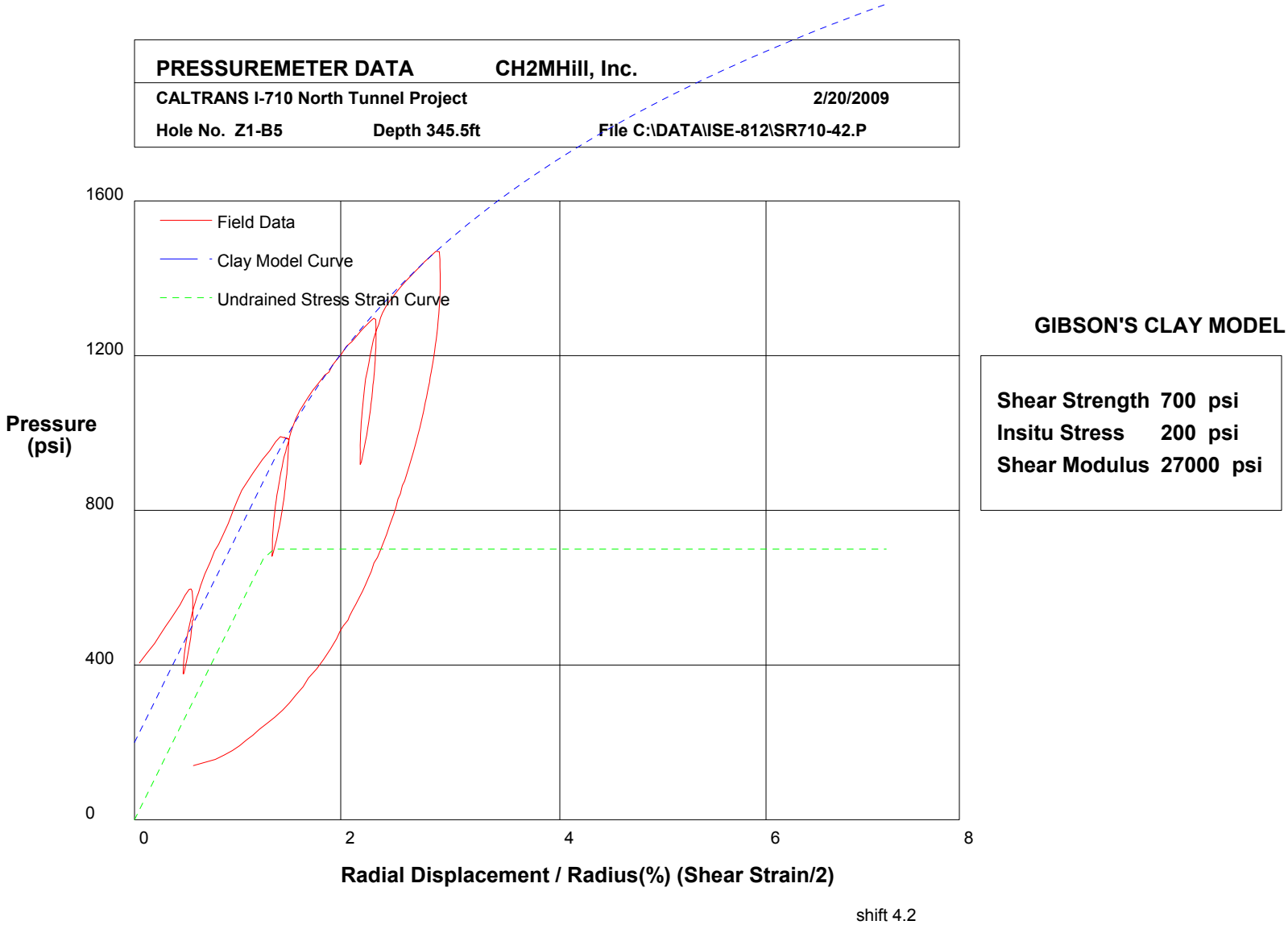
Appendix II - Pressuremeter Model Interpretation



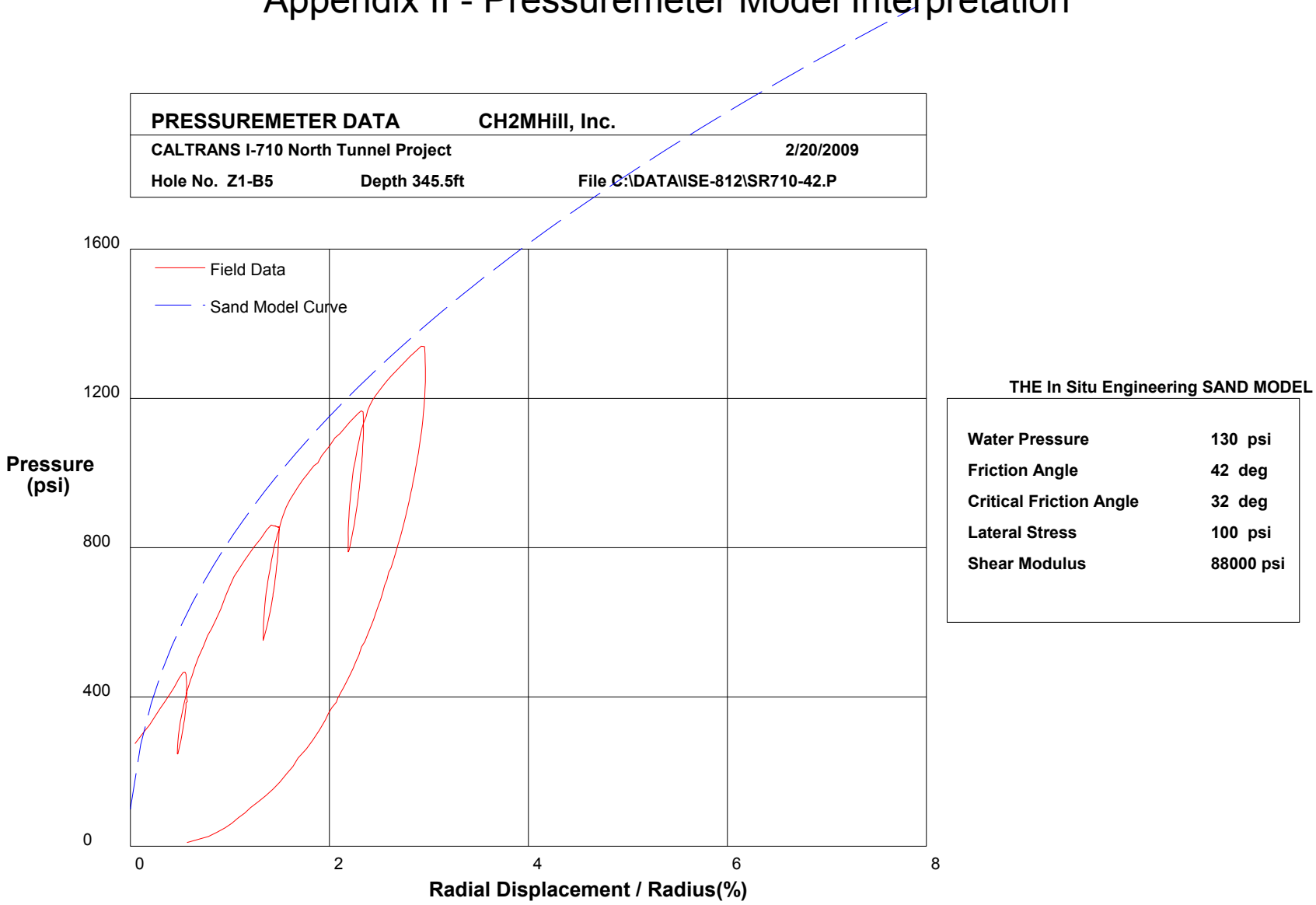
Appendix II - Pressuremeter Model Interpretation



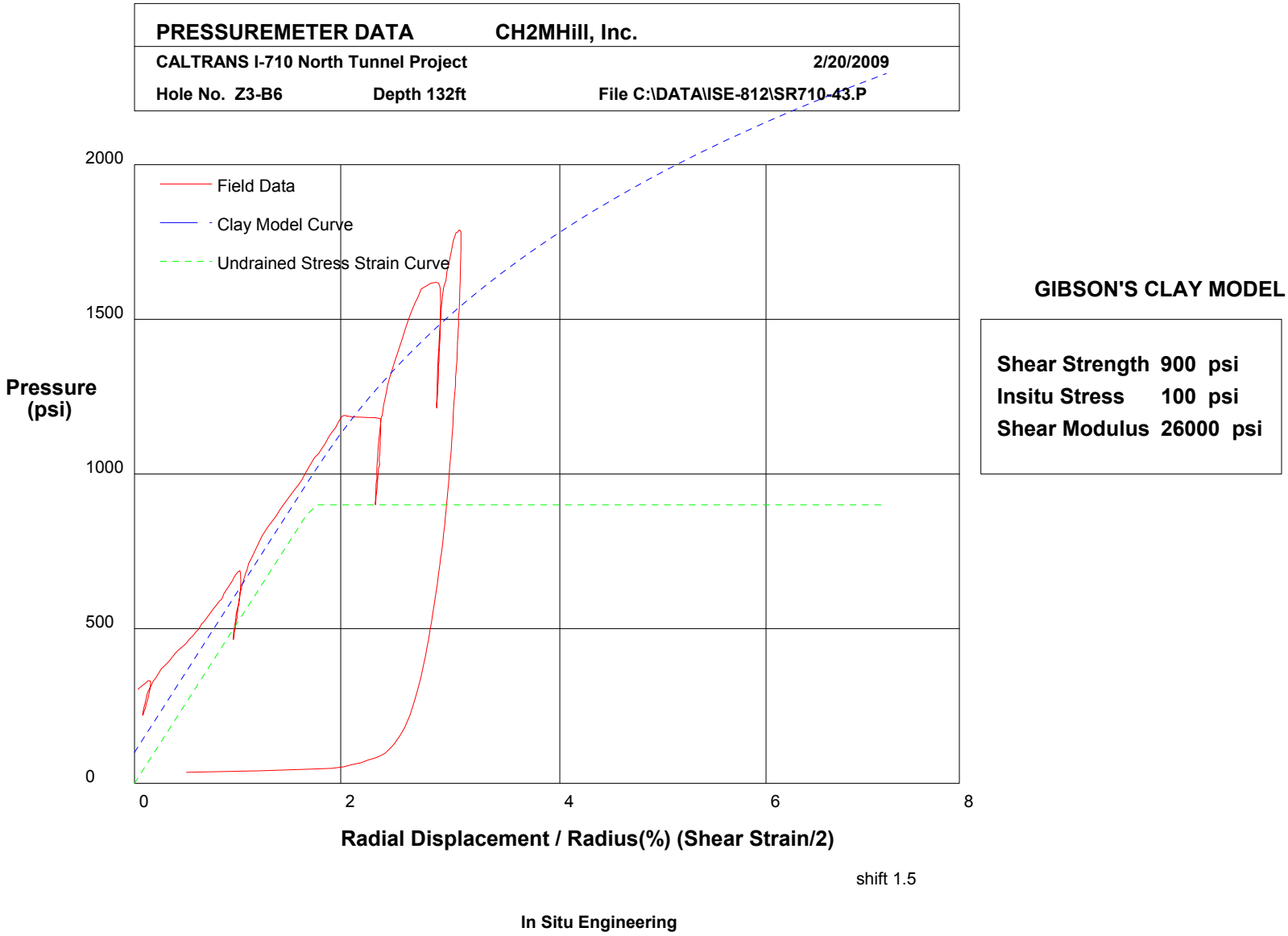
Appendix II - Pressuremeter Model Interpretation



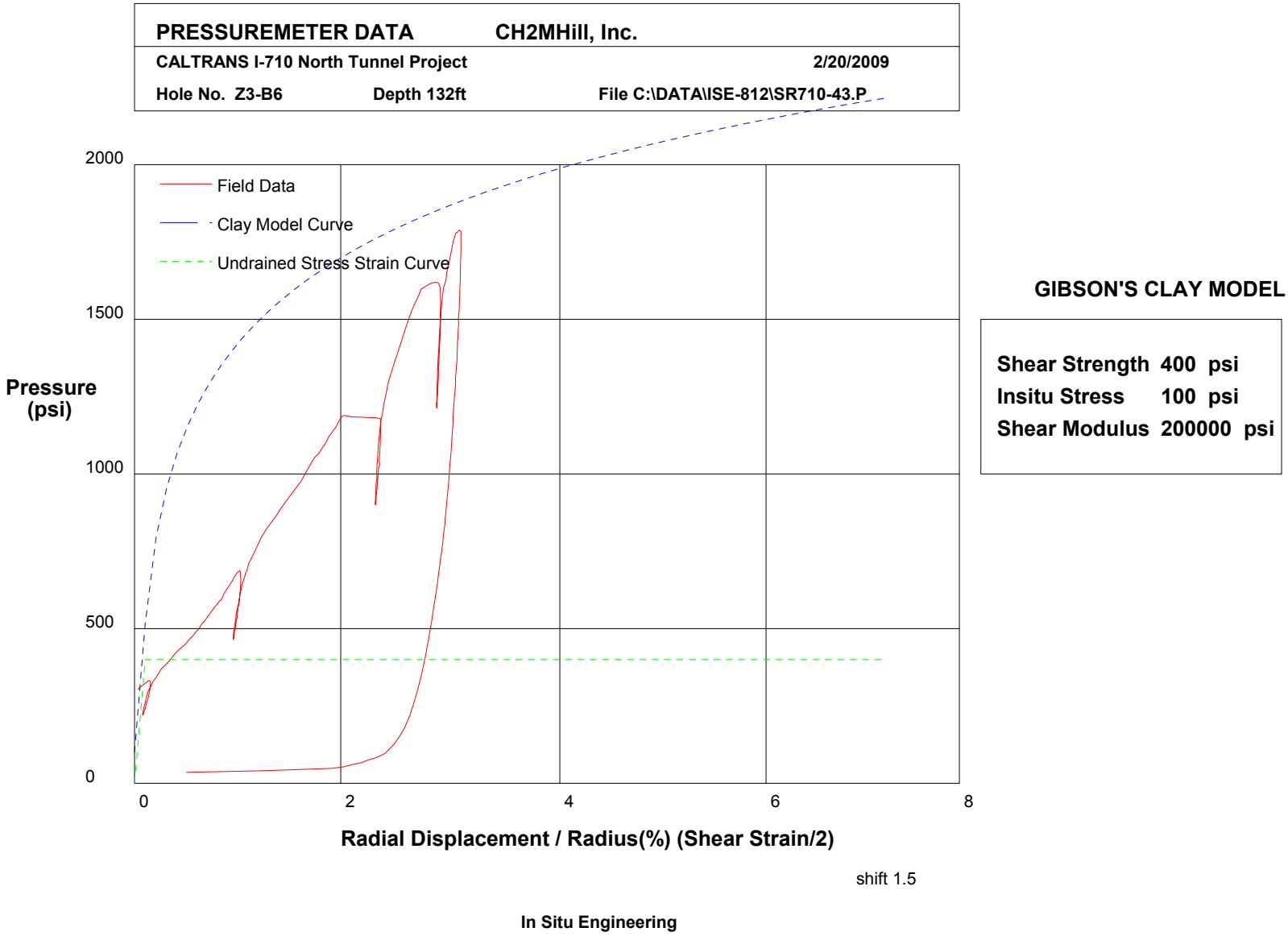
Appendix II - Pressuremeter Model Interpretation



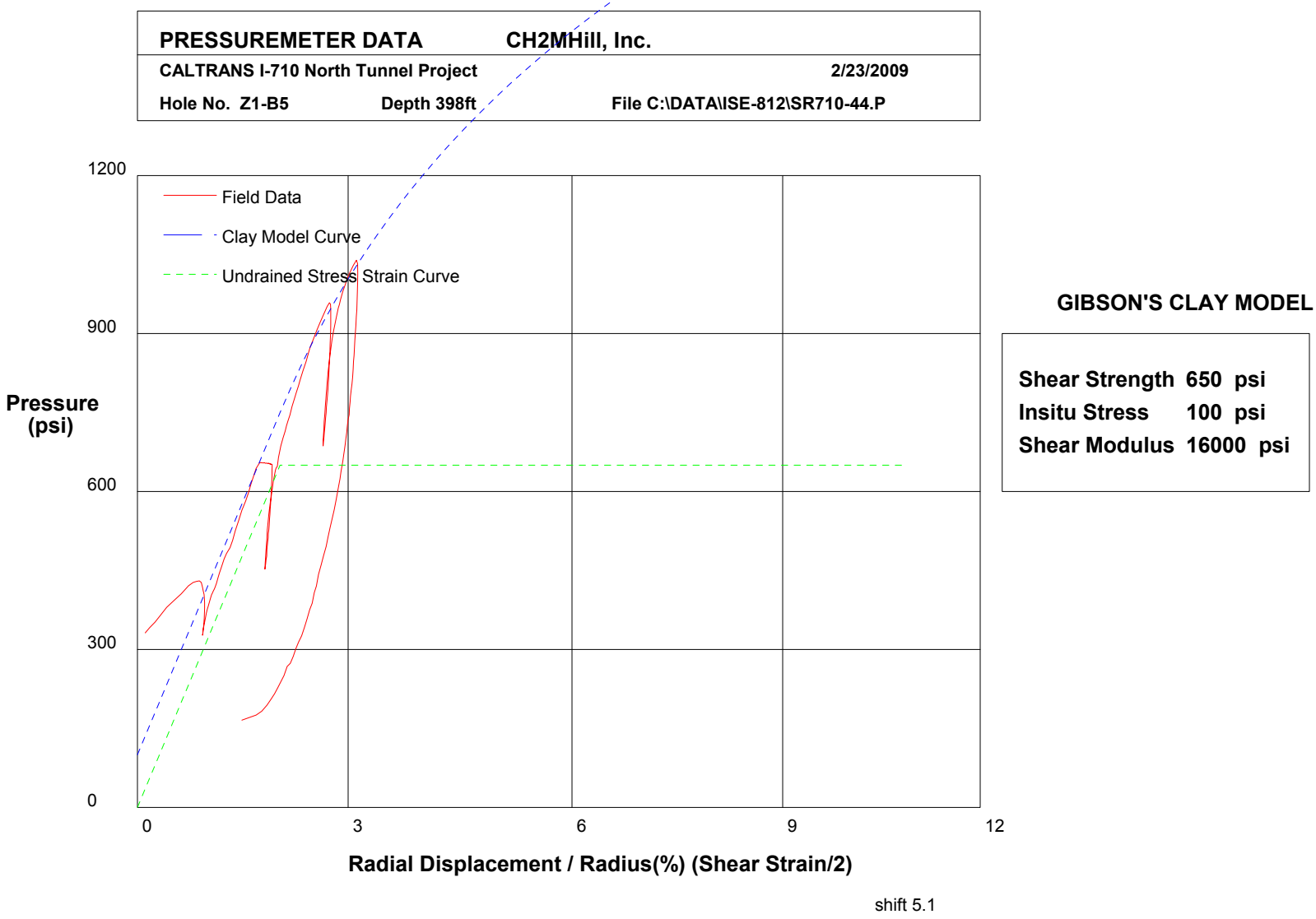
Appendix II - Pressuremeter Model Interpretation



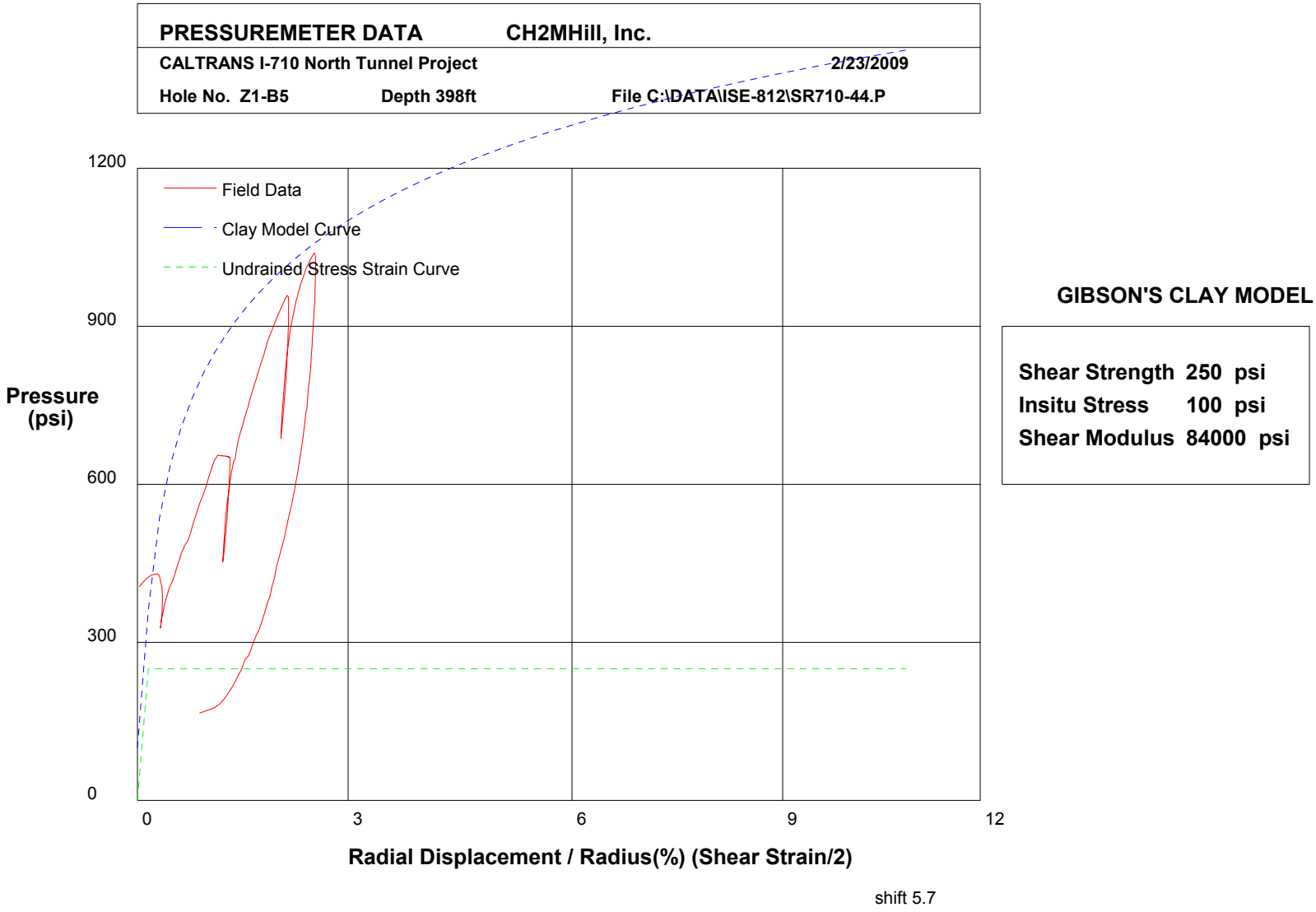
Appendix II - Pressuremeter Model Interpretation



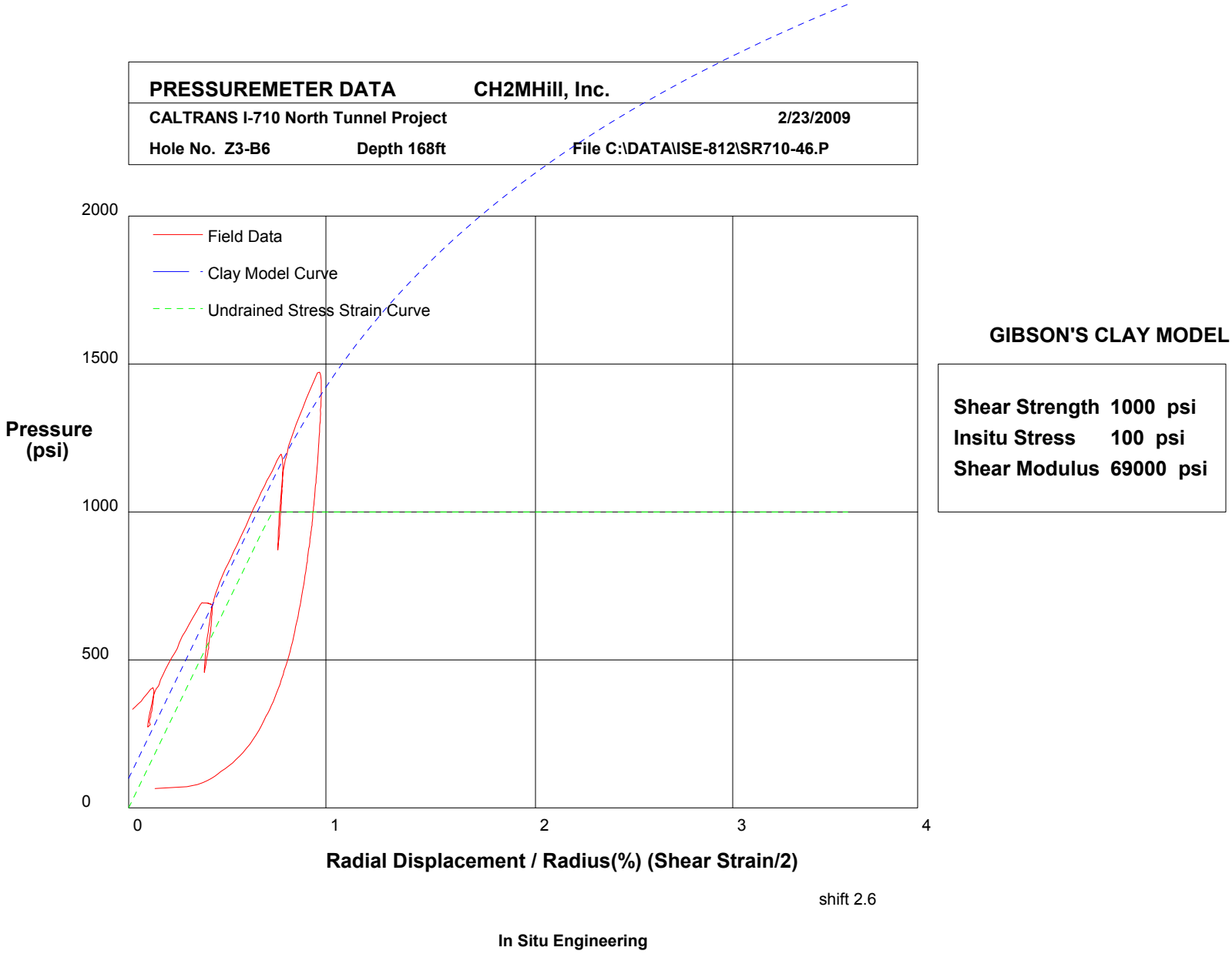
Appendix II - Pressuremeter Model Interpretation



Appendix II - Pressuremeter Model Interpretation



Appendix II - Pressuremeter Model Interpretation

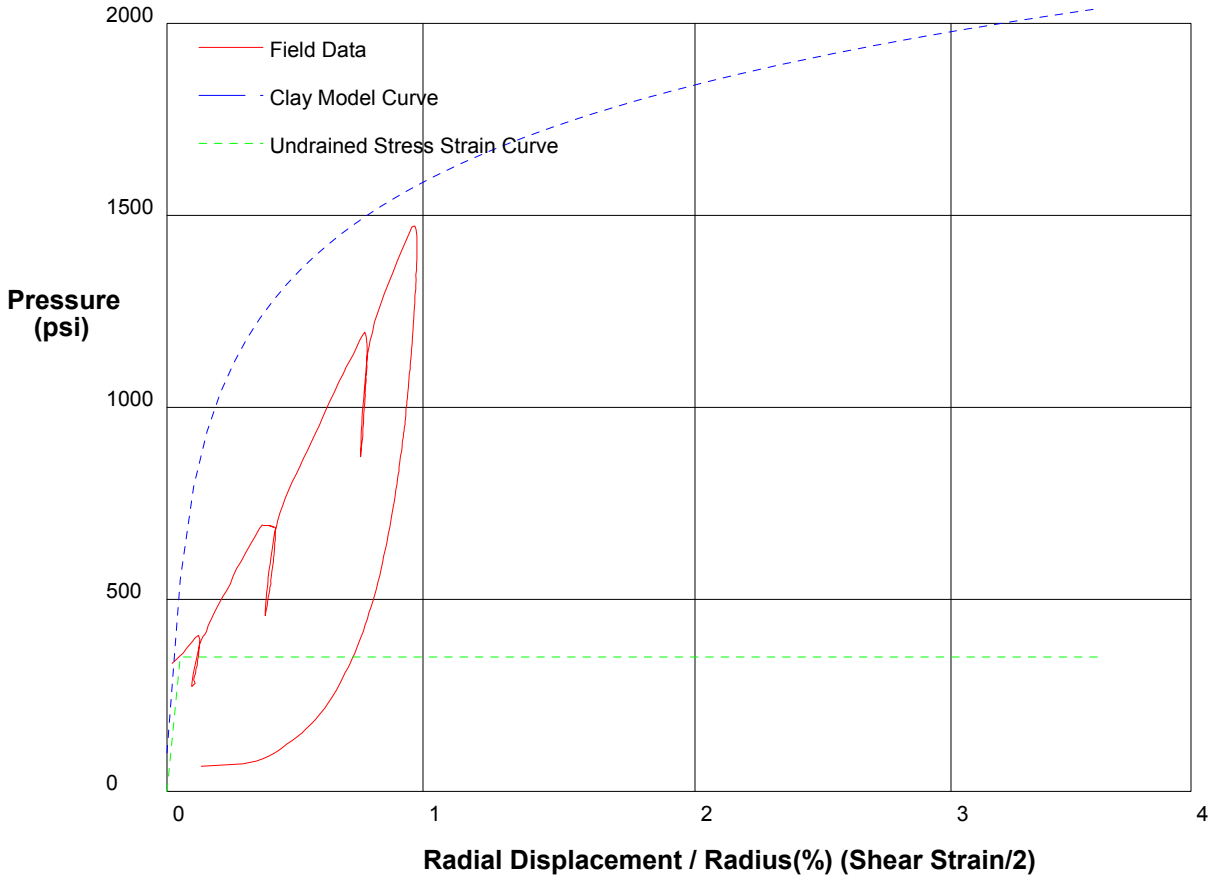


Appendix II - Pressuremeter Model Interpretation

PRESSUREMETER DATA **CH2MHill, Inc.**

CALTRANS I-710 North Tunnel Project **2/23/2009**

Hole No. Z3-B6 **Depth 168ft** **File C:\DATA\ISE-812\SR710-46.P**



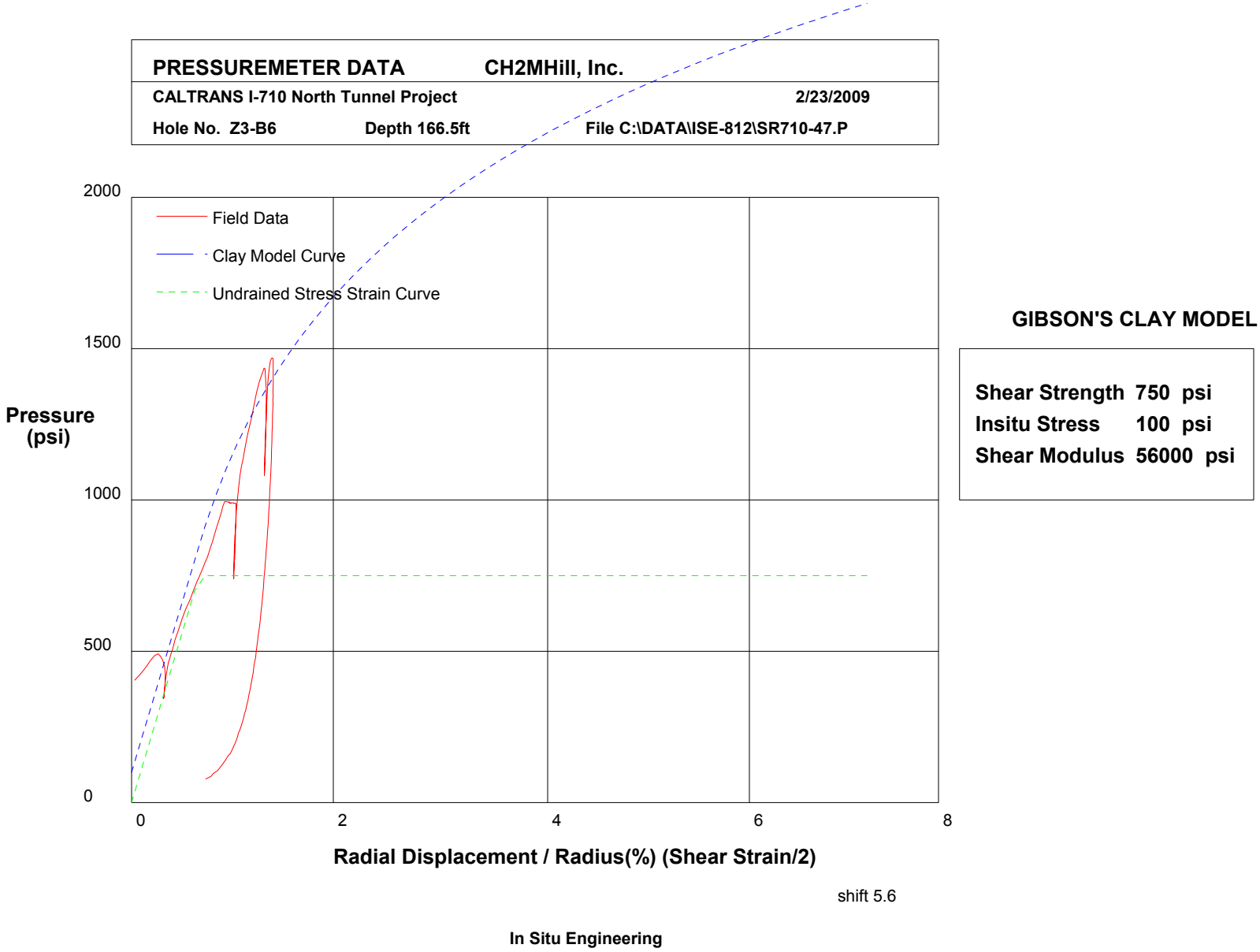
GIBSON'S CLAY MODEL

Shear Strength	**350 psi**
Insitu Stress	**100 psi**
Shear Modulus	**450000 psi**

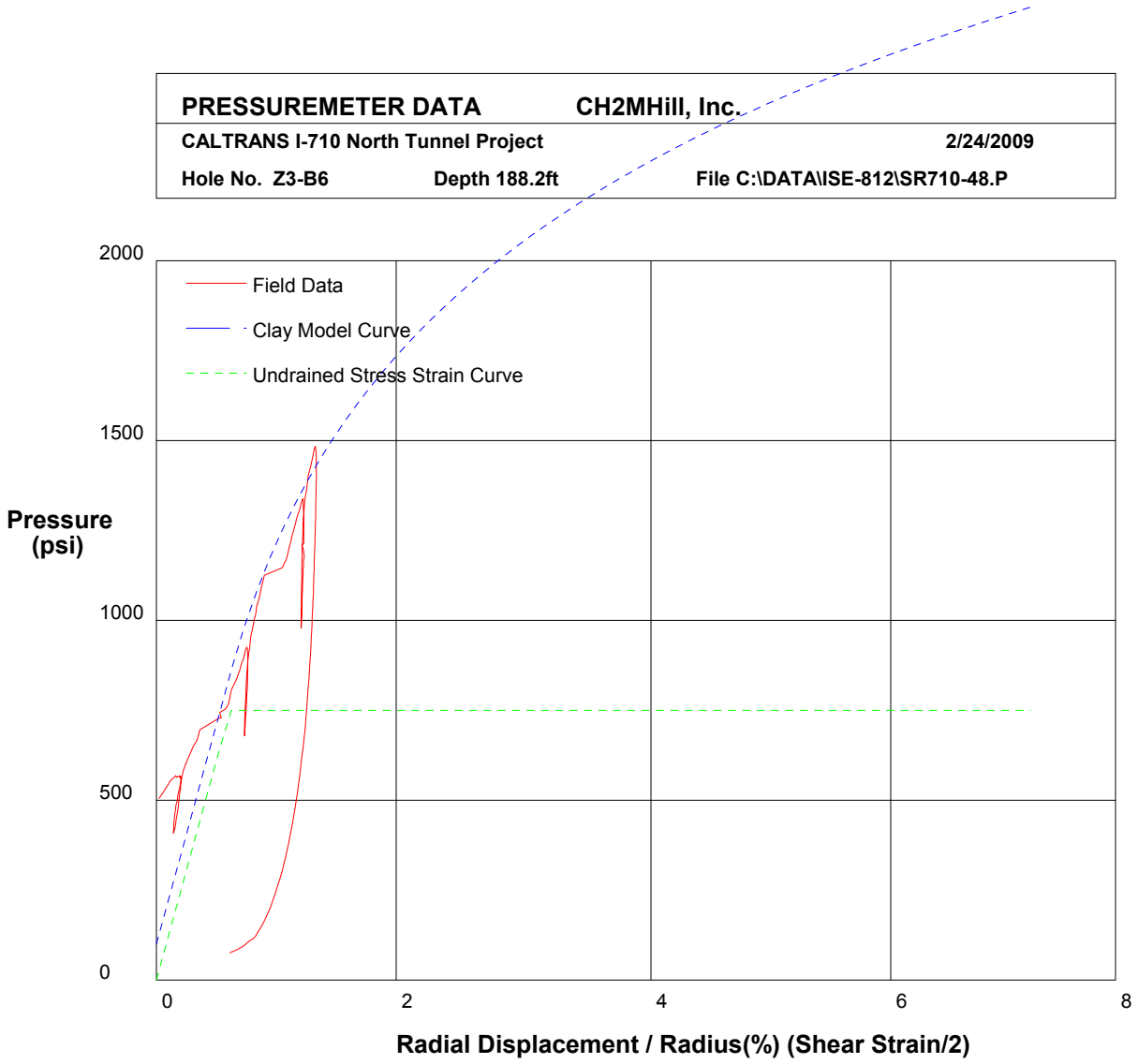
shift 2.6

In Situ Engineering

Appendix II - Pressuremeter Model Interpretation



Appendix II - Pressuremeter Model Interpretation



GIBSON'S CLAY MODEL

Shear Strength	**750 psi**
Insitu Stress	**100 psi**
Shear Modulus	**61000 psi**

In Situ Engineering

Appendix II - Pressuremeter Model Interpretation